Raleigh Fire Department

Master Plan

PREPARED FOR

City of Raleigh

Raleigh Fire Department

PREPARED BY

Darkhorse Emergency, in partnership with NC Fire Chief Consulting

June 2025

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Executive Summary

The Raleigh Fire Department (RFD) Master Plan represents a comprehensive evaluation of the department's current capabilities, future service demands, and strategic recommendations to meet the evolving needs of the City of Raleigh. This master planning effort was initiated in response to Raleigh's position as one of the fastest-growing areas in the country, with an understanding that current infrastructure and personnel investments must be analyzed and planned strategically to meet both current and future emergency service needs.

Key Context:

- Raleigh is experiencing unprecedented growth, with a 1.16% annual population increase.
- RFD’s call volume has increased by 17% since 2024, from 47,167 incidents in 2021 to 55,549 in 2024. This growth is anticipated to continually increase with population, up to ~79,000 incidents annually by 2050 (46% increase).
- Geographic expansion through voluntary annexation has the potential to significantly expand RFD’s service area, outside of current station coverage.

Our Approach

This master planning effort employed a multi-faceted, evidence-based methodology:

<u>Phase 1 - Stakeholder Engagement:</u>

- 7 comprehensive stakeholder workshops covering all levels of RFD
- External partner interviews (City departments, Emergency Communications, Wake EMS)
- Topics: staffing, training, equipment, facilities, communications, and strategic vision

<u>Phase 2 - Performance Diagnostics:</u>

- Comprehensive analysis of 2022-2024 response data using Darkhorse's proprietary analytics platform
- Root cause analysis of response performance gaps
- Benchmarking against NFPA 1710 standards and peer departments

<u>Phase 3 - Predictive Modeling:</u>

- Population growth and call volume forecasting through 2050
- Service area expansion modeling for Northeast and Southeast special study areas

- Resource optimization scenarios and deployment analysis

Phase 4 - Strategic Recommendations:

- Phased implementation plan with clear timelines and resource requirements
- Financial modeling for capital investments and operational costs
- Risk mitigation strategies and performance improvement targets

Key Findings

Current Performance Challenges

Response Time Performance

- Only 54% of first-due units meet NFPA 1710 response time standards
- 90th percentile total response time: 9 minutes and 3 seconds, vs. 6 minutes/6 minutes 20 seconds targets.
- Alarm handling time: 2 minutes, 46 seconds vs. 1-minute standard.

Root Cause Analysis reveals three primary factors:

1. **Alarm handling delays:** Most cost-effective improvement opportunity (30-second reduction = +8.66% performance).
2. **Unit Workload:** "Busy overgoals" increasing steadily as call volume outpaces resources, additional resources are needed to effective serve Raleigh as it grows.
3. **Geographic Coverage Gaps:** Two critical areas: Wilders Grove and Neuse Crossroads. New stations should be planned to address these gaps.

Identified Resource Gaps

- RFD’s staffing factor of 3.63 is below the industry minimum of 3.75, meaning RFD is understaffed compared to its peers
- RFD is underserved by ladder trucks (6 minutes, 5 seconds response time city-wide)
- Five stations are at or nearing end-of-life and require replacement

Future Demand Projections

Call Volume Growth

- Current: ~55,000 calls annually
- 2030: Continues steady growth with increasing urban density

- 2050: Nearly 79,000 annual calls (46% increase)

Potential Geographic Expansion

- Northeast Special Study Area: +8.5 square miles
- Southeast Special Study Area: +17.5 square miles
- Southwest Growth (Asbury Area): Call volume expected to triple by 2050

Highest Impact Growth Areas

- Station 11: 1,929 calls (2023) → 5,919 calls (2050)
- Station 8: 1,197 calls (2023) → 5,713 calls (2050)
- Station 5: Projected to exceed 5,000 calls annually by 2050

Strategic Recommendations

Immediate Action (Years 1-2)

Priority 1: Improve Alarm Handling

- Target: Reduce alarm handling time by 30 seconds.
- Impact: +8.66% first-due performance, 1,527 fewer late responses annually.
- Collaborate with Raleigh-Wake Emergency Communications Center to refine EMS dispatch protocols and ensure dispatch aligns with patient needs.

Priority 2: Address Staffing Gap

- Hire 18 additional firefighters to achieve a 3.75 staffing factor
- Reduce overtime costs and burnout-related absences
- Establish foundation for future growth

Priority 3: Infrastructure Quick Wins

- Deploy traffic pre-emption systems on major corridors
- Add 4 mechanics to fleet maintenance division
- Expand community risk reduction programs

Mid-Term Expansion (Years 3-10)

Station Infrastructure Modernization

- Replace/relocate 5 aging stations (priority: Station 23, 9, 8, 10, 17)
- Systematic approach, maintaining 3-concurrent-project limit

New Station Development

- Construct Station 30 (Wilders Grove)
- Begin development process for Station 31 (Neuse Crossroads)

Apparatus and Staffing

- Add 4 frontline units and their staff: 2 ladder companies, 1 engine, 1 Quick Response Vehicle
- Transition to 4-firefighter engine companies per NFPA 1710
- Optimize ladder truck deployment city-wide

Formalization of Automatic Aid Agreements

- Priority partnerships include Cary Fire Department for southwestern coverage, Knightdale Fire Department for southeastern expansion areas, and Wake-New Hope Fire Department for northeast coordination.
- These agreements require careful negotiation of operational protocols, cost-sharing arrangements, and performance standards to ensure seamless integration during emergency response.

Long-Term Strategic Goals (Years 10-25+)

Achieve Full Geographic Coverage

- Complete construction of Station 31
- Construct Stations 32 and 33 for annexation areas
- Complete infrastructure renewal (all stations meeting modern standards)
- Implement comprehensive Standards of Cover

Technology, Innovation, and Continuous Improvement

- Pursue CFAI accreditation and continuous improvement framework
- Implement predictive analytics for resource deployment
- Integrate emerging firefighting technologies

Administrative Enhancement

- Add battalion chief positions to maintain 5-station maximum span of control
- Strengthen mutual aid agreements with Cary, Knightdale, Wake-New Hope

Comprehensive Infrastructure Renewal

- Complete the rebuild of Station 17
- Ensure all fire stations meet modern standards for energy efficiency, operational effectiveness, and firefighter health and safety.

Sustainability and Resilience

- Environmental initiatives, inclusing net-zero energy for all new construction, integrating solar, energy storage, and efficient HVAC systems
- Fleet modernization explores alternative fuels and incorporate advanced technologies

Financial Investment Framework

25-Year Investment: Approximately $808 million split into three planning horizons:

<u>Short-Term Planning Horizon (2025-2030)</u>

- Apparatus Costs - $25.2 Million
- Personnel Costs - $9.8 Million
- Station Costs
    - Land Acquisition - $6 Million
    - Design & Construction Costs[1] - $76.1 Million

Total Investment - $116.9 Million

<u>Mid-Term Planning Horizon (2031-2035)</u>

- Apparatus Costs - $47.1 Million
- Personnel Costs - 5.3 Million
- Station Costs
    - Land Acquisition Costs - 4.4 Million

[1] Includes Design & Engineering, Construction, Soft, FF&E, and 1st Year Maintenance/Repair Costs

    - Design & Construction Costs - $143.4 Million

Total Investment - $200.2 Million

<u>Long-Term Planning Horizon (2036-2050)</u>

- Apparatus Costs - $196.0 Million
- Personnel Costs - $19.8 Million
- Station Costs
    - Land Acquisition Costs - $1.7 Million
    - Design & Construction Costs - $273.3 Million

Total Investment - $490.8 Million

Revenue Capacity:

- Property tax projections support planned investments
- Total property valuations projected to reach $1.3 trillion by 2050
- Annual property tax revenue capacity: $4 billion by 2050
- Sales tax capacity of approximately $394.4 million by 2050

Cost Management Strategies:

- Proactive land banking to reduce acquisition costs
- Standardized station designs for 10-15% construction savings
- Regional partnerships and automatic aid agreements
- Phased implementation aligned with revenue capacity

Performance Improvement Targets

By 2030:

- First-due performance: 54% → 75%+ (21% improvement)
- Total response time: 9:03 → 6:30 target range
- Effective Response Force: 48% → >70% compliance

By 2050:

- Maintain NFPA 1710 compliance despite 46% call volume growth
- Achieve comprehensive geographic coverage through strategic station placement
- Establish sustainable financial model for ongoing operations

Key Success and Accountability

Key Performance Indicators:

- NFPA 1710 compliance rates (first-due and ERF)
- Overgoal incident reduction
- Financial sustainability ratios
- Firefighter safety and wellness metrics

Continuous Improvement:

- Regular performance monitoring and plan updates
- Standards of Cover adoption
- CFAI accreditation pursuit
- Data-driven decision making culture

This master plan serves as a vital strategic tool to ensure RFD enhances and maintains its high standards of service delivery, firefighter safety, and community protection as Raleigh continues its trajectory as one of America's highest growth cities

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I. Introduction

Purpose of the Master Plan

The Raleigh Fire Department Master Plan serves as a strategic roadmap designed to guide the department's evolution over the next 25 years, with particular focus on the next 5-10 years. The purpose of this plan is to conduct a comprehensive evaluation and assessment of the department's current operations, resources, and capabilities, while developing actionable recommendations to meet projected future demands.

As the Capital City of North Carolina and one of the fastest growing areas in the country, Raleigh faces unique challenges in maintaining effective emergency services while addressing rapid urban development, changing population demographics, and evolving community needs. This master plan provides the analytical foundation and strategic framework needed to make informed decisions about resource allocation, capital investments, and operational improvements.

The plan is intended to be a living document that helps the City phase investments within both optimal and constrained operating and capital resources. It establishes priorities based on risk assessment, service demand analysis, and compliance with industry standards and best practices. The master plan will support the City's budgeting process, capital improvement planning, and long-term financial forecasting related to fire and emergency services.

Scope and Objectives

The scope of the Raleigh Fire Department Master Plan encompasses a comprehensive analysis of all aspects of the department's operations, infrastructure, and service delivery model. Key components include:

1. **Current State Assessment**: Evaluation of existing operations, staffing levels, response capabilities, facilities, apparatus, and service delivery performance against NFPA 1710 standards and other industry benchmarks.
2. **Standards of Cover Analysis**: Assessment of current deployment strategies, response times, geographic coverage, and resource distribution in relation to risk profiles throughout the service area.
3. **Growth Projections**: Analysis of population growth, development patterns, and land use changes within the City of Raleigh and surrounding areas, including potential annexation areas.
4. **Future Needs Projection**: Identification of future service demands, facility requirements, staffing needs, and apparatus investments based on growth projections and service level requirements.

5. **Financial Analysis**: Development of comprehensive financial models for capital investments, operational costs, and potential revenue sources to support the implementation of recommendations.

The objectives of the master plan include:

- Identify strategies to maintain and enhance compliance with NFPA 1710 standards as the city grows
- Recommend optimal locations for future fire stations based on projected development and service demands
- Determine appropriate staffing levels, apparatus requirements, and administrative capabilities needed to serve current and future needs
- Develop a prioritized implementation plan with phased recommendations for short-term (0-5 years), mid-term (5-10 years), and long-term (10-25 years) horizons
- Identify opportunities for alternative service delivery approaches, operational efficiencies, and inter-agency partnerships
- Provide detailed cost estimates for recommended capital investments and operational expansions
- Create a replicable planning methodology that can be utilized for future departmental master plans

The master plan is developed with an understanding of the City's commitment to excellence in service delivery, firefighter safety, and fiscal responsibility, while supporting Raleigh's position as a 21st Century City of Innovation focused on environmental, cultural, and economic sustainability.

II. Master Plan Development

Master Plan Methodology

Our approach to developing the Raleigh Fire Department (RFD) Master Plan was grounded in a multi-faceted, evidence-based methodology that combined rigorous data analysis with extensive stakeholder engagement. This comprehensive approach ensured that our recommendations are both analytically sound and practically implementable.

The master planning process was structured around five key phases:

1. **Project Initiation & Charter:** We began by aligning expectations with RFD leadership and key city stakeholders, establishing clear objectives, timelines, and communication protocols. This phase created a solid foundation for the project and ensured all parties shared a common understanding of goals and deliverables.
2. **Data Gathering & Stakeholder Engagement:** We collected and consolidated comprehensive datasets from multiple sources, including RFD's CAD/RMS systems, spatial data, operational records, and municipal development plans. Concurrently, we initiated a structured stakeholder engagement process to gather qualitative insights and institutional knowledge.
3. **Department Diagnostic Analysis:** Using Darkhorse's proprietary analytics platform, we conducted a detailed performance assessment of RFD's current operations. This included comprehensive analysis of response times, resource allocation, deployment patterns, geographic coverage, and compliance with NFPA 1710 standards. This diagnostic phase identified key performance gaps and root causes of operational challenges.
4. **Growth Projections & Future State Analysis:** We developed detailed population and call volume projections based on Raleigh's growth patterns, development plans, and demographic trends. These projections were integrated into our deployment modeling tool to simulate future service demands and evaluate various resource allocation scenarios.
5. **Financial Forecast & Recommendations Development:** We created comprehensive financial models to estimate costs associated with our recommendations, allowing for prioritization of initiatives within budgetary constraints. The final recommendations were formulated to address both immediate operational needs and long-term strategic objectives.

Throughout this process, we employed Darkhorse's suite of specialized analytical tools, including:

- **Diagnostics:** For historical data analysis and root cause identification
- **Deployment Analyzer:** For scenario modeling and optimization of resource allocation
- **HQ:** For performance monitoring and visualization

Stakeholder Engagement Framework

Our stakeholder engagement strategy was designed to ensure comprehensive input from all relevant parties while maintaining a structured, efficient process. We categorized stakeholders into the following groups:

Workshop	Content	Key Stakeholders
Staffing and Human Resources	• Current staffing levels and ratios, challenges and gaps • Recruitment and retention strategies • HR support functions and administrative roles • Impact of staffing on workload, absenteeism, overtime, and burnout	• Fire Chief • Asst. Chief Logistics • Asst. Chief Operations • Human Resources • B.C. Fire Health & Safety • Asst. Chief Professional Development
Community and Prevention Services	• Fire prevention and public education programs • Community safety initiatives • Effectiveness of current prevention strategies • Data on socio-economic factors and prevention efforts	• Fire Chief • Fire Marshal • Disaster Preparedness & City EOC)
Response, Equipment and Facilities	• Response Plans • Apparatus and gear needs • Facility and hall status and new hall needs • Impact of equipment and facilities on service delivery • Challenges with existing systems and equipment	• Fire Chief • Asst. Chief Logistics • Asst. Chief Operations • Information Technology • Fire Marshall

Communications and Response	• Emergency services communication, dispatch, and response practices • Communication systems in place • Data bridge between communication centers and RFD	• City of Raleigh Emergency Communications Center
Community Expansion	• Planned expansion/annexation • Timeline for expansion/annexations • Planning process	• City Planning & Development • Disaster Preparedness & City EOC
Strategy and Innovation	• Future vision for the City of Raleigh • Planned and envisioned infrastructure improvements and changes	• Fire Chief • City Organization Vision & Strategic Plans Group • City Strategy & Innovation
IT, Software, and Data Management	• Software systems in place • Challenges with existing systems and opportunities for improvement • Data storage and record keeping practices	• Information Technology • Asst. Chief Logistics/Equipment

This structured approach ensured we captured diverse perspectives while maintaining focus on key strategic questions. The engagement process was iterative, with preliminary findings being shared with stakeholders for validation and refinement before final recommendations were developed.

Benchmarking Analysis

To provide context for our analysis and recommendations, we conducted comprehensive benchmarking against comparable fire departments serving similar communities. Our benchmarking framework included:

1. Department Comparisons: Evaluation of staffing levels, response times, and resource allocation against departments serving cities of similar size, density, and growth patterns.
2. Standards Compliance: Assessment of RFD's current performance against industry standards, particularly NFPA 1710 requirements for response times, staffing, and effective response force assembly.
3. Best Practices Review: Identification of innovative approaches and operational models from leading departments across North America that could be adapted to RFD's context.
4. Financial Benchmarking: Comparison of capital and operational expenditures, including station construction costs, apparatus investment, and staffing expenses across five similarly situated communities.

Integration and Final Plan Development

The final phase of our methodology involved synthesizing the quantitative analysis, stakeholder input, and benchmarking results into a cohesive, actionable master plan. This integration process included:

1. Findings Consolidation: Bringing together insights from all data sources and stakeholder feedback to identify key themes and priorities.
2. Preliminary Recommendations Workshops: Working sessions with RFD leadership to review initial findings and draft recommendations, ensuring alignment with departmental vision and city objectives.
3. Implementation Planning: Development of phased implementation strategies with clear timelines, resource requirements, and budget allocations.
4. Final Report Development: Creation of a comprehensive yet accessible report documenting the analysis, findings, and recommendations in a format that supports ongoing decision-making.
5. Analytical Tools Transfer: Implementation of Darkhorse's analytical platform within RFD to enable ongoing monitoring of performance and adaptation of strategies as conditions evolve.

This integrated approach has resulted in a "living" master plan that not only provides immediate strategic direction but also establishes the analytical foundation for continuous improvement and adaptation to Raleigh's evolving emergency service needs.

III. Current State Analysis

Community Overview

The City of Raleigh, North Carolina's capital city, is one of the fastest-growing urban areas in the United States. As the center of the Research Triangle region, Raleigh benefits from a robust economy driven by technology, education, healthcare, and government sectors. The city is characterized by a unique blend of historic neighborhoods, modern downtown development, expanding suburbs, and areas experiencing increasing density and vertical growth.

Key community characteristics include:

- Population: Approximately 499,825 residents within city limits[2]
- Geographic area: approximately 150.9 square miles
- Population density: 3,312 people per square mile
- Growth rate: 1.16% annual growth rate, one of the highest among major U.S. cities
- Development patterns: Significant vertical growth in Raleigh’s core,, with expanding suburban development in outer regions
- Diverse building stock - From historic structures in established neighborhoods to modern high-rises downtown
- Major corridors including interstates 40, 440, and 540
- Special hazards, including state government facilities, universities, and technology centers requiring specialized response capabilities

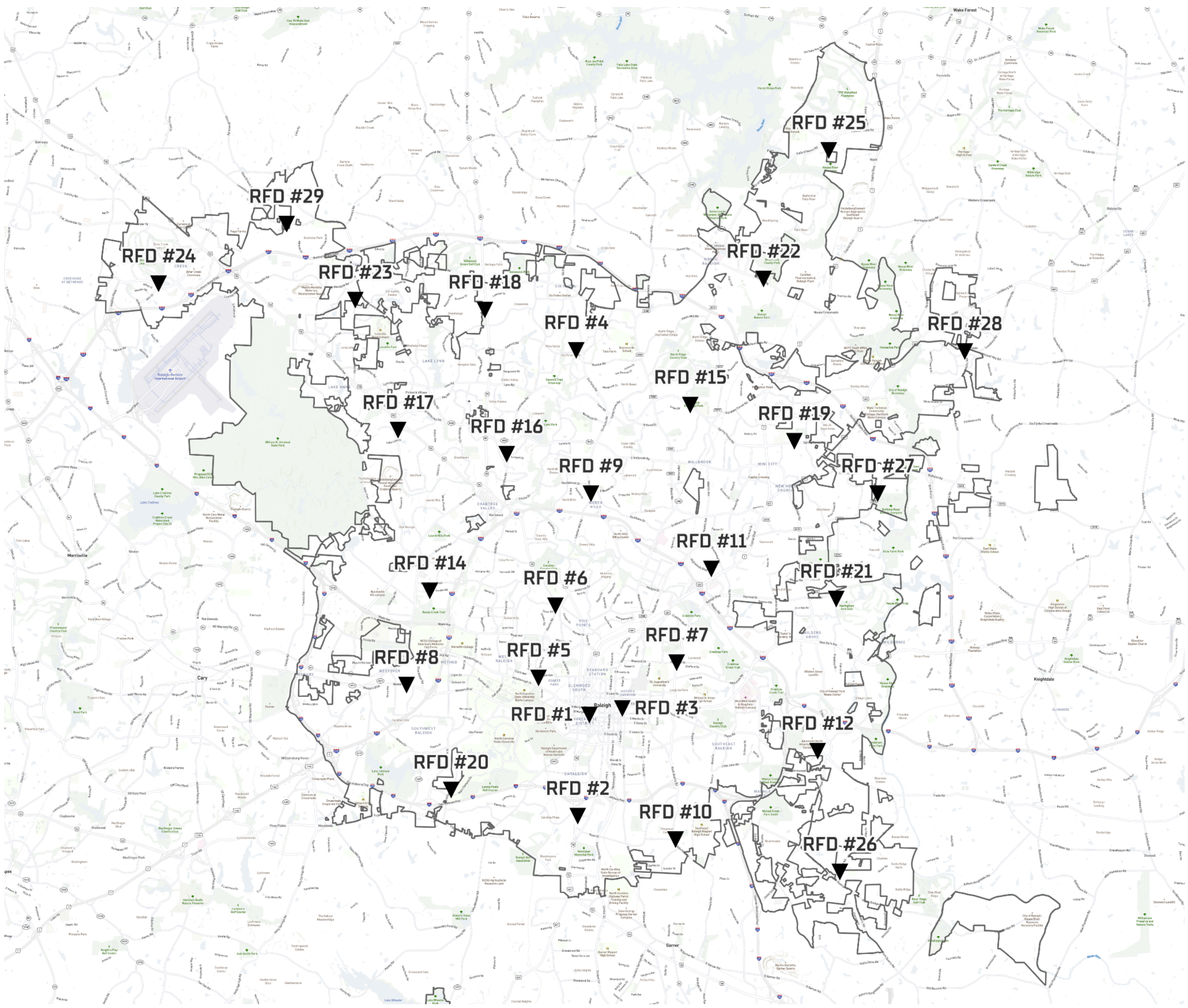
As a 21st Century City of Innovation, Raleigh emphasizes environmental, cultural, and economic sustainability. The city's growth has led to changing land use patterns, with increasing density in previously low-density areas and expanding development in previously unincorporated regions. This growth pattern creates specific challenges for emergency service delivery, requiring strategic resource allocation to maintain effective response capabilities.

[2] *U.S. Census Bureau, Population Estimates Program (V2024)*

Raleigh Fire Department

The Raleigh Fire Department (RFD) provides comprehensive emergency services to the community, including fire suppression, emergency medical services, technical rescue, hazardous materials response, and fire prevention. RFD is committed to excellence and adherence to National Fire Protection Association (NFPA) standards in all aspects of service delivery.

RFD operational resources are distributed throughout the City in twenty-eight different fire stations, one training center, one support center, and RFD Headquarters.



Current RFD station locations.

Apparatus and Staffing Overview

Raleigh Fire Department maintains a diverse fleet of emergency response vehicles and specialized apparatus to serve the community. The department operates numerous frontline apparatus:

- Engine companies
- Ladder companies
- Rescue companies
- Battalion chiefs
- Specialized units (hazmat, technical rescue, etc.)

RFD is staffed by more than 500 uniformed personnel who operate on a three-platoon system, with each platoon working 24-hour shifts. This staffing model aims to ensure continuous coverage while providing adequate rest periods for personnel between shifts.

Service Area and Response Jurisdiction

RFD's primary response jurisdiction covers the incorporated areas of the City of Raleigh. The department works closely with:

- Wake County EMS, which provides advanced life support (ALS) services
- Raleigh-Wake Emergency Communications Center, which handles dispatching services

Additionally, through mutual aid agreements, RFD provides assistance to neighboring jurisdictions and receives support when needed.

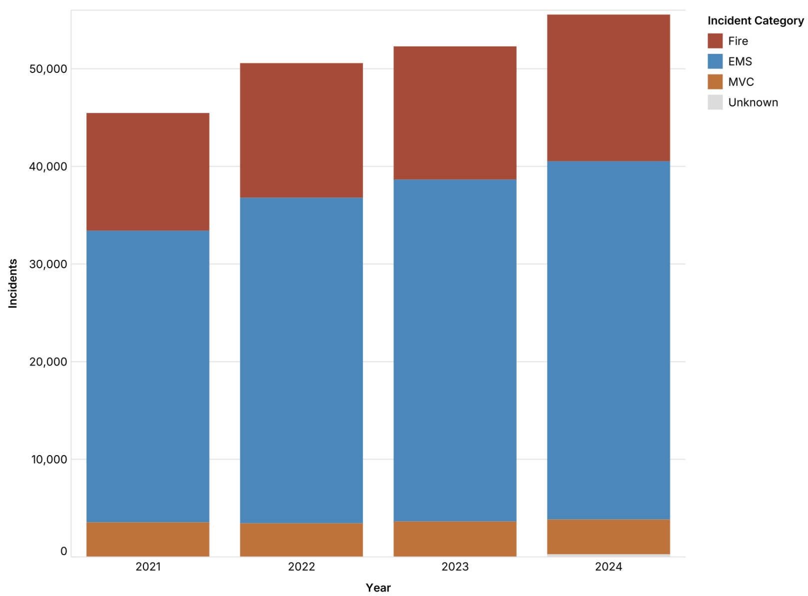
Municipal Fire Departments:

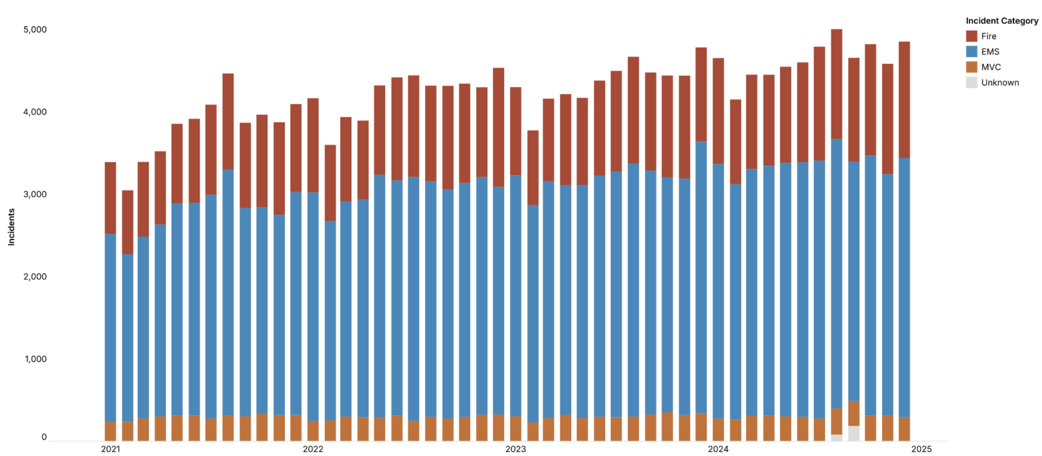
- Cary Fire Department
- Wake County Fire Services
- Apex Fire Department
- Garner Fire Department
- Knightdale Fire Department
- Wake Forest Fire Department
- Zebulon Fire Department
- Morrisville Fire Department
- Holly Springs Fire Department
- Fuquay-Varina Fire Department

County/Volunteer Departments:

- Northern Wake Fire Department
- Wake New Hope Fire Department
- Fairview Rural Fire Department
- Swift Creek Fire Department
- Wendell Holmes Fire Department
- Hopkins Rural Fire Department

Incident and Response Analysis

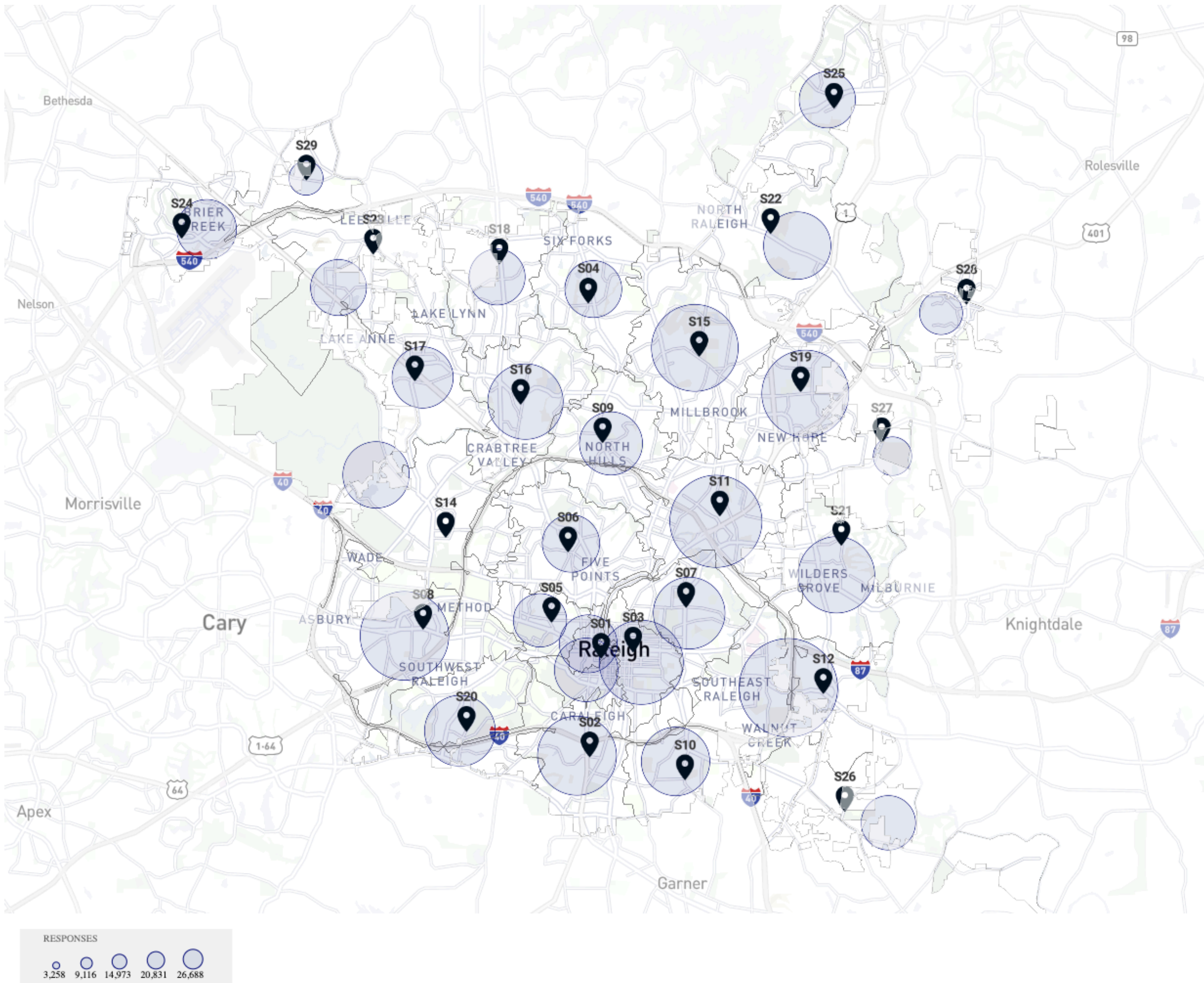




The Raleigh Fire Department has experienced substantial growth in emergency call volume, reflecting the broader population and development trends affecting the region. From 2021 to 2024, annual call volume increased from 47,167 to 55,549 incidents, representing an 18%

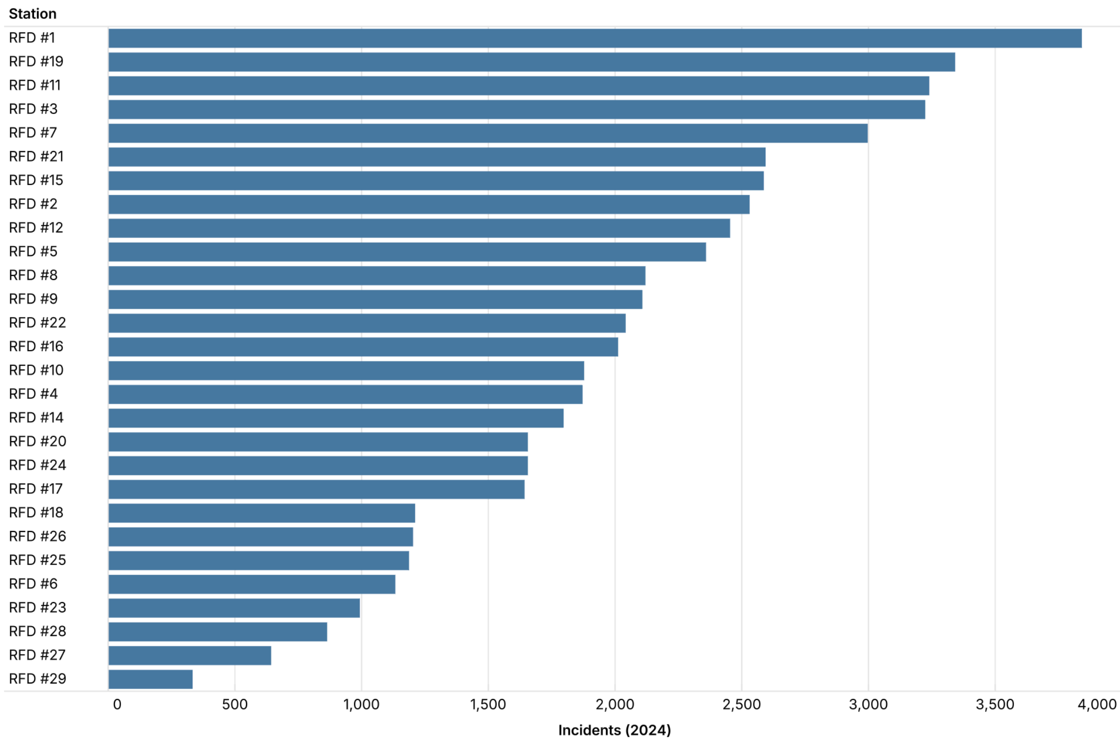
increase over just three years. This growth pattern suggests that demand for emergency services is outpacing population growth, indicating both increased community needs and potentially changing demographics.

The distribution of call types reflects RFD's role as a comprehensive emergency services provider. Emergency medical calls predominate, consistent with national trends and the department's role in the regional EMS system.



Incidents by station zone (2024)

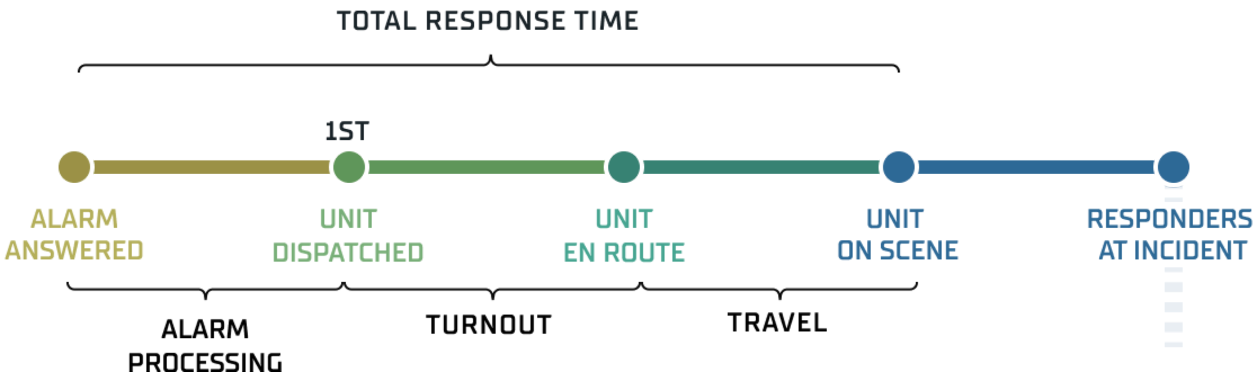
Geographic analysis reveals that the highest volume areas are concentrated in the downtown core and specific station zones, particularly around Stations 7, 11, and 19. These areas reflect the intersection of high population density, commercial activity, and vulnerable populations that generate elevated emergency service demand. Emerging growth patterns are evident in the southeast and southwest corridors, where new development and population influx are creating additional service pressures.



Incidents by station (2024)

Performance Against NFPA Standards

Performance in fire and emergency is typically measured by evaluating the total response time and several other intervals. The National Fire Protection Association (NFPA) has created the most widely adopted standards and targets for fire & emergency response performance.



The **alarm processing** interval measures the time elapsed from the earliest timestamp (usually call answered) to the dispatch of the first unit.

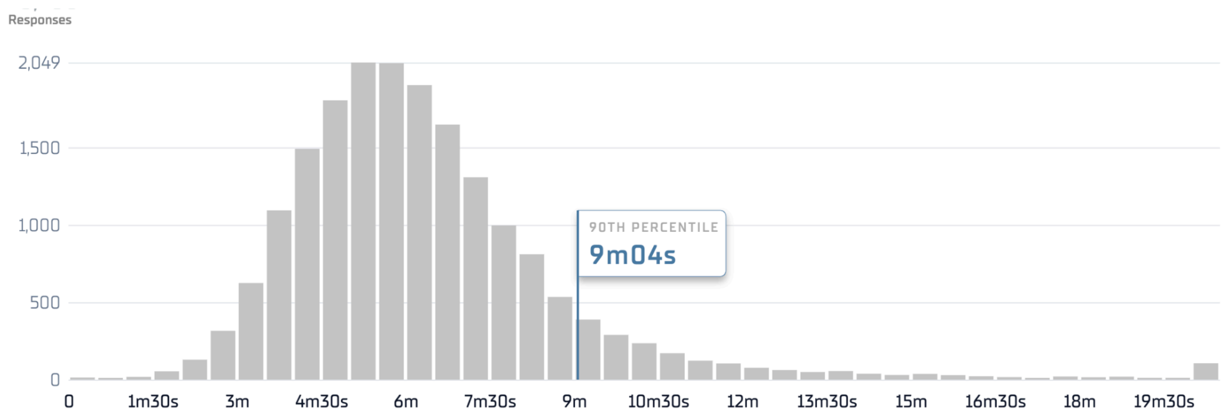
The **turnout interval** measures the time between the dispatch of the first-due unit to its departure from the station

The **travel interval** measures the time between the first-due unit's departure from the station to its arrival at the scene.

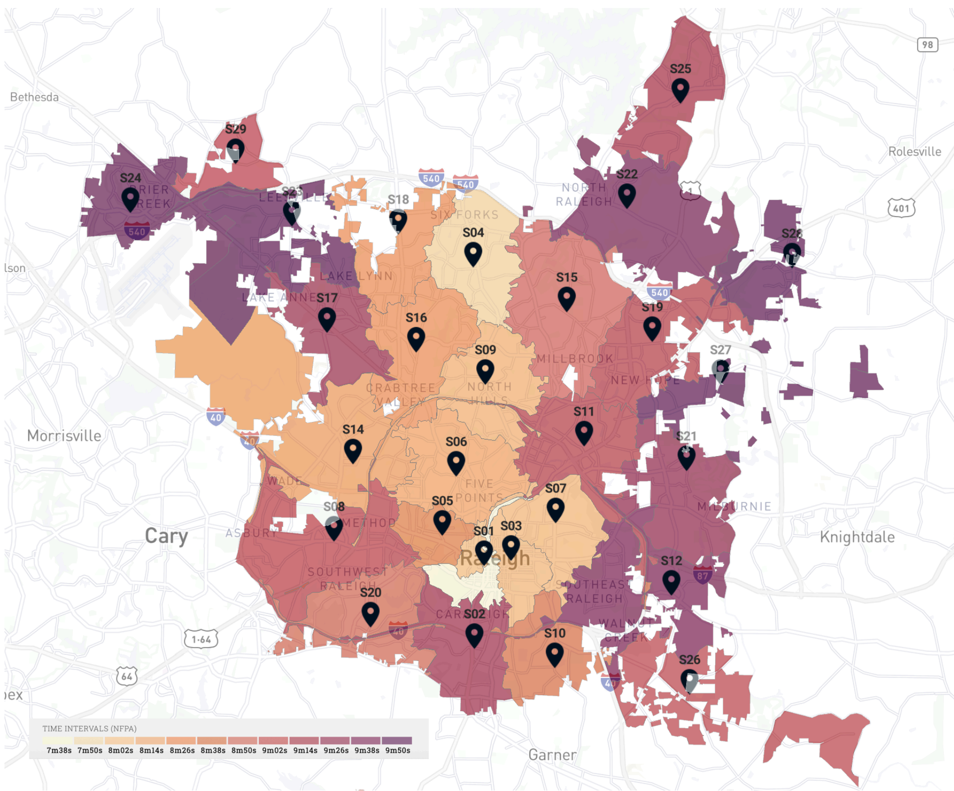
The industry standard is to measure these intervals at the 90th percentile.

Target Category	Total Response	Alarm	Turnout	Travel
1st Due – EMS	6m00s	1m	1m	4m
1st Due – Non-EMS	6m20s	1m	1m20s	4m

Total Response Time



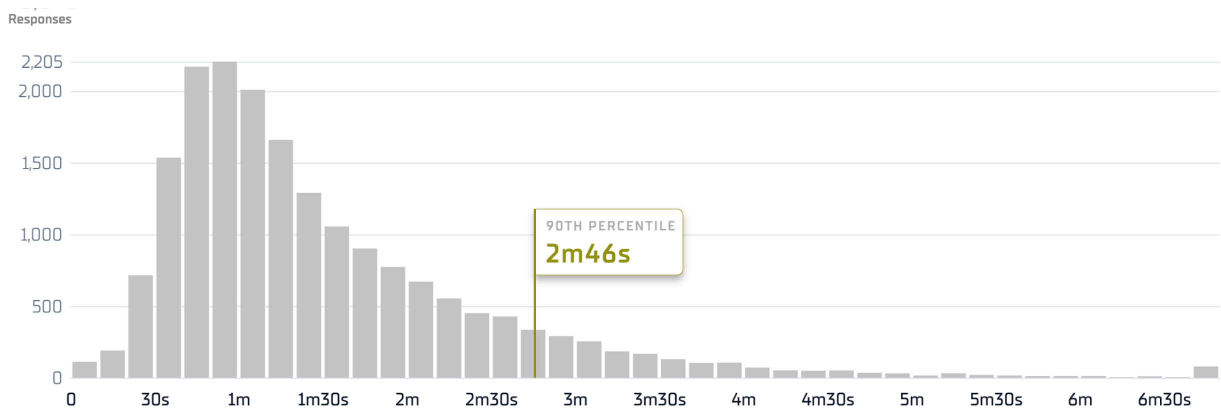
RFD 90th percentile total response time to emergent incidents (2024).



2024 total response time (90th percentile) by station zone

The department's current performance against National Fire Protection Association (NFPA) 1710 standards reveals significant opportunities for improvement. Only 54% of first-due units meet NFPA response time targets, with total response times averaging 9 minutes and 3 seconds at the 90th percentile. These figures fall well short of the NFPA targets of 6 minutes for EMS calls and 6 minutes 20 seconds for non-EMS emergencies.Performance is generally better in Raleigh's core, and worsens in its distal regions.

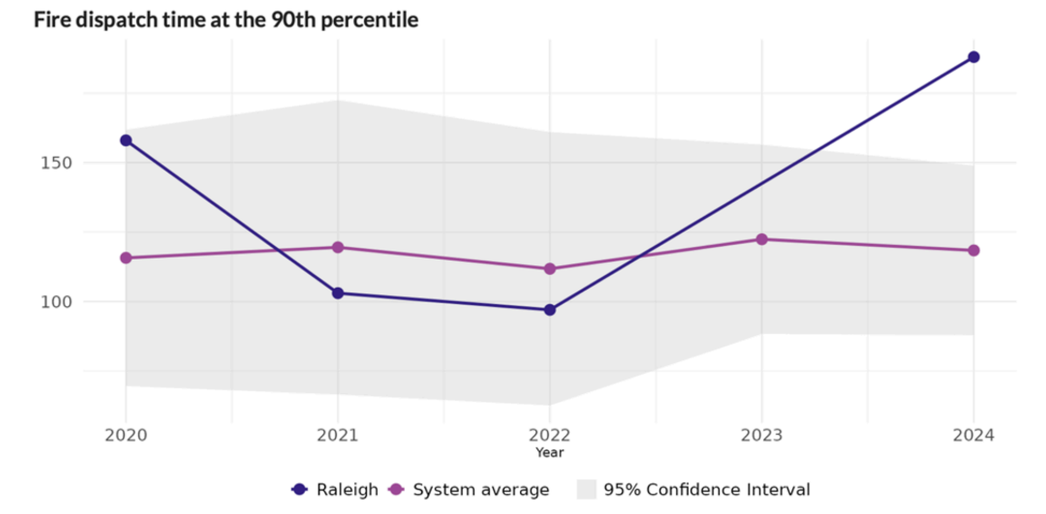
Alarm Handling Time



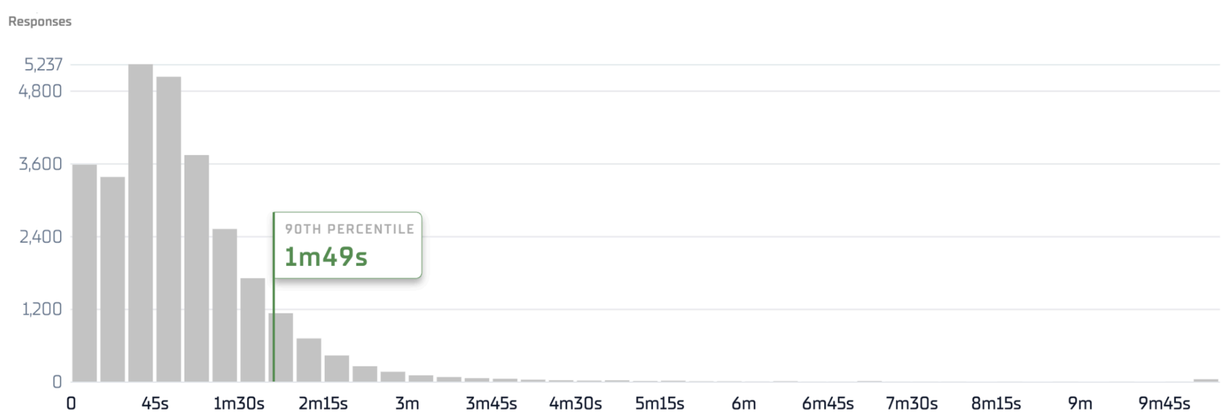
90th percentile alarm handing time for emergent incidents (2024).

Detailed analysis of response intervals reveals that alarm processing represents the most significant delay, currently averaging 2 minutes and 46 seconds compared to the NFPA target of 1 minute. This delay in the initial processing and dispatch of emergency calls creates a cascading impact on overall response performance.

When benchmarking against other North Carolinian municipalities, Raleigh has a substantially longer alarm handling time compared to the state average. Considering all incident types, the state average 90th percentile time is approximately 2 minutes. Raleigh exceeds the 95% confidence interval of the comparison group.



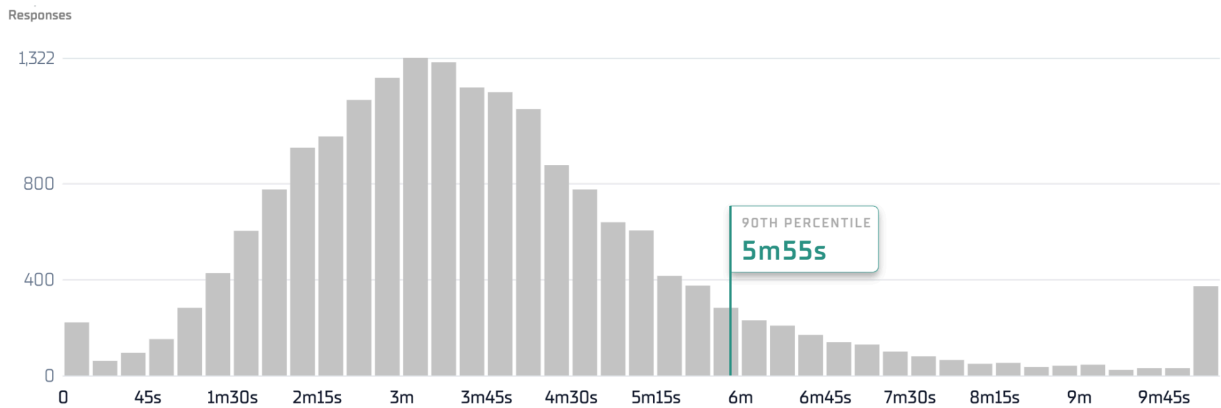
Turnout Time



RFD 90th percentile turnout time to emergent incidents (2024).

Turnout time, measuring the interval from dispatch to unit departure from station until it arrives on-scene, is 1 minute 47 seconds at the 90th percentile, exceeding targets for both EMS and fire calls. While travel times fall within acceptable ranges for most areas, the cumulative impact of delays in earlier intervals significantly impacts overall performance.

Travel Time

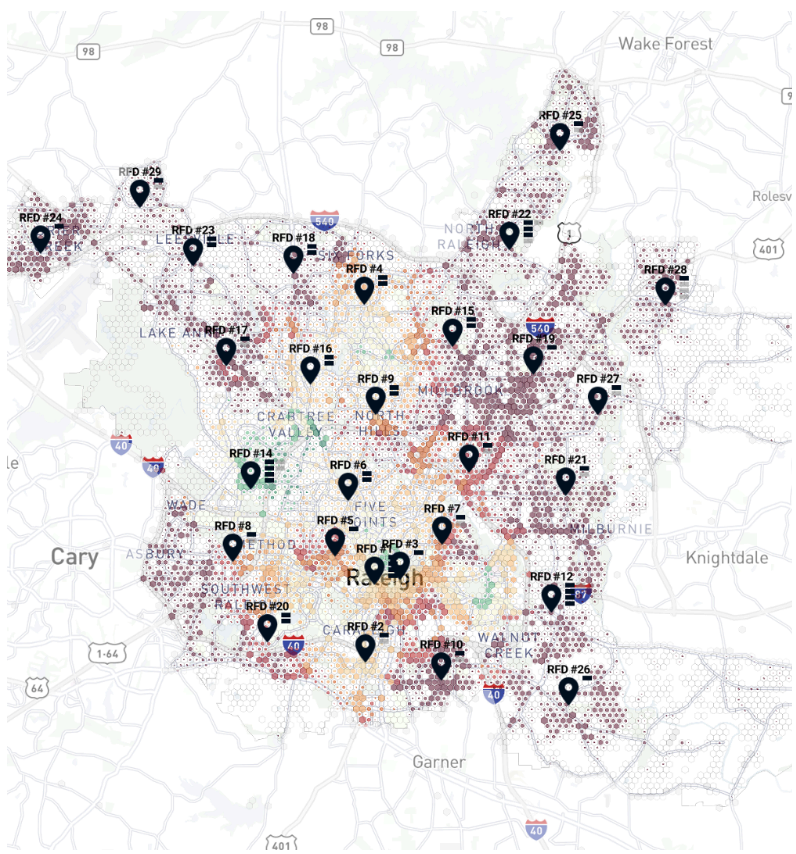


RFD 90th percentile travel time to emergent incidents (2024).

While travel times fall within acceptable ranges for most areas, the cumulative impact of delays in earlier intervals significantly impacts overall performance.

Effective Response Force Capabilities

Effective Response Force (ERF) analysis reveals concerning gaps in the department's ability to assemble adequate staffing for complex incidents. Current performance shows only 48% compliance with ERF standards for low and moderate risk incidents, which require 26 firefighters to arrive within 10 minutes and 20 seconds. High-risk incidents, requiring 39 firefighters within 12 minutes and 30 seconds, show even lower compliance rates. This performance gap indicates that RFD struggles to quickly assemble the comprehensive emergency response teams necessary for effective incident management, particularly for



structure fires and other complex emergencies.

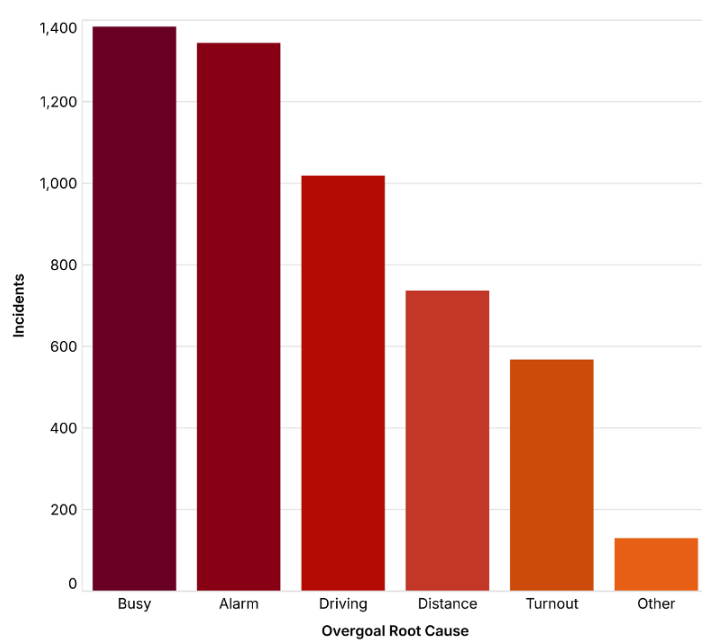
Modeled ERF performance (2024)

Overgoals and Root Cause Analysis

Examining incidents that missed the NFPA target ("overgoal" incidents) and understanding why they were late is crucial for identifying the underlying causes that contribute to late responses. By conducting thorough root cause analysis, we identified systemic patterns that contribute to late responses for RFD, and by understanding these patterns, we can identify and prescribe the highest-impact improvements, tailored to the department's current state and needs.

Root cause analysis examines each time interval related to a response, including alarm handling, dispatch delays, turnout time, and travel time, and incorporates factors such as expected driving time, distance, and the workload and distribution of units. Using this approach, we identified the root cause for each late calls and categorized them as follows:

- **Busy:** The biggest contributor to the late call was that units from the closest station were unable to respond right away because they were preoccupied with another call or were backfilling in another area. This prompts another unit to come backfill or respond from a station further away.
- **Alarm Handling:** The time between when the call was answered and when the first unit was dispatched was the biggest contributor to the late response.
- **Driving:** The time it took for the first arriving unit to drive to the scene was the biggest contributing factor to the late response.
- **Distance:** The closest station to the incident was too far away to reasonably expect units to arrive in under 4 minutes.
- **Turnout:** The time between when the first arriving unit was dispatched and when it arrived on-scene was the biggest contributing factor to the late response.
- **Other:** The late response does not fall under any of the above categories.



The three largest contributing factors to late responses are:

1. **Unit Workload (Busy)**
2. **Alarm Handling Time (Alarm)**
3. **Station Coverage and Driving Efficiency (Driving + Distance)**

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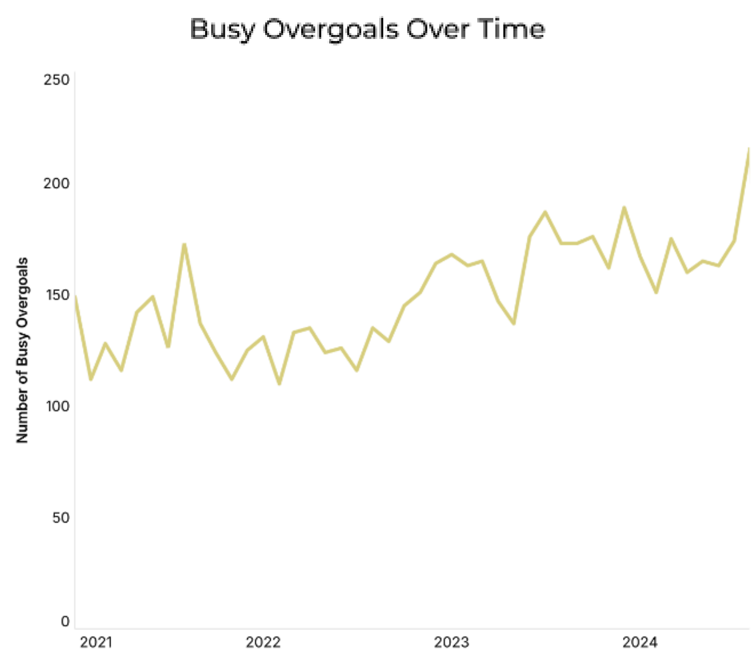
1. Unit Workload

"Busy" overgoals are incidents that missed the NFPA 1710 first due target because the best-suited unit to respond was busy on another call or backfilling in another area, and are attributed to overall unit workload. These types of overgoals indicate where call volume is outpacing RFD's resources and ability to provide effective service.

Over the past three years, we observed a steady increase in the number of "Busy" overgoals, suggesting this is an issue on the rise that will continue to compound as population increases and city limits expand:

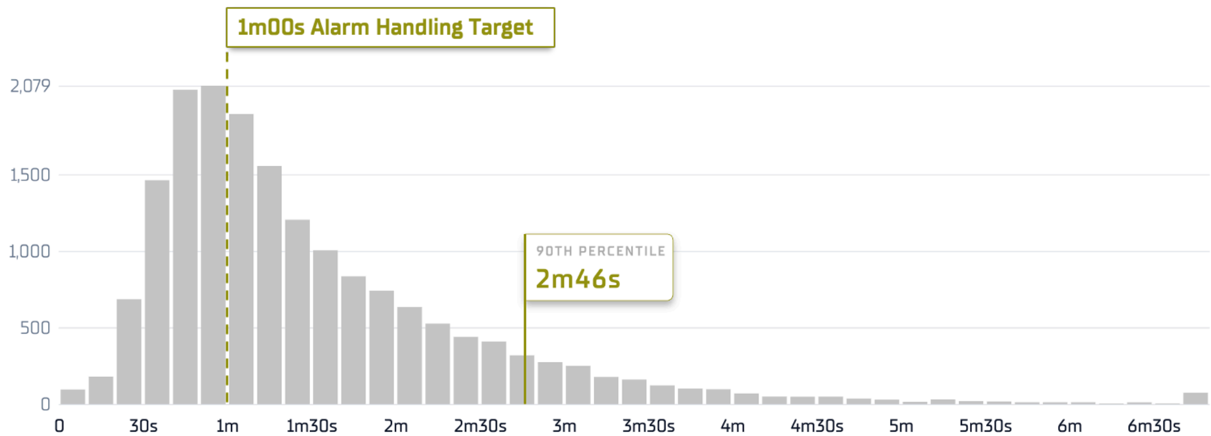
Geographically, "Busy" overgoals are clustered around Raleigh's core and higher-volume areas, but are distributed throughout the City. As units become busy in Raleigh, units from other stations will backfill where needed, resulting in a reduced ability to respond around their own home station. This paradoxical situation indicates that Raleigh's incident volume is outpacing RFD's ability to effectively respond to them all,



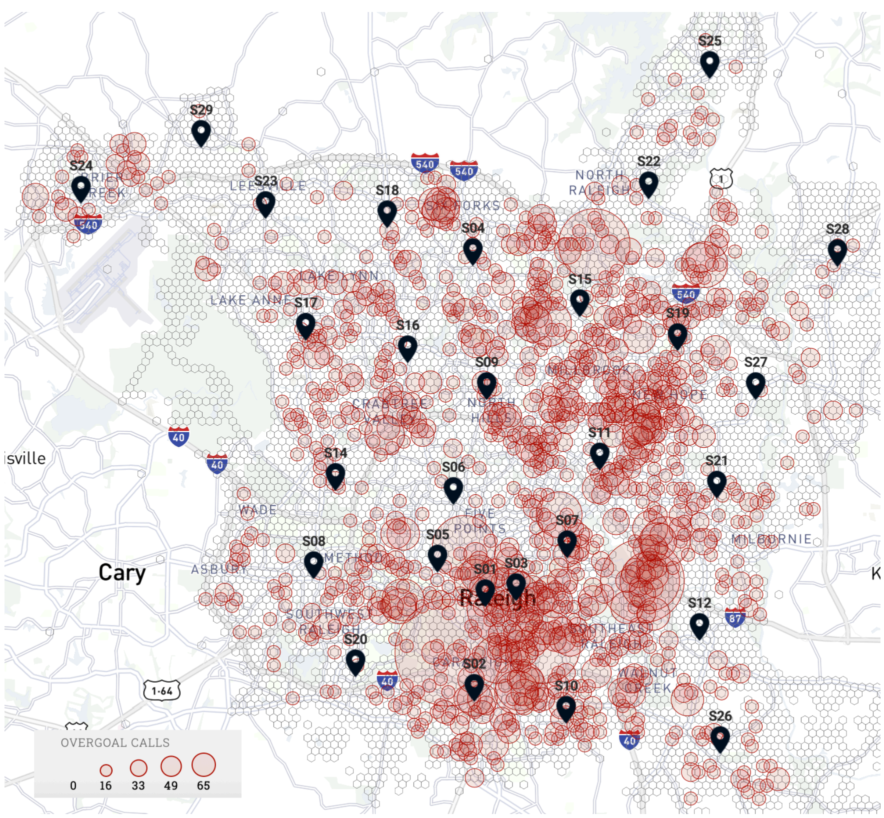
and suggests the department requires additional resources.

In a rapidly growing city like Raleigh, proactively addressing the need for additional resources will be paramount in ensuring effective service delivery over the long term.

2. Alarm Handling



90th percentile alarm handing time for emergent incidents (2024) and NFPA 1710 alarm handling target.



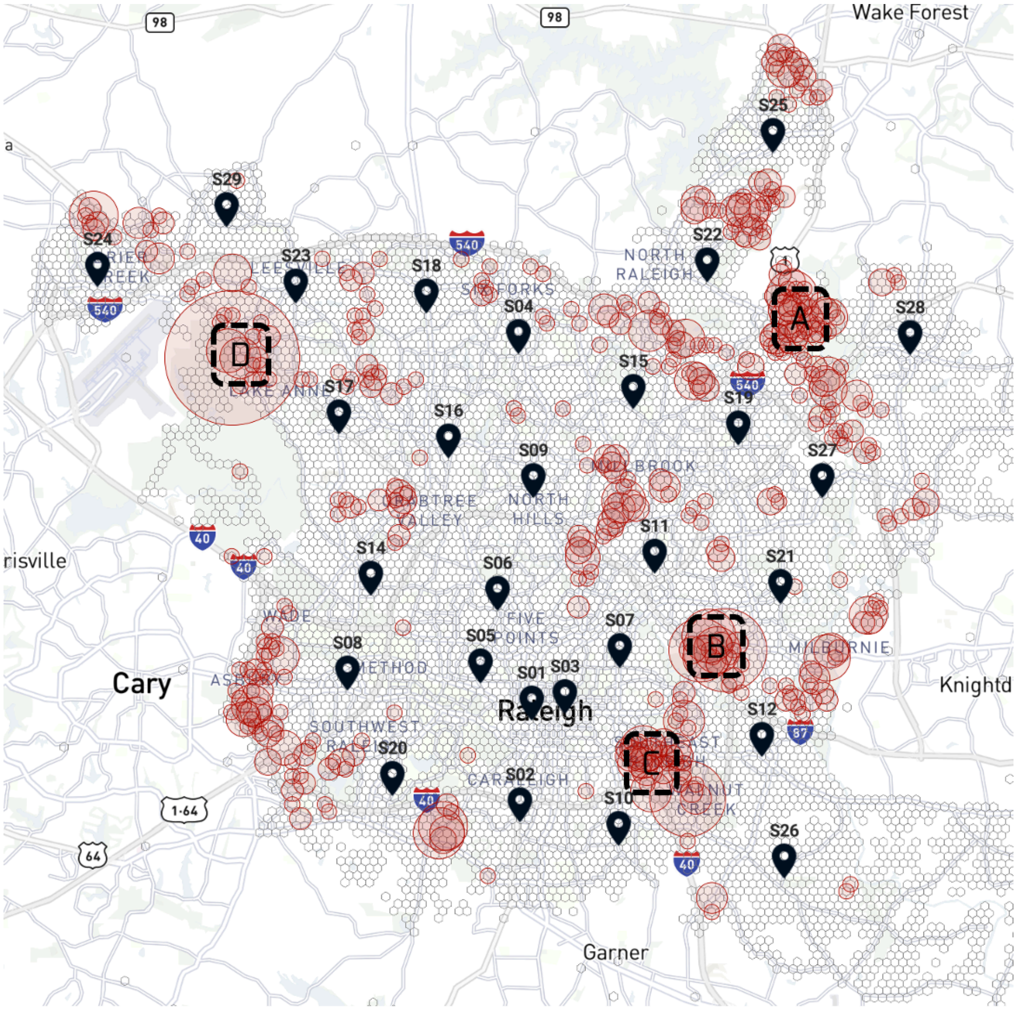
Overgoal incidents with a "Busy" root cause (2024).

“Alarm” overgoals are responses that missed the NFPA 1710 first due target because the call took too long to dispatch units after the initial phone pick-up. These types of overgoals indicate that there is an opportunity to improve the call handling/dispatch process to be more efficient.

Process improvements to alarm handling are often the most cost-effective and highest-impact measures a department can take to improve performance, and can also be the fastest to implement. In RFD’s case, a 30-second reduction in call handling time would result in a +8.66% increase in first-due performance and 1,527 more on-time responses, city-wide.

Alarm Handling Time	Performance	Overgoal Incidents
Current (2m46s)	52% (2024)	8,806 (2024)
Current - 10s (2m36s)	55.17% **(+3.17%)**	8,165 **(-641)**
Current - 20s (2m26s)	58.22% **(+6.22%)**	7,731 **(-1,075)**
Current - 30s (2m16s)	60.66% **(+8.66%)**	7,279 **(-1,527)**

3. Station Coverage



Clusters of overgoal incidents with a "Distance" root cause (2024). a) 3304 Glen Royal Rd; b) Neuse Crossroads; c) Wilders Grove; d) SE Raleigh

"Distance" overgoals are responses that missed the NFPA 1710 1st-Due target because the closest station was too far away for a unit to be expected to arrive on-scene in under 4 minutes. These types of overgoal incidents indicate where there are existing gaps in station coverage, and where additional stations may be needed.

In order to warrant an additional station, areas with high distance overgoals should:

- Exhibit consistently late responses due to driving distance

- Cover a relatively wide geographic area, rather than being skewed by high-volume, isolated locations.

The analysis revealed a 4 locations that warranted closer inspection:

Location	Challenge	Conclusion
a) Neuse Crossroads	Despite its proximity to Station 22, Neuse Crossroads has limited ingress and a large network of residential roads, complicating emergency access.	This location represents a wide geographic area with systemic challenges due to driving distance. In order to arrive within the NFPA 1710 1st due target, a new station is required.
b) Wilders Grove	Wilders Grove is a high volume area located between Stations 7, 12, and 21, but is too far from any of these stations to expect a reasonable response time.	Because this location represents a wide geographic area with systemic challenges due to driving distance, in order to arrive within the NFPA 1710 1st due target, a new station is required.
c) SE Raleigh	The area between Stations 3, 10, and 12 is relatively high-volume, and responses are consistently late due to their distance from these stations.	Station 3 is being relocated SW of its current location, and will yield improved coverage in SE Raleigh. Once completed, this area should be re-evaluated to determine whether additional measures should be taken.
d) 3304 Glen Royal Ave	This Healing Transitions location is among the highest call volume locations for RFD annually, with almost exclusively EMS calls and assists. Due to its distance from stations, units cannot arrive in a timely manner.	Because this is an isolated location, it does not represent a systemic issue warranting an additional station. Instead, alternative approaches should be attempted, such as alternative response types or risk reduction strategies.

In conclusion, two areas within Raleigh would strongly benefit from the addition of a station: Neuse Crossroads and Wilders Grove.

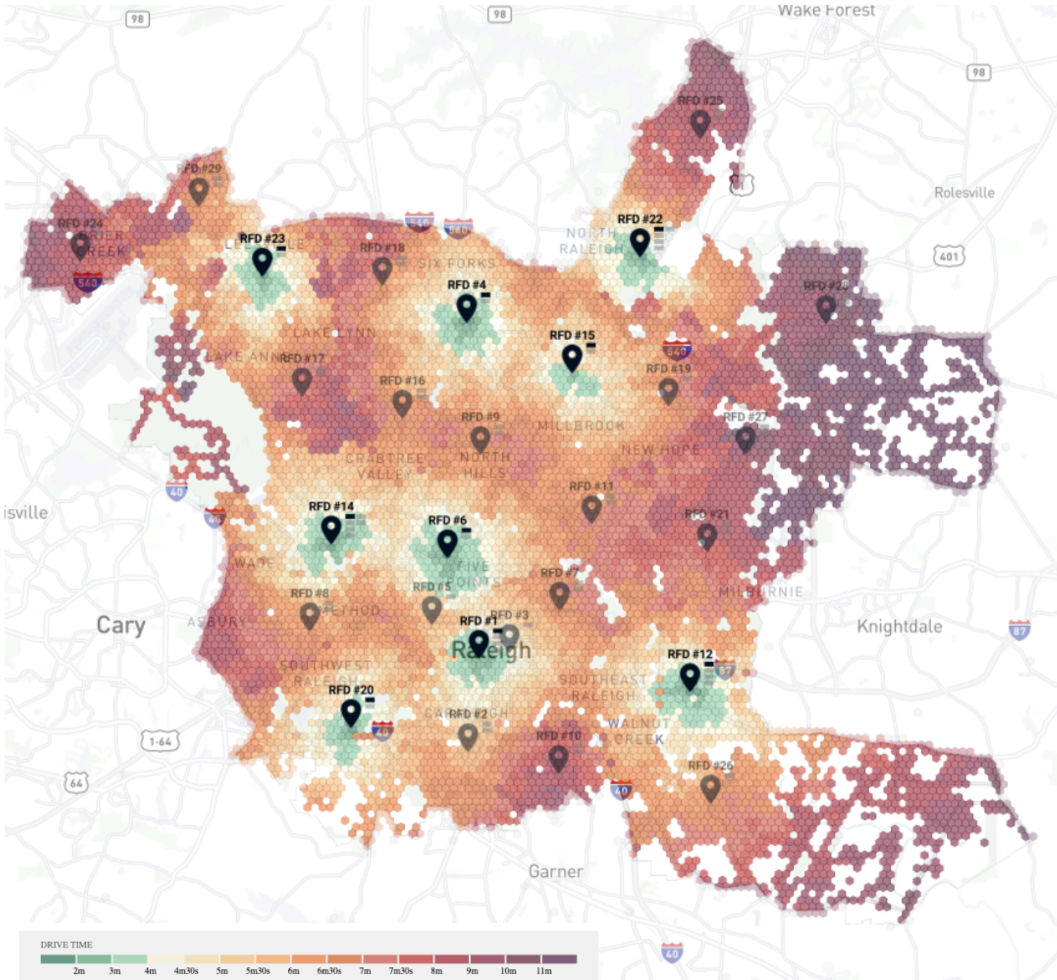
Operational Challenges and Support Services

EMS Dispatching and Workload

The Raleigh-Wake 9-1-1 Center is immediately sending/dispatching RFD to medical emergencies when emergency medical dispatch (EMD) is being utilized. Calls are managed through EMD, and if the call does not meet EMD protocol for a fire engine response, the RFD unit is canceled en route. This process elevates the call volume for RFD and presents situations where the dispatch is not making a meaningful difference to a patient.

Ladder Truck Deployment

The department faces a significant ladder truck coverage deficiency that impacts both routine operations and major incident response. With current limitations producing response times of 6 minutes and 5 seconds at the 90th percentile, coverage is inadequate for Raleigh's size and building complexity. This gap particularly affects aerial firefighting capabilities, high-rise rescue operations, and ventilation support during structure fires. In a large, rapidly growing city like Raleigh, ladder trucks—which are specialized for rescue operations, ventilation, and elevated fire suppression—must be able to respond quickly across the entire service area to ensure effective emergency response.



Modeled 90th percentile drive time for ladder trucks and their current position (2024)

The current deployment of ladder trucks results in long response times for these critical resources. Analysis shows that for a ladder truck to reach any incident in Raleigh, the expected travel time is up to 6 minutes and 5 seconds at the 90th percentile. This exceeds optimal response standards and leaves significant portions of the city without timely access to specialized rescue and aerial firefighting capabilities.

The lack of adequate ladder truck coverage has cascading effects on emergency operations:

- **Delayed Rescue Operations:** Without timely ladder truck arrival, rescue operations are delayed, potentially compromising victim survival

- **Compromised Firefighting Effectiveness:** Ladder trucks provide essential elevated water streams and ventilation capabilities that are critical for controlling structure fires

- **Resource Deployment Challenges:** The limited number of ladder trucks forces longer travel distances, reducing overall system resilience and requiring additional units to provide backup coverage

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Staffing Factor

The number of personnel needed to staff one 24/7 firefighting position, accounting for the number of shifts and time spent in absence.

Staffing Analysis and Human Resources

The department operates with a staffing factor of 3.63, falling below the industry minimum standard of 3.75. This metric, , indicates that RFD is understaffed relative to industry benchmarks. The practical impact manifests in a daily shortfall where the department aims for 152 personnel on duty per shift, but often operates with fewer firefighters available from the total pool of 184 per shift.

This staffing shortfall creates a costly cycle of overtime dependency, burnout risk, and coverage gaps that can only be addressed through expensive overtime assignments. The resulting stress on personnel not only affects operational effectiveness but also threatens long-term sustainability as burnout and injury-related leave create additional coverage challenges. The immediate need for 18 additional firefighters would bring RFD to the minimum industry standard, while the long-term goal of transitioning to 4 firefighters per engine company would align with NFPA 1710 recommendations and significantly improve operational effectiveness.

Support Services

Fleet maintenance capacity represents a critical constraint, with an understaffed maintenance division requiring outsourcing for repairs that could be managed in-house. This situation limits staff development opportunities due to excessive workload demands while increasing operational costs through external service contracts.

Training and professional development face similar challenges, with limited dedicated training staff struggling to provide adequate development opportunities amid high call volumes. The department needs specialized certification programs, particularly NFPA 1403 live-burn instructors, while addressing insufficient training capacity for a growing organization. Limited succession planning and career development programs compound recruitment challenges in an increasingly competitive employment market.

Additionally, the facilities themselves represent a constraint on the support services and training. The current RFD training facilities were originally constructed in the 1950's. Although it was upgraded in the 1980's with small additions thereafter, much of the current facilities are outdated and cannot support the needs of modern training and increased recruitment:

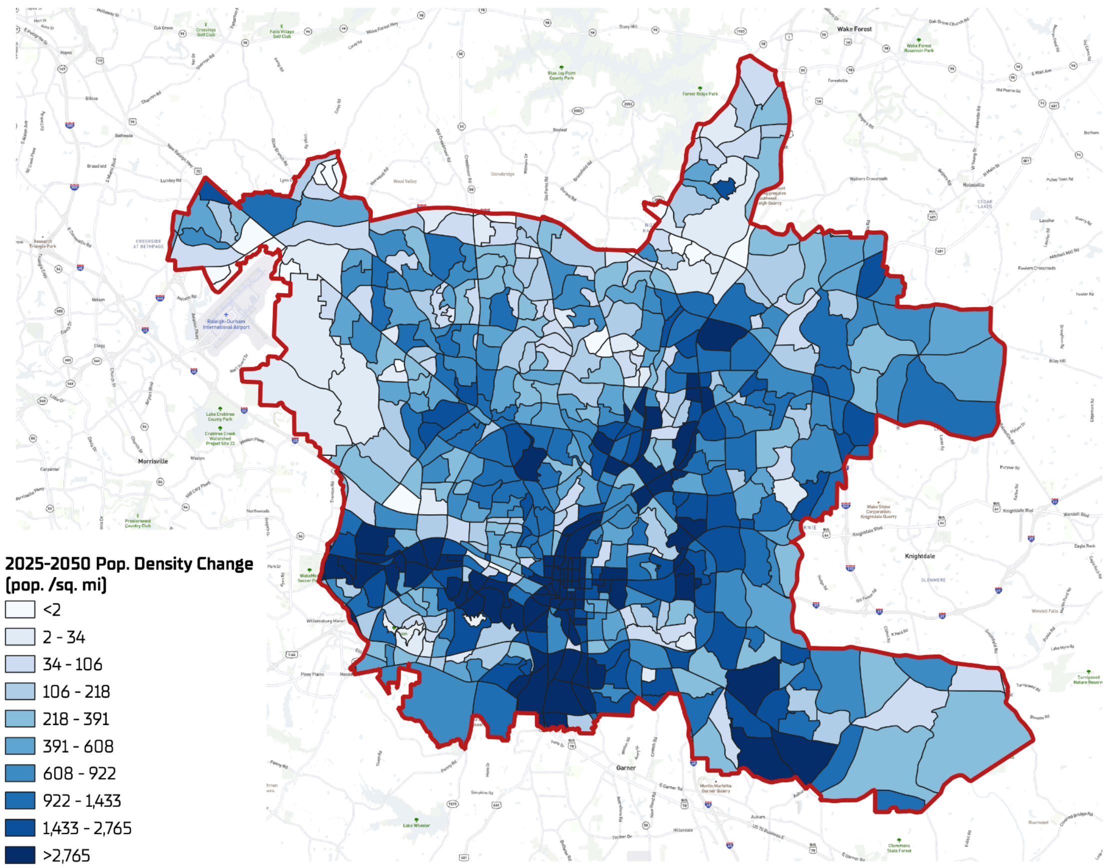
- The burn cells in the burning building are currently 12-15 years old and are due for replacement.
- Space constraints and scheduling have forced much of the academy training offsite, which has negatively impacted the instruction time for recruits as instructors have to transit from multiple locations.
- Consistency cannot be maintained, as the same off-site location may not be available year to year.

With respect to logistics and fleet maintenance, RFD has a robust parts and logistics program. However, the current facilities overflow into 14 Connex boxes and could strongly benefit from a larger space/warehouse. Additionally, RFD is current space-constrained with respect to its fleet. There is no suitable warehouse storage of USAR and HazMat resources, and all station bays are occupied. Numerous legacy stations have equipment stored outside; future facilities need to anticipate growth and the evolving mission of the fire department. Unused space should be built in to accommodate unknown future needs.

IV. Future State Analysis

Population Growth and Urban Development Projections

Raleigh's position as one of North America's fastest-growing metropolitan areas creates both opportunities and challenges for emergency service delivery. The city's current population of 499,825 residents is expected to continue growing at an annual rate of 1.16%, driven by economic diversification across technology, education, healthcare, and government sectors. This growth stems from Raleigh's role as the capital city and anchor of the Research Triangle region, making it an attractive destination for both businesses and residents seeking opportunities in a dynamic, innovation-focused economy.



Expected population density change from 2025-2050, by transportation analysis zone (TAZ).

Forecasting Methodology

Analyses of Raleigh's current call demand and expected population growth were conducted in order to effectively plan for the future. These analyses combine three data sources:

1. Population forecasts at the Transportation Analysis Zone (TAZ) level for all of Wake County, sourced from the NC Capital Area Metropolitan Planning Organization's 2050 Metropolitan Transport Plan (CAMPO MTP).
2. RFD's historical call volume for its most recent year of complete data (2024).
3. Historical call volume for Raleigh's neighbouring fire departments, sourced from the National Fire Incident Reporting System (NFIRS) open data library, in order to provide an expectation of call volume for areas outside of Raleigh's current service area boundary that may underggo voluntary annexation in the future.

Raleigh's call demand forecast was conducted by first calculating the baseline ratio between call demand and population at the TAZ level for 2024. Final call volume estimates were determined by applying the call volume ratio to the CAMPO MTP population forecasts for 2030, 2040, and 2050.

Raleigh's growth will occur through two primary mechanisms:

- **Annexations:** Voluntary incorporation of adjacent unincorporated areas
- **Densification:** Increased development intensity within existing city limits

Due to the unpredictable nature of voluntary annexations, future city limits were estimated to reflect the present Future Extraterritorial Jurisdiction (ETJ) boundary, representing the maximum potential growth through annexation.

Population Projections

Based on expected population growth and annexations, we project:

- Current population: Approximately 499,825 residents
- 2030 projection: Continued steady growth with increasing density
- 2050 projection: Substantial population increase driven by both annexation and densification

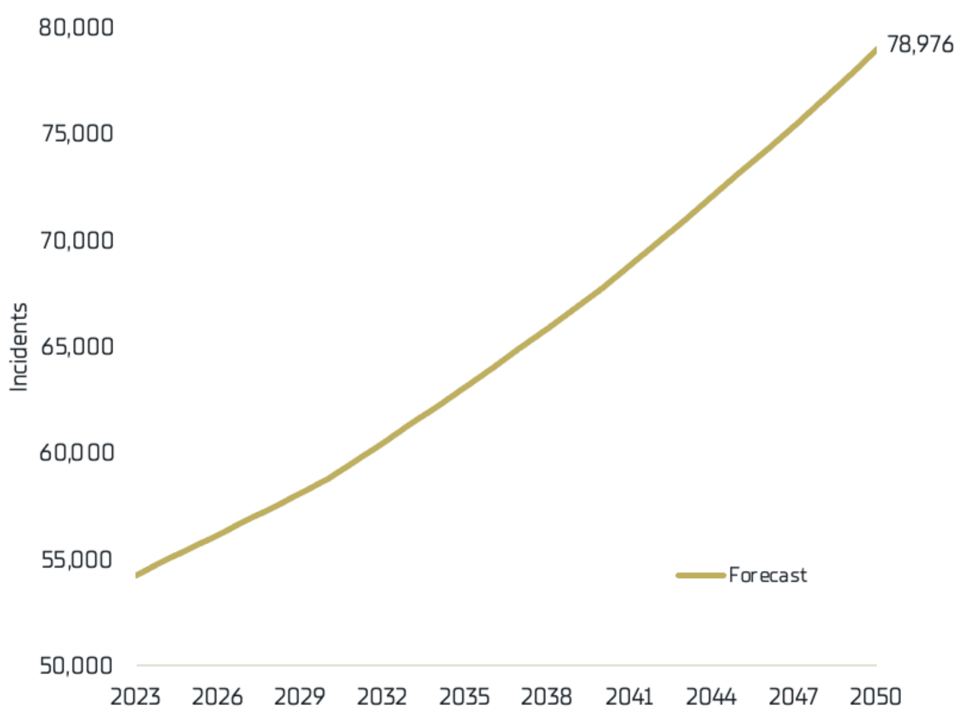
The city's growth pattern shows significant vertical development in Raleigh's core, coupled with expanding suburban development in outer regions. This dual growth pattern creates specific challenges for emergency service delivery.

Future Fire Service Call Demand Forecast

By 2050, Raleigh will experience tremendous growth in call volume, primarily attributed to densification and development within its current service area. Key projections include:

- Current call volume: Approximately 55,000 annual calls (2024)
- 2050 projection: Nearly 79,000 annual calls
- Growth rate: 46% increase over 25 years

This represents an average annual growth rate that will stress current resources and require strategic expansion of services.



Geographic Distribution of Future Demand

The demographic forecasting reveals development patterns that will significantly impact emergency service delivery. Urban core areas are experiencing significant vertical development and densification, with high-rise construction and mixed-use developments replacing lower-density structures. Simultaneously, suburban expansion continues in outer regions, creating sprawling residential communities that extend the geographic footprint requiring emergency coverage. This dual growth pattern of densification and expansion creates complex service delivery challenges, as higher-density areas generate increased call volumes while geographic expansion strains response time capabilities.

Three key growth areas have been identified:

- **Southwest Raleigh:** Areas west of Station 8, particularly around Asbury
- **Northeast expansion areas:** Potential annexation zones requiring new coverage
- **Southeast development:** Densification around Station 26 and potential annexation zones requiring additional coverage

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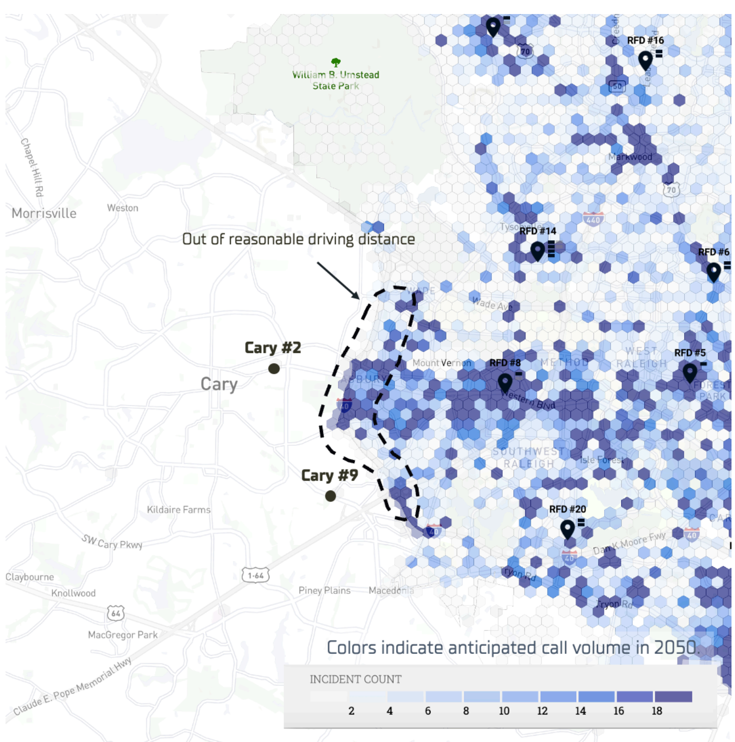
Significant Growth Areas

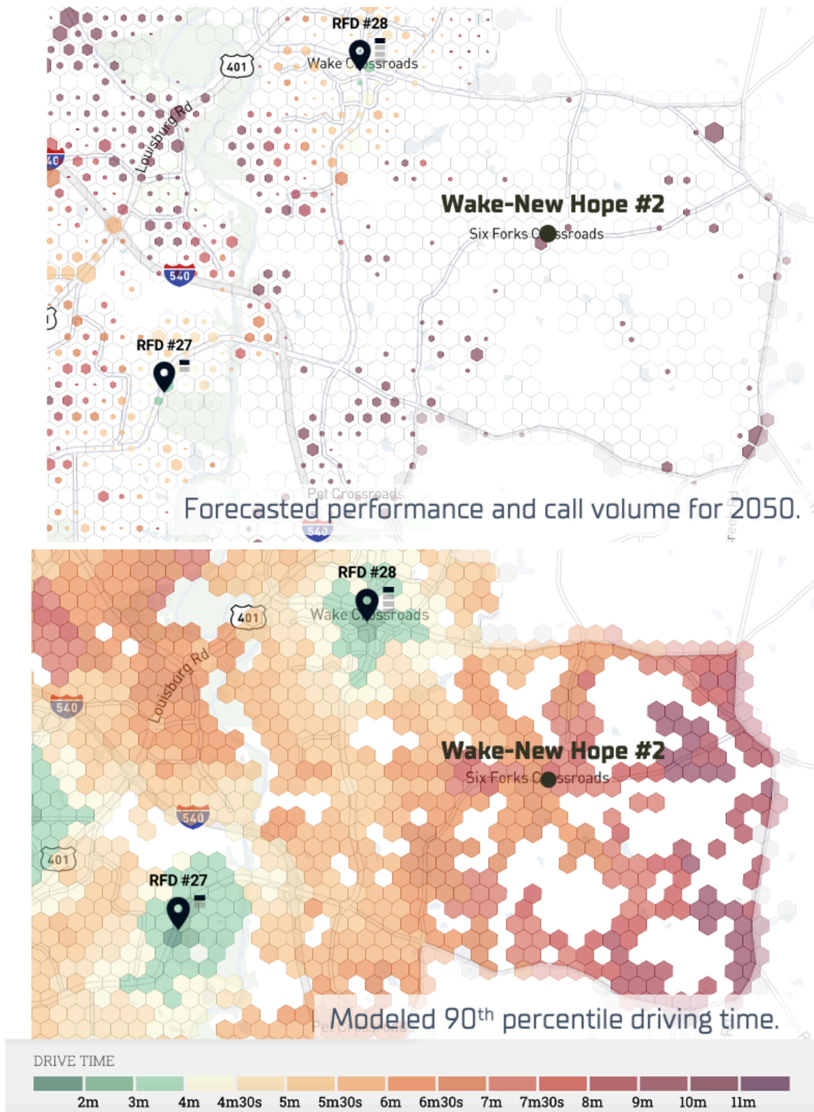
Southwest Raleigh (Asbury Area)

Southwest growth in the Asbury area, located west of Station 8, presents particular challenges due to projected call volume growth. This area is expected to experience tripling of call volume by 2050, driven by substantial residential and commercial development. The distance from existing stations places this growth area outside reasonable driving distance for optimal emergency response, necessitating either new station development or strategic partnerships with neighboring jurisdictions such as Cary Fire Department.



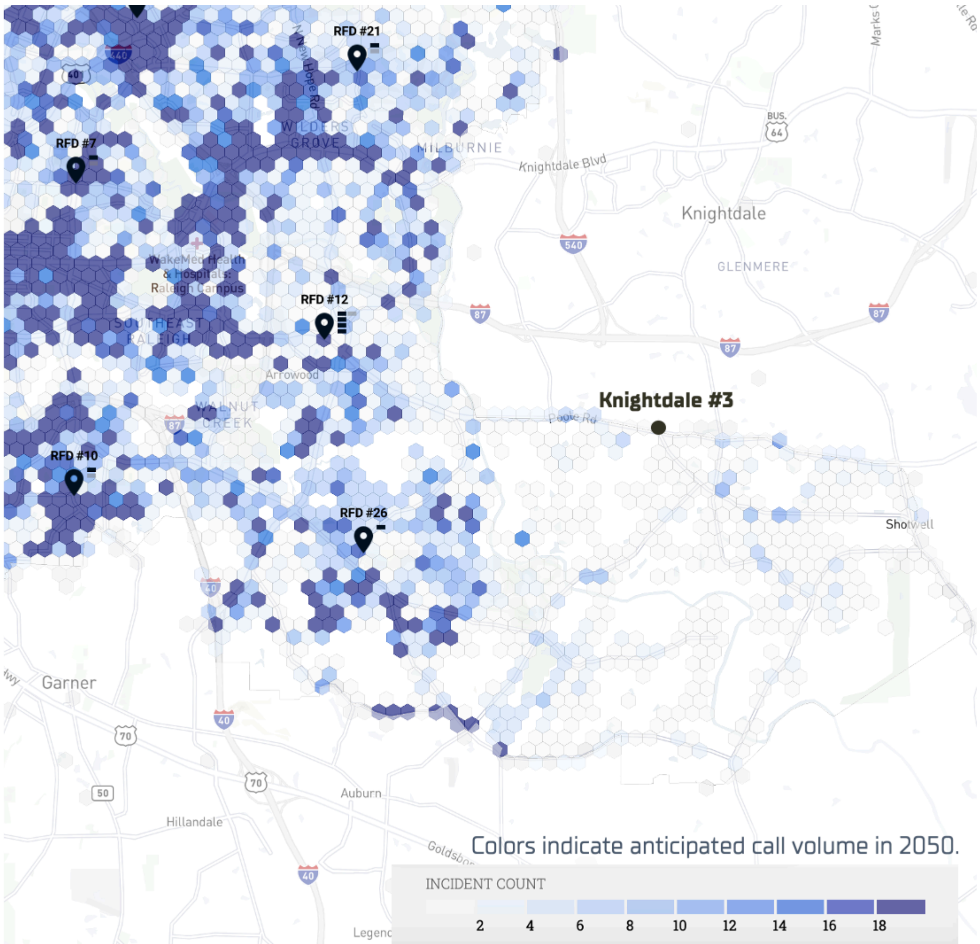
Northeast Special Study Area (NESSA)

The Northeast Special Study Area encompasses 8.5 square miles of potential annexation that is currently beyond reasonable driving distance from existing Raleigh stations. Travel times to this area exceed 6 minutes from current stations, creating coverage gaps that will require new infrastructure.



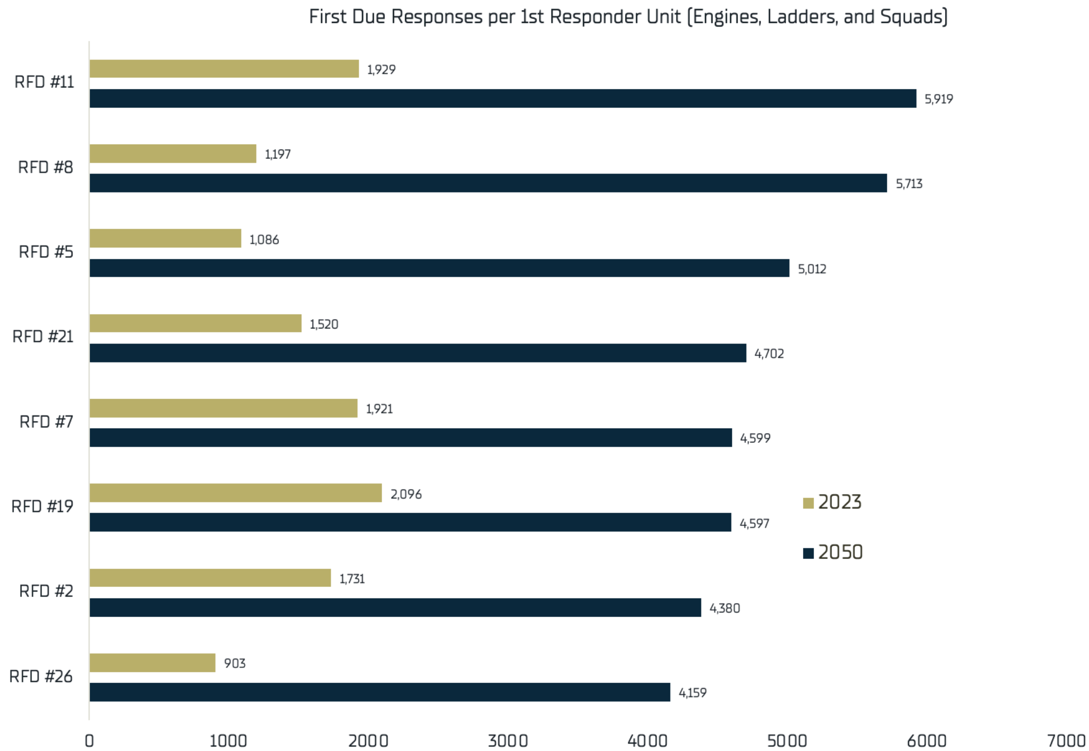
Southeast Special Study Area (SESSA)

The Southeast Special Study Area adds approximately 17.5 square miles of potential service area, though much development is expected to occur near existing Station 26. However, the Neuse River presents a geographic barrier that will limit Station 26's ability to serve the eastern portions of this expansion area effectively.



Station-Level Impact

Station-level impact analysis reveals that growth will not be uniformly distributed across the service area. Station 11 faces the highest potential demand city-wide by 2050, with projections showing growth from 1,929 calls in 2023 to 5,919 calls by 2050, representing a 206% increase that will fundamentally change operational demands. Station 8 is expected to see call volume grow from 1,197 to 5,713 incidents annually, a 377% increase driven primarily by southwestern development patterns. Station 5 is also projected to exceed 5,000 calls annually, while Station 26 will experience significant impacts from southeastern development. Other stations that are expected to experience significant growth are Stations 21, 7, 19, and 2.



These projections indicate that without strategic intervention, several stations will become severely overloaded, leading to degraded response performance and increased reliance on mutual aid or cross-staffing arrangements. The implications extend beyond simple call volume increases to encompass resource utilization, personnel fatigue, and equipment wear patterns that will require comprehensive operational adjustments.

Service Area Coverage Analysis

Current geographic coverage analysis reveals a well-distributed station network that adequately serves established neighborhoods within the existing city limits. However, gaps are emerging in growth corridors where development is outpacing infrastructure development. Response time analysis shows acceptable performance in core areas but degraded response capability in peripheral growth zones and critical gaps in identified expansion areas.

Modeling of the 2050 service area under current station configurations projects concerning performance trends. With existing stations only, first-due performance is expected to decline, with annual overgoal incidents reaching 14,289 and average drive times extending to 4 minutes and 39 seconds at the 90th percentile. These projections indicate that maintaining current infrastructure while accommodating growth will result in systematic degradation of emergency response capabilities.

Implementation of the recommended station plan would significantly improve these projections. The comprehensive infrastructure approach would achieve a performance improvement of 2.1% over the status quo scenario. Annual overgoal incidents would decrease to 13,882, a reduction of 407 late responses annually.

Scenario (2050 Demand, Future ETJ)	First Due	Overgoals	Drive Time (90th)	Low/Moderate ERF
Current Station Locations	53.43%	14,289	4:43	45.29%
Optimal moves + 4 Stations	54.43% **(+1.33%)**	13,882 **(-407)**	4:33 **(-0:06)**	47.49% **(+2.20%)**

Future State - Conclusion

The future state analysis reveals that while Raleigh faces significant challenges in maintaining service levels amid rapid growth, strategic planning and phased implementation of improvements can ensure continued excellence in fire and emergency services. The key to success lies in proactive infrastructure development, enhanced regional cooperation, and sustained investment in personnel and technology.

Success metrics for the future state include:

- Maintaining or improving NFPA 1710 compliance rates
- Achieving effective response force targets consistently
- Ensuring equitable service delivery across all areas
- Building sustainable financial models for long-term operations

The recommendations that follow will detail specific strategies to achieve these objectives while managing fiscal constraints and operational complexities.

V. Financial Forecast and Coordination

To inform strategic planning for fire station development, a comparative analysis of fire departments in peer jurisdictions was conducted between Raleigh, Charlotte, Durham, Greensboro, Virginia Beach, and Minneapolis. This benchmarking study evaluated a wide range of operational, financial, and planning practices related to fire station design, land acquisition, construction methods, and long-term facility management. The findings highlight both common strategies and notable variations in how municipalities approach fire station development in the context of growth, budget constraints, and evolving service demands.

Building on that comparative foundation, this section then presents a comprehensive cost modeling framework to support long-range decision-making by projecting the full life-cycle costs of fire station development—from initial construction through decades of operation and apparatus replacement. By aligning lessons learned from peer cities with Raleigh's internal data and projected growth patterns, the model provides a structured and scalable approach to planning future investments. This section is divided into key components, each representing a critical financial dimension of fire station planning:

- Staffing Models and Salary Projections: Detailed estimates of personnel costs for 13 station configurations, including escalation projections over 5, 10, and 25 years based on conservative, moderate, and aggressive growth scenarios.

- Battalion and Division Chief Expansion: Analysis of command staffing requirements based on NFPA-recommended span of control, including phased additions and long-term salary escalation impacts.

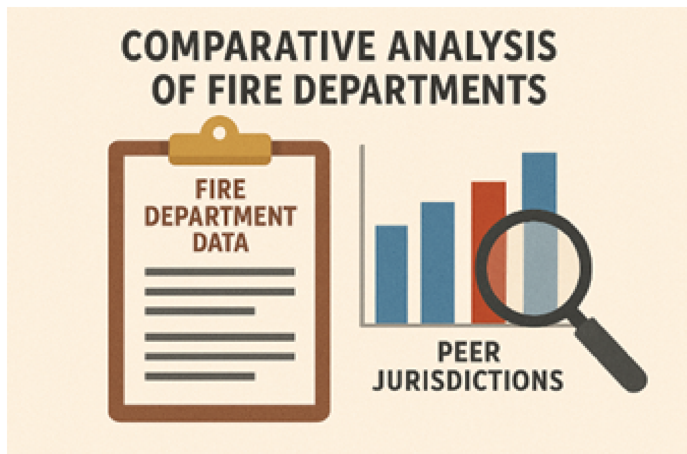
- Fire Apparatus Replacement Planning: A 25-year apparatus replacement model built on NFPA life cycle standards, with annual cost escalation and funding through the Equipment Usage Charge model.

- Fire Station Operating Costs: Review of historical operating costs from existing Raleigh fire stations, identifying key drivers such as square footage, construction type, utility usage, insurance premiums, and maintenance expenses. This data serves as the foundation for projecting future operating costs under varying economic conditions.

- New Station Construction Cost Forecasting: Development of a total construction cost model based on current per-square-foot costs and industry-standard multipliers for general conditions, contingency, design fees, and furnishings. A 25-year forecast is included using a structured escalation rate.

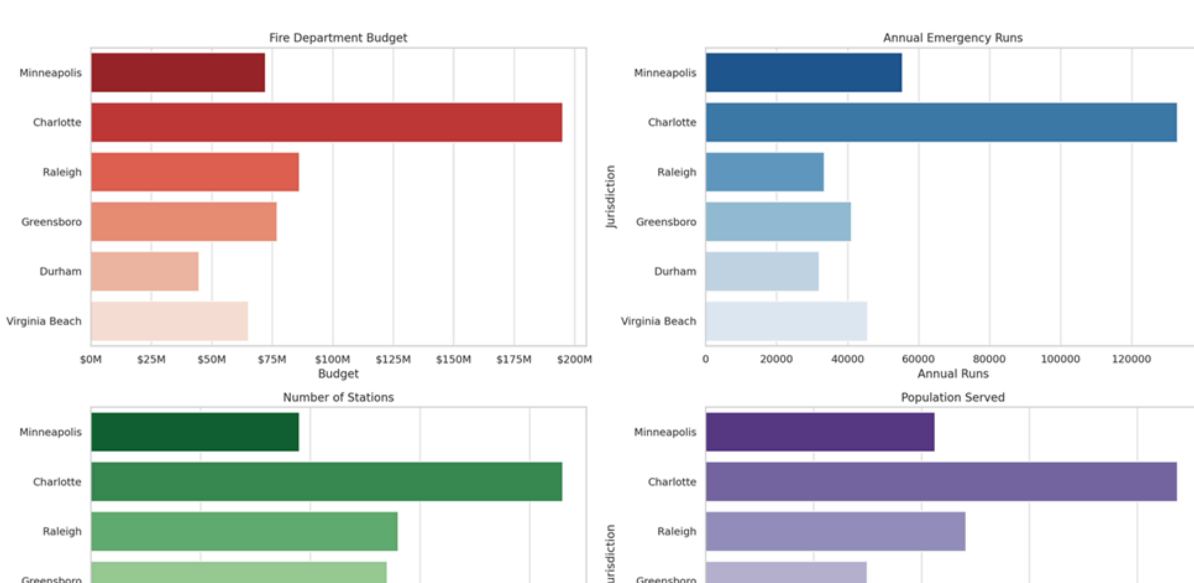
- Cost Growth Assumptions: Each major cost category includes projections under conservative (3%), moderate (5%), and high (7%) annual escalation scenarios to help the City plan under different fiscal and economic conditions.

Jurisdiction Surveys



The project entailed conducting an analysis of the fire station development and construction process of the Raleigh Fire Department compared to five other similarly situated communities. A questionnaire was developed to seek input from other departments related to financial cost modeling, land acquisition, development design, construction, timing and phasing, certificate of occupancy and completion. The surveys were sent out to seventeen jurisdictions around the country, of which five provided responses through either the questionnaire or direct conversation. These were the cities of Charlotte, NC, Durham, NC, Greensboro, NC, Virginia Beach, VA and Minneapolis, MN.

The City of Raleigh Fire Department can be compared to fire departments in Minneapolis, Greensboro, and Virginia Beach based on key operational metrics such as population, budget, service area, and emergency response workload. Each of these cities shares enough similarities with Raleigh to serve as meaningful benchmarks.



Key observations are presented below, and a full description of each department's methodology can be found in Section VII. Appendices.

Summary

Raleigh's approach to fire station construction follows a structured and methodical process, ensuring compliance with regulations and maintaining cost efficiency. The city employs multiple project management methods, including Design-Bid-Build, Design-Build, and CMAR, selecting the most appropriate based on project complexity.

The city's construction timeline extends over five years, incorporating extensive feasibility studies, land selection, permitting, design, and construction phases. Compared to other municipalities, where fire station projects can be completed in two to three years, Raleigh's thorough planning process ensures long-term sustainability but may also contribute to delays.

In terms of land acquisition, Raleigh requires a minimum of three acres for fire station sites, ensuring operational efficiency and space for future expansion. Unlike Greensboro and Charlotte, which secure land years in advance, Raleigh waits until funding is authorized before purchasing property. While this approach ensures fiscal responsibility, it may also limit site availability and lead to higher acquisition costs over time.

Raleigh maintains a strong commitment to sustainability by mandating LEED Silver certification for fire stations over 10,000 square feet and embracing net-zero energy initiatives. This aligns with the city's broader sustainability goals and positions Raleigh as a leader in energy-efficient fire station design alongside Charlotte and Durham. However, Raleigh differs from cities such as Greensboro and Virginia Beach, which implement energy-saving practices in all fire stations without size-based thresholds.

The station design process in Raleigh is managed by a Division Chief who works directly with engineers. Unlike Charlotte and Greensboro, where firefighter committees play an active role in the design process, Raleigh's approach does not formally include firefighter input. While this streamlined approach ensures efficiency, it may miss valuable insights from personnel who will operate in the facilities.

Regarding fire station layout and functionality, Raleigh does not employ standardized prototype station designs, instead opting for flexibility in each station's layout. Cities such as Charlotte and Greensboro use standardized designs to streamline construction and lower costs, which could be a consideration for Raleigh moving forward. Additionally, Raleigh does not require community rooms in fire stations, whereas cities like Virginia Beach and Greensboro integrate community spaces into their designs to foster public engagement.

Raleigh does not currently co-locate fire stations with EMS or other agencies, maintaining dedicated fire department facilities. In contrast, cities such as Greensboro and Minneapolis have embraced co-location to optimize resource sharing and improve emergency response coordination. While Raleigh's standalone approach ensures that fire operations remain independent, exploring co-location opportunities could enhance operational efficiency and cost savings.

To strengthen its fire station construction strategy, Raleigh may benefit from adopting a more proactive land acquisition policy, similar to Greensboro and Charlotte, to reduce acquisition costs and secure optimal locations ahead of time. Additionally, refining the project timeline to streamline pre-construction phases could accelerate project delivery while maintaining regulatory compliance. Including firefighter input in the design process, implementing standardized prototype designs, and exploring co-location opportunities with EMS could further enhance efficiency, functionality, and cost-effectiveness. Maintaining Raleigh's commitment to sustainability by continuing net-zero energy initiatives and potentially expanding contingency funding based on project complexity will ensure long-term operational success.

By incorporating these strategic refinements, Raleigh can enhance its fire station construction approach, balancing cost, quality, and efficiency while maintaining long-term sustainability and public safety excellence.

Development of Financial Models

As the City of Raleigh continues to grow and expand through annexation, it is prudent for the Raleigh Fire Department (RFD) to proactively plan for the operational and personnel-related costs associated with establishing new fire stations. Ensuring adequate fire protection and emergency response in newly annexed areas requires a broad cost analysis that accounts for both station operation expenses and staffing requirements.

This section provides reasonable cost estimates for future fire station operations, including utilities, maintenance, insurance, and personnel salaries, based on recent financial data from existing stations. By analyzing these costs and considering projected budgetary impacts, this analysis will offer data-driven recommendations for optimizing resource allocation in future station planning.

Additionally, as Raleigh's geographic footprint expands, administrative capabilities within the RFD must also evolve to manage increased operational complexity. The Battalion and Division Chief analysis will explore potential administrative enhancements necessary to support new fire stations, including command structure adjustments, that ensure efficient emergency response and station administration across all areas.

Analysis of Staffing Costs

The chart *13 Station Configurations* presents 13 different fire station configurations utilized by the Raleigh Fire Department, each with specific apparatus assignments and associated staffing levels. The columns represent various station setups that include different combinations of engines, ladders, squads, rescues, hazmat units, and command positions such as battalion chiefs, division chiefs, and safety officers.

Key features of the chart include station apparatus/resource configurations and staffing levels:

Fire Station Configurations:

- Each column (A–M) represents a unique combination of firefighting and emergency response units.
- Apparatus types include Engines, Ladders, Rescues, Squads, HazMat, Water Rescue, Air, and Mini pumper units.
- Command roles such as Battalion Chiefs, Division Chiefs, and Safety Officers appear in select configurations.

Staffing Levels (These are actual assigned staff, not daily on-duty staffing):

- Firefighters: Ranges from 0 to 6 per configuration.
- Senior Firefighters: Varies between 6 and 15 per configuration.
- Lieutenants & Captains: Generally assigned in groups of 3 or 6.
- Battalion Chiefs: Assigned in specific station setups, with some configurations having 3.
- Division Chiefs: Appear in only one configuration.
- Safety Officers[3]: Assigned in one specific station set-up, with a configuration of 3.

[3] Safety Officers are compensated at a Captain's rate.

A		B		C		D	
Engine		Engine		Engine		Engine	
		Engine		Ladder		Rescue	
Staffing Levels	#		#		#		#
Firefighters	3	Firefighters	6	Firefighters	6	Firefighters	3
Senior Firefighters	9	Senior Firefighters	12	Senior Firefighters	12	Senior Firefighters	12
Lieutenants	3	Lieutenants	6	Lieutenants	6	Lieutenants	6
Captains	3	Captains	6	Captains	6	Captains	6
Battalion Chiefs		Battalion Chiefs		Battalion Chiefs		Battalion Chiefs	
Division Chiefs		Division Chiefs		Division Chiefs		Division Chiefs	
Safety Officer		Safety Officer		Safety Officer		Safety Officer	

E		F		G		H	
Engine		Squad		Engine		Engine	
HazMat		Mini		Battalion Chief		Air	
	#		#		#		#
Firefighters	0	Firefighters	0	Firefighters	3	Firefighters	3
Senior Firefighters	9	Senior Firefighters	9	Senior Firefighters	6	Senior Firefighters	6
Lieutenants	3	Lieutenants	3	Lieutenants	3	Lieutenants	3
Captains	3	Captains	3	Captains	3	Captains	3
Battalion Chiefs		Battalion Chiefs		Battalion Chiefs	3	Battalion Chiefs	
Division Chiefs		Division Chiefs		Division Chiefs		Division Chiefs	
Safety Officer		Safety Officer		Safety Officer		Safety Officer	

I		J		K		L	
Engine		Engine		Engine		Engine	
Water Rescue		Air		Ladder		Ladder	
		Mini		Battalion Chief		HazMat	
				Division Chief		Battalion Chief	
	#		#		#		#
Firefighters	0	Firefighters	3	Firefighters	6	Firefighters	3
Senior Firefighters	9	Senior Firefighters	6	Senior Firefighters	15	Senior Firefighters	12
Lieutenants	3	Lieutenants	3	Lieutenants	6	Lieutenants	6
Captains	3	Captains	3	Captains	6	Captains	6
Battalion Chiefs		Battalion Chiefs		Battalion Chiefs	3	Battalion Chiefs	3
Division Chiefs		Division Chiefs		Division Chiefs	3	Division Chiefs	
Safety Officer		Safety Officer		Safety Officer		Safety Officer	

M	
Squad	
Mini	
Ladder	
Battalion Chief	
Safety Officer	
	#
Firefighters	3
Senior Firefighters	9
Lieutenants	6
Captains	6
Battalion Chiefs	3
Division Chiefs	
Safety Officer	3

13 Station Configurations with Apparatus and Staffing

Salary Escalation

Using the *City of Raleigh 2025 "Compensation and Benefits"* plan, the midpoint salaries for each staffing level (Firefighters, Senior Firefighters, Lieutenants, Captains, Battalion Chiefs, Division Chiefs, and Safety Officers) were applied to the respective personnel counts in each of the 13 fire station configurations. This provided a baseline annual salary cost for each station setup.

Using the fire station configurations and staffing levels outlined, salary costs, at the midpoint range, were estimated for each station type.

A		Employee Cost
Engine		
Staffing Levels	#	
Firefighters	3	$198,264
Senior Firefighters	9	$630,648
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$1,380,857

B		Employee Cost
Engine		
Engine		
	#	
Firefighters	6	$396,528
Senior Firefighters	12	$840,864
Lieutenants	6	$489,348
Captains	6	$574,542
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$2,301,282

C		Employee Cost
Engine		
Ladder		
	#	
Firefighters	6	$396,528
Senior Firefighters	12	$840,864
Lieutenants	6	$489,348
Captains	6	$574,542
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$2,301,282

D		Employee Cost
Engine		
Rescue		
	#	
Firefighters	3	$198,264
Senior Firefighters	12	$840,864
Lieutenants	6	$489,348
Captains	6	$574,542
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$2,103,018

E		Employee Cost
Engine		
HazMat		
	#	
Firefighters	0	$0
Senior Firefighters	9	$630,648
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs	0	$0
Division Chiefs	0	$0
Safety Officer		
Total Cost		$1,162,593

F		Employee Cost
Squad		
Mini		
	#	
Firefighters	0	$0
Senior Firefighters	9	$630,648
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$1,162,593

G		Employee Cost
Engine		
Battalion Chief		
	#	
Firefighters	3	$198,264
Senior Firefighters	6	$420,432
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs	3	$336,648
Division Chiefs		$0
Safety Officer		
Total Cost		$1,487,289

H		Employee Cost
Engine		
Air		
	#	
Firefighters	3	$198,264
Senior Firefighters	6	$420,432
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$1,150,641

I		Employee Cost
Engine		
Water Rescue		
	#	
Firefighters	0	$0
Senior Firefighters	9	$630,648
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$1,162,593

J		Employee Cost
Engine		
Air		
Mini		
	#	
Firefighters	3	$198,264
Senior Firefighters	6	$420,432
Lieutenants	3	$244,674
Captains	3	$287,271
Battalion Chiefs		$0
Division Chiefs		$0
Safety Officer		
Total Cost		$1,150,641

K		Employee Cost
Engine		
Ladder		
Battalion Chief		
Division Chief		
	#	
Firefighters	6	$396,528
Senior Firefighters	15	$1,051,080
Lieutenants	6	$489,348
Captains	6	$574,542
Battalion Chiefs	3	$336,648
Division Chiefs	3	$373,944
Safety Officer		
Total Cost		$3,222,090

L		Employee Cost
Engine		
Ladder		
HazMat		
Battalion Chief		
	#	
Firefighters	3	$198,264
Senior Firefighters	12	$840,864
Lieutenants	6	$489,348
Captains	6	$574,542
Battalion Chiefs	3	$336,648
Division Chiefs		$0
Safety Officer		
Total Cost		$2,439,666

M		Employee Cost
Squad		
Mini		
Ladder		
Battalion Chief		
Safety Officer		
	#	
Firefighters	3	$198,264
Senior Firefighters	9	$630,648
Lieutenants	6	$489,348
Captains	6	$574,542
Battalion Chiefs	3	$336,648
Division Chiefs		$0
Safety Officer	3	$287,271
Total Cost		$2,516,721

Station Configurations with Apparatus and Staffing

Explanation of growth percentages considered:

A reasonable percentage escalation figure to use for projecting salary growth for the Raleigh Fire Department (RFD) should account for factors such as:

- Historical Salary Increases – Reviewing past raises for firefighters in Raleigh.
- Cost of Living Adjustments (COLA) – Based on inflation and market conditions.
- Budget Trends – Firefighter salaries may increase based on city budget increases.
- Regional & National Trends – Comparing salary growth with other North Carolina fire departments and major cities.

Salary growth estimates considered for these projections:

- <u>Conservative Growth</u>: 3% annually (aligns with standard COLA and controlled city budget expansion.)
- <u>Moderate Growth</u>: 5% annually (includes COLA + potential competitive adjustments.)
- <u>High Growth</u>: 7% annually (accounts for aggressive wage increases due to market demands or recruitment challenges.)

Justification basis for these growth rates:

- In recent years, firefighter salary adjustments in North Carolina have ranged from 3% to 7% annually, depending on the economic climate and budget allocations.
- Inflation rates have averaged 2.5%–4% annually in recent years, influencing COLA increases.
- Other North Carolina municipalities (Charlotte, Durham, Greensboro, etc.) have implemented salary increases in the 3%–6% range to maintain competitive pay and retain skilled firefighters.
- Retention efforts may push salary growth toward the higher end of this range to attract and retain personnel.

Building on the fire station configurations and staffing levels outlined, salary projections were integrated to estimate long-term budget impacts. The salary projections were based on costs escalated at the three growth estimates (3, 5 & 7%), at the 5, 10 and 25-year marks for each of the 13 station configurations shown in the following charts. A staffing factor of 0.25 per position was added to account for vacancy costs.

3.00%	5 Years	10 Years	25 Years
A	$1,972,008	$2,286,098	$3,561,665
B	$3,334,771	$3,865,913	$6,022,967
C	$3,334,771	$3,865,913	$6,022,967
D	$3,047,468	$3,532,850	$5,504,066
E	$1,684,705	$1,953,035	$3,042,764
F	$1,684,705	$1,953,035	$3,042,764
G	$2,155,219	$2,498,490	$3,892,566
H	$1,667,385	$1,932,957	$3,011,483
I	$1,684,705	$1,953,035	$3,042,764
J	$1,667,385	$1,932,957	$3,011,483
K	$4,669,107	$5,412,774	$8,432,926
L	$3,535,302	$4,098,384	$6,385,149
M	$3,646,962	$4,227,828	$6,586,819

Future Estimated Staffing Costs at 3%

5.00%	5 Years	10 Years	25 Years
A	$2,171,046	$2,770,866	$5,760,431
B	$3,671,355	$4,685,682	$9,741,197
C	$3,671,355	$4,685,682	$9,741,197
D	$3,355,054	$4,281,993	$8,901,957
E	$1,854,745	$2,367,177	$4,921,191
F	$1,854,745	$2,367,177	$4,921,191
G	$2,372,749	$3,028,296	$6,295,611
H	$1,835,677	$2,342,841	$4,870,599
I	$1,854,745	$2,367,177	$4,921,191
J	$1,835,677	$2,342,841	$4,870,599
K	$5,140,368	$6,560,556	$13,638,925
L	$3,892,126	$4,967,449	$10,326,969
M	$4,015,056	$5,124,342	$10,653,138

Future Estimated Staffing Costs at 5%

7.00%	5 Years	10 Years	25 Years
A	$2,385,840	$3,346,265	$9,232,450
B	$4,034,584	$5,658,713	$15,612,566
C	$4,034,584	$5,658,713	$15,612,566
D	$3,686,989	$5,171,193	$14,267,486
E	$2,038,246	$2,858,745	$7,887,369
F	$2,038,246	$2,858,745	$7,887,369
G	$2,607,500	$3,657,153	$10,090,201
H	$2,017,292	$2,829,356	$7,806,283
I	$2,038,246	$2,858,745	$7,887,369
J	$2,017,292	$2,829,356	$7,806,283
K	$5,648,935	$7,922,923	$21,859,596
L	$4,277,197	$5,998,990	$16,551,404
M	$4,412,289	$6,188,464	$17,074,167

Future Estimated Staffing Costs at 7%

Additional Battalion Chief Needs

An analysis of RFD's call volumes indicates that none of their five Battalion Chiefs (BCs) are overextended, with each handling a workload that is proportional to their responsibilities and geographic areas.

2024 Call Volume by Battalion Chief:

- BC 1: Handled 171 emergency calls, primarily serving the northeast portion of the city.
- BC 2: Managed 269 emergency calls, covering the southeast portion.
- BC 3: Responded to 278 emergency calls, serving the southwest portion.
- BC 4: Answered 168 emergency calls, primarily covering the northwest portion.
- BC 5: Processed 397 emergency calls while serving the central portion of the city.

Observations:

- <u>Balanced Workload:</u> Each Battalion Chief is operating within a manageable call volume. The distribution of calls aligns with their regional responsibilities, ensuring that no BC is overwhelmed by the number of service requests.

  The current operational structure enables a balanced distribution of emergency call responses among the Battalion Chiefs. While BC 5 shows a higher call volume, this is a deliberate outcome of their expanded role in supporting all neighboring districts. Overall, the department's approach ensures effective emergency management and regional coordination across Raleigh.

- <u>Geographic Coverage and Coordination:</u> BC 1, BC 2, BC 3, and BC 4 are each primarily responsible for their respective quadrants of the city: northeast, southeast, southwest, and northwest, and their neighboring quadrants. BC 5 not only covers the central portion of the city but also provides cross-support by answering emergency calls for all of the other four BCs. These additional response responsibilities account for BC 5's higher call volume compared to the others.

Proposed Phased Expansion of Battalion Chiefs

Currently, RFD operates 29 fire stations under the leadership of five battalion chiefs, averaging approximately 5.8 stations per chief. According to NFPA and industry standards, the recommended span of control for battalion chiefs ranges between three and five stations. To ensure this does not exceed five stations per battalion chief, it is recommended that staffing adjustments be made.

Under a strict five-station maximum, five battalion chiefs can effectively manage up to 25 stations. However, with 29 stations currently in operation, the department exceeds this threshold and should plan to expand its battalion chief ranks by adding one additional position. With this adjustment, six battalion chiefs would be able to manage up to 30 stations (30 ÷ 6 = 5). Once a 31st station becomes operational, an additional battalion chief position should be added. <u>This approach should continue incrementally, with an additional battalion chief for every five new stations.</u>

To align leadership with station growth, the following phased approach is recommended:

- <u>First Additional Battalion Chief Position</u>: Hiring should occur as soon as funding allows. With this addition, the department will have six battalion chiefs, maintaining the recommended span of control for up to 30 stations.

- <u>Second Additional Battalion Chief Position:</u> This position should be filled when an additional station increases the total to more than 30. With seven battalion chiefs, the department will be equipped to manage up to 35 stations, maintaining the five-station span of control.

Cost of Additional Battalion Chief Positions Through Year 25

Under Raleigh's current three-shift schedule, filling one battalion chief position requires hiring three personnel. The initial 2025 annual salary for a battalion chief is projected to be $112,216, bringing the total cost per position to $336,648. Factoring in an annual salary escalation rate of 5% and staffing factor of 0.25 per position from 2025 onward, the estimated costs of additional battalion chief positions was projected accordingly. Annual costs for one Battalion chief position at the 3% and 7% escalation rates are also shown below (including staffing factor).

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	% Increase	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Battalion Chief x3	$364,702	$375,643	$386,912	$398,520	$410,475	$422,790	$435,473	$448,537	$461,994	$475,853	$490,129	$504,833

	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Battalion Chief x3	$519,978	$535,577	$551,644	$568,194	$585,240	$602,797	$620,881	$639,507	$658,692	$678,453	$698,807	$719,771	$741,364	$763,605

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	% Increase	**5.0%**	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Battalion Chief x3	$364,702	$382,937	$402,084	$422,188	$443,298	$465,462	$488,736	$513,172	$538,831	$565,773	$594,061	$623,764

	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Battalion Chief x3	$654,952	$687,700	$722,085	$758,189	$796,099	$835,904	$877,699	$921,584	$967,663	$1,016,046	$1,066,848	$1,120,191	$1,176,200	$1,235,010

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	% Increase	**7.0%**	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Battalion Chief x3	$364,702	$390,231	$417,547	$446,776	$478,050	$511,513	$547,319	$585,632	$626,626	$670,490	$717,424	$767,644

	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Battalion Chief x3	$821,379	$878,875	$940,397	$1,006,224	$1,076,660	$1,152,026	$1,232,668	$1,318,955	$1,411,282	$1,510,071	$1,615,776	$1,728,881	$1,849,902	$1,979,396

25 Year Cost Escalation for Battalion Chief Positions at 3%, 5% and 7% Respectively

Division Chief Positions in the Raleigh Fire Department

The RFD currently has three Division Chief positions. Two of these are administrative roles, staffed Monday through Friday, overseeing departmental training, facilities, apparatus, and equipment management. The third position is responsible for the department's operational force, which is structured into battalions. Each battalion consists of approximately five fire stations and one battalion chief. This operational Division Chief is a duty shift position, requiring three personnel to staff it 24/7.

Recommended Expansion of Division Chief Positions

In accordance with NFPA and industry standards, the recommended span of control is five direct reports per supervisor. The current structure, where one Division Chief oversees five Battalion Chiefs, meets this standard. However, with the planned addition of an extra Battalion Chief position, the span of control will exceed the recommended limit. To maintain an effective management structure, an additional Division Chief position is recommended. This new position would provide oversight for up to five additional battalions, ensuring the desired span of control remains intact until the department surpasses 50 total stations.

When a second operational Division Chief is added, it is recommended that their responsibilities be divided geographically, either into north/south or east/west regions. This regional division would improve oversight efficiency, enhance incident coordination, and provide a clear command structure for emergency response operations.

Cost Considerations for Additional Division Chiefs

Under Raleigh's current three-shift schedule, filling one operational Division Chief position requires hiring three personnel. The initial projected 2025 annual salary for a Division Chief is $124,648, resulting in a total cost of $373,944 per position. With an estimated annual salary escalation rate of 3, 5 and 7% from 2025 onward, along with a 0.25 staffing factor per position, the long-term financial impacts of additional Division Chief positions was projected.

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	% Increase	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Division Chief x3	$405,106	$417,259	$429,777	$442,670	$455,950	$469,629	$483,718	$498,229	$513,176	$528,571	$544,429	$560,761

	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Division Chief x3	$577,584	$594,912	$612,759	$631,142	$650,076	$669,578	$689,666	$710,356	$731,666	$753,616	$776,225	$799,512	$823,497	$848,202

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	% Increase	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Division Chief x3	$405,106	$425,361	$446,629	$468,961	$492,409	$517,029	$542,881	$570,025	$598,526	$628,452	$659,875	$692,869

	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Division Chief x3	$727,512	$763,888	$802,082	$842,186	$884,296	$928,510	$974,936	$1,023,683	$1,074,867	$1,128,610	$1,185,041	$1,244,293	$1,306,507	$1,371,833

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	% Increase	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Division Chief x3	$405,106	$433,463	$463,806	$496,272	$531,011	$568,182	$607,955	$650,512	$696,048	$744,771	$796,905	$852,688

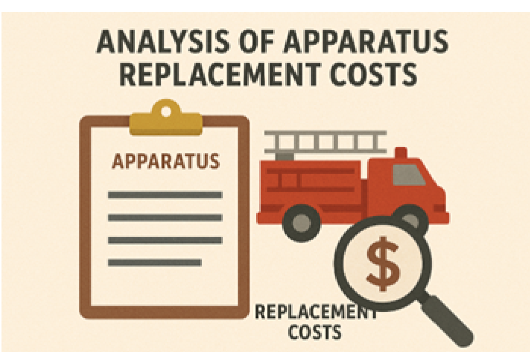
	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Division Chief x3	$912,376	$976,243	$1,044,580	$1,117,700	$1,195,939	$1,279,655	$1,369,231	$1,465,077	$1,567,632	$1,677,367	$1,794,782	$1,920,417	$2,054,846	$2,198,686

25 Year Cost Escalation for Division Chief Positions at 3%, 5% and 7% Respectively.

Apparatus Replacement Costs

At the beginning of Fiscal Year 2024, the Raleigh Fire Department collaborated with the City's Budget and Management Services to perform an in-depth review of its fleet acquisition and maintenance strategy. This initiative aimed to evaluate the department's existing fire apparatus inventory and to determine whether its replacement cycle aligned with national standards and operational demands. Leveraging detailed data on vehicle age, mileage, engine hours, and repair expenditures, the evaluation led to the creation of a new apparatus replacement model grounded in data and operational sustainability.

The assessment found that 65% of the department's fleet, which consisted of 55 active vehicles, including 37 engines and 10 ladders, was considered beyond its recommended service life. Eighteen vehicles that should have been relegated to reserve status were still in frontline service, while another eighteen had clearly reached the end of their lifecycle and were eligible for retirement. The reserve fleet was also in poor shape, with ten of eleven vehicles meeting the criteria for decommissioning.



This long range plan develops a new apparatus replacement program that looks not just to the next decade but extends through 2050. This comprehensive 25-year plan is built upon the foundation of the Fire Fleet Study Project FY2025's 10-year model that scheduled 39 vehicle replacements through FY2034, typically following a cadence of replacing three engines and one ladder truck annually. That shorter plan introduced a steadier and more predictable replacement pattern, modestly accelerating the pace between FY2025 and FY2028 to ensure continued operational capacity. It relied on the Equipment Usage Charge fund for financing, distributing a vehicle's replacement costs across five years and applying a 4% annual cost escalation to reflect inflation and market conditions.

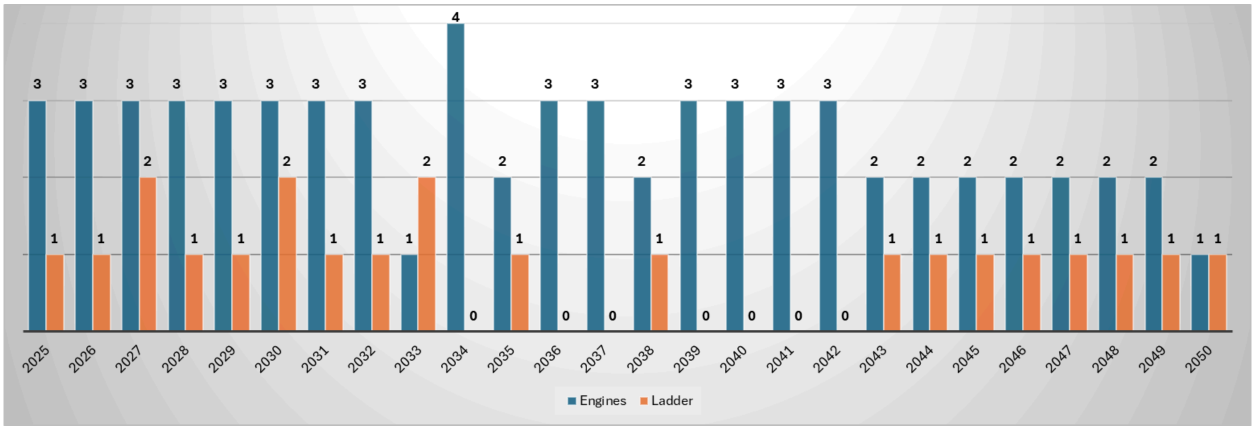
This newer, extended 25-year plan utilizes the National Fire Protection Association's (NFPA) guidelines for replacing apparatus by age, recognizing that projecting replacements based on mileage, engine hours, or repair history is difficult due to strategic vehicle rotations across stations. This more ambitious plan replaces 84 apparatus between 2026 and 2050, comprising 63 engines and 21 ladder trucks[4]. On average, this reflects an annual replacement of roughly 2.5 engines and just under one ladder per year. The plan anticipates replacing all of the department's current fleet, more than 150% of the existing inventory, over the 25-year horizon, ensuring that aging vehicles are cycled out well before they become a liability, while providing room for fleet growth.

One key revision in the new long-range model is the assumption of a higher annual escalation rate of 7% to more accurately reflect industry trends. According to one major apparatus manufacturer, the previous 4% estimate used by the City was increasingly unrealistic due to global supply chain issues, inflation, and rising material and labor costs. As such, the financial planning behind the replacement strategy needed to evolve accordingly.

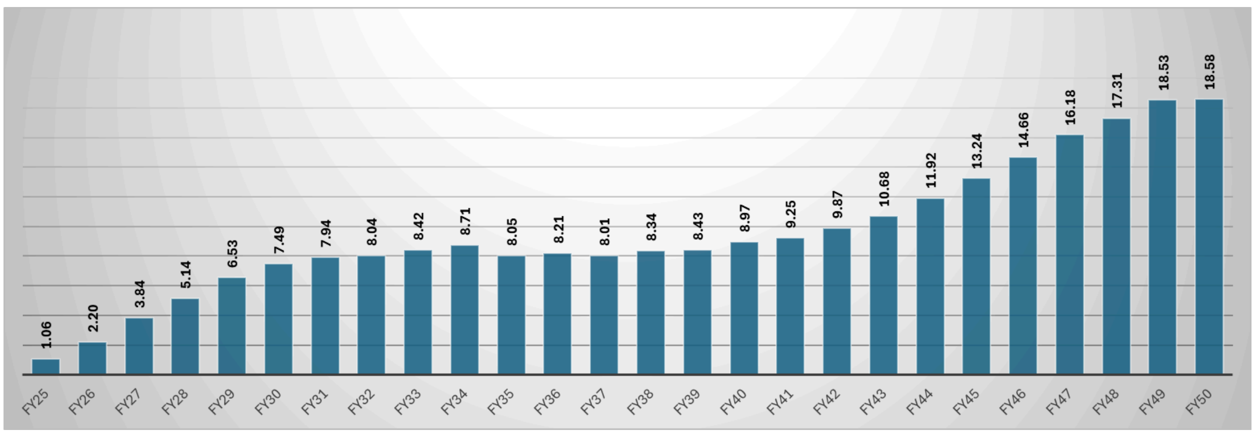
The Equipment Usage Charge model remains central to funding this initiative. Over the 25-year term, this mechanism spreads out the financial burden of high-cost fire apparatus acquisitions, stabilizing annual budget impacts. Although the total cost over this extended period is expected to increase significantly due to the higher escalation rate, the structured funding approach prevents sudden spikes in capital needs and ensures that the department is never caught without reliable apparatus to meet public safety demands.

This apparatus replacement strategy places the Raleigh Fire Department in a strong position to sustain its operational readiness for decades to come. By steadily cycling out older equipment and replacing it with modern apparatus in alignment with national standards, the department will remain equipped to serve the growing needs of the community while maintaining fiscal responsibility and long-term fleet resilience.

[4] The replacement plan includes recommended additions to the fleet of one ladder in 2027, one ladder in 2030 and an additional engine in 2034.



25-Year Apparatus Replacement Plan



Apparatus Replacement Annual EUC Costs (In Millions of Dollars)

Fire Station Operating Costs

The chart below provides a detailed breakdown of operating costs for ten fire stations constructed since 2000 in Raleigh. The data includes information about the station size, construction type, and essential utilities, along with a total annual operating cost for each station.

Station Information	Station 6	Station 12	Station 14	Station 22	Station 24	Station 25	Station 26	Station 27	Station 28	Station 29
Construction Year	2021	2018	2021	2021	2002	2000	2003	2003	2007	2014
Heated Sq. Footage	14,450	17,616	17,404	16,888	5,710	5,640	10,808	6,873	9,849	11,518
# of Stories	2	1	1	2	1	1	1	1	1	1
# of Bays	2	3	3	3	2	2	2	2	3	3
Const Type	Exposed Steel	Exposed Steel	Exposed Steel	Exposed Steel	Wood Joist	Exposed Steel	Exposed Steel	Wood Joist	Exposed Steel	Exposed Steel
Drive through bay(s)	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Bay square footage	3,360	4,620	4,620	5,018	1,891	1,891	2,000	2,015	3,842	3,976
Station Costs										
Electricity	$ 13,495.16	$ 18,114.53	$ 14,522.52	$ 16,859.14	$ 6,957.71	$ 9,831.51	$ 13,511.84	$ 8,653.30	$ 9,288.68	$ 11,151.02
Water	$ 1,162.35	$ 2,550.87	$ 1,517.76	$ 1,395.70	$ 939.77	$ 964.42	$ 1,323.90	$ 986.44	$ 979.26	$ 1,302.36
Sewer	$ 1,517.22	$ 929.16	$ 1,998.36	$ 2,013.12	$ 1,395.90	$ 1,448.64	$ 1,915.92	$ 1,459.08	$ 1,449.36	$ 1,886.76
Stormwater	$ 677.58	$ 1,978.37	$ 1,814.80	$ 1,368.96	$ 574.08	$ 741.84	$ 1,245.36	$ 1,121.64	$ 1,095.12	$ 1,474.92
Gas	$ 2,534.87	$ 5,550.73	$ 2,811.98	$ 3,508.75	$ 2,056.62	$ 3,254.17	$ 2,703.89	$ 2,631.52	$ 2,418.55	$ 4,256.62
Cable	$ 83.24	$ 50.00	$ 108.24	$ 98.24	$ -	$ 61.66	$ -	$ 52.64	$ -	$ 60.74
Internet	$ 109.98	$ 219.98	$ 149.98	$ 109.98	$ 149.98	$ 139.98	$ 139.98	$ 149.98	$ 149.98	$ 149.98
Insurance	$ 4,143.95	$ 36,910.30	$ 36,052.70	$ 40,367.50	$ 1,017.75	$ 10,787.00	$ 2,708.53	$ 1,243.08	$ 1,717.71	$ 2,197.58
Annual Maintenance	$ 8,750.00	$ 22,020.00	$ 21,755.00	$ 16,888.00	$ 8,279.00	$ 8,178.00	$ 15,671.00	$ 8,591.00	$ 14,281.00	$ 16,701.00
Other										
Total Operating Cost	$ 32,474.35	$ 88,323.94	$ 80,731.34	$ 82,609.39	$ 21,370.81	$ 35,407.22	$ 39,220.42	$ 24,888.68	$ 31,379.66	$ 39,180.98

Operating Cost of Ten RFD Stations Constructed Post-2000

The stations in the chart showcase a wide range of sizes, construction styles, and operating costs, each with its own unique characteristics. While some stations boast large square footage and multiple bays, others operate within more compact spaces, leading to significant differences in expenses.

Construction and Size Details

The largest stations in terms of heated square footage are Station 12 (17,616 sq. ft.), Station 14 (17,404 sq. ft.), and Station 22 (16,888 sq. ft.). These stations not only provide more space for operations but also feature larger bay square footage, ranging from 4,620 to 5,018 sq. ft., allowing for increased vehicle capacity. In contrast, Station 24 and Station 25 are the smallest facilities, each with under 6,000 sq. ft. and a bay area of only 1,891 sq. ft., significantly limiting vehicle space compared to their larger counterparts.

Most stations are single-story structures, with only Station 6 and Station 22 featuring two stories. This distinction is important because multi-story buildings require additional heating and cooling efforts, influencing energy costs. Another key structural difference is the construction type. While the majority of the stations utilize exposed steel, Station 24 and Station 27 are built with wood joist construction, which may impact maintenance, durability, and energy efficiency over time.

Drive-through bays are another significant factor, with most stations featuring them. However, Station 6 and Station 24 are exceptions, requiring vehicles to back into place, which impact operational efficiency.

Utility and Operating Costs

Energy expenses vary significantly across the stations, with electricity costs ranging from over $18,000 at Station 12, the highest, to under $7,000 at Station 24, the lowest. Similarly, water usage is notably high at Station 12 ($2,550.87) and Station 22 ($1,395.70), reflecting their large operational scale. Smaller stations, such as Station 24 and Station 25, consume far less water, resulting in significantly lower costs.

Gas expenses also differ widely, with Station 12 and Station 22 exceeding $5,500 and $3,500, respectively, while other stations, such as Station 24 and Station 27, maintain costs below $2,700. These fluctuations may be attributed to differences in heating requirements, insulation efficiency, and building design. The variations in stormwater, sewer, and internet expenses are relatively minor, though Station 12 and Station 14 tend to have higher costs across these categories, reflecting the demands of larger, more complex facilities.

Insurance and Maintenance Disparities

One of the most striking disparities among stations lies in insurance costs. Station 22 carries a staggering $40,367.50 insurance premium, while Station 12 and Station 14 are similarly high at over $36,000 each. In stark contrast, Station 24 has an insurance cost of only $1,017.75, the lowest among all stations. These vast differences suggest that factors such as station size, construction year, and risk assessments play a major role in determining insurance premiums.

Maintenance expenses also follow a similar trend. Station 12 and Station 14 incur over $21,000 annually in maintenance, while Station 22 requires approximately $16,888. In contrast, smaller and older stations, such as Station 24 and Station 25, maintain annual maintenance costs under $8,300, significantly reducing their financial burden.

Total Operating Costs

When examining total operating expenses, Station 12 stands out as the most expensive to run, with an annual cost of $88,323.94, followed closely by Station 14 ($80,731.34) and Station 22 ($82,609.39). Their large size, high insurance, and increased energy consumption contribute to these high figures. Conversely, Station 24 emerges as the most cost-efficient facility, with total costs at only $21,370.81. Other stations with relatively low expenses include Station 27 ($24,888.68) and Station 6 ($32,474.35), reflecting their smaller scale and lower overhead costs.

General Observations

Overall, station size and age appear to have a strong correlation with operating costs. Larger, newer stations tend to incur higher expenses due to increased energy use, insurance, and maintenance requirements. However, some cost variations are influenced by factors beyond size alone, such as construction materials (Wood Joist vs. Exposed Steel), the presence of drive-through bays, and heating efficiency. Insurance is a particularly volatile expense, with some stations paying exponentially more than others despite comparable operations.

The stations with the highest total costs, Station 12, 14, and 22, may benefit from energy efficiency improvements or reassessments of their insurance policies to optimize expenses. Meanwhile, smaller stations like Station 24 and Station 27, which operate with significantly lower costs, exemplify efficient resource management and could serve as models for cost-saving strategies.

Projecting Future Operating Costs

When projecting the future operating costs for three various fire station sizes (14,000, 16,000 and 18,000 square ft), three different cost escalation rates based on historical inflation trends, industry standards, and anticipated future economic conditions were considered.

Cost growth estimate percentages:

- Conservative Growth: 3% was used as it is suitable for budgeting when there is confidence in stable economic conditions, long-term contracts, or government intervention to keep utility and insurance costs controlled.
- Moderate Growth: 5% annually can be suitable for standard financial planning where cost increases are expected but not extreme.
- High Growth: 7% annually can be used for contingency planning where cost volatility is expected due to energy market fluctuations, climate change adaptation costs, and economic instability.

Justification for these rates:

The conservative growth rate is aligned with the long-term average inflation rate in the U.S., which has historically ranged between 2% and 3%. If inflation remains stable and utility providers keep rate increases moderate, this would be a reasonable assumption for future cost growth.

- The 5% rate accounts for moderate inflation and utility price increases, which have historically been higher than the general inflation rate due to factors such as infrastructure investments and regulatory compliance. Insurance costs also tend to rise at a rate faster than general inflation due to increased disaster risks.

- The high growth rate of 7% can account for rising energy costs, climate-related utility price hikes, supply chain disruptions, and inflationary pressures. Over the past few years, utility and insurance costs have occasionally seen higher spikes, exceeding 6-8% in some years.

The initial square foot cost used for this study was derived from the average 2024 actual operating costs for the ten study stations. The square foot figure used was $4.06 per square ft. For the financial growth planning purpose the cost escalation assumption used was the moderate growth rate (5%). The following charts provide a 25-year projection of operational costs for a 14,000, 16,000 and 18,000 square foot fire station, based on a 3, 5 and 7% cost escalation rate.

Station sq '	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
% Increase	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
14,000	$56,840	$58,545	$60,302	$62,111	$63,974	$65,893	$67,870	$69,906	$72,003	$74,163	$76,388	$78,680	$81,040
16,000	$64,960	$66,909	$68,916	$70,984	$73,113	$75,306	$77,566	$79,893	$82,289	$84,758	$87,301	$89,920	$92,617
18,000	$73,080	$75,272	$77,531	$79,856	$82,252	$84,720	$87,261	$89,879	$92,576	$95,353	$98,213	$101,160	$104,195

Station sq '	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
% Increase	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
14,000	$83,471	$85,976	$88,555	$91,212	$93,948	$96,766	$99,669	$102,659	$105,739	$108,911	$112,179	$115,544	$119,010
16,000	$95,396	$98,258	$101,206	$104,242	$107,369	$110,590	$113,908	$117,325	$120,845	$124,470	$128,204	$132,050	$136,012
18,000	$107,320	$110,540	$113,856	$117,272	$120,790	$124,414	$128,146	$131,991	$135,950	$140,029	$144,230	$148,557	$153,013

Station sq '	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
% Increase	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
14,000	$56,840	$59,682	$62,666	$65,799	$69,089	$72,544	$76,171	$79,980	$83,979	$88,177	$92,586	$97,216	$102,076
16,000	$64,960	$68,208	$71,618	$75,199	$78,959	$82,907	$87,053	$91,405	$95,976	$100,774	$105,813	$111,104	$116,659
18,000	$73,080	$76,734	$80,571	$84,599	$88,829	$93,271	$97,934	$102,831	$107,972	$113,371	$119,040	$124,992	$131,241

Station sq '	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
% Increase	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
14,000	$107,180	$112,539	$118,166	$124,075	$130,278	$136,792	$143,632	$150,813	$158,354	$166,272	$174,585	$183,315	$192,480
16,000	$122,492	$128,616	$135,047	$141,800	$148,890	$156,334	$164,151	$172,358	$180,976	$190,025	$199,526	$209,502	$219,978
18,000	$137,803	$144,693	$151,928	$159,524	$167,501	$175,876	$184,670	$193,903	$203,598	$213,778	$224,467	$235,690	$247,475

Station sq '	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
% Increase	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
14,000	$56,840	$60,819	$65,076	$69,631	$74,506	$79,721	$85,302	$91,273	$97,662	$104,498	$111,813	$119,640	$128,015
16,000	$64,960	$69,507	$74,373	$79,579	$85,149	$91,110	$97,487	$104,312	$111,613	$119,426	$127,786	$136,731	$146,302
18,000	$73,080	$78,196	$83,669	$89,526	$95,793	$102,498	$109,673	$117,351	$125,565	$134,355	$143,759	$153,823	$164,590

Station sq '	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
% Increase	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
14,000	$136,976	$146,564	$156,823	$167,801	$179,547	$192,115	$205,563	$219,953	$235,350	$251,824	$269,452	$288,313	$308,495
16,000	$156,544	$167,502	$179,227	$191,773	$205,197	$219,560	$234,930	$251,375	$268,971	$287,799	$307,945	$329,501	$352,566
18,000	$176,111	$188,439	$201,630	$215,744	$230,846	$247,005	$264,296	$282,797	$302,592	$323,774	$346,438	$370,689	$396,637

Station Operating Costs for Three Station Sizes at 3, 5 and 7% Escalation Respectively

New Station Construction Costs

Analyzing commercial construction cost escalation over the past two decades in Raleigh, North Carolina, reveals significant variability influenced by factors such as material prices, labor costs, and economic conditions. While specific annual escalation rates for Raleigh are limited, national and regional data can provide some insight into broader trends.

National Trends:

- 2000s to Early 2010s: The Associated General Contractors of America (AGC) reported periods where construction input costs exceeded bid prices, notably from December 2009 to January 2012, indicating contractor cost squeezes.
- 2016 to 2018: Another significant cost squeeze occurred between October 2016 and November 2018, with input costs rising faster than bid prices.
- 2020 to 2022: The COVID-19 pandemic led to unprecedented cost increases, with materials like steel mill products and lumber undergoing substantial price hikes. This period saw a cost squeeze from December 2020 to June 2022.

While these sources provide a general understanding of construction cost trends, obtaining precise annual escalation rates for Raleigh's commercial construction over the past twenty years would require access to detailed local historical data from industry reports, local government publications, or construction firms operating in the area.

Cost Escalation Considerations

Determining the average annual commercial construction cost per square foot in North Carolina over the past two decades is challenging due to limited publicly available historical data. However, recent figures and general trends can provide some insight.

In 2024, construction costs for commercial buildings in the Eastern U.S., including North Carolina, continue to reflect industry-wide trends in labor, materials, and inflation. The average cost to build a single-story commercial structure ranges from $301 to $361 per square foot, while mid-rise office buildings command a significantly higher cost, ranging from $599 to $719 per square foot. These figures highlight the increasing expenses associated with commercial construction, particularly in rapidly growing regions.

Looking back to 2009, the median construction cost for a single-story office building across various U.S. regions ranged between $160 and $170 per square foot. Adjusting for inflation, that figure would equate to approximately $200 to $220 per square foot in today's dollars, depending on location and specific building specifications. Over the past decade, the average annual inflation rate for construction costs in the U.S. has generally ranged between 3% and 6%, but North Carolina has experienced slightly higher increases. Reports indicate that construction costs in the state have risen between 4% and 7% annually, primarily due to fluctuations in material costs and labor availability.

Several economic factors drive the ongoing increase in construction costs. Material prices, labor rates, and broader economic conditions all contribute to overall expenses. According to the Mortenson Construction Cost Index, national construction costs rose by 1.2% in the second quarter of 2024, marking a 1.9% increase over the past year. This steady upward trend underscores the need for Raleigh planners to account for inflation when budgeting for future projects.

The prices of essential building materials, such as steel, lumber, and concrete, remain highly volatile. Global supply chains, trade policies, and geopolitical events play a crucial role in determining material costs. Unexpected disruptions, such as tariffs, natural disasters, or pandemics, can lead to rapid price increases. A notable example was the COVID-19 pandemic, which caused a surge in both lumber and steel prices due to supply chain breakdowns and increased demand. These fluctuations make it challenging to predict future material costs with certainty.

The cost and availability of skilled labor continue to be significant factors influencing construction expenses. In high-growth areas like Raleigh, rapid expansion has led to increased competition for skilled workers. As a result, labor shortages drive up wages, further contributing to rising project costs. The construction industry faces an ongoing challenge in balancing workforce availability with the demand for new projects.

Broader economic trends, such as inflation rates, interest rates, and potential recessions, have direct implications for construction costs. When inflation is high, material and labor costs rise accordingly, increasing the overall price of construction projects. On the other hand, rising interest rates can slow down investment in new developments, which may, in some cases, help stabilize costs by reducing demand. The interplay between these factors makes it difficult to predict long-term cost trends with absolute certainty.

As part of the Research Triangle, the City of Raleigh has experienced significant growth, which directly impacts commercial construction costs. Increased demand for new buildings raises the cost of materials, land, and labor, as developers compete for limited resources. While this growth presents economic opportunities, it also introduces unpredictability, as factors such as corporate relocations, shifting population trends, and local policy changes can either accelerate or slow the pace of construction cost increases.

The construction industry is increasingly adopting new technologies, such as sustainable building practices and advanced construction methods. While these innovations can raise initial costs due to higher upfront expenses, they may ultimately reduce long-term operational costs. Additionally, regulatory changes, such as new building codes, environmental laws, and zoning regulations, can introduce unexpected expenses that impact project budgets.

North Carolina's vulnerability to hurricanes and severe weather events further complicates construction cost projections. Extreme weather can disrupt supply chains, delay construction schedules, and increase demand for weather-resistant materials, all of which contribute to higher expenses. As climate change continues to influence regional weather patterns, these risks may become even more significant.

Unforeseen global events, including pandemics, wars, and international trade conflicts, can have cascading effects on supply chains, interest rates, and material availability. The uncertainty surrounding these events makes long-term cost predictions speculative, requiring builders and planners to incorporate contingency strategies into their financial planning.

Given the factors outlined, construction cost growth in North Carolina is expected to range between 5% and 7% annually, especially in areas experiencing high demand and supply chain constraints. Material shortages and labor scarcity are likely to push costs toward the higher end of that spectrum.

For projects such as fire stations, the City should consider several key cost drivers:

- Materials: Essential building materials like steel, concrete, and electrical components have been subject to significant price fluctuations, impacting overall project costs.
- Labor: As the Raleigh area continues to expand, competition for skilled construction workers is likely to drive wages higher.
- Land Acquisition: If new fire stations are constructed in annexed or newly developed areas, land prices may rise at a faster rate than general construction inflation.
- Regulatory Compliance: Changes in building codes and the increasing emphasis on sustainability and energy efficiency may add additional costs over time.

Given these factors, fire station projects must be planned with flexible budgets that account for escalating costs and economic uncertainties.

Observations:

- The interplay of these dynamic and often unpredictable factors creates significant uncertainty in forecasting future construction costs. While historical data and economic models provide some guidance, unforeseen events and localized conditions often lead to deviations from predictions.
- While precise annual data over the past twenty years for North Carolina is scarce, it's evident that commercial construction costs have experienced significant growth, particularly in recent years.

Forecast Assumptions

To forecast the future costs of fire station construction in Raleigh over the next twenty-five years, a structured planning model was developed using both current cost data and escalation assumptions derived from regional and national construction trends. This model incorporates a multi-tiered cost breakdown that includes not only core construction expenses but also design, professional fees, contingency allowances, equipment, and operational costs, to provide a holistic projection for long-term financial planning.

The baseline construction cost was anchored to the current estimate for Raleigh Fire Station 15, which places the cost of construction at $537 per square foot. Recognizing the historic volatility and escalation of construction inputs in Raleigh and comparable markets, a conservative annual escalation rate of 6.8% was applied to future years. This rate reflects a moderate growth trajectory informed by past construction cost increases in the region and provides a buffer for inflation, material fluctuations, and labor market constraints.

To develop a comprehensive cost forecast, several layers of expense were factored into the projection model. First, the general conditions were calculated at 18% of the core construction and design contingency costs to account for site management, logistics, and temporary facilities. Profit margins for contractors were estimated at 7% of the sum of construction, general conditions, and design contingencies. Additional allocations of 2% were included for bonds and insurance, based on recent Raleigh projects.

A 10% contingency was added to the total construction subtotal, recognizing the need for flexibility in addressing unforeseen circumstances, particularly given the unpredictability of weather events, supply chain issues, and economic shifts affecting labor and materials. These figures were then used to determine a Total Construction Cost (TCC), which served as the foundation for calculating soft costs.

Architectural design services were projected at 12.5% of the TCC plus public art, while other professional fees—such as engineering, permitting, and geotechnical analysis—were estimated at 8% of the same base. To account for variability in design requirements and regulatory changes, a 10% design contingency was applied to the combined architectural and professional fees. Additionally, a 1% allocation was included for public art, in compliance with city policy and standard civic project budgeting practices

Fixtures, furniture, and equipment (FF&E) were estimated at 14.26% of the overall project cost, consistent with outfitting and furnishing previous Raleigh fire facilities. This figure ensures readiness for immediate occupancy and operational functionality upon project completion.

To complement the capital construction forecast, ongoing operating costs and equipment expenditures were also projected. Annual station operating costs were estimated at $4.06 per square foot, with a 5% annual escalation rate reflecting trends in utilities, maintenance, and facility management. Personnel equipment costs—covering items like personal protective equipment (PPE), uniforms, and accessories—were projected at $15,000 per individual with the same 5% annual escalation to reflect rising costs in gear manufacturing and supply.

This planning model provides the City of Raleigh with a structured, inflation-adjusted financial roadmap for fire station expansion through 2050. By grounding the forecast in current data, applying consistent escalation assumptions, and accounting for both hard and soft costs, this model supports proactive capital planning, reduces fiscal uncertainty, and enhances the city's ability to meet its growing public safety infrastructure needs in a rapidly evolving urban environment.

Land Acquisition Costs

The long-range financial model includes a forecast of land acquisition costs associated with the future fire station development. These projections are intended to assist the capital planning decisions for the construction or relocation of five fire stations, Stations 8, 9, 30, 31, and 32, by estimating land purchase costs at the approximate time of construction.

The stations under review include two replacements, Station 8, relocating west along Western Boulevard, and Station 9, shifting north along Six Forks Road, and three new stations: Station 30 near New Bern Avenue and Trawick Road, Station 31 between U.S. Route 1 and 401 near Perry Creek Road, and Station 32, located near Old Milburnie Road at the city's eastern edge near the extraterritorial jurisdiction (ETJ).

Land cost estimates began with the respective 2025 values, reflecting current market conditions. Station 8 and Station 9 are estimated at $600,000 per acre, Station 30 at $550,000 per acre, Station 31 at $500,000 per acre, and Station 32 at $400,000 per acre. These baseline values were escalated using location-specific historical growth rates: 6% annually for Station 8, 5% for Station 9, 4% for Stations 30 and 31, and 3% for Station 32. These rates align with observed trends in Raleigh's real estate market, where urban and high-demand suburban areas have shown stronger appreciation than outer or transitional regions.

Using these appreciation rates, projected land costs for 3-acre parcels, the minimum needed per site, were calculated for 2035, 2040, and 2050. For example, Station 8's 3-acre land requirement is projected to rise from $1.8 million in 2025 to approximately $4.3 million by 2040 and over $7.7 million by 2050. Similar growth trajectories are projected for the other sites, with Station 9 reaching over $6 million by 2050, Station 30 approaching $4.4 million, Station 31 nearing $4 million, and Station 32 rising to $2.5 million. These forecasts suggest that the cost burden of land acquisition will more than double for each site over the 25-year horizon, particularly for those in rapidly developing urban corridors. The annual per acre cost projections for the five station areas are shown in the charts below.

Site Location	Station	Growth rates	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Western Blvd	8	6%	$600,000	$636,000	$674,160	$714,610	$757,486	$802,935	$851,111	$902,178	$956,309	$1,013,687	$1,074,509	$1,138,979	$1,207,318
Six Forks Road	9	5%	$600,000	$630,000	$661,500	$694,575	$729,304	$765,769	$804,057	$844,260	$886,473	$930,797	$977,337	$1,026,204	$1,077,514
New Berm/Trawick	30	4%	$550,000	$572,000	$594,880	$618,675	$643,422	$669,159	$695,925	$723,762	$752,713	$782,821	$814,134	$846,700	$880,568
Perry Creek Road	31	4%	$500,000	$520,000	$540,800	$562,432	$584,929	$608,326	$632,660	$657,966	$684,285	$711,656	$740,122	$769,727	$800,516
Old Milburne Road	32	3%	$400,000	$412,000	$424,360	$437,091	$450,204	$463,710	$477,621	$491,950	$506,708	$521,909	$537,567	$553,694	$570,304

Site Location	Station	Growth rates	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Western Blvd	8	6%	$1,207,318	$1,279,757	$1,356,542	$1,437,935	$1,524,211	$1,615,664	$1,712,603	$1,815,360	$1,924,281	$2,039,738	$2,162,122	$2,291,850	$2,429,361	$2,575,122
Six Forks Road	9	5%	$1,077,514	$1,131,389	$1,187,959	$1,247,357	$1,309,725	$1,375,211	$1,443,972	$1,516,170	$1,591,979	$1,671,578	$1,755,156	$1,842,914	$1,935,060	$2,031,813
New Berm/Trawick	30	4%	$880,568	$915,790	$952,422	$990,519	$1,030,140	$1,071,345	$1,114,199	$1,158,767	$1,205,118	$1,253,322	$1,303,455	$1,355,594	$1,409,817	$1,466,210
Perry Creek Road	31	4%	$800,516	$832,537	$865,838	$900,472	$936,491	$973,950	$1,012,908	$1,053,425	$1,095,562	$1,139,384	$1,184,959	$1,232,358	$1,281,652	$1,332,918
Old Milburne Road	32	3%	$570,304	$587,413	$605,036	$623,187	$641,883	$661,139	$680,973	$701,402	$722,444	$744,118	$766,441	$789,435	$813,118	$837,511

To account for volatility in the real estate market, a sensitivity analysis was conducted, applying alternative low and high growth scenarios. For instance, Station 8's land costs by 2050 could range from $4.8 million (under a 4% growth scenario) to $12.3 million (at 8% growth). Even semi-rural locations like Station 32 could see costs vary from $1.5 million to $4.1 million depending on growth trajectories. These ranges reflect potential impacts of infrastructure development, rezoning, or shifts in regional economic activity, and they highlight the fiscal risks of deferring land purchases. The respective cost shifts under the various growth projections are shown below.

Sensitivity	Station	GR	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Western Blvd	8	4%	$600,000	$624,000	$648,960	$674,918	$701,915	$729,992	$759,191	$789,559	$821,141	$853,987	$888,147	$923,672
Western Blvd	8	6%	$600,000	$636,000	$674,160	$714,610	$757,486	$802,935	$851,111	$902,178	$956,309	$1,013,687	$1,074,509	$1,138,979
Western Blvd	8	8%	$600,000	$648,000	$699,840	$755,827	$816,293	$881,597	$952,125	$1,028,295	$1,110,558	$1,199,403	$1,295,355	$1,398,983
Six Forks Road	9	3%	$600,000	$618,000	$636,540	$655,636	$675,305	$695,564	$716,431	$737,924	$760,062	$782,864	$806,350	$830,540
Six Forks Road	9	5%	$600,000	$630,000	$661,500	$694,575	$729,304	$765,769	$804,057	$844,260	$886,473	$930,797	$977,337	$1,026,204
Six Forks Road	9	7%	$600,000	$642,000	$686,940	$735,026	$786,478	$841,531	$900,438	$963,469	$1,030,912	$1,103,076	$1,180,291	$1,262,911
New Berm/Trawick	30	2%	$550,000	$561,000	$572,220	$583,664	$595,338	$607,244	$619,389	$631,777	$644,413	$657,301	$670,447	$683,856
New Berm/Trawick	30	4%	$550,000	$572,000	$594,880	$618,675	$643,422	$669,159	$695,925	$723,762	$752,713	$782,821	$814,134	$846,700
New Berm/Trawick	30	6%	$555,000	$588,300	$623,598	$661,014	$700,675	$742,715	$787,278	$834,515	$884,586	$937,661	$993,920	$1,053,556
Perry Creek Road	31	2%	$500,000	$510,000	$520,200	$530,604	$541,216	$552,040	$563,081	$574,343	$585,830	$597,546	$609,497	$621,687
Perry Creek Road	31	4%	$500,000	$520,000	$540,800	$562,432	$584,929	$608,326	$632,660	$657,966	$684,285	$711,656	$740,122	$769,727
Perry Creek Road	31	6%	$500,000	$530,000	$561,800	$595,508	$631,238	$669,113	$709,260	$751,815	$796,924	$844,739	$895,424	$949,149
Old Milburne Road	32	1%	$400,000	$404,000	$408,040	$412,120	$416,242	$420,404	$424,608	$428,854	$433,143	$437,474	$441,849	$446,267
Old Milburne Road	32	3%	$400,000	$412,000	$424,360	$437,091	$450,204	$463,710	$477,621	$491,950	$506,708	$521,909	$537,567	$553,694
Old Milburne Road	32	5%	$400,000	$420,000	$441,000	$463,050	$486,203	$510,513	$536,038	$562,840	$590,982	$620,531	$651,558	$684,136

Sensitivity	Station	GR	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Western Blvd	8	4%	$960,619	$999,044	$1,039,006	$1,080,566	$1,123,789	$1,168,740	$1,215,490	$1,264,110	$1,314,674	$1,367,261	$1,421,951	$1,478,829	$1,537,982	$1,599,502
Western Blvd	8	6%	$1,207,318	$1,279,757	$1,356,542	$1,437,935	$1,524,211	$1,615,664	$1,712,603	$1,815,360	$1,924,281	$2,039,738	$2,162,122	$2,291,850	$2,429,361	$2,575,122
Western Blvd	8	8%	$1,510,902	$1,631,774	$1,762,316	$1,903,301	$2,055,566	$2,220,011	$2,397,612	$2,589,421	$2,796,574	$3,020,300	$3,261,924	$3,522,878	$3,804,708	$4,109,085
Six Forks Road	9	3%	$855,457	$881,120	$907,554	$934,780	$962,824	$991,709	$1,021,460	$1,052,104	$1,083,667	$1,116,177	$1,149,662	$1,184,152	$1,219,676	$1,256,267
Six Forks Road	9	5%	$1,077,514	$1,131,389	$1,187,959	$1,247,357	$1,309,725	$1,375,211	$1,443,972	$1,516,170	$1,591,979	$1,671,578	$1,755,156	$1,842,914	$1,935,060	$2,031,813
Six Forks Road	9	7%	$1,351,315	$1,445,907	$1,547,120	$1,655,419	$1,771,298	$1,895,289	$2,027,959	$2,169,917	$2,321,811	$2,484,337	$2,658,241	$2,844,318	$3,043,420	$3,256,460
New Berm/Trawick	30	2%	$697,533	$711,484	$725,713	$740,228	$755,032	$770,133	$785,535	$801,246	$817,271	$833,616	$850,289	$867,295	$884,640	$902,333
New Berm/Trawick	30	4%	$880,568	$915,790	$952,422	$990,519	$1,030,140	$1,071,345	$1,114,199	$1,158,767	$1,205,118	$1,253,322	$1,303,455	$1,355,594	$1,409,817	$1,466,210
New Berm/Trawick	30	6%	$1,116,769	$1,183,775	$1,254,802	$1,330,090	$1,409,895	$1,494,489	$1,584,158	$1,679,208	$1,779,960	$1,886,758	$1,999,963	$2,119,961	$2,247,159	$2,381,988
Perry Creek Road	31	2%	$634,121	$646,803	$659,739	$672,934	$686,393	$700,121	$714,123	$728,406	$742,974	$757,833	$772,990	$788,450	$804,219	$820,303
Perry Creek Road	31	4%	$800,516	$832,537	$865,838	$900,472	$936,491	$973,950	$1,012,908	$1,053,425	$1,095,562	$1,139,384	$1,184,959	$1,232,358	$1,281,652	$1,332,918
Perry Creek Road	31	6%	$1,006,098	$1,066,464	$1,130,452	$1,198,279	$1,270,176	$1,346,386	$1,427,170	$1,512,800	$1,603,568	$1,699,782	$1,801,769	$1,909,875	$2,024,467	$2,145,935
Old Milburne Road	32	1%	$450,730	$455,237	$459,790	$464,388	$469,031	$473,722	$478,459	$483,244	$488,076	$492,957	$497,886	$502,865	$507,894	$512,973
Old Milburne Road	32	3%	$570,304	$587,413	$605,036	$623,187	$641,883	$661,139	$680,973	$701,402	$722,444	$744,118	$766,441	$789,435	$813,118	$837,511
Old Milburne Road	32	5%	$718,343	$754,260	$791,973	$831,571	$873,150	$916,807	$962,648	$1,010,780	$1,061,319	$1,114,385	$1,170,104	$1,228,610	$1,290,040	$1,354,542

The underlying market assumptions are supported by Raleigh's broader urbanization patterns. The city's population has grown steadily, fueled by its technology, education, and biomedical sectors. As a result, demand for developable land remains high, particularly in urban and suburban areas. Western Boulevard and Six Forks Road, serving Stations 8 and 9 respectively, exemplify this trend with escalating land prices attributed to proximity to downtown, NC State University, and high-end residential and commercial development. In contrast, areas targeted for Stations 30 and 31 are experiencing steady growth tied to suburban expansion and road infrastructure improvements, while Station 32 is positioned in an emerging corridor near the city's ETJ boundary, where future zoning and annexation may stimulate value appreciation.

Looking ahead, the financial implications of these projections are significant. The high initial costs and sharp escalation rates for Stations 8 and 9 suggest that early land acquisition in urban zones may provide the most cost-effective path forward. Delays in acquisition could subject the city to considerably higher expenditures, especially if appreciation rates outpace expectations. For suburban and transitional areas, land acquisition remains relatively affordable but is also expected to grow steadily, reinforcing the need for proactive land banking strategies.

Given the scale of potential cost increases and the variability inherent in long-range forecasts, it is recommended that the city verify current pricing data through local records, including Wake County's Register of Deeds and planning databases. The projections should also be periodically updated to incorporate new growth data, infrastructure plans, and changes in zoning regulations.

In summary, this analysis underscores the financial urgency of strategic land acquisition for Raleigh's future fire stations. Rising property values, driven by continued urban growth, infrastructure investments, and shifting jurisdictional boundaries, will significantly impact the long-term capital requirements of fire service expansion. Timely investment in land acquisition, particularly in high-growth corridors, can serve as a key fiscal safeguard in the city's fire infrastructure planning.

Twenty-Five Year Financial Cost Model

To aid the City of Raleigh in effectively planning for future financial resource allocation, including the Capital Improvement Program and annual operating budgets, a comprehensive financial model has been developed. This model incorporates current and future costs associated with facility design and construction, equipment acquisition, operating and maintenance expenses, and personnel costs. The financial outlook is organized across three planning horizons: short-term (up to 5 years), mid-term (6 to 10 years), and long-term (11 to 25 years). The model distinguishes between replacement stations, which adds improved operational capacity, and new stations that expand fire protection services in growth areas and involve additional staffing and apparatus.

Short-Term Planning Horizon (2025–2030)

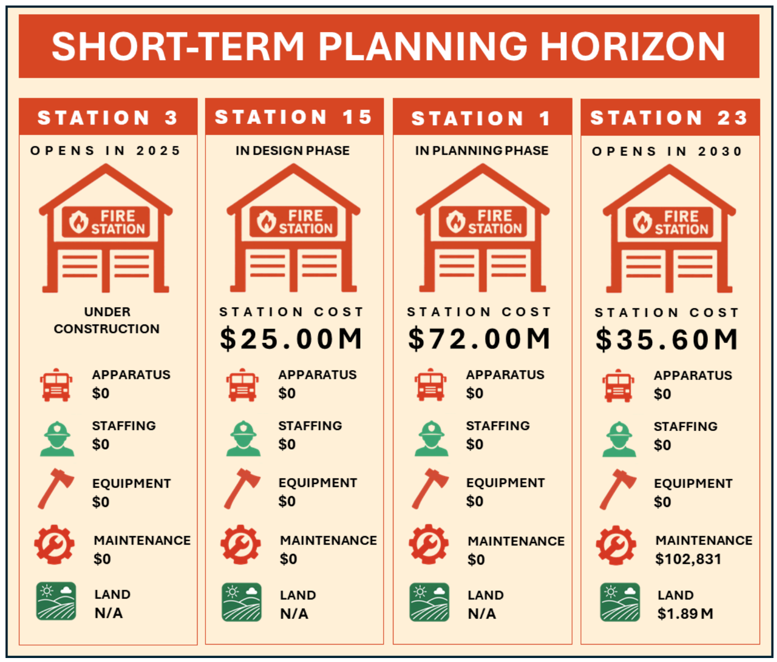
The short-term planning horizon, covering the years 2025 through 2030, marks the City of Raleigh's initial phase in a multi-decade strategy to modernize and sustain its fire station infrastructure. This period is defined by a focus on replacement rather than expansion, as all projects underway involve the reconstruction of existing facilities rather than the addition of new stations. Three significant replacement projects, Stations 1, 3, and 15, are already in progress, reflecting the City's prioritization of updating aging infrastructure to meet current operational standards and improve working conditions for fire personnel.

Fire Station 3 entered the construction phase in October 2024 and is scheduled for completion by November 2025. The project has a total budget of $11.5 million and will result in a modernized replacement facility for one of Raleigh's older stations. The design and construction scope includes structural upgrades, energy-efficient systems, and essential FF&E to support 24-hour operations. The existing personnel and apparatus will transition into the new facility upon its completion, avoiding the need for additional staffing.

Fire Station 15 is currently in the planning phase and is scheduled to be completed by 2027. It will be a three-bay station exceeding 17,000 square feet and has a projected cost of more than $25 million. As with Station 3, this facility will replace an existing station that has reached the end of its service life. While the final design is still underway, the project is being developed to align with the City's design standards for safety, functionality, and long-term efficiency. No additional personnel or equipment is anticipated at this time.

The most complex and highest-cost project in this planning horizon is the replacement of Fire Station 1, which will also consolidate the fire department's administrative headquarters. This multi-story, five-bay facility will encompass approximately 50,000 square feet and is projected to cost $72 million. Currently in the early planning phase, the new Station 1 will serve both operational and administrative functions, replacing outdated infrastructure that no longer meets the department's needs. This project will represent a significant advancement in the City's emergency services infrastructure once completed.

Station 23



In contrast to the three active replacement projects, the proposed replacement of Station 23 is the start of a broader financial planning model. Station 23, currently located at 8312 Pinecrest Road, is not owned by the City of Raleigh. It is a leased, co-located station owned by a neighboring county fire department. The replacement structure will be wholly owned and occupied by the city. The plan calls for the commencement of design in 2026, with a scheduled completion and full occupation by 2030. The total projected cost for the replacement of Station 23 is approximately $35.64 million. This cost reflects a comprehensive breakdown of expenditures required to design, construct, furnish, and commission a modern fire station that aligns with current standards and operational requirements. Design costs are projected at $2.95 million and include architectural planning, engineering studies, permitting, and design contingencies. Construction costs are estimated at $18.53 million and reflect anticipated market escalation for labor and materials, as well as site-specific conditions. An additional $2.12 million is allocated for contingency funding to address unforeseen issues that may arise during the construction process. Property acquisition in the area of Pinecrest Road and Country Trail is estimated at $1,890,000 for a three acre parcel.

Soft costs are projected at $7.11 million, which cover professional service fees, project management, LEED Silver certification, and commissioning services. These investments ensure the facility will be energy efficient, code-compliant, and functionally optimized for emergency response operations. Furniture, fixtures, and equipment (FF&E) are estimated at $4.17 million and include essential station furnishings and specialty systems required to support day-to-day operations. This includes office and living space furnishings, kitchen appliances, communication infrastructure, and fitness equipment.

Once completed and occupied in 2030, Station 23 will incur new operational costs associated with its larger and more modern footprint. First-year building operations are projected to cost $97,934, covering utilities, insurance and maintenance. This figure is derived from 2024 per-square-foot operating cost averages for Raleigh stations built after 2000 and escalated annually at a rate of five percent through the year of opening. While this cost is relatively modest compared to the total capital investment, it marks the beginning of the building's long-term impact on the operating budget and will increase with age and inflation over time.

Because Station 23 is a replacement facility rather than a net-new station, there are no added personnel or apparatus costs associated with the project. The existing complement of staff and equipment will transition into the new building upon completion. This limits the financial impact on the operating budget during the short-term horizon, allowing the city to focus its attention and resources on the foundational capital work needed to sustain its current level of service.

The inclusion of Station 23 in the cost model allows the City to assess financial readiness and resource allocation strategies for future replacement projects while actively managing the design and construction of Stations 1, 3, and 15. With these three active projects staggered across different phases, Raleigh remains within its capacity limits for concurrent capital projects and can maintain focused oversight. The short-term period thus represents a pivotal stage in modernizing the fire department's infrastructure and in testing the administrative and financial frameworks needed to guide longer-term investments.

In sum, the short-term period marks the beginning of Raleigh's long-range fire infrastructure strategy, establishing both the construction cadence and project management framework that will be necessary in subsequent years.

Mid-Term Planning Horizon (2031–2035)

The mid-term planning horizon marks a critical period of sustained infrastructure investment as Raleigh continues to modernize its fire facilities and expands its capacity to respond to increasing service demands. This period includes the replacement of three aging fire stations—Stations 9, 8, and 10, as well as, the initiation of the city's first new fire station in this cycle, Station 30, which will serve a newly urbanized or underserved area. Unlike replacement facilities, Station 30 introduces ongoing operational costs associated with additional staff and equipment.

Station 9

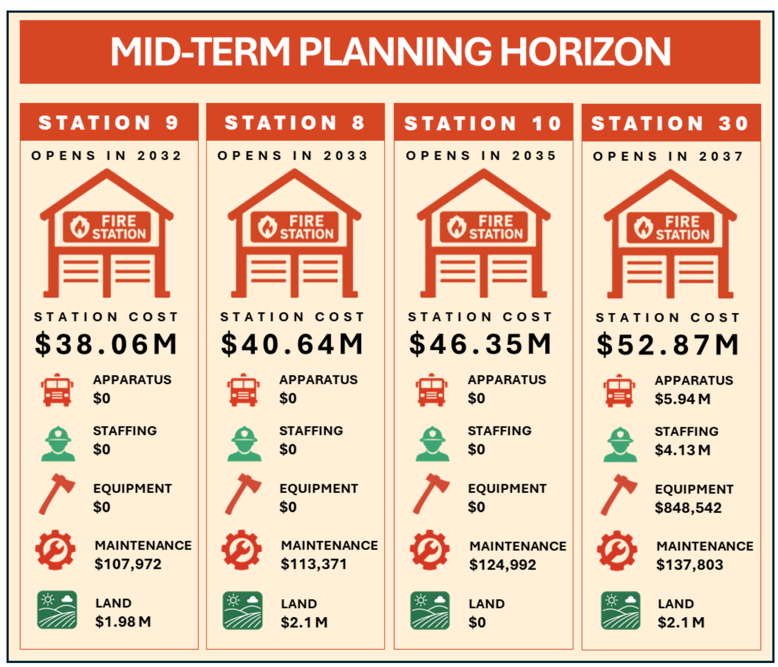
Station 9 enters the construction pipeline during the early years of the mid-term horizon. With design beginning in 2027, construction and occupancy are expected to conclude by 2032. The total project cost for Station 9 is $40.04 million. This includes land acquisition, design, construction, contingency, soft costs, and furnishings. The station will not house new personnel or apparatus, as it is a one-for-one replacement for an existing facility. First-year facility operation costs, including repairs and utilities, are projected at $107,972. These costs reflect a 5% annual escalation based on average square foot utility costs for post-2000 fire stations in Raleigh.

Station 8

Station 8 follows a similar trajectory, with design beginning in 2028 and full occupancy projected by 2033. This project is estimated to cost $42.78 million. It includes property acquisition and an identical scope of work—replacing an existing facility without expanding staff or adding new vehicles. First-year operating costs are projected at $113,371. The investment ensures the city maintains reliable infrastructure for its existing fire coverage footprint.

Station 10

Station 10 is another replacement project, beginning design work in 2030 and targeting occupancy in 2035. The projected cost for this station is $46.35 million. This figure includes anticipated increases in construction and soft costs over the course of the planning cycle. By the time the station becomes operational, the estimated annual repair and utility cost will be approximately $124,992. Like the other mid-term replacements, Station 10 does not introduce new apparatus or staffing but ensures



that aging infrastructure is retired and replaced with facilities that meet current design standards and operational needs.

Station 30

In contrast to the replacement projects, Station 30 represents an expansion of the department's service capacity. Scheduled to begin design in 2032 with occupancy anticipated in 2037, Station 30 will be a double-company fire station housing both an engine and a ladder truck. The total capital cost of the facility is projected at $52.87 million. In addition to building costs, the city will incur new expenses related to equipment and staffing. Apparatus acquisition is estimated at $5.94 million, while personnel equipment will cost $848,542. The station will require 30 new fire personnel, with a projected total salary obligation of $4.13 million in the first year of operation, based on a 5% annual increase from 2025 baseline figures. The estimated repair and utility costs for the first year of building operation are $137,803. The opening of Station 30 will also necessitate ongoing operational funding in future years, as salaries and facility maintenance are recurring expenses. This station signifies a shift in departmental growth, supporting the city's broader efforts to maintain service coverage amid population growth and land development.

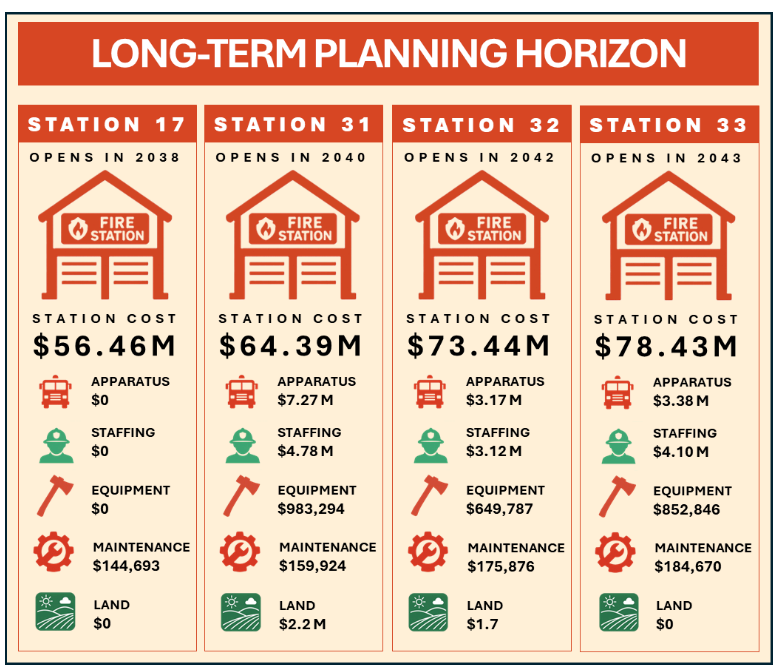
These mid-term investments will test Raleigh's capital planning capacity, particularly because the city limits itself to managing no more than three concurrent fire station projects at any given time. Coordinated scheduling will be essential to avoid overlap, particularly in the later years of this period as Station 30 design and Station 10 construction both progress simultaneously. This phase represents a transition point between the reinvestment in core infrastructure and the expansion of services to meet future demand.

Long-Term Planning Horizon (2036–2049)

The long-term planning horizon features continued reinvestment in the city's aging infrastructure while simultaneously expanding the fire department's footprint to address the growing demands of urban development. The period includes one additional station replacement and the development of three new stations, each contributing significantly to both the capital and operational obligations of the City of Raleigh.

Station 17

Station 17 is the final replacement station identified in the planning period. Its design begins in 2033, with the building scheduled for completion and occupation in 2038. This facility will replace an



older station that has reached the end of its service life. The total cost of the project is projected at $56.46 million, reflecting continued construction cost escalation, increasing soft costs, and expanded compliance obligations. First-year building operational costs are estimated at $144,693. Since this is a replacement facility, there are no additional expenses associated with apparatus or staffing, but the investment will ensure that the existing coverage area is supported by a modern, energy-efficient building capable of supporting contemporary firefighting and emergency response operations.

Station 31

Following the completion of Station 30 in the prior phase, Station 31 represents Raleigh's second new double-company station. It will begin design in 2035 and be ready for operation in 2040. The total project cost is forecasted at $64.39 million. This investment includes a full complement of support costs: $7.27 million is allocated for apparatus procurement, $4.78 million for salaries of 30 new personnel, and $982,294 for individual personnel equipment such as protective gear and uniforms. Facility maintenance and utilities are projected to cost $159,524 in the first year. Station 31 will contribute significantly to Raleigh's growing public safety needs, particularly in areas identified as high-growth zones through the city's land use and development planning strategies. This station's ongoing operational impact will be substantial, increasing the city's recurring public safety expenses through both labor and infrastructure support.

Station 32

Station 32 will be the second to last capital project in the long-term planning horizon, designed in 2037 and placed in service by 2042. Unlike Stations 30 and 31, this station will house a single engine company. The total cost for this station is estimated at $73.44 million. The increase reflects continued escalation of construction and soft costs, along with expanded regulatory and energy-efficiency requirements. Apparatus acquisition is projected at $3.16 million, and personnel costs include salaries for 18 new firefighters, estimated at $3.12 million. Personnel equipment will cost $649,787. First-year building operation costs, covering utilities and maintenance, are projected to be $175,876. Station 32 will serve newly annexed or densely populated areas, extending the department's reach and contributing to overall service equity across the city.

Station 33

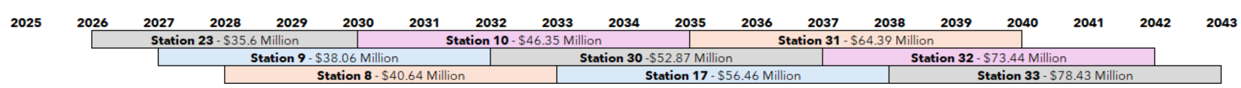
Station 33 will serve as the final construction project in the long-term planning horizon. This station will be designed in 2038, with construction completed in 2042 and occupancy beginning in 2043. Like Station 32, it will be a single engine company facility intended to support service demands in newly developed areas of the city. The total project cost is estimated at $78.43 million, reflecting continued escalation in both construction and soft costs.

Apparatus acquisition is projected at $3.38 million. Staffing costs for 18 new firefighters are forecast at $4.09 million, and an additional $852,846 is allocated for personnel equipment, including protective gear and uniforms. First-year maintenance and utility costs are projected to be $184,670. Station 33 will reinforce the department's capacity to provide equitable coverage across the city's expanding footprint and represents the final anticipated capital investment within this long-range plan.

By the end of the long-term planning horizon, Raleigh will have invested in the construction or replacement of nine fire stations. Of these, four are new facilities, adding a total of 96 personnel and six new apparatus units to the fire department. These additions carry long-lasting operational cost implications, including salaries, benefits, maintenance, and periodic equipment replacement. Strategic alignment between the City's capital improvement program and annual budget processes will be essential to ensure that these growing obligations are sustainable.

The long-term horizon also underscores the compounding nature of infrastructure investments. While construction projects are episodic and limited to five-year periods, their operational costs are continuous. As new stations come online, the City must be prepared to support them not only in the year of opening but in perpetuity, with annual increases reflecting salary growth, inflation, and facility aging. As such, the decisions made during this planning horizon will shape Raleigh's fire protection capabilities and budgetary needs for decades to come.

Financial Model



The full financial model is presented as a secondary document. The financial model developed for Raleigh's fire station construction program relies on a consistent set of planning assumptions to ensure uniformity and accuracy across project forecasts. These assumptions are grounded in industry standards, historical cost data, and escalation trends observed in the region, and are fully outlined in the appendices of this report.

Risk Management and Cost Savings

Fire station development projects are complex undertakings that span multiple years, involve numerous stakeholders, and are highly susceptible to a variety of risks that can affect costs, timelines, and operational outcomes. For the City of Raleigh, which employs a structured and methodical approach to planning, these risks must be clearly understood and proactively managed to ensure that future fire station investments are delivered on time, within budget, and in accordance with service delivery objectives.

Funding Uncertainty: One of the most significant risks Raleigh faces is the potential for delays in capital funding authorization. The city's current phased Capital Improvement Program (CIP) model allocates funding for design and construction in separate budget cycles. While this ensures fiscal discipline and allows for design refinement before full construction commitments are made, it also introduces timing uncertainty. Projects can stall between phases if future appropriations are delayed or reprioritized, particularly during budget rebalancing periods or in response to economic downturns. These interruptions may result in escalated costs due to inflation, loss of key personnel or design continuity, and diminished contractor interest.

Construction Cost Escalation: Closely related to funding risks is the issue of land acquisition. Raleigh does not currently engage in proactive land banking, instead waiting until funding is approved before purchasing property for new stations. In a fast-growing city with increasing development pressure, this reactive model poses several challenges. Site availability may diminish, prices may rise sharply, and zoning constraints may increase if strategic parcels are not secured in advance. The city could find itself forced to purchase suboptimal sites or engage in costly site adaptation measures that would otherwise be avoidable with earlier acquisition.

Another major area of risk lies in construction market volatility. The cost of labor and materials has fluctuated significantly in recent years due to supply chain disruptions, inflation, and regional demand surges. Without mechanisms to adjust project budgets dynamically, Raleigh could face the prospect of bids that exceed original estimates, necessitating scope reductions or project delays. Additionally, longer pre-construction timelines, such as the two to two-and-a-half years currently allocated for permitting and design, further expose projects to market swings that may erode the purchasing power of allocated funds.

Regulatory changes and permitting delays represent additional threats to project schedules. Building code updates, environmental policy shifts, or changes in local zoning ordinances can all introduce unexpected requirements mid-process. These may demand redesigns or additional studies, especially for facilities involving specialized infrastructure such as net-zero energy systems or multi-agency co-location. Similarly, prolonged permitting timelines or unexpected rejections can push projects off their planned trajectories, creating a cascade of delays and cost implications.

<u>Environmental and climate-related risks:</u> Raleigh is situated in a region prone to severe weather events, including hurricanes and flooding. These events can disrupt construction activity, delay materials delivery, and impact worker safety. Longer term, they may also require increased investment in resilient design features that were not initially budgeted. For stations built in low-lying or rapidly developing areas, the lack of early environmental review or mitigation planning could lead to costly mid-project adjustments or post-occupancy issues.

<u>Personnel-related risks:</u> Without structured input from end users during the design phase, there is a risk that completed facilities may not fully meet operational needs, requiring retrofits or limiting effectiveness. Furthermore, turnover among project management staff, architects, or city officials over a multi-year timeline can result in knowledge gaps, design drift, or miscommunication unless thorough documentation and handoff protocols are in place.

Risk Mitigation Strategies

<u>Performance Monitoring:</u> To effectively manage these risks, the City of Raleigh should consider establishing a formalized risk mitigation strategy that is integrated into the fire station development process. This strategy would begin with the creation of a risk register for each project, maintained by the project manager and reviewed at major milestones. The register would identify potential risks, assign likelihood and impact ratings, and define mitigation strategies such as securing flexible design contingencies, adjusting permitting timelines, or advancing land acquisition where possible.

<u>Adaptive Planning:</u> The city should also consider building greater flexibility into its CIP model by pre-allocating small reserves that can be deployed when construction markets change unexpectedly. A policy enabling limited pre-funding of land purchases based on service risk forecasts could significantly reduce exposure to rising real estate costs and preserve access to ideal locations. Internally, stronger cross-departmental collaboration between Planning, Budget, Fire, and Real Estate staff would help align risk management across key stages of project development.

Finally, embedding risk awareness into staff training and project documentation processes would ensure continuity of knowledge even as project personnel change. This would preserve institutional memory and reduce the chances of rework or scope misalignment during handoffs.

By recognizing the diverse and interconnected risks that accompany fire station development, and by adopting proactive, structured mitigation measures, Raleigh can strengthen the resilience and reliability of its capital planning program. This approach will help ensure that public safety infrastructure continues to evolve in step with community growth while maintaining fiscal discipline and project execution integrity.

Cost Saving Strategies

As the City looks to reduce the cost of building new fire stations, it should consider the following strategies that decrease cost while maintaining safety and effectiveness:

- Land Banking
- Multi-Use and shared facilities
- Standardized and Scalable Designs
- Multi-Story Stations
- Hot Bunking
- Service Contracts for Out-Of-Jurisdiction Coverage

Land Banking

Land acquisition represents one of the most critical and challenging aspects of fire station development. Fire stations require strategic positioning to ensure optimal emergency response access, but these prime locations face intense competition from commercial development, creating significant acquisition challenges.

As Raleigh continues expanding, available land becomes increasingly scarce while property prices escalate, making acquisition both complex and costly. The city must navigate these constraints while ensuring fire stations are optimally positioned to serve community needs. Balancing accessibility, affordability, and long-term suitability makes land acquisition among the most demanding yet essential components of fire station development.

Land banking—the strategic acquisition and retention of land for future use—provides an effective cost-reduction strategy for fire station development. By securing sites in advance, the city can better manage costs, ensure optimal site selection, and align infrastructure

development with long-term community planning. Among surveyed peer communities, Greensboro and Virginia Beach utilize land banking approaches, identifying and securing properties before construction needs arise. Durham recently received approval to purchase land for six planned future stations, while Charlotte seeks to reinstate funding for future station site identification and acquisition through their capital improvement program.

Cost Management Benefits

Land banking's primary advantage lies in avoiding escalating real estate costs. As urban development progresses, property prices rise due to inflation and increased demand. Early acquisition enables the city to secure sites at lower prices while preventing competition with private developers, ultimately saving taxpayer dollars. This proactive approach allows selection of ideal locations that optimize emergency response coverage rather than accepting whatever parcels remain available during construction phases.

Strategic Planning Advantages

Land banking enables thoughtful site selection that minimizes displacement of existing residents or businesses, allowing fire stations to integrate seamlessly into broader urban development strategies. Early acquisition ensures the city maintains designated sites for critical infrastructure in fast-growing areas where suitable land may become scarce or prohibitively expensive. This approach positions fire stations to effectively serve areas projected for future growth while preparing the city for unforeseen emergencies or urgent infrastructure needs.

Without land banking strategies, city leaders may face rushed decision-making under tight deadlines, potentially resulting in suboptimal site selection or inflated acquisition costs.

Operational and Financial Benefits

Early land acquisition provides valuable time for careful fire station design without immediate construction pressures. Zoning requirements, environmental assessments, and regulatory approvals can be addressed proactively, avoiding costly construction delays. This extended timeline enables thoughtful planning regarding building layout, infrastructure requirements, and operational efficiency.

Until construction begins, banked land can generate interim value through temporary uses such as parking facilities, community gardens, or local events, providing direct income or community benefits while maximizing investment value.

From a fiscal management perspective, purchasing land separately from construction budgets allows cost distribution across multiple fiscal years, making financial burdens more manageable. Having land already acquired simplifies the funding process for fire station construction by eliminating one major expense component from project budgets.

Multi-Use and Shared Facilities

Co-locating partner agencies within Raleigh fire stations presents significant operational and financial advantages while enhancing the range and quality of city services delivered to residents.

Operational Benefits

Co-location enhances collaboration and coordination by enabling agencies to work more effectively together through improved communication and joint emergency response capabilities. Physical proximity facilitates unified planning for large-scale incidents or disasters, as agencies can better coordinate strategies and responses. This arrangement enables expertise sharing, allowing agencies to leverage specialized skills and resources while providing collaborative training opportunities that enhance personnel capabilities and strengthen inter-agency partnerships.

Financial Advantages

Cost-sharing arrangements for utilities, maintenance, and infrastructure reduce operating expenses while maximizing space utilization within fire stations, ensuring underutilized areas are optimized. Shared resources including technology, equipment, and administrative services streamline operations and lower overall expenses for participating agencies.

Service Enhancement

Co-located facilities function as one-stop service hubs where residents can conveniently access multiple services at a single location. These arrangements create centralized incident management hubs, enabling more efficient agency response and recovery during crises such as natural disasters or public health emergencies. Community perception tends to be positive, as co-location demonstrates unified public safety presence, efficient taxpayer resource utilization, and commitment to inter-agency collaboration, reinforcing public trust and support.

Potential Partner Agencies

Several agencies could benefit from fire station co-location, including Wake County EMS for immediate medical support during fire-related incidents and medical aid calls, the Raleigh Police Department for enhanced public safety coordination and joint operations, and city/county community services or health organizations to provide accessible preventive care and public outreach programs.

Implementation Requirements

Successful co-location implementation requires proactive planning to address potential challenges and ensure smooth inter-agency collaboration:

- Feasibility Assessment: Comprehensive studies should evaluate compatibility between fire stations and potential co-locating agencies, assessing space requirements, operational needs, cost implications, and regulatory considerations. Stakeholder engagement including fire personnel, partnering agencies, and community representatives ensures all perspectives are considered and concerns addressed early in planning processes.

- Governance and Protocols: Clear agreements including Memorandums of Understanding should specify cost-sharing arrangements for utilities and maintenance, ensuring fairness and transparency. These agreements must delineate shared space usage and access protocols, minimizing scheduling or resource allocation conflicts. Clear decision-making mechanisms and conflict resolution processes facilitate collaboration and accountability.

- Emergency Response Planning: Joint emergency response plans should prioritize fire department access to critical spaces while accommodating co-located agency needs. Regular drills test and refine protocols, ensuring readiness for high-pressure situations and avoiding operational bottlenecks.

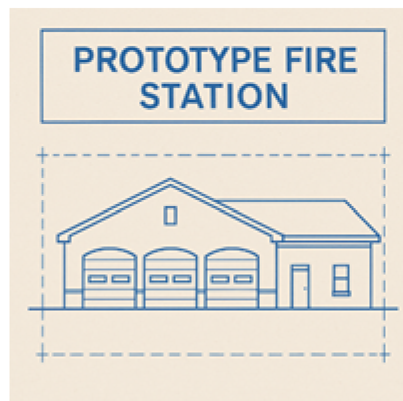
- Space and Security Management: Dedicated areas should be allocated for each agency's critical functions including workstations, storage, and meeting rooms, while shared spaces are optimized through scheduling systems. Modern access control systems must provide tiered access, ensuring sensitive areas such as apparatus bays and emergency operation centers remain secure. Regular security protocol reviews reduce risks and ensure safe working environments.

- Regulatory Compliance: Collaboration with city officials, planners, and legal experts ensures zoning requirements and safety standards are met. Facility audits and design modifications may be necessary to accommodate partner agency needs while adhering to fire codes, accessibility requirements, and other regulations. Clear liability agreements prevent disputes regarding accidents or property damage.

- Ongoing Management: Regular feedback sessions with personnel from both agencies help identify and resolve emerging issues. Periodic assessments of operational efficiency, space utilization, and financial performance enable necessary adjustments. Technology integration including shared scheduling systems and communication platforms streamlines operations and enhances collaboration.

Through careful planning and proactive management, co-location arrangements can significantly improve public safety coordination, operational efficiency, and community service delivery while demonstrating responsible stewardship of taxpayer resources.

Standardized and Scalable Designs



As Raleigh continues to expand, the city faces significant challenges in balancing the need for additional fire stations with fiscal constraints. The adoption of standardized and scalable designs presents a practical approach to reducing costs while maintaining operational effectiveness and construction quality.

Standardized fire station designs utilize pre-approved architectural plans that can be replicated across multiple locations with site-specific modifications to address local conditions and operational requirements. Scalable designs enable Raleigh to adjust facility size, apparatus bay capacity, and living quarters based on the response area's projected growth and call volume demands. This approach promotes construction efficiency while avoiding the cost overruns typically associated with extensive customization. These designs undergo comprehensive safety and zoning compliance reviews during initial development, streamlining the approval process for subsequent projects.

This methodology offers several operational advantages:

- Predefined blueprints enable contractors to move directly from design to construction phases without delays from site-specific modifications. Reduced customization requirements accelerate permitting timelines, allowing fire stations to become operational more quickly.

- Financial benefits extend beyond shortened construction schedules. Standardized plans enable bulk material procurement, reducing overall project costs and improving procurement efficiency. Contractors develop expertise with repeated designs, leading to more efficient labor processes and reduced construction inefficiencies.

- Standardized designs also improve operational consistency across the fire department. Personnel transferring between stations encounter familiar layouts, enhancing response efficiency and reducing training requirements. Maintenance providers benefit from uniform infrastructure, simplifying upkeep procedures and reducing long-term operational expenses.

- The scalable nature of these designs accommodates future expansion needs. Fire stations can be constructed with provisions for additional apparatus bays, dormitories, or administrative spaces as requirements evolve. Prefabricated components can be integrated during later phases, eliminating costly renovations or complete facility replacement.

However, some considerations must be addressed. Site-specific factors, including zoning requirements, soil conditions, and topographic constraints, may necessitate design modifications. Community aesthetic preferences require attention, as standardized designs must complement local architectural character. Some locations may require specialized equipment storage, training facilities, or unique operational spaces that add complexity to standard designs.

These challenges can be effectively managed through strategic planning and stakeholder collaboration. Working closely with architects, engineers, and community representatives allows Raleigh to adapt standardized designs to meet site-specific, aesthetic, and operational requirements while preserving cost-effectiveness and construction efficiency.

Multi-Story Stations

When planning new fire station construction, the Raleigh Fire Department must evaluate the comparative advantages and disadvantages of single-story versus multi-story facilities. This decision requires careful analysis of land availability, construction costs, operational efficiency, and long-term maintenance requirements. Each design option presents distinct benefits and constraints that must be assessed against the city's emergency service objectives.

Single-story fire stations offer significant operational benefits:

- Turnout times are optimized as firefighters can access apparatus bays directly without navigating stairs or sliding poles, potentially saving critical seconds during emergency dispatch.
- Single-level designs ensure universal accessibility for all personnel, including those with mobility limitations or injuries.
- From a construction perspective, single-story facilities typically require lower initial capital investment due to simplified structural requirements that eliminate the need for additional reinforcements, stairwells, or elevator systems.
- Maintenance operations are streamlined with all spaces accessible from ground level, simplifying cleaning, repairs, and routine upkeep.
- Safety risks are reduced by eliminating vertical circulation elements that pose fall hazards.
- Equipment movement is also simplified, as heavy firefighting apparatus and gear can be transported throughout the facility without vertical constraints.

Despite these advantages, single-story designs present notable limitations, particularly in land-constrained environments. These facilities require larger site footprints, which can be prohibitively expensive in areas where land availability is limited or costs are elevated. Utility expenses for heating and cooling may be higher due to the increased horizontal area requiring climate control. Future expansion opportunities are constrained, as outward growth may be limited by property boundaries or zoning restrictions.

Conversely, multi-story fire stations provide effective solutions for densely developed or land-constrained areas. Vertical construction maximizes space usage on smaller sites, reducing overall land acquisition requirements. Functional separation is enhanced by locating living quarters and administrative offices on upper floors while dedicating ground-level space exclusively to emergency operations. Energy efficiency may be improved through compact vertical design that reduces heating and cooling demands. Expansion flexibility is increased, as additional floors can be added rather than requiring horizontal site expansion.

Multi-story construction also presents disadvantages. Emergency response times may be marginally slower due to the time required for personnel to descend stairs or use sliding poles. Construction and maintenance costs are typically higher due to requirements for stairwells, ADA-compliant elevators, and enhanced structural reinforcement. Safety risks increase with vertical circulation elements, particularly during high-stress emergency situations. Building systems including HVAC, plumbing, and electrical infrastructure become more complex in multi-level facilities, resulting in higher installation and maintenance costs.

Construction cost also differ between the two and, and cost-effectiveness varies significantly based on local conditions. In urban areas with high land values, multi-story designs often provide superior economic value by minimizing site requirements and preparation costs. In suburban or rural areas where land is more readily available and affordable, single-story stations may offer better economic performance, particularly when elevator systems are not required.

Single-story stations often require lower initial construction investment due to simplified structural design. Elimination of vertical circulation systems reduces accessibility compliance costs, and mechanical, electrical, and plumbing systems are less complex, reducing installation expenses. However, under certain conditions, single-story construction can be more expensive. Larger foundations and roof areas require additional materials and labor. In urban areas where land costs are significant, the larger site requirements can substantially increase total project costs. Site preparation expenses may be higher due to the need for extensive grading, drainage, and utility work across a larger area.

Multi-story facilities can provide cost advantages in specific circumstances. Smaller foundation and roof areas reduce material and labor costs for these components. In land-constrained areas, vertical design maximizes site utilization without requiring additional land acquisition, providing economic benefits when land costs are high. However, there are more cost factors for multi-story construction compared to single-story construction. Structural reinforcement requirements for upper floors increase engineering and material expenses. Stairwell and elevator installation adds significant construction costs while ensuring safety and accessibility compliance. Multi-level mechanical systems require more complex design and installation, increasing overall project costs.

Long-term operational costs must also be evaluated. Single-story facilities may incur higher utility expenses due to the energy requirements for heating and cooling larger horizontal spaces. Multi-story stations may experience elevated maintenance costs associated with stairwell, elevator, and complex mechanical system upkeep.

The optimal design selection for Raleigh Fire Department facilities must consider multiple variables including land availability, construction budget constraints, operational efficiency requirements, and long-term cost projections. In urban areas characterized by expensive or limited land availability, multi-story fire stations provide cost-effective solutions through reduced land-related expenses. In suburban or rural areas with adequate space availability, single-story stations may be preferable due to simplified construction and enhanced operational accessibility. Through comprehensive evaluation of financial and operational factors, the city can determine the most appropriate and cost-effective fire station design to meet current and projected emergency service requirements.

Shared Berthing

Shared berthing, where firefighters share sleeping spaces based on shift schedules, represents a potential strategy for reducing fire station space requirements and construction costs. This approach minimizes the number of beds and sleeping quarters required, enabling smaller facility designs or repurposing space for essential functions such as training areas, equipment storage, or specialized operational rooms.

Cost savings extend beyond initial construction through reduced heating, cooling, and maintenance expenses for smaller dormitory areas. When positioned strategically near apparatus bays, shared sleeping arrangements may improve emergency response times by reducing mobilization distances. Given the shift-based nature of fire service operations, shared berthing optimizes space utilization since not all personnel require simultaneous bed access.

However, shared berthing presents significant challenges affecting firefighter health and morale. Hygiene concerns are paramount, as shared sleeping surfaces increase disease transmission risks without rigorous cleaning protocols. Regular sanitation and fresh bedding rotation requirements add operational workload and logistical complexity. Sleep disruption poses another critical issue, as personnel arriving and departing for shift changes may disturb resting firefighters, compromising recovery and performance capabilities. Sustained sleep quality reduction can negatively impact job performance, safety, and overall well-being.

Personnel morale considerations are equally important. Many firefighters rely on private sleeping quarters for decompression between high-stress emergency calls. The absence of personal rest space can contribute to psychological stress and burnout in an already demanding work environment where mental resilience is essential. Bunk assignment coordination becomes increasingly complex in high-volume stations with overlapping shifts or fluctuating staffing levels.

While shared berthing provides space efficiency and cost reduction benefits, the associated hygiene, sleep quality, and personnel well-being concerns require careful evaluation. Should the Raleigh Fire Department consider implementing this approach, comprehensive mitigation strategies must be developed, including strict sanitation protocols, noise reduction measures, and alternative rest areas. Successfully balancing space efficiency with firefighter health and morale will be essential to ensure shared berthing remains operationally viable without compromising emergency response effectiveness or personnel retention.

Service Contracts for Out-Of-Jurisdiction Coverage

Service agreements between the Raleigh Fire Department and Wake County present a cost-effective solution that leverages existing infrastructure, personnel, and expertise rather than requiring duplicated emergency services. Cooperative agreements enable both jurisdictions to share costs and maximize resource efficiency while collaborating on strategically located new fire station construction through cost-sharing models. This partnership approach strengthens regional emergency response capabilities while preventing unnecessary expenditures by ensuring infrastructure serves both city and county residents.

Formal service agreements enhance emergency response coverage and reduce response times in underserved areas, increasing the likelihood of saving lives, minimizing property damage, and improving public safety. Enhanced fire coverage can lead to improved Insurance Services Office (ISO) ratings for county areas, reducing insurance premiums for homeowners and businesses while making communities more attractive for development and benefiting the broader local economy.

Service agreements foster stronger working relationships between RFD and Wake County, promoting regional collaboration in fire protection and emergency management. Aligned training programs, operational protocols, and resource-sharing strategies improve coordination and readiness for large-scale incidents, natural disasters, and mutual aid situations, ensuring all residents receive consistent emergency response services regardless of jurisdiction.

Utilizing RFD's existing resources to expand county coverage provides justification for additional investments in personnel, equipment, and facility upgrades. Demonstrating capacity to serve larger regional populations strengthens RFD's position when pursuing grants, state funding, or budget allocations, ensuring the department remains well-funded and prepared to meet growing regional demands.

Several funding methodologies exist for county service districts, each offering different approaches to determining reimbursement costs for services provided outside city limits:

- Cost Per Square Mile Method: Based on RFD's annual budget of $86,055,052 divided by the city's 149.6 square miles, resulting in $575,234 per square mile. Partner jurisdictions would reimburse the city at this rate for each square mile of contracted coverage.

- Budget Percentage Method: RFD accounts for 6.173% of the city's total municipal operating budget. Applied to the city's tax rate of $0.3550, the fire department's share equals $0.0219 per $100 of assessed property valuation. Partners would calculate compensation based on the assessed value of areas receiving fire services using this rate.

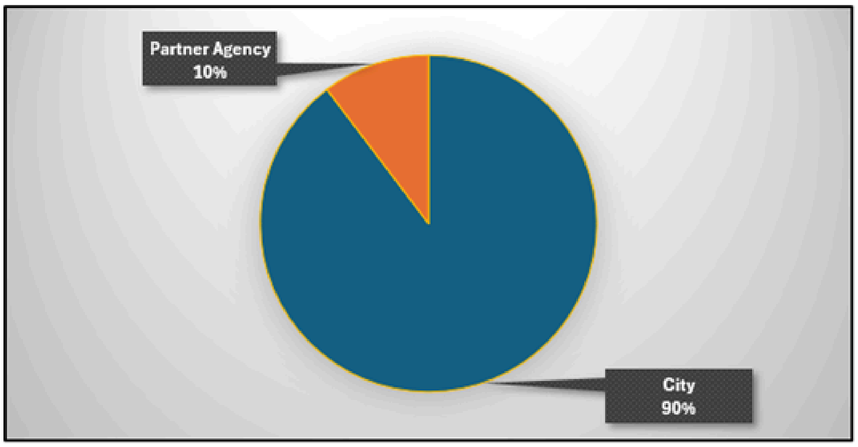
- Cost Per Call Method: Dividing the fire department's operating budget by total emergency calls (33,393 in 2024) yields a cost of $2,359 per call. Partner jurisdictions would reimburse based on the number of service calls within contracted areas.

- Multi-Factor Cost-Share Formula: This comprehensive approach analyzes five key elements: population served, geographic area, total heated building square footage, property tax valuation, and fire department response frequency. Each element receives equal 20% weighting initially, though adjustments can be made based on relative importance. Using rolling averages of three to five years smooths service demand fluctuations. Partner jurisdictions reimburse based on their proportional responsibility percentage, covering both initial construction and ongoing operational costs for stations serving multiple jurisdictions.

The multi-factor approach offers flexibility, allowing jurisdictions to negotiate element weighting to better reflect actual service demands while maintaining a total weighting of 100%. This methodology can accommodate both existing service provision and collaborative new station construction costs, creating a sustainable framework for regional fire protection services.

	Data	Municipal %	Municipal Wgt	Municipal Result
Population	700,000	91.50%	20.00%	18.30%
Geographic Area	149.6	82.38%	20.00%	16.48%
Total Heated Square Footage	1,500,000	78.95%	20.00%	15.79%
Poperty Valuation	$82,381,157,024	99.82%	20.00%	19.96%
Calls for Service	33,393	95.70%	20.00%	19.14%
				89.67%

	Data	Partner Agency %	Partner Agency Wgt	Partner Agency Result
Population	65,000	8.50%	20.00%	1.70%
Geographic Area	32.0	17.62%	20.00%	3.52%
Total Heated Square Footage	400,000	21.05%	20.00%	4.21%
Poperty Valuation	$150,000,000	0.18%	20.00%	0.04%
Calls for Service	1,500	4.30%	20.00%	0.86%
				10.33%



Revenue Projections

The Raleigh Fire Department's future fire station funding comes primarily from the City's General Fund, with property taxes, sales taxes, inspection fees, licenses, and miscellaneous fees serving as the most relevant revenue sources for fire station construction. These revenue streams grow directly with geographic and population expansion. While other General Fund components like intergovernmental revenue, interest earnings, and internal transfers support the city's overall financial position, they have less direct connection to city expansion. Sewer and water fees, though expected to increase with boundary extensions, are allocated to their respective enterprise departments and cannot fund fire stations.

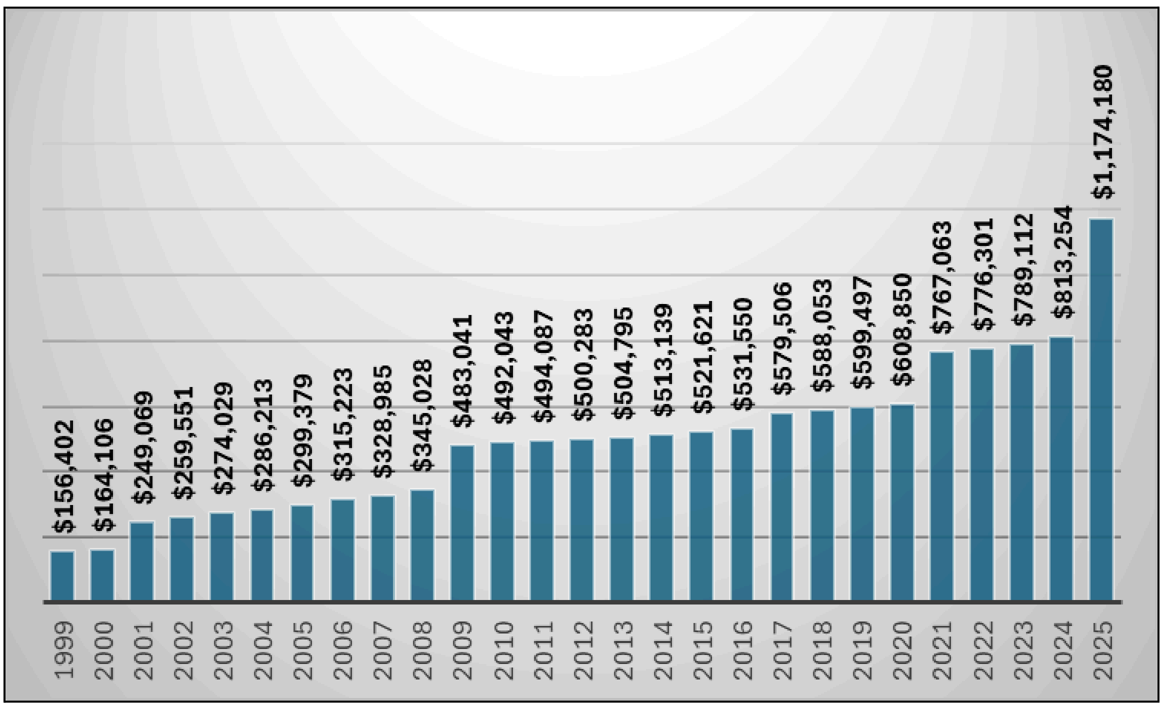
Annexation drives geographic growth, supporting increased property valuations, construction activity, and population density. Raleigh historically practiced involuntary annexation, averaging 1,283 acres annually from 2005 to 2011. State law changes in 2011 made annexation voluntary, requiring property owner consent, which reduced activity to just 197 acres annually through 2014. From 2015 through 2024, annexation increased modestly to an average of 467 acres per year. This 467-acre annual rate serves as the baseline assumption for forecasting through 2050, reflecting the city's recent experience under current legal constraints and anticipating continued steady boundary expansion.

An exception to this average growth rate could occur in the southeast area, where Raleigh's September 2022 Southeast Special Area report proposed expanding the city's Extraterritorial Jurisdiction (ETJ). This proposed expansion encompasses approximately 18 square miles of predominantly undeveloped or low-density rural land and could significantly influence the long-range funding model for fire station development development. The phased incorporation of this area into Raleigh's jurisdiction presents both opportunities and challenges for future financial planning.

The study outlined five ETJ expansion areas, with Area 1 (Southwest) anticipated within two years of adoption, though this has not yet occurred. Areas 2-4 are projected for expansion within two to ten years, while Area 5 may remain rural permanently. Area 1's expansion, including over 1,300 acres adjacent to active development zones, should generate development pressure and increase property tax revenues. Future annexation will require extending utility infrastructure, roadways, and public services, supporting intensive development and accelerating valuation growth.

While the study doesn't quantify specific revenue impacts, the fiscal analysis suggests new development could support two additional fire stations. If the full 18-square-mile area is annexed and developed according to city standards, particularly with higher-density zoning and mixed-use patterns, added valuation could exceed original model assumptions.[5]

However, several limitations warrant caution. The phased expansion means incremental revenue gains dependent on voluntary annexation influenced by landowner interest and market conditions. Substantial portions are publicly owned, preserved, or designated for infrastructure like the Neuse River Resource Recovery Facility, limiting the taxable base. Service extension costs for fire protection, transportation, and parks will partially offset revenue gains. Development patterns remain uncertain, requiring detailed cost-benefit evaluations for each phase. While ETJ expansion presents significant revenue opportunities for fire station funding, projections must account for timing, regulatory constraints, infrastructure costs, and voluntary annexation requirements, with regular model updates reflecting evolving growth patterns.



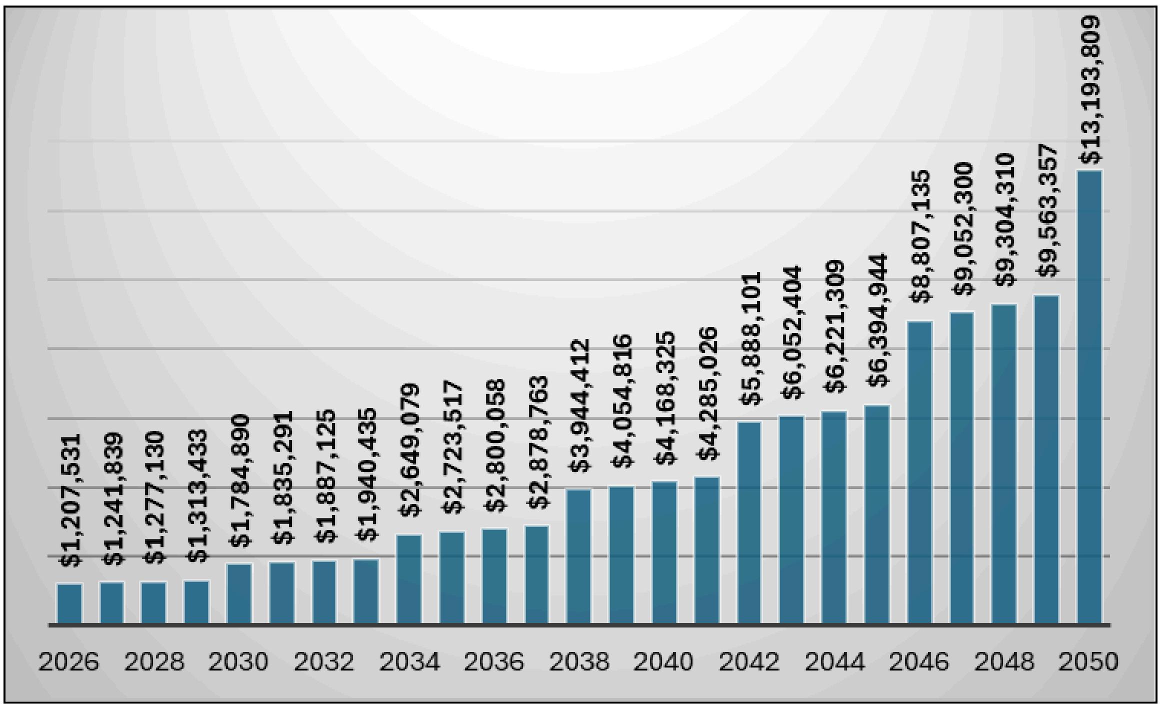
Historical Total Property Valuation (In 100 thousands of dollars)

Property tax revenue represents a major funding source for fire station infrastructure. Forecasting future property valuation required analyzing historical data from 1999 through 2024. Initial exponential smoothing models proved inadequate due to Wake County's periodic property revaluations, which create irregular spikes in assessed values that traditional time

[5] The city's report projected new venue between $36.5 million (low growth rate) and $275 million (high growth rate) over a 30-year time frame of Areas 1 – 4 being brought into the city's corporate limits.

series methods cannot capture. Revaluations occurred in 2001, 2009, 2017, and 2021, with the county transitioning from an eight-year to a four-year cycle in 2017.

To address these nonlinear changes, the study adopted a hybrid forecasting method simulating the revaluation cycle. This approach applies a 38.80 percent increase every four years, reflecting average percentage changes from recent revaluations in 2017, 2021, and 2025. Non-revaluation years use an annual growth rate of 2.76 percent, representing the average increase during those periods from 1999 to 2024. For personal property, a consistent 3.76 percent annual growth rate was applied based on the same 26-year period. These projections exclude potential southeast study area revenues and aim to replicate cyclical property growth more realistically than standard forecasting models.



Projected Total Property Tax Valuation (In 100 thousands of dollars)

Using this forecasting framework, total property valuation is projected to reach $178.4 billion by 2030, $272.3 billion by 2035, and $1.3 trillion by 2050. At the current tax rate of $0.335 per $100 assessed valuation, this generates projected annual property tax revenues of $204.5 million in five years, $519 million in ten years, and $4 billion by 2050. These figures assume a constant tax rate, though rates are reviewed annually and may be adjusted for fiscal needs, voter-approved bonds, or revenue neutrality policies.

Sales tax provides additional funding for fire protection infrastructure. Based on 2009-2025 data showing 5.14 percent average annual growth, sales tax revenue is projected to grow by $44.9 million in five years, $102.6 million in ten years, and $394.4 million by 2050. Sales tax is more economically sensitive than property tax, fluctuating with employment, consumer spending, retail activity, and inflation.

These long-range projections have inherent risks: property valuations are affected by annexation, market trends, revaluation practices, legal changes, development policies, and macroeconomic conditions. Revaluation magnitude and impact vary widely based on housing and commercial market performance. Sales tax projections face greater uncertainty from consumer trends, online retail shifts, inflation, state policy changes, and economic cycles.

Twenty-five-year revenue projections must be approached cautiously. While assumptions reflect reasonable interpretations of past trends, they require regular review and updates as new data and policy decisions emerge. These projections nonetheless provide a broad framework for assessing Raleigh's financial capacity to invest in fire stations and maintain public safety infrastructure as the city grows.

Sales tax revenue is also an additional funding mechanism for city services, including fire protection infrastructure. Sales tax projections were based on historical data from 2009 through 2025. Over this 17-year period, average annual growth in sales tax collections was 5.14 percent. While this figure reflects a relatively stable long-term trend, sales tax revenue is more susceptible to economic cycles than property tax. Changes in employment, consumer spending, retail activity, and inflation all impact year-to-year sales tax collections. Because exponential smoothing and regression models did not provide reliable future forecasts due to the lack of consistent growth patterns, this study adopted a constant annual growth model using the historical average of 5.14 percent. This assumption aligns with the long-run growth trend while avoiding overstated gains based on short-term spikes.

VI. Discussion of Findings, Recommendations, and Implementation Roadmap

Key Findings and Discussion

Current Performance Challenges

The analysis reveals that RFD's current performance falls short of NFPA 1710 standards in several critical areas. With only 54% of first-due units meeting target response times and a 90th percentile total response time of 9 minutes and 3 seconds in 2024, there are opportunities for improvement. The root cause analysis identifies three primary contributors to delayed responses:

1. **Alarm Handling Delays**: With a 90th percentile alarm handling time of 2 minutes and 46 seconds against a 1-minute target, this represents the most cost-effective improvement opportunity. A 30-second reduction in call handling time would result in an 8.66% increase in first-due performance citywide, and reducing overgoal incidents by over 1,500 annually.

2. **Unit Workload (Busy Overgoals)**: The most significant factor affecting response performance is the unavailability of the closest unit due to other calls or backfill assignments. This issue has increased steadily over the past three years, indicating that call volume is outpacing available resources. Geographic analysis shows these busy overgoals are concentrated around Raleigh's core and higher-volume areas but are distributed throughout the city.

3. **Geographic Coverage Gaps**: Distance overgoals identify two key areas requiring immediate attention: the Wilders Grove area between stations 7, 11, 12, and 21, and the Neuse Crossroads area in Raleigh's northeast between stations 19, 22, and 28. These areas consistently experience late responses due to driving distance from existing stations.

Alarm Handling and Dispatch Protocols

Addressing alarm handling challenges is often the fastest and most cost-effective way to improve department performance. NFPA 1710 and 1225 define a 60-second 90th percentile target for alarm handling; the current 90th percentile alarm handling time falls far past this target at 2 minutes and 45 seconds. Additionally, RFD's alarm handling time is disproportionate to that of the rest of the state, exceeding the 95% confidence interval for alarm handling state-wide. The current level of performance is concerning and is a significant opportunity to raise the bar for all public safety agencies by unilaterally improving alarm handling times across all agencies.

Additionally, current dispatching protocols for EMS incidents are resulting in an unnecessarily higher workload for RFD units, and in some cases, do not make a meaningful impact for the patient. Actions should be taken to improve dispatching protocols and identify opportunities for improvements in the call handling process:

- **It is recommended that the staffing levels and outcomes be assessed for Raleigh-Wake County 9-1-1.** A common issue facing fire departments and other emergency service provider is that while populations grow and fire and emergency demands increase, support personnel (such as through 911 emergency communications centers) do not grow proportionally to those needs. A further analysis would determine if that may be the case within the city of Raleigh.

- **RFD, in partnership with Raleigh-Wake 9-1-1, should evaluate a change to use key words to help screen medical emergency calls <u>before</u> the calls are fully processed through EMD.** Other communities utilize certain key words when making the decision to send the fire department. Using these key words, the fire department is dispatched and then the response model is adjusted as the 9-1-1 telecommunicator receives more information. It is recommended that Raleigh Fire Department, in partnership with Raleigh-Wake 9-1-1, evaluate a change to use key words to help screen medical emergency calls before the calls are fully processed through EMD. Doing so will drastically improve alarm handling times by enabling dispatchers to begin assigning responders before going through the entire EMD protocol.

- **It is recommended that RFD reviews current protocols with the Wake County Medical Director to ensure that there is a demonstrated outcome that justifies the fire department response.** Generally, throughout North Carolina, municipal firefighters responding as Emergency Medical Technicians are responding to "Delta" and "Echo" level medical emergencies, to ensure that patients with the most acute medical emergencies are receiving the closest response possible, and that there are enough personnel at the medical emergency to provide initial patient care and packaging for transport to a medical facility. In addition, fire department companies are sent when no EMS unit is available or there will be a lengthy delay of EMS units when they are not readily available. There are some cases of certain “Charlie” level calls being answered as well across the state.   It is unusual for fire department first responders to provide an emergency response to “Alpha” or “Bravo” level medical emergencies.

- **Add quick response vehicles (QRVs) to Raleigh’s apparatus deployment.** QRVs are light-duty vehicles that typically respond to low-acuity medical calls. When considering medical demand, adding QRVs to an apparatus fleet can offer multiple benefits. By handling low-acuity medical calls, QRVs alleviate some of the EMS workload and extra wear and tear on heavier-duty apparatus like engines, and as a dedicated low-acuity medical unit, QRVs can simplify the dispatching process for those incidents. In addition, because they are smaller, QRVs can accelerate more quickly and can navigate urban environments more easily than engine companies.

It was also reported that EMS calls increase on the weekends, when Wake County EMS has fewer units available for calls. If Wake County EMS staffing decreased during weekends, resulting in higher EMS workload for RFD, it is recommended that this is discussed with Wake County EMS to ensure appropriate staffing levels are maintained. While municipal government is a key element of the emergency medical response system by providing supplemental responses for the persons needing the most critical care, legislatively, response to medical emergencies falls upon the county. In North Carolina, EMS patient care and transport is the legislative responsibility of county government.

Staffing

With respect to operational staffing, the analysis reveals critical staffing shortfalls that compound operational challenges. RFD currently operates with a staffing factor of 3.63, below the industry minimum of 3.75. This inadequate staffing creates a cycle where stress, burnout, and injury-related leave create coverage gaps that can only be filled with costly overtime hours. This is a costly approach that risks worsening the underlying causes of absence.

While RFD aims to have 152 on duty per 24 hour shift, with 184 total firefighters per shift they often fall short of this minimum level. RFD has been able to maintain its level of service despite this, but ultimately needs to bolster its staffing levels.

Non-operational staffing also needs consideration:

- RFD currently does not have integrated human resources, instead sharing HR resources with the City. Operational staff need to go outside of the department for assistance with administrative paperwork, and are not familiar with HR processes. Various HR functions are spread between multiple divisions in the Department, which should be consolidated.

- RFD needs to bolster its ability to recruit and train additional staff. RFD does not currently have a dedicated recruitment officer, and needs two additional NFPA 1403 live burn instructors.

- RFD's fleet maintenance division is currently understaffed, resulting in the outsourcing of repairs and maintenance. RFD's current maintenance staff are not able to undertake additional training due to the workload, and outsourcing repairs and maintenance that could be conducted in-house induces costs that could be avoided.

Support Facilities

Training Facilities

When considering the department's capacity for training, fleet maintenance, and other operations logistics, RFD is space-constrained. The current training facilities are out-of-date, originally constructed in the 1950's. The facilities were not originally designed to accommodate the modern needs of RFD with respect to recruitment, training, and burn facilities. Despite various additions and improvements over the years, RFD's current training facilities are due to be replaced, to address the needs of a modern fire department.

In order to accommodate the level of recruitment discussed above, classroom sizes, burn buildings, and other training facilities need to be improved. The current training facilities require much of RFD's training to be conducted off-site. Training off-site reduces the consistency of training, as the availability of off-site locations is not guaranteed year to year, and negatively impact the instruction time of recruits as instructors need to transit between multiple locations.

RFD should aim to centralize training to one in-house location that can accommodate both academy instruction as well as continuing education. Doing so would greatly simplify the logistics of training, improving the consistency and quality of training for new recruits and current operational staff.

As the current burn building are 12-15 years old, RFD should also evaluate the efficacy of Connex-style modular training facilities to supplement or potentially replace the current live burn structures. Other North Carolina cities have invested in these structures, which have proven to be effective for firefighters as well as cost-effective to construct and operate. Being modular, these burn facilities can be replaced or expanded as-needed.

Currently, even with eleven full-time instrucors, the training division needs to pull from Operations for additional instructors or adjuncts. In 2020, the it was identified that seven new instructors were needed, yet since that time, only two of those positions have been filed.

The training division would benefit from deeper analysis and benchmarking to ensure that the department has an appropriate sized facility and an adequate number of staff to manage recruit training as well as firefighter continued education training and special services (e.g., Hazmat and USAR training).

Logistics and Fleet Management

Like its training facilities, RFD's logistics and fleet management division is space-constrained and needs to be expanded. RFD has a robust parts and logistics program that is currently overflowing into fourteen Connex boxes. There is no suitable warehouse storage for Hazmat and USAR resources. Numerous stations have equipment stored outside. Additionally, as RFD's apparatus fleet continues to grow, so will the need for maintenance. In addition to more staff, maintenance and logistics facilities will also need to grow.

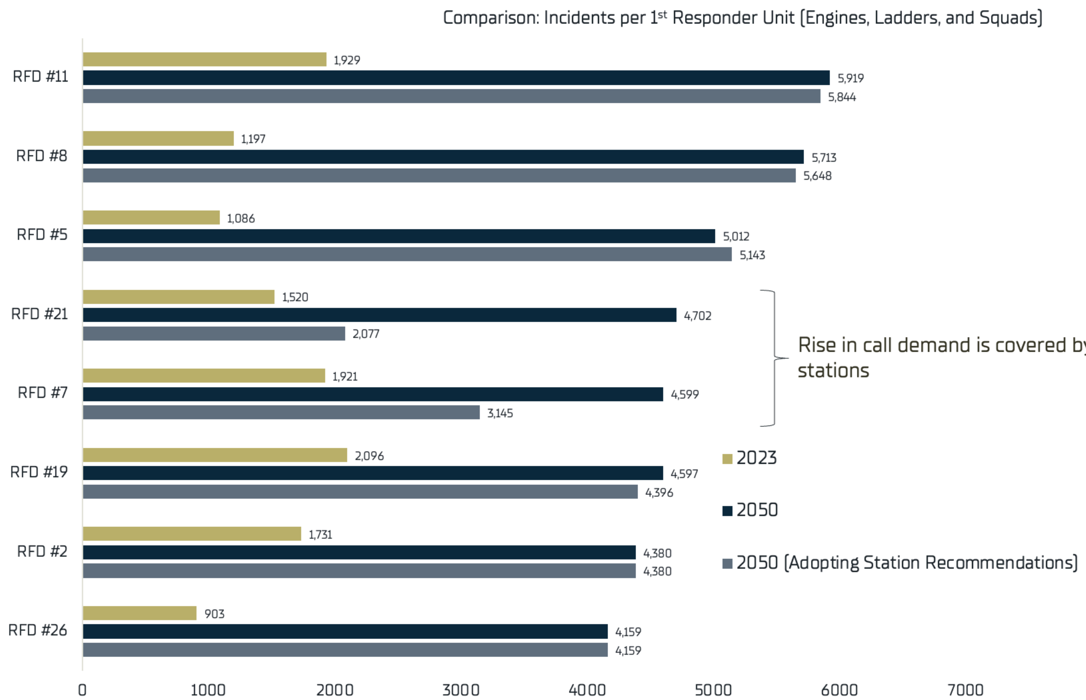
Apparatus Deficiencies and Ladder Truck Coverage

Unit Workload

The most significant factor affecting response performance is unit workload. This issue has increased steadily over the past three years, indicating that call volume is outpacing available resources, and will continue to do so as Raleigh grows. Geographic analysis shows these busy overgoals are concentrated around Raleigh's core and higher-volume areas, but are distributed throughout the city. Raleigh's busiest stations in terms of call volume per first responder unit would immediately benefit from an additional unit, particularly:

1. Station 19
2. Station 11
3. Station 8
4. Station 7 (before construction of station 30)

The construction of Station 30 will alleviate some of the workload experienced by Station 7. Following its construction, the 4th apparatus should then be moved to Station 2.



Ladder Trucks

Raleigh is underserved by ladder trucks, creating operational gaps that directly impact the department's ability to conduct effective rescue and firefighting operations. In a large, rapidly growing city like Raleigh, ladder trucks—which are specialized for rescue operations, ventilation, and elevated fire suppression—must be able to respond quickly across the entire service area to ensure effective emergency response.

The current deployment of ladder trucks results in unacceptably long response times for these critical resources. Analysis shows that for a ladder truck to reach any incident in Raleigh, the expected travel time is up to 6 minutes and 5 seconds at the 90th percentile. This exceeds optimal response standards and leaves significant portions of the city without timely access to specialized rescue and aerial firefighting capabilities.

The master plan analysis demonstrates significant improvement potential through strategic ladder truck additions and repositioning:

- **Optimizing existing ladder deployment** alone could reduce ladder truck response times by 13 seconds, city-wide.
- **Adding one additional ladder truck** would reduce average response times by 21 seconds

- **Adding two ladder trucks** would achieve a 25-second reduction, bringing the 90th percentile travel time down to 5 minutes and 40 seconds

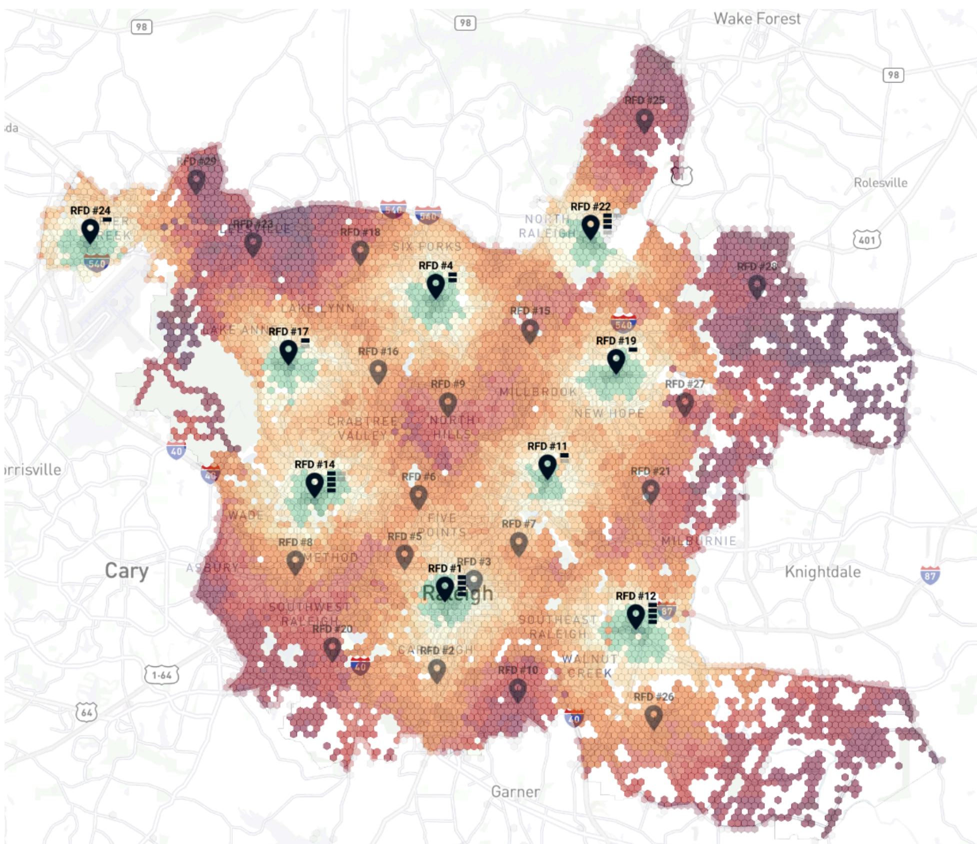
Scenario	Drive Time (90th Percentile)
Optimize existing ladder deployment	5:52 (-0:13)
Optimize existing ladder deployment + 1 ladder	5:44 (-0:21)
Optimize existing ladder deployment + 2 ladders	5:40 (-0:25)

The optimal placement of Raleigh's nine existing ladder trucks is as follows:

- Station 1
- Station 4
- Station 11
- Station 12
- Station 14
- Station 17
- Station 19
- Station 22
- Station 24

This configuration takes into account existing station size limitations, and maximizes coverage and availability of ladder trucks across the city.

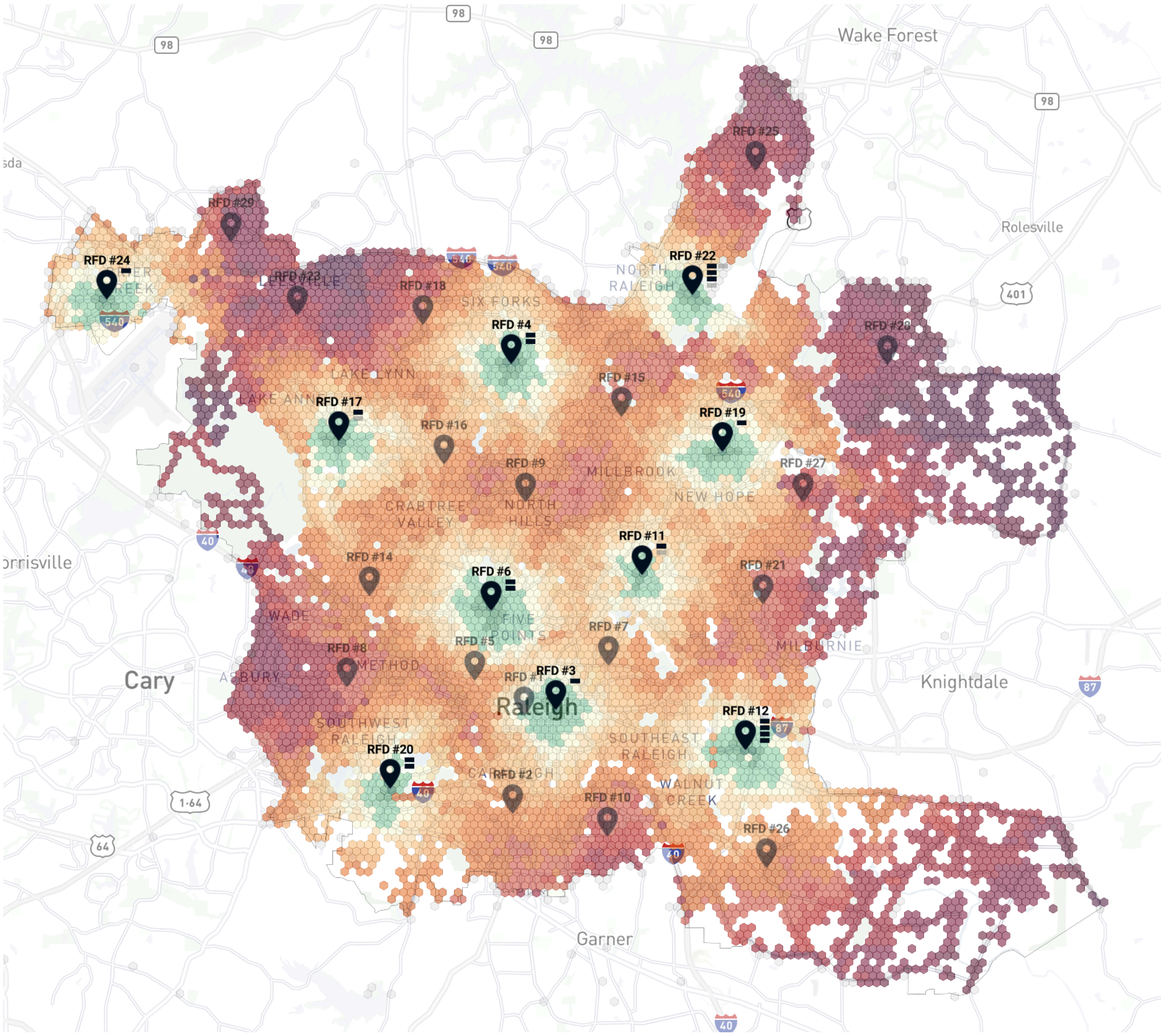
As additional trucks are added to Raleigh's



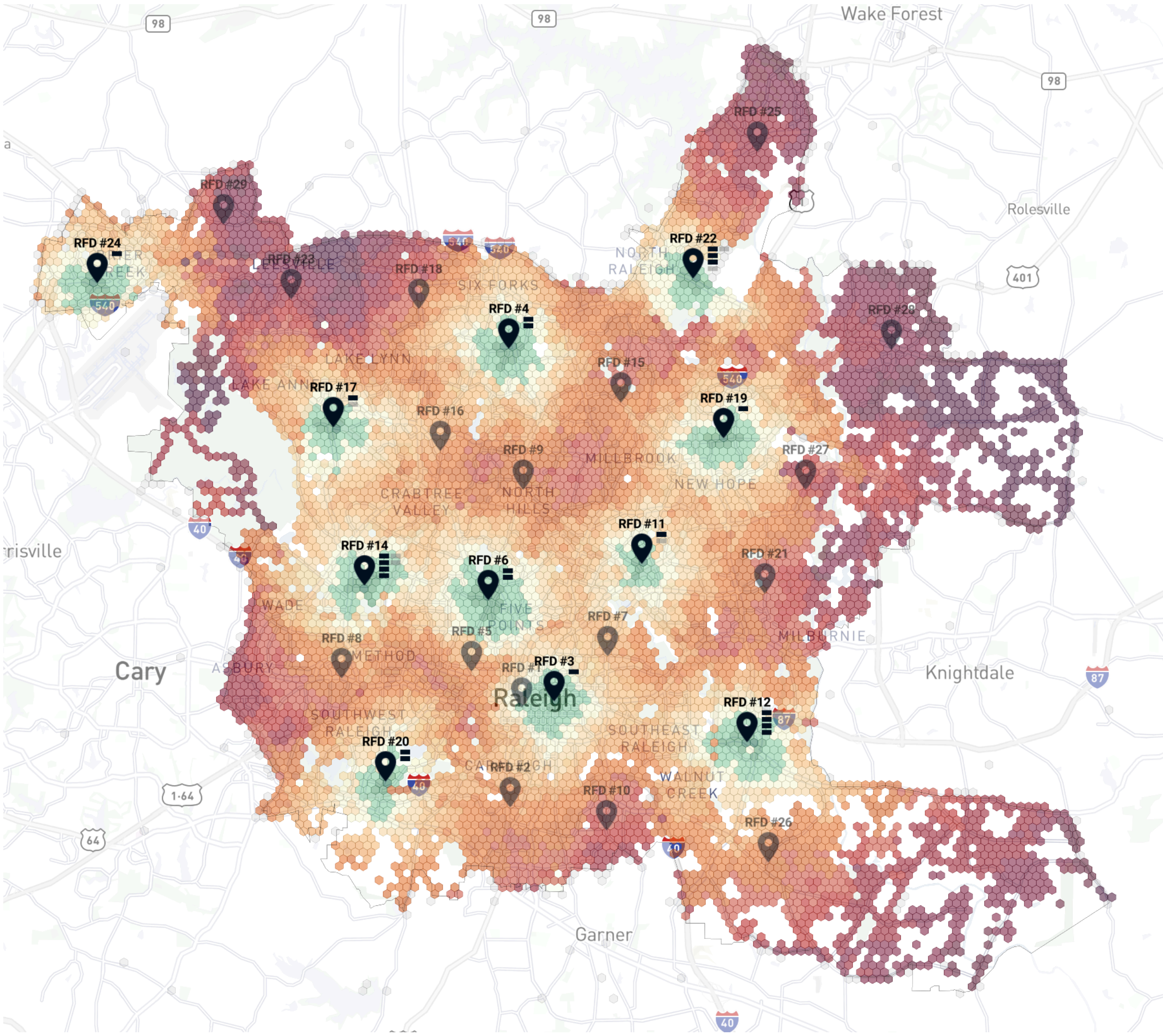
Optimal locations for current ladder trucks, and modeled 90th percentile drive time.

deployment, the optimal ladder distribution changes:

- 10 Ladder Trucks: Stations 3, 4, 6, 11, 12, 17, 19, 20, 22, and 24



- 11 Ladder Trucks: Stations 3, 4, 6, 11, 12, 14, 17, 19, 20, 22, and 24



Station Coverage Gaps and Anticipated Challenges

Two areas within Raleigh were identified to have systemic coverage issues, and would strongly benefit from the addition of a new station nearby: Wilders Grove and Neuse Crossroads.

Beyond coverage gaps, several stations are experiencing or will experience significant increases in call volume that will strain existing resources. Key findings include:

- Stations 11, 8, 19, 2, and 26 are projected to see substantial workload increases by 2050
- Station 11 calls are projected to increase from 1,929 in 2023 to 5,919 in 2050
- Station 8 calls are expected to grow from 1,197 to 5,713 over the same period
- Without additional apparatus, these high-volume stations will experience increased busy overgoals and degraded response performance

The analysis demonstrates that adding four frontline apparatus (two ladder companies, one engine company, and one Quick Response Vehicle) would significantly improve both first-due performance and Effective Response Force capabilities while addressing the specific ladder truck coverage deficiency that currently limits RFD's operational effectiveness.

Phased Recommendations

The Raleigh Fire Department Master Plan employs a phased implementation approach designed to address the most critical operational needs first, while building the foundation for sustainable long-term growth. The recommendations are structured across three distinct phases: Immediate (0-2 years) focuses on high-impact operational improvements; Mid-term (3-10 years) addresses systematic infrastructure modernization through station replacement and resource expansion; and Long-term (11-25 years) manages geographic service area expansion driven by annexation patterns while completing infrastructure renewal.

While discussed here, detailed station construction timelines and staffing expansion plans are presented in dedicated sections later in this report, providing the framework necessary for successful implementation of these strategic priorities.

Immediate Actions (0-2 Years)

The Raleigh Fire Department faces critical performance gaps that require immediate intervention to establish a foundation for future growth and service excellence. Analysis of current operations reveals three high-impact areas where focused action can yield measurable improvements in emergency response performance while preparing the organization for the challenges ahead.

1. **Address alarm processing delays:** The most impactful and cost-effective improvement RFD can implement is reducing alarm handling time. Working with the Raleigh-Wake Emergency Communications Center, the department should:

    a. Implement keyword-based screening protocols to streamline dispatch decisions
    b. Refine EMS dispatch protocols to prevent unnecessary responses
    c. Establish performance monitoring systems to track progress toward the 1-minute NFPA standard

    d. Provide additional training for dispatchers on fire department operational priorities

Timeline and Implementation: Begin ECC collaboration immediately in 2025, deploy monitoring systems and training programs throughout 2026, and achieve the 30-second reduction target by 2027.

Estimated Investment: Minimal direct costs, primarily focused on process improvement, training, and system modifications.

2. **Increase minimum staffing:** RFD should immediately hire 18 additional firefighters to achieve a staffing factor of 3.75, the industry minimum standard. This investment will:
    a. Reduce overtime costs and burnout-related absences, improving both financial sustainability and personnel wellness
    b. Improve unit availability and reduce busy overgoals
    c. Enhance firefighter safety and operational effectiveness
    d. Provide a foundation for future growth

The implementation requires aggressive recruitment efforts, potentially including a dedicated recruitment officer position, enhanced compensation packages to compete in the regional market, and streamlined hiring processes to accelerate candidate processing. Integration of HR support within RFD will provide the administrative infrastructure necessary to support ongoing recruitment and retention efforts.

Timeline and Implementation: Begin recruitment immediately in 2025, complete hiring and training by end of 2026, achieve consistent 3.75 staffing factor in 2027.

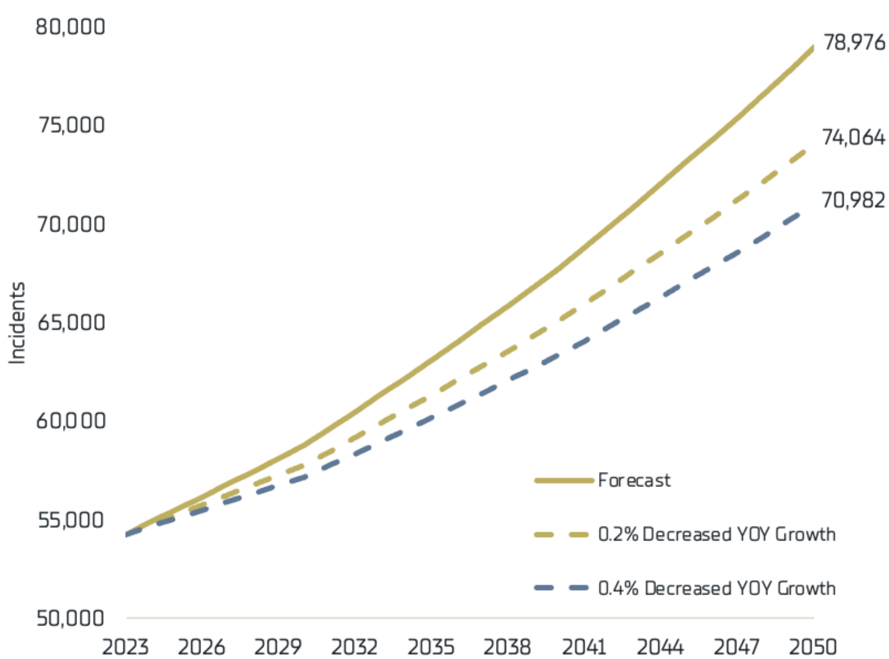
3. **Operational Infrastructure Enhancement:** Three critical infrastructure improvements will provide immediate operational benefits while establishing the foundation for long-term development:

    a. **Fleet maintenance enhancement** through addition of 4 mechanics over a 4-year period will expand in-house repair capabilities, reduce costly outsourcing, and provide advanced training opportunities for maintenance staff working with increasingly complex modern apparatus.

    b. **Addition of one ladder company and optimizing existing ladder deployment** are the first steps in addressing Raleigh's need for additional ladder trucks and maximizing the impact of existing units. The first unit should be operational in 2027. Ladder deployment should follow the recommendations outlined in the previous section.

    c. **Traffic management system deployment** represents a technology-based approach to improving response times during peak traffic periods. Strategic placement of traffic pre-emption systems on major corridors will provide measurable travel time improvements. Coordination with Raleigh's Department of Transportation ensures optimal intersection selection and system integration.

    d. **Community risk reduction expansion** through addition of prevention specialists and enhanced partnership development offers a proactive approach to reducing emergency demand. This investment in prevention programming can help offset call volume growth while improving overall community safety through targeted risk reduction efforts.



Mid-Term Recommendations (3-10 Years)

The mid-term phase focuses on systematic infrastructure modernization and strategic expansion to address identified coverage gaps while positioning the department for future growth. This phase represents the most intensive period of capital investment and organizational development, requiring careful project management to maintain operational effectiveness during construction and expansion activities.

1. **Station Infrastructure Modernization:** The systematic replacement of aging fire stations represents the core infrastructure challenge facing RFD over the next decade. Five stations require complete replacement or relocation due to end-of-life conditions, inadequate facilities, or suboptimal locations that limit operational effectiveness. The replacement program follows a priority-based sequence that addresses the most critical needs first while maintaining the department's three-concurrent-project limitation.

    a. **Station 23:** Relocate from leased facility to city-owned property, optimally positioned around Country Trail/Pinecrest Road. The project timeline spans 2026-2030, with design beginning in 2026 and construction completing in 2030 at an estimated cost of $35.64 million.

    b. **Station 9:** Relocate along Six Forks Road to optimize coverage and accommodate modern apparatus. Design begins in 2027 with construction completing in 2032 at an estimated cost of $38.06 million.

    c. **Station 8:** Strategic relocation addresses both aging infrastructure and positioning for anticipated growth in the Asbury area. Moving slightly west to the Western Boulevard/Jones Franklin Road area provides optimal coverage for projected call volume increases while replacing end-of-life facilities. The timeline spans 2028-2033 with an estimated investment of $40.64 million.

    d. **Station 10:** Reconstruction will maintain its optimal location while providing modern facilities. The timeline spans 2030-2035 with design beginning in 2030 and construction completing in 2035 at an estimated cost of $46.35 million.

    e. **Station 17:** Redevelopment undergoes on-site reconstruction due to its optimal location for service delivery. Design begins in 2033 with construction completing by 2037 at an estimated cost of $56.46 million.

2. **New Station Development:** Station 30 construction addresses the critical coverage gap in the Wilders Grove area, where high call volumes and extended response times from surrounding stations create systematic service deficiencies. Located near the New Bern Avenue/Trawick Road intersection, this double-company station will house Engine 30 and Ladder 30, requires 30 new firefighters and will provide measurable performance improvements of 1.89% in first-due performance and 590 fewer late responses annually.

   The timeline for Station 30 spans 2032-2037, with design beginning in 2032 and construction completing in 2037. Total investment of $52.87 million includes facility construction, apparatus procurement, and first-year staffing costs.

   Planning for Station 31 should be initiated in 2035.

3. **Continued Apparatus Enhancement** addresses growing per-unit workload and RFD's critical need for additional units. Adding a second new ladder company in 2030, a Quick Response Vehicle in 2032, and an additional engine company in 2034 will achieve a 25-second citywide reduction in ladder response times, and a measurable decrease in busy overgoals. The deployment of these resources should follow the recommendations mentioned in the previous section.

4. **Staffing Standards Implementation:** Transitioning to 4-firefighter engine companies as recommended by NFPA 1710 will improve Effective Response Force performance from 48% to 58% and reduce the number of individual units needed for complex incidents.

5. **Formalization of automatic aid agreements** with neighboring jurisdictions provides cost-effective coverage enhancement for border areas while improving response capabilities during large incidents. Priority partnerships include Cary Fire Department for southwestern coverage, Knightdale Fire Department for southeastern expansion areas, and Wake-New Hope Fire Department for northeast coordination.

   These agreements require careful negotiation of operational protocols, cost-sharing arrangements, and performance standards to ensure seamless integration during emergency response.

Long-Term Strategic Goals (10-25 Years)

The long-term phase addresses geographic service area expansion driven by annexation patterns while completing infrastructure renewal and establishing sustainable operational frameworks. This phase requires flexible and adaptive management, as voluntary annexation timing and development patterns may vary from current projections.

1. **Complete Station Coverage Projects:** Station 31 construction serves the Neuse Crossroads area and northeast expansion zones, providing 16% performance improvement in Response Zone 22 and 2.38% citywide first-due performance enhancement. This double-company station requires 30 new firefighters and represents critical coverage for areas currently experiencing systematic late responses due to geographic barriers and complex road networks.

   The timeline spans 2035-2040, with design beginning in 2035 and operations commencing in 2040. The total investment of $64.39 million positions RFD for northeast growth while addressing current service deficiencies. Coordination with Wake-New Hope #2 provides partnership opportunities for optimal resource utilization.

2. **Geographic Service Area Expansion:** Station 32 and 33 development depends on annexation patterns for the Northeast and Southeast Special Study Areas, respectively. These single-company stations will serve newly annexed areas while maintaining coverage standards as the city grows. Station 32 targets the 8.5-square-mile NESSA expansion, while Station 33 utilizes existing RFD land at Auburn Knightdale Road to serve the SESSA area east of the Neuse River barrier.
   a. Implementation timing depends on voluntary annexation progress, with current projections suggesting Station 32 construction in 2040-2042 and Station 33 in 2041-2043.
   b. Each station requires 18 new firefighters and represents investments of $73.44 million and $78.43 million respectively.

3. **Administrative Structure Enhancement:** Add battalion and division chief positions to maintain appropriate spans of control as the number of stations increases. Following NFPA standards of five stations per battalion chief, add:
   a. One additional battalion chief when Station 31 comes online
   b. One additional division chief to oversee expanded operations

4. **Comprehensive Infrastructure Renewal:** Complete the rebuild of Station 17 in 2037 and ensure all fire stations meet modern standards for energy efficiency, operational effectiveness, and firefighter health and safety.

5. **Technology and Standards Integration:** CFAI accreditation pursuit establishes a continuous improvement framework that embeds performance measurement and enhancement into departmental operations. This 2-3 year process provides industry recognition while creating systematic approaches to service delivery optimization.
   a. Standards of Cover adoption provides data-driven justification for resource allocation decisions while establishing clear performance expectations for

different risk categories. Integration with predictive analytics platforms enables real-time deployment optimization and automated performance monitoring.

b. Modern training facility development, potentially integrated with Station 33 construction, provides NFPA 1403 compliant live-burn training capabilities. This facility could serve regional training needs through partnership arrangements with neighboring departments.

6. **Sustainability and Resilience:** Environmental initiatives, including net-zero energy stations for all new construction post-2035 integrate solar technology, energy storage, and efficient HVAC systems providing long-term operational cost savings. Fleet modernization explores alternative fuels and electric/hybrid apparatus while incorporating advanced communication and navigation systems.

Station Infrastructure Plan

The Raleigh Fire Department's station infrastructure faces a critical juncture requiring both systematic replacement of aging facilities and strategic expansion to address coverage gaps and future growth. This comprehensive station plan addresses five aging stations requiring replacement/relocation and four new stations needed to maintain service standards through 2050.

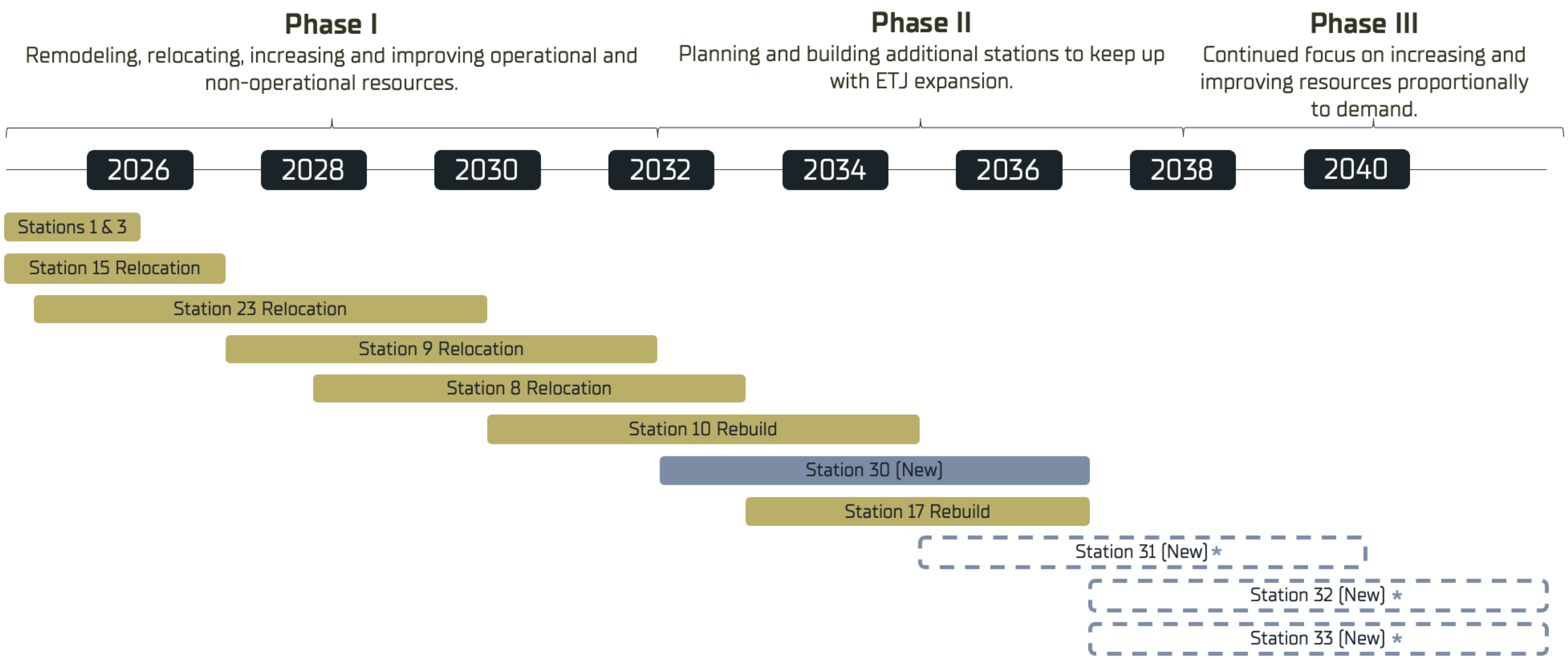
Aging Station Replacement Program

Priority	Station	Current Issues	Recommendation	Justification	Timeline	Estimated Cost
1	23	- End-of-life facility - Substandard conditions - Leased property	Relocate to Country Trail/Pinecreast Rd. area	Current location provides inadequate coverage; relocation optimizes service area	Design 2026, Construction 2028-2030	$37.53 million
2	9	- End-of-life facility - Lot too small to rebuild	Relocate along Six Forks Rd.	Maintain current service level while accommodating modern apparatus	Design 2027, Construction 2030-2032	$40.44 million
3	8	- Nearing end-of-life - Lot too small to rebuild	Relocate west to address Asbury area growth	Western Boulevard/Jones Franklin Rd. areas serves projected call volume growth	Design 2028, Construction 2031-2033	$42.79 million
4	10	- Nearing end-of-life - Lot too small to rebuild	Rebuild, explore options to swap land with adjacent Parks site	Current location optimal; land swap enables on-site reconstruction	Design 2030, Construction 2033-2035	$46.35 million
5	17	- Nearing end-of-life	Rebuild on current site	Optimal location; redevelop existing property	Design 2033, Construction 2036-2038	$56.46 million

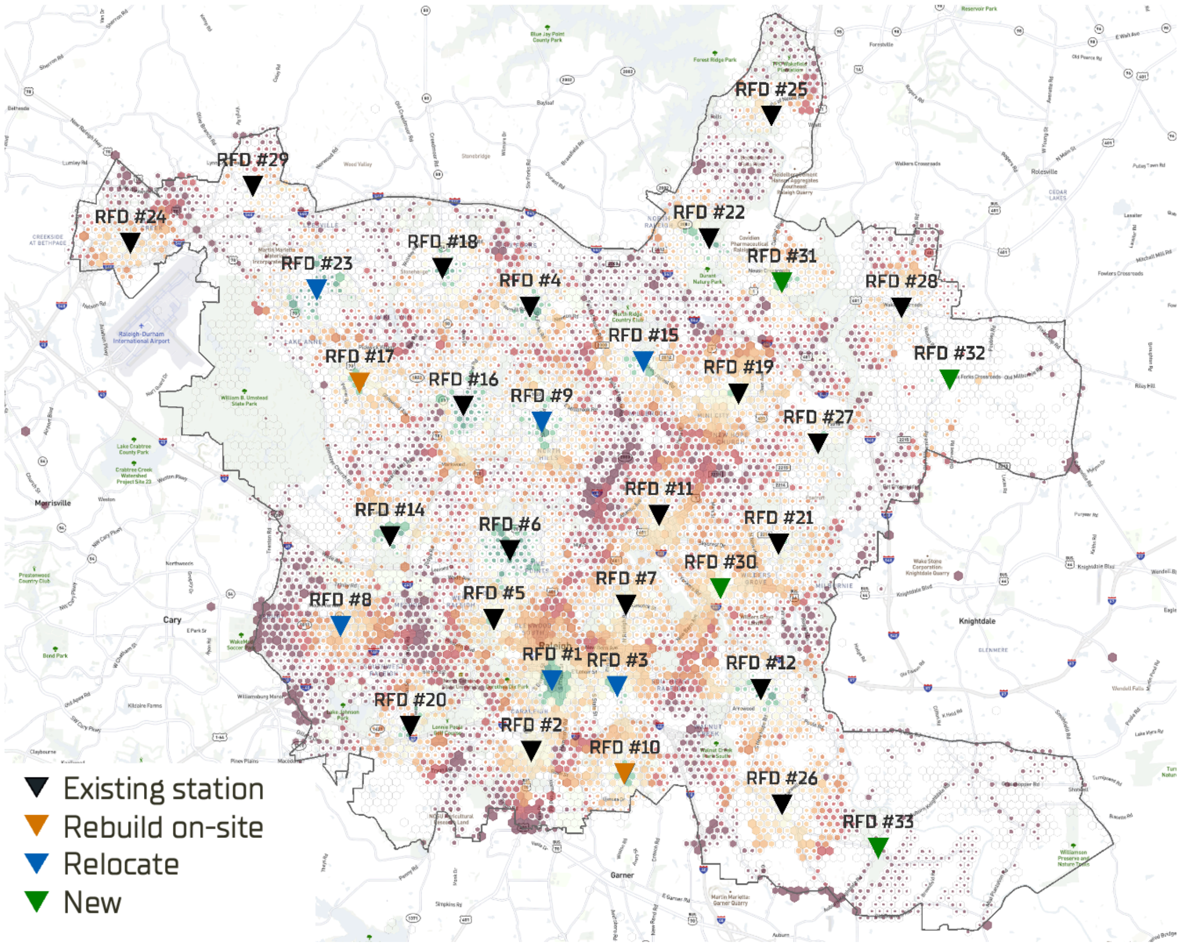
New Station Development Program

Group	Station	Location	Justification	Performance Impact	Configuration	Timeline	Estimated Cost
Coverage Gap Stations (Immediate Need)	30	Near New Bern Ave./Trawick Rd. intersection	Addresses critical coverage gap between Stations 7, 1, 12, and 21	+1.89% first-due performance, 590 fewer late responses annually	Double-company (Engine and Ladder)	Design 2032, Construction 2035-2037	$67.17 million (including apparatus, equipment, and staffing)
	31	Perry Creek Rd. area, between Stations 22 and 28	Addresses critical coverage gap in Neuse Crossroads	+2.38%[6] first-due performance city-wide; +16% performance improvement in Response Zone 22	Double-company (Engine and Ladder)	Design 2035, Construction 2038-2040	$81.09 million (including apparatus, equipment, and staffing)
Growth Area Stations (Future Expansion)	32	Old Milburnie Rd.	Serves Northeast Special Study Area Expansion	+2.71%[6] first-due performance when area is annexed	Single-company (Engine)	Design 2037, Construction 2040-2042[7]	$83.02 million (including apparatus and staffing)
	33	Auburn Knightdale Rd./Battle Bridge Rd. (existing RFD land)	Serves SESSA Expansion; enhances coverage East of Neuse River	Enhanced coverage east of Neuse River	Single-company (Engine)	Design 2038, Construction 2041-2043[7]	$86.76 million (including apparatus, equipment, and staffing)

[6] Performance compounds and assumes previous stations are constructed.
[7] Due to uncertainty regarding timing of voluntary annexations, exact timing should remain flexible and station planning should be carried out in anticipation of service area expansion.



* Exact timing dependent on service area expansion.



Station plan final state, reflecting stations currently in the process of relocation (1, 3 and 15), and adopting all relocation/reconstruction recommendations outlined above.

Performance Impact Analysis

Current vs. Future State Comparison

Scenario	First-Due Performance	Overgoal Incidents
2024 Performance (Modeled)	57%	22,723
2050 Projected Performance (No Action)	53%	14,289
2050 Projected Performance (Adopting Station Plan)	59%	12,718

Geographic Coverage Analysis

Critical Coverage Gaps Addressed:

Wilders Grove Area (Station 30):

- Current Challenge: High call volume area between multiple stations, outside of reasonable 4-minute travel time capability.
- Solution Impact: Direct coverage, reducing response times by over 1 minute
- Population served: Growing residential and commercial corridor

Neuse Crossroads (Station 31):

- Current Challenge: Geographic barriers and complex road network; limited ingress/egress, complicating emergency response routes
- Solution impact: 16% performance improvement in Response Zone 22
- Strategic value: Addresses consistently late responses due to distance

Future Growth Area Coverage:

Northeast Special Study Area (Station 32):

- Service area: ~8.5 square miles of potential annexations
- Current coverage: >6 minutes from existing stations
- Growth timing: Dependent on voluntary annexation patterns
- Partnership potential: Wake-New Hope #2

Southeast Special Study Area (Station 33):

- Service area: ~17.5 square miles of potential expansion
- Geographic barrier: Neuse River limits Station 26 response capability
- Strategic location: utilizes existing RFD land

6-Year Staff Recommendations

Position Type	# of Positions added 2026*	2027	2028	2029	2030	2031	**Total**
Firefighters	**18**	**30**	**15**	**15**	**30**	**26**	**134**
• Increase staffing from 184 to 190 to adopt staffing factor of 3.75	18	-	-	-	-	-	
• Upgrade 27 engine companies to 4FF per shift (4/year)	-	4 (x3.75)	4 (x3.75)	4 (x3.75)	4 (x3.75)	7 (x3.75)	
• Add 2 Ladder companies	-	4 (x3.75)	-	-	4 (x3.75)	-	
Prevention and Public Education Staff			**1**				**1**
• 1 Community Risk Reduction Specialist							
Recruitment Staff	**1**						**1**
HR Staff	**1**			**1**			**2**
Training Staff	**1**	**1**					**2**
• 2 NFPA 1403 Live Burn Instructors							
Mechanics	**2**	**1**		**1**			**4**
Total New Positions by Year	**23**	**32**	**16**	**17**	**30**	**26**	**144**

* Calendar year 2026

Financial Strategy and Implementation

Funding Approach

The financial analysis projects significant investment requirements over the next 25 years. Total infrastructure costs, including station construction, apparatus replacement, and staffing, will require careful phasing and strategic funding, split into 3 planning horizons:

<u>Short-Term Planning Horizon (2025-2030)</u>

- Apparatus Costs - $25.2 Million
- Personnel Costs - $9.8 Million
- Station Costs
    - Land Acquisition - $6 Million
    - Design & Construction Costs[8] - $76.1 Million

Total Investment - $116.9 Million

<u>Mid-Term Planning Horizon (2031-2035)</u>

- Apparatus Costs - $47.1 Million
- Personnel Costs - $5.3 Million
- Station Costs
    - Land Acquisition Costs - $4.4 Million
    - Design & Construction Costs - $143.4 Million

Total Investment - $200.2 Million

<u>Long-Term Planning Horizon (2036-2050)</u>

- Apparatus Costs - $196.0 Million
- Personnel Costs - $19.8 Million
- Station Costs
    - Land Acquisition Costs - $1.7 Million
    - Design & Construction Costs - $273.3 Million

Total Investment - $490.8 Million

[8] Includes Design & Engineering, Construction, Soft, FF&E, and 1st Year Maintenance/Repair Costs

Operating Costs: New stations will add approximately 96 firefighters and associated operational costs. Using a 5% annual escalation rate, personnel costs alone will exceed $300 million over the planning period.

Revenue Projections: Property tax revenue growth, driven by annexation and revaluation cycles, is projected to support these investments. With property valuations expected to reach $1.3 trillion by 2050, the tax base will provide sufficient capacity for planned investments.

Cost Management Strategies

As the cost of land is expected to continually increase, RFD should employ the following strategies to proactively reduce the expected cost for future stations:

Land Banking: Implement a proactive land acquisition program to secure optimal sites before prices escalate. Based on peer city analysis, early land acquisition can save millions in future costs while ensuring strategic positioning.

Standardized Designs: Develop prototype station designs to reduce design costs and construction timelines. This approach, successfully used by peer cities, can reduce project costs by 10-15% while maintaining operational effectiveness.

Phased Implementation: Maintain the current limit of three concurrent construction projects to ensure manageable oversight and budget control.

Partnership Opportunities: Explore co-location with other agencies and shared construction costs with neighboring jurisdictions for border stations.

VII. Conclusion

The Raleigh Fire Department stands at a critical juncture. Rapid city growth presents both challenges and opportunities that require immediate action and long-term strategic thinking. The recommendations outlined in this master plan provide a comprehensive roadmap for maintaining and enhancing fire protection services over the next 25 years.

Success will require commitment to several key principles:

- **Data-driven decision making** using performance metrics and predictive analytics
- **Proactive planning** that anticipates rather than reacts to growth
- **Strategic partnerships** that leverage regional resources and capabilities
- **Continuous improvement** through standards adoption and accreditation
- **Financial discipline** that balances service needs with fiscal responsibility

The investments recommended in this plan are substantial but necessary to ensure that Raleigh's fire protection capabilities keep pace with the city's growth and evolution. By implementing these recommendations systematically and maintaining focus on performance improvement, RFD can continue to provide excellent service to the community while preparing for future challenges.

Immediate action on improving alarm processing times, staffing, systematic infrastructure modernization, strategic expansion to address coverage gaps, and long-term planning for sustainable growth will position the Raleigh Fire Department as a model for urban fire service delivery in the 21st century.

VIII. Appendices

Supplementary Information

RFD Station Locations

Station 1	220 S. Dawson St.
Station 2	263 Pecan Rd.
Station 3	13 S. East St.
Station 4	121 Northway Ct.
Station 5	300 Oberlin Rd.
Station 6	2601 Fairview Rd.
Station 7	2100 Glascock St.
Station 8	5001 Western Blvd
Station 9	4465 Six Forks Rd.
Station 10	2711 Sanderford Rd.
Station 11	2925 Glenridge Rd.
Station 12	807 Bus Way
Station 14	3510 Harden Rd.
Station 15	1815 Spring Forest Rd.
Station 16	5225 Lead Mine Rd.
Station 17	4601 Pleasant Valley Rd.
Station 18	8200 Morgans Way
Station 19	4209 Spring Forest Rd
Station 20	1721 Trailwood Dr
Station 21	2651 Southall Rd.
Station 22	10050 Durant Rd.
Station 23	8312 Pinecrest Rd.
Station 24	10440 Fossil Creek Ct.
Station 25	2740 Wakefield Crossing.
Station 26	3929 Barwell Rd.
Station 27	5916 Buffaloe Rd.
Station 28	3500 Forestville Rd.
Station 29	12117 Leesville Rd.
Keeter Training Center	105 Keeter Center Drive
Support Services Center	4120 New Bern Ave.
RFD HQ	Dillon Building 310 W. Martin St.

Current Apparatus Deployment

Apparatus	Apparatus Type	Crew
Station 1		
Engine 1	Engine	3
Engine 13	Engine	3
Investigations Unit	Investigator	1
Ladder 1	Ladder Truck	4
Station 2		
Engine 2	Engine	3
Hazmat 2	Hazmat	Cross-staffed
Station 3		
Engine 3	Engine	3
Station 4		
Engine 4	Engine	3
Ladder 4	Ladder Truck	4
Station 5		
Engine 5	Engine	3
Station 6		
Engine 6	Engine	3
Ladder 6	Ladder Truck	4
Station 7		
Squad 7	Squad	4
Mini 7	Mini Pumper	Cross-staffed
Station 8		
Engine 8	Engine	3
Hazmat 8	Hazmat	Cross-staffed
Station 9		
BC 5	Battalion Chief	1
Engine 9	Engine	3
Station 10		
Engine 10	Engine	3
Air 10	Air Truck	Cross-staffed

Station 11		
Engine 11	Engine	3
Engine 118	Engine	Cross-staffed
Station 12		
Engine 12	Engine	3
Ladder 12	Ladder Truck	4
BC 2	Battalion Chief	1
DC 1	Division Chief	1
Rehab 12	Rehab Unit	Cross-staffed
Station 14		
Squad 14	Squad	4
Ladder14	Ladder Truck	4
BC 3	Battalion Chief	1
Incident Safety Officer 14	Incident Safety Officer	1
Mini 14	Mini Pumper	Cross-staffed
ATV 14	ATV	Cross-staffed
Station 15		
Engine 15	Engine	3
Ladder 15	Ladder Truck	4
Station 16		
Engine 16	Engine	3
Rescue 16	Rescue	5
Station 17		
Engine 17	Engine	3
High Water Rescue 17	High Water Rescue	Cross-staffed
Station 18		
Engine 18	Engine	3
Battalion Chief 4	BC	1
Station 19		
Engine 19	Engine	3
Station 20		

Engine 20	Engine	3
Ladder 20	Ladder Truck	4
Station 21		
Engine 21	Engine	3
Water Rescue	Water Rescue	Cross-staffed
Station 22		
Engine 22	Engine	3
Ladder 22	Ladder Truck	4
Battalion Chief 1	Battalion Chief	1
Hazmat 22	Hazmat	Cross-staffed
ATV 22	ATV	Cross-staffed
Station 23		
Engine 23	Engine	3
Ladder 23	Ladder Truck	4
Station 24		
Engine 24	Engine	3
Station 25		
Engine 25	Engine	3
Hazmat 25	Hazmat	Cross-staffed
Station 26		
Engine 26	Engine	3
Station 27		
Engine 27	Engine	3
Hazmat 27	Hazmat	Cross-staffed
Station 28		
Engine 28	Engine	3
ATV28	ATV	Cross-staffed
Air 28	Air	Cross-staffed
Mini 28	Mini Pumper	Cross-staffed
Station 29		
Engine 29	Engine	3
Hazmat 29	Hazmat	Cross-staffed
Keeter Training Center		

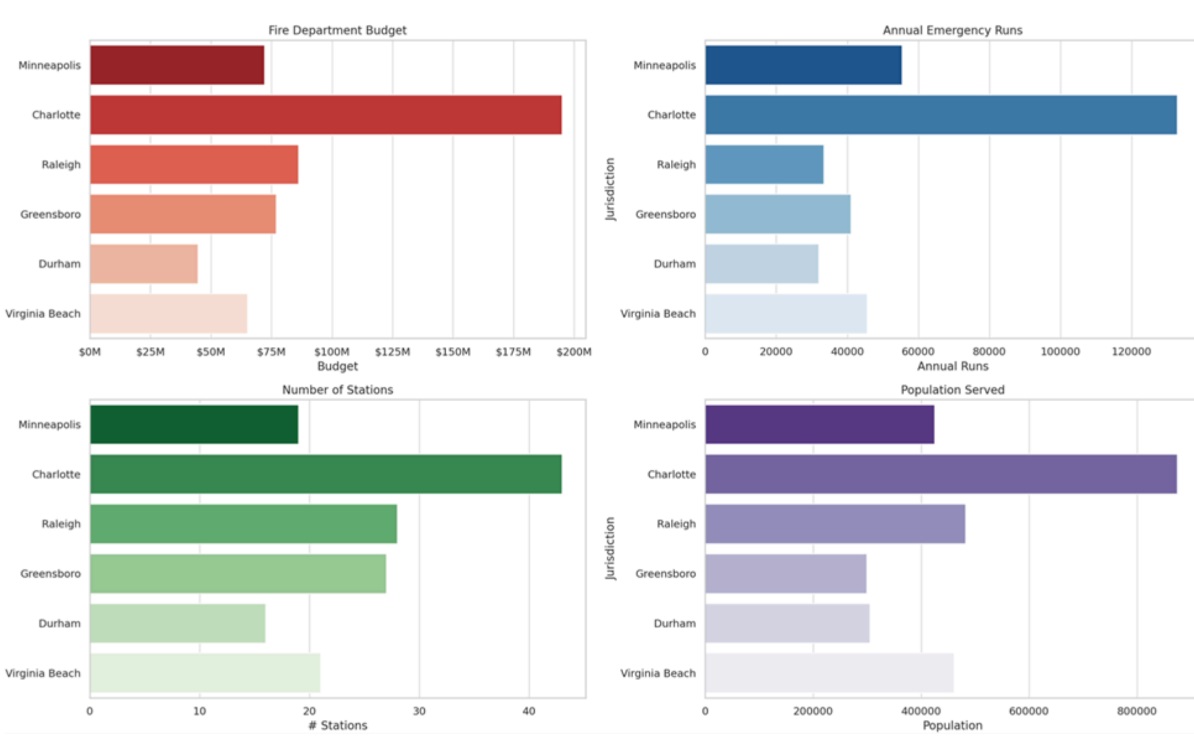
Engine 128	Engine	3
RFUSAR	Rescue	1
RFCDO	Career Development Officer	1
RFEMSA	Assistant EMS Coordinator	1
RFHMPM	Hazmat Program Manager	1
RFUSARPM	Rescue Program Manager	1
RFD HQ		
RFC1	Fire Chief	1
RFC401	Investigator Chief	1
RFLC	Logistics Chief	1
RFOPSC	Operations Chief	1
RFINVC	Investigator Chief	1
RFSC	Safety Chief	1
RFC402	Investigator	1
RFPDDC	Professional Development Division Chief	1
RFCHAPLAIN	Chaplain	1

Supporting Data, Analysis, and Methodology

Jurisdiction Surveys

Overview

The City of Raleigh Fire Department can be compared to fire departments in Minneapolis, Greensboro, and Virginia Beach based on key operational metrics such as population, budget, service area, and emergency response workload. Each of these cities shares enough similarities with Raleigh to serve as meaningful benchmarks.



Minneapolis, for instance, has a population of 425,366, which is slightly lower than Raleigh's 482,425. However, both cities operate with similar budgets, $72.1 million for Minneapolis compared to Raleigh's $86.1 million. Minneapolis also handles a high volume of EMS calls, responding to 36,632 annually, which aligns closely with Raleigh's 20,603 EMS responses. While their fire call volume differs, with Minneapolis handling 3,230 compared to Raleigh's 12,790, the overall scale of operations makes Minneapolis a useful comparison.

Greensboro, another North Carolina city, also shares operational similarities with Raleigh. Although Greensboro's population of 299,000 is notably smaller, its service area of 136 square miles is close to Raleigh's 149 square miles. Budget-wise, Greensboro operates at $77 million, which is only slightly lower than Raleigh's $86.1 million. The city's 27 fire stations are nearly identical to Raleigh's 28, and its total annual runs, 40,975, fall within a comparable range to Raleigh's 33,393. While Greensboro does not provide EMS services, its overall fire department operations make a relevant comparison.

Virginia Beach also stands out as a suitable peer. With a population of 460,706, it closely mirrors Raleigh's demographic size. While its budget of $65 million is lower than Raleigh's, Virginia Beach handles a significant number of emergency calls, 45,588 annually. More notably, its EMS call volume, 28,386, is similar to Raleigh's 20,603, reinforcing the idea that both fire departments manage similar emergency response demands. With 21 fire stations compared to Raleigh's 28, Virginia Beach operates at a scale that makes it a useful reference.

Although Charlotte and Durham are not the ideal candidates for direct comparison to the City of Raleigh Fire Department, they still offer valuable insights that can be useful for benchmarking and operational analysis.

Charlotte, as the largest city in North Carolina, operates on a much larger scale than Raleigh. With a population of 874,597, nearly double that of Raleigh, and a budget of $195 million, its fire department has significantly greater resources. It also manages a much higher call volume, handling 132,853 annual runs compared to Raleigh's 33,393. While this difference makes direct comparisons challenging, Charlotte's fire department can still serve as a useful benchmark for evaluating how a larger, more heavily funded department manages fire and emergency services. Raleigh can analyze Charlotte's resource allocation, staffing strategies, and operational efficiencies to identify best practices that could be scaled down to fit its own needs.

Durham is notably smaller than Raleigh, with a population of 304,786 and a budget of $44.7 million, nearly half of Raleigh's $86.1 million. Despite these differences, Durham still provides a meaningful comparison because of its geographic proximity and shared regional characteristics. Both cities operate within the Research Triangle area and likely face similar emergency response challenges, such as urban growth, traffic congestion, and mutual aid agreements. Durham's response volume, 31,910 annual runs, is close to Raleigh's 33,393, which suggests that while its budget is lower, its call demand is comparable. Analyzing Durham's approach to managing fire and EMS services with fewer financial resources could provide Raleigh with insights on cost efficiency and service optimization.

While neither Charlotte nor Durham completely aligns with Raleigh in terms of size, budget, or call volume, both cities offer valuable perspectives. Charlotte serves as a model of a larger, well-funded fire department, helping Raleigh consider future growth and resource needs. Durham, as a smaller peer in the same region, offers lessons in managing similar emergency response demands with a more constrained budget. By examining both cities, Raleigh can gain a broader understanding of fire department operations across different scales, helping it refine its own policies, resource allocation, and service strategies.

Project Management Methods

When constructing fire stations, municipalities across the country employ a variety of project management methods, each chosen based on the needs and complexity of the project. The survey instrument asked the respondents to provide the construction method utilized in their new fire station construction projects. This section examines the construction approaches used by Charlotte, Greensboro, Virginia Beach, Durham, and Minneapolis, comparing them to Raleigh's methodology.

Charlotte employs a mix of methods tailored to each project. Firehouses 30 and 45 are being built using the Design-Bid-Build (DBB) approach, which allows for competitive bidding and clear separation of responsibilities. Meanwhile, Firehouse 44 is being constructed using the Design-Build (DB) method, integrating the design and construction phases to streamline the process. Additionally, Firehouses 11 and 46 are utilizing the Construction Manager at Risk (CMAR) approach, in which a construction manager provides pre-construction services and assumes cost-related risks. Throughout these projects, the city maintains a structured oversight process, including biweekly Owner-Architect-Construction (OAC) meetings.

Greensboro, in contrast, adheres primarily to the Design-Bid-Build method for its fire station projects. This traditional approach ensures competitive bidding while maintaining distinct roles for design and construction teams.

Virginia Beach has utilized both the Design-Bid-Build and Design-Build approaches, favoring Design-Build in recent fire station projects. This preference indicates a shift toward a more integrated and potentially faster construction process, reducing the risks associated with project delays and miscommunication.

Durham has adopted the CMAR method for its current fire station project (Station 19) and has previously implemented both CMAR and Design-Build for past projects. CMAR was used for Station 9, while Design-Build was chosen for Stations 17 and 18, demonstrating the city's adaptability in selecting the most suitable approach based on project requirements.

Minneapolis relies predominantly on the Design-Bid-Build approach, leveraging internal personnel to manage the process. However, the city makes exceptions when partnering with larger developments, indicating a level of flexibility in its approach to fire station construction.

Raleigh, similar to many of these municipalities, takes a flexible approach in selecting a project management method. North Carolina State Regulations allow for alternative delivery methods, and Raleigh has used Design-Bid-Build, Design-Build, and CMAR based on the complexity of the project.

In comparing Raleigh's approach to those of other cities, Charlotte and Durham similarly employ multiple methods, adjusting to project demands. Greensboro and Minneapolis lean more heavily on the Design-Bid-Build model, providing a structured and competitive process but potentially sacrificing efficiency in more complex projects. Virginia Beach has shifted toward Design-Build for recent projects, suggesting a prioritization of streamlined workflows and quicker project execution.

Ultimately, Raleigh's method aligns with other municipalities that utilize a variety of construction strategies, ensuring flexibility in project execution, along with a focus on competitive bidding and prioritizing cost-effectiveness while maintaining the ability to adapt to project-specific needs. This approach allows Raleigh to effectively manage fire station construction while adhering to state regulations and ensuring fiscal responsibility.

Construction Process

The process of constructing a new fire station varied among the surveyed municipalities, with each jurisdiction following distinct procedures for land acquisition, funding, design, and construction. This section examines the fire station construction timelines in Charlotte, Greensboro, Virginia Beach, Durham, and Minneapolis and contrasts these approaches with Raleigh's method.

In Charlotte, fire stations 30, 44, 45, and 46 had available land, allowing the city to design each station according to its needs. However, firehouse 11 presented a unique challenge as it had to be redesigned to fit within the existing land constraints where the original firehouse was located. This demonstrates the city's ability to adapt its construction plans based on land availability and existing infrastructure.

Greensboro follows a proactive approach to land acquisition, identifying station locations years in advance and purchasing land in anticipation of future needs. This early acquisition strategy ensures that the construction process is not delayed by site selection challenges. Once land is secured, the process from design through occupancy typically takes two years, beginning with cost modeling and progressing through design, permitting, and construction.

The City of Virginia Beach follows a structured and phased approach, starting with funding approval by the City Council, a process that can span two to four years. Once funding is secured, the city proceeds with site location and land acquisition, followed by an eight to twelve-month design development phase. Construction takes approximately twelve to sixteen months, leading to the final stages of certificate of occupancy and completion.

Durham follows a similar structured approach, beginning with a Capital Improvement Plan (CIP) request for land, followed by land acquisition and a subsequent CIP request for station design and construction. These phases can overlap to streamline the process. The city then moves through design, construction, and completion phases, culminating in an open house and a ceremonial truck push-in to mark the station's official opening.

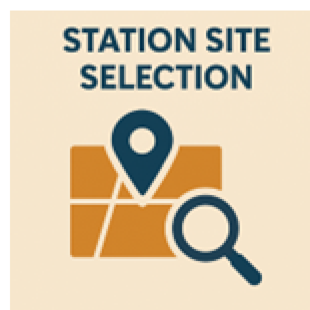
Minneapolis starts its process with preliminary cost modeling and preliminary design to determine land size requirements before purchasing a site. After land acquisition, the city issues a formal design Request for Proposals (RFP) and then proceeds to construction. Minneapolis also utilizes in-house personnel for IT infrastructure and purchasing furniture, fixtures, and equipment, streamlining procurement.

Raleigh, in contrast, follows a comprehensive and structured five-year process. The city begins with a feasibility study to determine priorities before selecting an appropriate property. When replacing an outdated station, officials must decide whether renovation or full replacement is necessary. The design and permitting phase takes approximately two to two and a half years, with all permits finalized before the bidding process begins. The construction phase also spans approximately two to two and a half years, incorporating accommodation costs and additional budget considerations.

Compared to other cities, Raleigh's process is notably longer, reflecting a thorough planning and permitting phase before construction begins. While cities like Greensboro and Virginia Beach complete their projects in approximately two to three years, Raleigh prioritizes extensive feasibility studies and regulatory compliance, ensuring long-term sustainability and efficiency in fire station development. Raleigh's structured timeline may result in longer completion times, but it also ensures a high level of project planning and financial oversight, distinguishing it from other municipalities that may expedite construction through earlier land acquisition or alternative funding strategies.

Station Site Selection

The surveyed municipalities took different approaches when determining how to site and design new fire stations. Some jurisdictions prioritize finding a property that fits a standard fire station template, while others adapt their designs based on available land.



Charlotte takes a flexible approach, with some firehouses, such as 30, 44, 45, and 46, built on land that allowed for a predetermined design. However, Firehouse 11 had to be redesigned to fit within the constraints of an existing site, demonstrating the city's ability to modify station designs when necessary.

Greensboro also follows a hybrid approach. The city has a "standard" template for station design, and it seeks to purchase lots that match these specifications. However, adjustments are made based on site constraints and community needs, allowing for continuous improvement and adaptation of the template based on feedback from firefighters and other stakeholders.

Virginia Beach faces increasing challenges in acquiring land, as available parcels are becoming scarcer. As a result, the city prioritizes securing a site that can accommodate the required square footage for personnel and apparatus. The characteristics of the available property ultimately dictate whether a station will be a single or multi-story facility, reflecting a site-driven design strategy.

Durham typically selects sites that can accommodate its preferred fire station designs. However, in cases where donated land is used, the city has had to adjust its plans. A current project, for instance, is being built on donated land, necessitating a two-story design to accommodate site limitations.

Minneapolis employs a mixed approach, similar to other municipalities. The decision on whether to design based on available land or find a site to match a predetermined station design depends on various factors, including state, county, and city requirements. The need for conditional use permits and zoning considerations also influence whether the design or the site takes precedence.

Raleigh, in contrast, follows a more structured approach by seeking a minimum of three acres for new fire station sites. This ensures that stations have sufficient space to accommodate operational needs without requiring significant design alterations. Compared to other cities, Raleigh's approach prioritizes securing adequate land first before finalizing a station design, reducing the need for modifications based on site constraints.

Overall, while some municipalities modify station designs to fit available land, others, like Raleigh, prioritize securing sites that meet specific size requirements. This distinction highlights different planning strategies, with some cities maintaining greater flexibility to accommodate site-specific challenges, while others focus on ensuring optimal station layout and functionality from the outset.

Fire Station Land Acquisition and Land Banking Strategies

The surveyed municipalities took different approaches when determining how and when to acquire land for future fire stations. While some cities engage in proactive land acquisition, purchasing property well in advance of construction needs, others rely on funding availability to dictate land purchases.

Charlotte maintains an ongoing land search process through monthly meetings with the city's Real Estate department, with a portfolio manager continuously evaluating potential sites. However, land acquisition is typically dependent on having funds available in a designated land fund, which was retired for several years and recently requested for reestablishment in the FY 2026 budget. In a typical scenario, funding for land is allocated within a three-year process before acquisition occurs.

Greensboro follows a long-term strategic approach, utilizing Fire Service Areas (FSA) to identify ideal fire station locations well in advance. The city actively purchases land for fire stations that may not be constructed for over 20 years, ensuring long-term preparedness. Additionally, Greensboro engages in land banking to secure land for future stations when risk assessments indicate a trend of increasing need. If an FSA score is close to the point of unacceptable risk and is projected to increase in the next five to ten years, the city proactively pursues funding to acquire land in advance.

Virginia Beach does not explicitly maintain a dedicated land banking fund, but its Economic Development and Public Works Facilities Management departments track and manage available city properties. When appropriate sites become available, the city may acquire them to meet future public service needs, including fire station development.

Durham's approach varies significantly, with land acquisition occurring anywhere between three and fifteen years in advance, depending on funding availability, project prioritization, and site selection challenges. However, Durham does not engage in land banking due to funding constraints.

Minneapolis follows a more standardized process, typically beginning land acquisition five years before planned construction. Similar to Durham, Minneapolis does not maintain a land banking fund due to financial limitations, relying instead on securing funding when a fire station project is approved.

Raleigh, in contrast to cities like Greensboro and Charlotte that plan years in advance, begins its land acquisition process only after funding has been authorized. Unlike Greensboro, which actively purchases land based on future projections of need, Raleigh does not have dedicated funding for land banking. The city has acknowledged the potential benefits of such a program and may consider it in the future, but currently, land acquisition remains tied to immediate funding approvals.

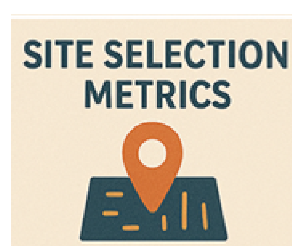
Overall, the municipalities surveyed exhibited a range of land acquisition and land banking strategies. Greensboro and Charlotte have historically taken proactive steps to secure land for future fire stations, while Virginia Beach utilizes a flexible model through its property management departments. Meanwhile, Durham, Minneapolis, and Raleigh operate within a more reactive framework due to funding limitations, securing land only when projects are approved. Raleigh's approach reflects a reliance on immediate funding rather than long-term planning through land banking, which distinguishes it from cities that take a more forward-looking approach to fire station site acquisition.

Site Selection Metrics

Determining appropriate site sizes for fire stations varied among the surveyed jurisdictions, with some using specific acreage guidelines while others remain flexible based on land availability.

Charlotte typically searches for two to three acres for a stand-alone fire station site. However, the department has communicated to its portfolio manager a willingness to utilize smaller parcels or integrate fire stations into mixed-use developments, such as parking decks or high-rise buildings, through public-private partnerships. This approach provides flexibility in land-scarce urban areas.

Greensboro follows a more defined metric, seeking sites with a minimum of 150 feet of frontage and an ideal lot size of three to four acres. In some cases, additional acreage is acquired to accommodate



warehouse space for various operational needs beyond just the fire station.

Virginia Beach does not adhere to a strict "rule of thumb" for fire station site selection due to the city's highly developed areas and limited land availability. Ideally, the city prefers to secure a three-acre site, which generally meets the program needs for a single-story fire/EMS facility with three to four bays. However, given space constraints, site size varies based on what is available in a given response area.

Durham takes a different approach, looking for parcels between four and five acres for fire station development. This preference suggests a need for larger sites, potentially to accommodate future expansion, training spaces, or auxiliary facilities.

Minneapolis prioritizes functionality over strict acreage metrics, emphasizing the importance of drive-through bays for fire apparatus. Standard planning considerations include a 12,000 to 15,000 square foot station, typically designed as a single-story structure, although two-story designs are considered in downtown locations where land is more constrained.

Raleigh, in contrast, follows a firm guideline by requiring a minimum of three acres for fire station sites. Unlike Charlotte, which exhibits flexibility in site selection and mixed-use integration, Raleigh adheres to this standard to ensure adequate space for its stations and operational needs.

Overall, while some cities, like Charlotte and Virginia Beach, are flexible in site selection based on land availability, others, such as Greensboro and Durham, have defined space preferences. Raleigh stands out by enforcing a strict three-acre minimum requirement, distinguishing itself from jurisdictions that take a more adaptable approach. This contrast highlights the different strategies municipalities employ to balance operational needs with real estate constraints.

Response Area Fire Station Adaptations

The design of a new fire station can be influenced by the surrounding area's characteristics in various ways across municipalities. Some cities maintain a standard station template, while others modify designs to match the specific needs of the response area.

Charlotte generally aims for a three-bay firehouse design but has demonstrated flexibility in response to operational demands. For example, Firehouse 11, designated as a Technical Rescue Firehouse, required a fourth bay to accommodate additional equipment. This adjustment increased the station's square footage from approximately 14,600 to over 17,000 square feet, illustrating how operational needs can lead to modifications in the standard design.

Greensboro follows a largely uniform design for fire stations, with one notable exception. Station 7 was specifically designed to align with the characteristics of its local area, making it a rare case where response area factors influenced the station's layout.

Virginia Beach takes a more location-sensitive approach, acknowledging the diverse nature of the city, which includes industrial zones, waterfront (beachfront) areas, and rural countryside. The Fire Department seeks to ensure that new stations blend cohesively with their respective environments. In some cases, this process involves input from local civic leagues to ensure that design choices align with community expectations and aesthetics.

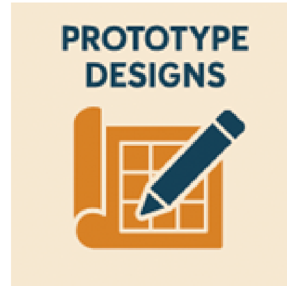
Durham's station design strategy is highly responsive to future development projections. A notable example is the Research Triangle Park (RTP), where a long-term 50-year development plan aims to transform the area into a mixed-use community with a population of 100,000. In response, Durham revised its initial 2018 plan for a two-bay station in the RTP area, opting instead for a four-bay station that is scheduled for construction in 2027 or 2028. This adjustment demonstrates how long-term urban planning influences fire station design in anticipation of future demand.

Minneapolis takes a neighborhood-conscious approach to fire station design. Stations located in residential areas are intentionally designed to avoid an industrial appearance, ensuring that they fit seamlessly into their surroundings. This sensitivity to neighborhood aesthetics ensures that new stations do not disrupt the character of the communities they serve.

Raleigh's approach to fire station design in response to area development and building characteristics has not been explicitly stated. However, based on its general fire station planning methods, Raleigh likely considers response area characteristics when determining station specifications, similar to how other municipalities adapt their designs based on operational and community needs.

Overall, while some cities like Greensboro maintain a largely standardized design, others, including Charlotte, Durham, and Virginia Beach, demonstrate significant flexibility in adjusting fire station designs to meet the needs of specific response areas. Minneapolis focuses on ensuring aesthetic harmony with residential areas, while Durham integrates long-term planning considerations. Raleigh's approach, though not explicitly detailed, likely falls somewhere within these varying strategies, balancing standardization with necessary adaptations based on community and operational requirements.

Fire Station Prototype Designs



The use of prototype station designs was questioned in the survey. Charlotte has recently transitioned to a standardized design for new fire stations. The city now builds three-bay firehouses with a two-story section on one side, departing from its traditional three-bay saddlebag-style firehouse layout. This shift represents an effort to establish a more uniform station model while accommodating operational needs.

Greensboro also employs a standardized station design. The city utilizes a two-bay drive-through model that is deep enough to house up to four apparatus. This approach allows for consistency in station layout while maintaining flexibility to support different apparatus configurations.

Virginia Beach, in contrast, does not currently use a standardized prototype design. Each fire station is developed based on specific site constraints and operational needs, reflecting a more customized approach to station construction.

Similarly, Durham does not utilize a standardized fire station prototype. Each station is designed based on the requirements of its location and projected response demands.

Minneapolis does not adhere to a strict prototype design but incorporates several required components into all new fire stations. These include three apparatus bays, a commercial kitchen, a day room, and private bathrooms. This ensures that while stations may not follow a single prototype, they all meet essential functional and operational standards.

Raleigh, like Durham and Virginia Beach, does not employ a standardized prototype for fire station construction. Each station is designed based on specific needs, allowing for flexibility in layout and configuration.

Overall, Charlotte and Greensboro have moved toward standardized station designs, streamlining the construction process while maintaining adaptability. Virginia Beach, Durham, Minneapolis, and Raleigh, on the other hand, maintain a more flexible, site-specific approach to fire station construction. Raleigh's method aligns with the latter group, prioritizing customization over uniformity, contrasting with cities that have adopted prototype designs to enhance efficiency and consistency.

Energy Standards and Size Thresholds

The surveyed municipalities varied in their adoption of energy efficiency standards in their fire station construction, with some jurisdictions fully committing to LEED certification while others incorporating energy-saving practices without pursuing formal certification. Additionally, some cities imposed specific building size thresholds to trigger these energy standards, while others apply sustainability measures universally.

Charlotte and Greensboro do not impose a size-based threshold for energy standards, as all fire stations are constructed to meet LEED standards. Charlotte aims for full LEED certification in its fire station construction, ensuring that all new stations are designed with energy efficiency and environmental responsibility in mind. Similarly, Greensboro incorporates LEED Silver standards into all fire stations, ensuring that sustainability measures are consistently applied across projects.

Virginia Beach previously built fire stations to meet LEED standards but no longer seeks formal certification. However, the city continues to incorporate many of the energy-saving practices that were utilized in previous LEED-certified projects. A threshold does exist for the implementation of geothermal systems when a building reaches 12,000 square feet. This selective approach means that while energy efficiency is prioritized, some measures are only applied to larger facilities.

Durham follows a similar approach to Greensboro, adhering to LEED Green standards. The city's latest fire station design is expected to align with Durham's soon-to-be implemented High-Performance Building Policy, reinforcing its commitment to energy-efficient infrastructure. Unlike Charlotte and Greensboro, Durham enforces energy standards for all new construction and renovation projects exceeding 5,000 square feet. Additionally, all new construction and renovations, regardless of size, must comply with sustainability measures, including restrictions on fossil-fuel-based equipment unless cost-prohibitive, compliance with LEED refrigerant requirements, the installation of US EPA Watersense-certified water-saving devices, and the use of ENERGY STAR-certified appliances.

Minneapolis mandates that all new fire stations achieve LEED Silver certification, ensuring that sustainable building practices are consistently applied across projects. Energy standards apply universally, with no size-based exemptions. Given that all its fire stations exceed 13,000 square feet, energy-efficient designs are a standard expectation rather than an exception.

Raleigh, like Greensboro and Minneapolis, mandates LEED Silver certification for new fire station construction. This demonstrates a clear commitment to sustainable design and energy efficiency, ensuring that fire stations meet high environmental performance standards. However, Raleigh differentiates itself by setting a clear threshold energy standards are required for buildings over 10,000 square feet. This contrasts with Durham's lower 5,000-square-foot threshold and Minneapolis' universal requirement but aligns with Virginia Beach's selective approach, where size dictates the application of certain energy-efficient systems.

Overall, all of the surveyed municipalities incorporate some level of energy-efficient design into their fire stations, though their approaches vary. Charlotte and Greensboro construct all fire stations to LEED standards without a size-based trigger, while Minneapolis and Raleigh enforce LEED Silver certification with different size thresholds. Durham follows LEED Green standards and is preparing to adopt a more advanced energy efficiency policy. Virginia Beach, while no longer pursuing formal LEED certification, continues to integrate sustainable practices into its fire station designs. When considering size thresholds, Charlotte and Greensboro apply energy standards universally, while Virginia Beach and Raleigh impose specific size-based triggers. Durham and Minneapolis take the most comprehensive approaches, ensuring that all buildings integrate sustainability measures regardless of size. Raleigh's adherence to LEED Silver for large buildings aligns it with cities that enforce rigorous energy standards while allowing exemptions for smaller structures, balancing standardization with flexibility.

Construction Funding Methods

The funding of fire station construction projects did not vary significantly across the surveyed cities with all relying on Capital Improvement Program (CIP) funding while some also incorporated additional funding mechanisms.

Charlotte funds its fire station construction projects through the city's Capital Improvement Program (CIP) budget, ensuring that new stations and major renovations receive funding as part of the city's long-term infrastructure investment strategy.

Greensboro follows a similar model, utilizing its CIP, which is funded through city bonds. This approach allows the city to secure the necessary financial resources for fire station construction while leveraging municipal bond funding to spread costs over time.

Virginia Beach takes a more segmented approach to funding fire station projects. New and replacement fire stations are each assigned a single CIP project with dedicated funding, ensuring that each station receives a focused financial allocation. Additionally, for smaller-scale projects such as kitchen remodels or flooring replacements, the fire department maintains an annually funded, dedicated Fire Station Maintenance and Rehab CIP, providing continuous financial support for minor upgrades and repairs.

Durham and Minneapolis both rely on CIP funding for fire station construction, aligning with the general trend of municipalities using long-term capital investment programs to fund infrastructure development.

Raleigh also funds fire station construction through its CIP but follows a phased funding approach. In Raleigh, the design phase is funded first, and construction funding is allocated only after the design phase is completed. This phased approach allows the city to manage budget allocations more effectively and make necessary design adjustments before committing full construction funding.

Overall, the majority of municipalities, including Charlotte, Greensboro, Durham, and Minneapolis, rely on CIP funding for fire station construction. Virginia Beach maintains a dedicated CIP for smaller-scale renovations, while Raleigh's phased CIP funding method ensures a structured approach to financial planning. The contrast between Raleigh and other municipalities lies in the timing of funding allocation, with Raleigh ensuring that design is completed before committing construction funds, whereas other cities typically allocate full CIP funding upfront for new fire station projects.

Quantity, Quality and Cost Prioritization

When constructing new fire stations, municipalities must balance the competing priorities of quantity (station size), quality (building lifespan and resilience), and cost (budget constraints). Each jurisdiction weighs these factors differently based on funding availability, operational needs, and long-term planning goals. The survey inquired how Charlotte, Greensboro, Virginia

Beach, Durham, and Minneapolis prioritize these elements. These responses were then compared to Raleigh's approach.

Charlotte places equal importance on both quantity and quality when constructing fire stations. Ensuring that stations have sufficient space to house apparatus and personnel while maintaining a long lifespan is a key focus, even if these priorities result in higher costs.

Greensboro prioritizes cost as the most important factor due to limited bond funding. The city ensures that new fire stations meet minimum quantity requirements, such as accommodating at least two fire companies, while also striving for quality. Although the city's Capital Improvement Plan (CIP) sets a 50-year lifespan for stations, some existing stations have surpassed 60 years.

Virginia Beach prioritizes quantity over other factors. The size of a fire station is dictated by staffing levels, apparatus needs, and additional program requirements. Additionally, all city fire stations are constructed to meet hurricane Category II classification, reinforcing the importance of structural resilience in coastal areas.

Durham follows a quantity-first approach, emphasizing the need for adequate station size to meet operational demands. While quality and cost are considered, the ability to house necessary resources remains the primary concern.

Minneapolis, by contrast, is primarily constrained by cost. The available budget dictates the project scope, with lot size further limiting the square footage of new fire stations. However, all stations are built with a target 50-year lifespan, ensuring a long-term return on investment despite financial constraints.

Raleigh's approach to balancing these priorities has not been explicitly stated. However, given its phased Capital Improvement Program (CIP) funding model, it is likely that Raleigh seeks a balance between cost constraints and maintaining quality, ensuring that fire stations meet long-term operational and financial sustainability goals.

Overall, cities take varied approaches based on their specific needs and financial conditions. Charlotte and Virginia Beach prioritize station size and resilience, while Greensboro and Minneapolis emphasize cost due to funding limitations. Durham places quantity above all else, ensuring that new fire stations can accommodate operational requirements. Raleigh's approach, although not explicitly stated, reflects a structured balance between cost, quality, and quantity, ensuring fire stations are built sustainably and efficiently over time.

Contingency Budgeting

Contingency budgeting is a critical component of fire station construction, ensuring that unexpected costs can be covered without jeopardizing the overall project. The municipalities surveyed allocated varying percentages of total project costs toward contingencies, reflecting their approach to risk management and financial planning.

Charlotte sets aside the highest contingency budget among the surveyed jurisdictions, allocating 40% of total project costs. This significant reserve likely accounts for potential cost fluctuations, design modifications, and unforeseen challenges that may arise during construction.

Greensboro, by contrast, maintains one of the lowest contingency allocations, setting aside only 3% of project costs. This limited reserve suggests a strong emphasis on precise budgeting and cost control, though it may leave projects more vulnerable to cost overruns.

Virginia Beach takes a moderate approach, setting aside between 12-15% of construction costs for contingencies. The percentage varies based on the complexity and type of project, ensuring that larger or more intricate projects have greater financial flexibility.

Durham follows a straightforward contingency policy, allocating 10% of total project costs to manage unexpected expenses. This allocation balances risk mitigation with financial efficiency.

Minneapolis adopts a contingency rate of 15%, ensuring a reasonable cushion to accommodate unforeseen costs while maintaining fiscal responsibility.

Raleigh takes a similar approach, requiring that no less than 10% of project costs be reserved for contingencies. This threshold allows for adaptability, ensuring that contingency funds are adjusted based on project complexity and specific risk assessments.

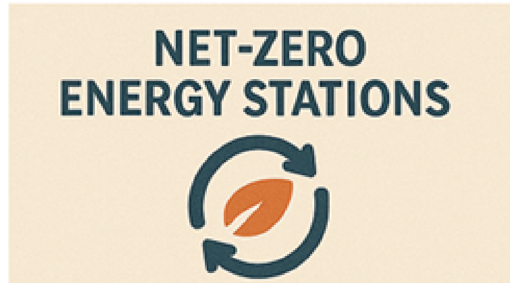
Overall, contingency budgeting practices varied widely among these jurisdictions. Charlotte's high 40% contingency allocation provides significant financial security but may lead to over-reserving funds. Greensboro's low 3% contingency allocation relies on stringent cost control but could be risky if unexpected expenses arise. Virginia Beach, Durham, and Minneapolis take a middle-ground approach, balancing financial caution with practical risk management. Raleigh's policy of maintaining a minimum 10% contingency reserve fits within the middle ground and offers flexibility while ensuring that projects have sufficient financial safeguards in place. This approach aligns Raleigh with more conservative budgeting practices while allowing for adjustments based on project needs.

Net-Zero Energy Fire Stations

Net-zero energy fire stations, often referred to as "electric stations," are designed to produce as much energy as they consume, significantly reducing their environmental impact. These stations typically integrate renewable energy sources such as solar panels, energy-efficient HVAC systems, and battery storage, allowing them to operate sustainably while minimizing reliance on fossil fuels. The Cities of Charlotte, Greensboro, Virginia Beach, Durham, and Minneapolis were asked if they have current or future plans for such facilities.

Charlotte is actively working toward a net-zero fire station with the construction of Firehouse 30. This facility is set to become an electric firehouse, marking a commitment to sustainable infrastructure and energy efficiency. By implementing renewable energy sources and innovative building systems, Charlotte aims to reduce operational costs and environmental impact.

Greensboro, in contrast, has no current plans to construct an electric fire station. This suggests that while sustainability may be a consideration in general fire station design, the city has not yet prioritized net-zero infrastructure.



Virginia Beach similarly does not have plans for a net-zero fire station. While the city incorporates energy-saving practices into its building designs, a dedicated effort toward constructing an all-electric fire station has not yet been initiated.

Durham, like Charlotte, is making strides toward sustainability with plans for an electric fire station. Station 19 is set to be an electric facility, aligning with broader city efforts to transition toward cleaner energy use and reduce the carbon footprint of public buildings.

Minneapolis does not currently have a plan to construct a net-zero energy fire station. Like Greensboro and Virginia Beach, this suggests that while energy efficiency may be a factor in fire station construction, a fully electric fire station is not a priority at this time.

Raleigh, in line with Charlotte and Durham, has confirmed plans for a net-zero energy fire station. This aligns with the city's broader sustainability initiatives, ensuring that new public safety infrastructure is built with energy efficiency in mind.

Overall, municipalities are at different stages in the adoption of net-zero energy fire stations. Charlotte, Durham, and Raleigh are leading in this effort, actively planning and constructing electric fire stations to support sustainability goals. In contrast, Greensboro, Virginia Beach, and Minneapolis have not yet committed to net-zero fire stations, reflecting differing priorities and funding considerations. As more cities move toward energy-efficient building practices, the trend toward net-zero infrastructure is likely to grow, making Raleigh's commitment part of a broader shift in fire station construction practices.

Hot Zone Design

Hot Zone design in fire stations is an essential layout strategy that helps minimize firefighters' exposure to harmful contaminants. By incorporating a structured decontamination layout—transitioning from red zones (high contamination) to yellow zones (decontamination areas) and finally to green zones (clean living spaces)—this design mitigates health risks associated with hazardous substances encountered during emergency response.

Charlotte incorporates clean area separation into its fire station designs, ensuring a basic level of Hot Zone protection. While not explicitly detailed, this approach aims to limit cross-contamination between high-risk zones and living areas.

Greensboro takes a more defined approach by enforcing strict separation between living spaces and areas where personal protective equipment (PPE) is stored. The city also includes separately ventilated turnout gear storage rooms, helping reduce the risk of exposure to contaminants brought in from emergency scenes.

Virginia Beach has begun incorporating some Hot Zone design principles in its latest fire station development, Burton Station #22. The design includes separated gear storage, extractors, dryers, deep sinks, and emergency wash-down areas. Additionally, these spaces have independent HVAC systems to prevent contaminated air from circulating into living quarters. However, Virginia Beach acknowledges that while these measures improve decontamination efforts, they may not fully meet official Hot Zone design classifications.

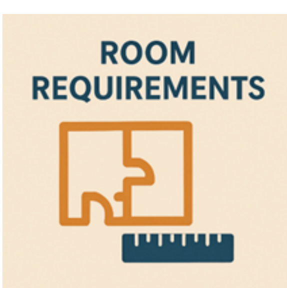
Durham has integrated dedicated decontamination rooms in its station designs, first in Station 18 and planned for Station 19. This inclusion demonstrates a growing commitment to firefighter health and safety through structured decontamination practices.

Minneapolis also adheres to Hot Zone design principles, incorporating wash areas near apparatus bays alongside extractors and dryers. This ensures that decontamination efforts begin immediately after returning from a call, reducing the risk of contamination spreading to clean areas.

Raleigh follows a similar approach by placing turnout gear extractors and dryers in separate areas away from living quarters. This design helps maintain a physical separation between workspaces exposed to contaminants and areas where firefighters eat, rest, and recover.

Overall, the integration of Hot Zone design in fire station development varies across municipalities. Greensboro, Minneapolis, and Durham have clearly adopted structured contamination control measures, while Virginia Beach has made significant steps in improving decontamination processes. Charlotte incorporates basic clean area separation, whereas Raleigh, like other cities, ensures that turnout gear extractors and dryers are located away from living quarters. As the awareness of firefighter health risks grows, municipalities continue to refine station designs to incorporate more effective decontamination processes, reducing long-term exposure to hazardous substances.

Room Requirements



Fire stations are designed to accommodate essential operational and personnel needs, and municipalities establish varying requirements for dedicated spaces within their stations. These "must-have" rooms typically include areas for exercise, gear storage, training, and community engagement.

Charlotte mandates exercise and gear rooms in its fire stations but does not incorporate training or community rooms as part of standard design requirements. This approach ensures that firefighters have spaces for physical fitness and proper storage of protective equipment while limiting additional facility needs.

Greensboro adopts a more comprehensive approach, requiring multiple essential rooms in fire station designs. These include day rooms, kitchens, exercise spaces, gear storage, offices, sleeping quarters, male and female restrooms and locker rooms, and decontamination rooms. This extensive list of required rooms reflects a commitment to both firefighter well-being and operational efficiency.

Virginia Beach incorporates an even broader set of required rooms in its fire stations. Current designs include kitchens, individual berthing rooms, single-person bathrooms, exercise rooms, separate dayrooms for Fire and EMS personnel, dedicated IT/telecom rooms, workshops, decontamination rooms with gear extractors and dryers, and officer offices. This design standard ensures a high level of functionality and adaptability within fire stations.

Durham includes exercise and gear rooms in all fire stations while incorporating training and community rooms at the battalion level. If a station does not include a designated training or community space, it is designed with other unique features, such as indoor or outdoor training elements that enhance firefighter readiness.

Minneapolis has not provided specific requirements for designated fire station rooms, making it unclear whether they adhere to similar standards as the other municipalities.

Raleigh does not require community rooms in its fire station designs, which sets it apart from cities like Greensboro and Virginia Beach that prioritize such spaces. However, Raleigh follows similar best practices regarding exercise and gear storage areas to maintain firefighter health and safety.

Overall, municipalities vary in their approach to essential fire station rooms. Charlotte, Greensboro, Virginia Beach, and Durham emphasize exercise and gear rooms as standard inclusions, while Greensboro and Virginia Beach mandate a wider range of facility spaces. Durham incorporates flexibility by ensuring each station has a unique feature to support operational needs. Raleigh's approach, which does not require community space, contrasts with cities that integrate broader engagement and training elements into their fire station designs. As fire station needs evolve, municipalities continue to refine facility designs to optimize functionality, firefighter well-being, and community interaction.

Design Process

The process for designing new fire stations varied across the municipalities, with different approaches to stakeholder involvement, architectural selection, and oversight. Charlotte takes a collaborative approach by utilizing a firehouse design group that includes a cross-section of all ranks within the department. This group is led by the Division Chief over Logistics and operates under the general oversight of the Deputy Chief of Business Administration. This inclusive method ensures that input from multiple levels of fire personnel is incorporated into the final design.

Greensboro follows a structured process in which the Fire Department helps establish the Scope of Work. The architect receives the Scope of Work along with previous station layouts and then provides an initial design to both the City and the Fire Department. A feedback and review process is conducted to manage changes, ensuring that both operational and design needs are met efficiently.

Virginia Beach's station design process has not been explicitly detailed, but like other municipalities, it likely follows a structured review process involving key city officials and fire department personnel to tailor each design to operational requirements.

Durham follows a formalized selection process by using a Request for Qualifications (RFQ) to choose an architect for each fire station project. This approach ensures that the design team is selected based on expertise and experience in public safety infrastructure.

Minneapolis did not provide details on its station design process, but as a major metropolitan area, it likely follows a systematic approach involving collaboration between fire officials, city planners, and architects.

Raleigh's approach differs from the collaborative models used in Charlotte and Greensboro. Instead of a fire personnel committee, a Division Chief works directly with engineers on the design process. While this method ensures efficient communication between the department and design professionals, it lacks the broader firefighter input seen in Charlotte's approach.

Overall, the station design process varies significantly by jurisdiction. Charlotte and Greensboro emphasize a collaborative feedback process that includes fire personnel, while Durham uses a competitive RFQ process to select an architect. Raleigh's streamlined approach, which relies on a Division Chief and engineers without a broader committee, contrasts with these models, highlighting different priorities in project oversight and stakeholder engagement.

Co-Location

The concept of co-location—where fire stations share facilities with other jurisdictions, agencies, or departments—varied among the surveyed municipalities. While some cities actively engage in co-location to improve efficiency and resource sharing, others have yet to adopt the practice.

Charlotte does not currently have any co-location facilities but remains open to the idea as long as fire department priorities are maintained. This suggests a willingness to explore shared facilities in the future, provided operational effectiveness is not compromised.

Greensboro has embraced co-location, operating shared facilities with EMS and other city agencies. Currently, six out of the city's 26 fire stations function as co-located facilities, including one that operates in partnership with a County Fire Department. Ongoing discussions indicate a continued interest in expanding co-location opportunities where feasible.

Virginia Beach's approach to co-location has not been explicitly detailed, but as a growing city with diverse emergency response needs, it is likely that considerations for shared facilities exist within its long-term infrastructure planning.

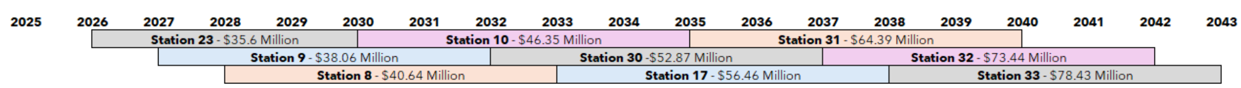
Durham engages in co-location with Durham County EMS on a case-by-case basis. When a fire department site selection aligns with EMS needs, co-location is considered. This flexible approach allows for efficiency while ensuring that the fire department's location strategy remains intact.

Minneapolis actively utilizes co-location, sharing fire station space with EMS services. This arrangement promotes interagency collaboration and resource optimization, demonstrating a commitment to multi-agency coordination.

Raleigh, in contrast, does not currently co-locate with EMS or outside agencies, although they are open to consider co-location in the future. Their current approach maintains dedicated fire department facilities, ensuring that station designs and operations are tailored exclusively to fire response needs.

Overall, the municipalities differed in their adoption of co-location. Greensboro and Minneapolis lead in co-locating with EMS and other agencies, while Durham incorporates co-location selectively based on location compatibility. Charlotte remains open to the possibility, while Raleigh maintains a strict separation between fire stations and external agencies.

Financial Model Assumptions



The financial model developed for Raleigh's fire station construction program relies on a consistent set of planning assumptions to ensure uniformity and accuracy across project forecasts. These assumptions are grounded in industry standards, historical cost data, and escalation trends observed in the region. They provide the necessary framework to estimate both one-time capital outlays and the recurring operational costs associated with each new or replacement facility.

A fundamental assumption embedded in the model is that all planned fire stations, whether replacement or new facilities, will be approximately 18,000 square feet in size. This standardization simplifies cost comparisons across projects and reflects the city's preference for a modern fire station design that accommodates 3 vehicle bays, living quarters, administrative offices, and storage areas. The size estimate was informed by recent construction projects within Raleigh and is consistent with contemporary design best practices for multi-company or future-expansion-capable fire stations.

Each station project is structured as a five-year process, encompassing two primary phases. The first 2.5 years are allocated for planning, design, and permit acquisition. During this phase, architectural and engineering services are engaged, site-specific constraints are addressed, and construction documents are prepared. The subsequent 2.5 years are reserved for physical construction, including site preparation, vertical build-out, and final inspection and commissioning. This phased timeline is applied uniformly to all station projects, with design costs applied in year one of the project timeline and construction costs projected for year four. Positioning the construction cost projection closer to the actual build completion period allows the model to account for escalation uncertainties and better reflect market conditions.

Construction cost escalation is a key driver in this model and is assumed to increase at an annual rate of 6.8 percent. This figure was selected based on construction inflation rates used in the latest construction pricing for fire station 15. The escalation rate accounts for fluctuations in labor rates, material costs, and supply chain disruptions that continue to impact the construction industry.

The total construction cost for each station includes a broad set of direct and indirect expenditures. Direct costs encompass labor, materials, equipment, general conditions, and the builder's overhead and profit. Indirect costs include construction bonds and insurance, cost escalation adjustments, and a construction contingency to cover unforeseen conditions or scope changes. Public art contributions are also included in the construction budget, set at two percent of the total construction cost in accordance with Raleigh's public art ordinance for civic buildings.

In addition to construction, the model allocates funding for soft costs, which include architectural and engineering fees, project management, permitting, LEED Silver certification costs, and enhanced building commissioning services. A design contingency is also factored into the soft costs to account for design changes and additional studies that may arise during the pre-construction phase.

Furniture, fixtures, and equipment (FF&E) are treated as a separate project component, with costs estimated at 14.26 percent of the total project cost. This includes furnishing for office spaces, dormitories, kitchens, dayrooms, and training areas, as well as specialized equipment required to support station operations. FF&E estimates are escalated in accordance with overall project escalation assumptions and updated during the design development phase.

For new stations that add service capacity, the model includes the cost of purchasing fire apparatus and staffing the facility. Apparatus costs are estimated based on 2025 pricing for engines and ladder trucks, escalated seven percent to the year of acquisition. Based on extended apparatus construction timelines, apparatus cost estimates are inserted in the financial model two years prior to station occupation dates. Similarly, salary costs are based on 2025 personnel compensation rates, increased by five percent annually through the year of station occupation. These costs represent the first full year of staffing for either 18 or 30 new firefighters, depending on whether the facility houses a single or double company. The salary projections are inclusive of base wages but do not account for overtime costs, medical or retirement benefits, or future increases from cost-of-living adjustments.

Personnel equipment costs are included for new stations and reflect the full outfitting of firefighters with personal protective equipment, uniforms, and communication gear. The base year cost of $15,000 per person in 2025 serves as the starting point, and this amount is escalated annually at a rate of five percent until the year the station opens.

Repair and utility costs are projected for each station beginning in the first year of occupancy. These estimates are based on the average square foot operating costs for Raleigh fire stations constructed after 2000 and are adjusted to reflect annual increases of five percent. These costs include routine maintenance, utilities such as electricity, gas, and water, insurance, and facility management services required to keep the building operational.

An important constraint incorporated into the model is the city's limitation to having no more than three fire station construction projects running concurrently. This limitation applies to all phases of a project, whether in design, permitting, or active construction, and reflects the financial and logistical capacity of Raleigh's capital program and management team. As such, the sequencing of station projects is designed to ensure that no more than three are underway at any given time, which in turn affects how quickly the city can expand or replace its fire infrastructure over the planning horizon.

These planning assumptions provide a stable, repeatable structure for forecasting future capital needs and operating costs. They ensure that each fire station project is evaluated consistently and in alignment with broader city planning and budgetary practices. By basing projections on uniform square footage, standardized cost components, and documented escalation rates, the City of Raleigh can more effectively integrate fire station development into its long-term financial and operational strategy.