CENTER FOR PUBLIC SAFETY MANAGEMENT, LLC

Fire Department Analysis Report

Springfield, Illinois

Final Report, January 2022

CPSM®

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Exclusive Provider of Public Safety Technical Services for
International City/County Management Association

THE ASSOCIATION & THE COMPANY

The International City/County Management Association is a 103-year old, nonprofit professional association of local government administrators and managers, with approximately 13,000 members located in 32 countries.

Since its inception in 1914, ICMA has been dedicated to assisting local governments and their managers in providing services to its citizens in an efficient and effective manner. ICMA advances the knowledge of local government best practices with its website (www.icma.org), publications, research, professional development, and membership. The ICMA Center for Public Safety Management (ICMA/CPSM) was launched by ICMA to provide support to local governments in the areas of police, fire, and emergency medical services.

ICMA also represents local governments at the federal level and has been involved in numerous projects with the Department of Justice and the Department of Homeland Security.

In 2014, as part of a restructuring at ICMA, the Center for Public Safety Management (CPSM) was spun out as a separate company. It is now the exclusive provider of public safety technical assistance for ICMA. CPSM provides training and research for the Association's members and represents ICMA in its dealings with the federal government and other public safety professional associations such as CALEA, PERF, IACP, IFCA, IPMA-HR, DOJ, BJA, COPS, NFPA, and others.

The Center for Public Safety Management, LLC, maintains the same team of individuals performing the same level of service as when it was a component of ICMA. CPSM's local government technical assistance experience includes workload and deployment analysis using our unique methodology and subject matter experts to examine department organizational structure and culture, identify workload and staffing needs, and align department operations with industry best practices. We have conducted 341 such studies in 42 states and provinces and 246 communities ranging in population from 8,000 (Boone, Iowa) to 800,000 (Indianapolis, Ind.).

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SECTION 1. EXECUTIVE SUMMARY

The Center for Public Safety Management LLC (CPSM) was contracted by the City of Springfield to complete an analysis of the city's Fire Department and EMS ground transport service.

The Springfield Fire Department (SFD) is responsible for providing services from four divisions that include Operations (fire suppression, first response emergency medical services, technical rescue and Haz-Mat response, and fleet maintenance); Fire Safety (fire code enforcement, fire investigation, firework safety, public education and juvenile intervention, and plans review); Training (all department training, promotional exams, equipment testing, health and safety); and Technical Services (information systems and equipment, data collection and reporting, radio systems and equipment, computer-aided dispatch systems).

The service demands of this community are numerous for the department and include EMS first response, fire, technical rescue, hazardous materials, and transportation emergencies to include extensive rail and vehicle traffic, mass transit system utilizing bus transportation, and other non-emergency responses typical of urban and suburban fire departments. A significant component of this report is the completion of an All-Hazard Risk Assessment of the Community. The All-Hazard Risk Assessment of the Community contemplates many factors that cause, create, facilitate, extend, and enhance risk in and to a community.

The response time and staffing components discussion of this report are designed to examine the current level of service provided by the SFD compared to national best practices. As well, these components provide incident data and relevant information to be utilized for future planning and self-review of service levels for continued improvement designed to meet community expectations and mitigate emergencies effectively and efficiently.

Other significant components of this report are an analysis of the current deployment of resources and the performance of these resources in terms of response times and the twelve SFD fire management zones; current staffing levels and patterns; department resiliency (ability to handle more than one incident); critical tasking elements for specific incident responses and assembling an effective response force; and private EMS ground transport system. CPSM analyzed these items and is providing recommendations where applicable to improve service delivery and for future planning purposes.

In summation, a comprehensive risk assessment and review of deployable assets are critical aspects of a fire department's operation. First, these reviews will assist the SFD in quantifying the risks that it faces. Second, the SFD will be better equipped to determine if the current response resources are sufficiently staffed, equipped, trained, and positioned. The factors that drive the service needs are examined and then link directly to discussions regarding the assembling of an effective response force and when contemplating the response capabilities needed to adequately address the existing risks, which encompasses the component of critical tasking.

This report also contains a series of observations and planning objectives and recommendations provided by CPSM which are intended to help the SFD deliver services more efficiently and effectively.

Recommendations and considerations for continuous improvement of services are presented here. CPSM recognizes there may be recommendations and considerations offered that first must be budgeted and/or bargained, or for which processes must be developed prior to implementation.

RECOMMENDATIONS

Capital Assets

1. CPSM recommends as a planning objective that, over a three-year period, the SFD conduct a facility assessment of all fire facilities. (See pp. 11-13.)
2. CPSM recommends the SFD develop, over a one-year period, a fire apparatus replacement plan that includes replacement according to recommendations in accordance with NFPA 1901, Standard for Automotive Fire Apparatus. (See pp. 13-15.)

   Planning objectives should include:

   - First-line apparatus should not exceed 15 years of service on the front line, and once they reach this age, should be replaced with a new apparatus and then rotated to reserve status. This replacement schedule should be inserted into the SFD fleet capital replacement plan. (2A)
   - Apparatus in reserve status and which have not been properly maintained as evidenced by maintenance records, or that are not operationally or roadworthy as evidenced by maintenance records, should be placed out of service. (2B)
   - Apparatus in reserve status in excess of 20 years old should comply with NFPA 1901 and be upgraded in accordance with NFPA 1912 if the department plans to continue to use this apparatus. (2C)
   - Apparatus and major apparatus components such as the motor, fire pump, aerial ladder assembly and hydraulics, chassis, and chassis components such as brakes, wheels, and steering equipment should be maintained in accordance with manufacturer and industry specifications and standards. (2D)
   - Apparatus components requiring annualized testing either fixed or portable such as fire pumps, aerial ladder and aerial ladder assemblies, ground ladders, self-contained breathing apparatus to include personnel fit-testing, and fire hose should be tested in accordance with manufacturer and industry specifications and standards. (2E)

Training

3. CPSM recommends the SFD make it a priority to fill the position of EMS Training Coordinator as soon as possible for reasons delineated in this analysis. (See p. 18.)
4. The SFD should make a concerted effort to send as many officers as possible to the National Fire Academy (NFA). Any officer who meets the admissions criteria should be encouraged to enroll in the academy's Executive Fire Officer Program. (See p. 18.)
5. CPSM recommends the SFD make it a priority to continue to develop and budget for a company fire officer training and development program that is competency-based on National Fire Protection Association (NFPA), International Association of Fire Chiefs (IAFC), International Fire Service Training Association (IFSTA), and Illinois state fire training standards. The program should focus on contemporary fire service issues including community fire protection and emergency services delivery approaches, fire prevention practices, firefighter safety and risk management and labor/staff relations; reviewing, approving, or preparing technical documents and specifications, departmental policies, standard operating procedures and other formal internal communications; improving organizational

performance through process improvement and best practices initiatives; and having a working knowledge of information management and technology systems. (See p. 20.)

6. CPSM recommends the SFD develop task books for firefighter, engineer, and battalion chief, in addition to the program under development for captain. Firefighters should be required to complete their book as part of their probationary period. For other ranks, all personnel aspiring for promotion to a higher rank should be required to successfully complete all elements of that rank's task book to be eligible to participate in the formal promotional testing process. (See p. 20.)
7. The SFD should continue to develop training programs that lead to the following rank-appropriate certifications becoming mandatory job requirements for supervisory and command levels within the department: (N/A)
   - Captain.
     - Fire Instructor I.
     - Fire Officer (or Company Fire Officer) I and II.
     - IMS I-300.
     - Illinois Fire Inspector (so companies can perform in-service inspections).
   - Battalion Chief.
     - Fire Instructor II.
     - Fire Officer III and/or Chief Fire Officer.
     - IMS- I-400.
     - Incident Safety Officer.
   - Division Chief
     - Fire Officer IV.
8. CPSM recommends the SFD develop and institute written and practical skills testing and proficiency evaluations as part of the department's comprehensive fire training program. (See p. 20.)
9. The SFD should provide all companies and personnel with high-intensity training on various subjects, including periodic live fire training on at least a semi-annual basis at an appropriate location where appropriate training facilities, structures, and props are available. (N/A)
10. CPSM recommends that the City of Springfield should make it a high priority to provide funding for the SFD to procure an appropriate training facility where it can safely perform NFPA 1403-compliant live fire training evolutions for all personnel on at least a semi-annual basis. (N/A)

Community Risk Reduction

11. CPSM recommends that the SFD implement an in-service company inspection program at residential, office, manufacturing, and retail business occupancy types throughout the city. (See p. 24.)
12. CPSM recommends that the SFD provide appropriate training in conducting routine fire prevention inspections to all field personnel, particularly company officers who will be responsible for supervising these company programs. (N/A)

13. CPSM recommends that the SFD complete a comprehensive review of the city's actual costs for providing fire prevention services. The review should include a full costing of providing all fire prevention services, reviewing the city's fire code(s), as well as a comparative analysis of the fees charged for similar services by other fire departments. The review should be designed to capture the full range of services provided and capture the full scope of the operational permits and certain inspections required as part of a comprehensive fire prevention program. (See p. 25.)
14. CPSM recommends that to fund the SFD's fire prevention and safety activities the city should consider the adoption of registration, inspection, and/or permit fees to offset the actual costs of providing these services in the city. These fees should include inspections conducted by in-service fire companies. (See p. 25.)
15. CPSM recommends that the SFD should evaluate the feasibility and give serious consideration to replacing uniformed personnel in the Fire Safety Division with certified civilian staff members. (See p. 26.)
16. CPSM recommends the City of Springfield consider the adoption of a more recent edition of the International Fire Code (2009 or later) and adopt a city ordinance that requires the installation of an automatic fire suppression (sprinkler) system in all new construction, including one and two-family dwellings. CPSM further recommends that the SFD develop a compelling public education program that includes discussing the significant life-saving benefits of installing residential fire sprinklers in all new one- and two-family dwellings. (See pp. 26-27.)
17. CPSM recommends that the SFD explore the feasibility of utilizing Remote Video Inspections (RIV) to assist with managing the Community Risk Reduction fire inspection workload. (See pp. 27-28.)
18. CPSM recommends that the SFD implement a company/community level voluntary home inspection and education program that targets vulnerable populations (young, elderly, and disabled) with a goal of reducing fires and civilian casualties. (See pp. 28-29.)
19. CPSM recommends that the SFD consider restructuring how fire investigations are performed, with two investigators assigned to each shift with fire investigations as an ancillary duty. Recommended rank for the investigators should be engineer. CPSM further recommends maintaining one Senior Fire Investigator in the Fire Safety Division with the rank of Captain who would coordinate and oversee fire investigation activities. (See p. 29.)
20. CPSM recommends that all SFD Battalion Chiefs and Captains should receive additional training in fire origin and cause determination and be assigned primary initial responsibility for this process. (See p. 29.)

Response Times

21. CPSM recommends that as a planning objective the SFD should take steps to definitively improve both the dispatch time and incident turnout times for both fire and EMS incidents in order to reduce overall response times to emergency incidents. (See pp. 63-66.)

Fire Operations

22. The SFD should build at least a portion of its training regimens and tactical strategies around the exterior or transitional attack for when the fire scenario and the number of available units/responding personnel warrant this approach. (See pp. 106-108.)
23. In acknowledgement of the fact that SFD engines operate in a minimal staffing mode and recognizing the potential for rapid fire spread particularly in the more densely developed

areas of the city, the SFD should equip all its apparatus with the appropriate appliances and hose as described herein. It should develop standardized tactical operations that will enable arriving crews to quickly deploy high-volume fire flows of 1,200 to 1,500 gallons per minute (if the water supply will permit this), utilizing multiple hose lines, appliances, and master stream devices. This flow should be able to be developed within four to five minutes after arrival of an apparatus staffed with three personnel. (See pp. 106-108.)

24. CPSM recommends that as a planning objective, the SFD should continue to make pre-plan development a high priority until such time as plans have been developed for all high- and medium-hazard occupancies located in the city, placing a high priority on those identified structures that are not protected by automatic sprinkler systems. (See pp. 114-116.)

25. CPSM recommends that the SFD include mutual aid from the Chatham and Sherman FPDs on their box assignments/running cards when appropriate for major/multiple alarm incidents that occur within the city. (See pp. 124-126.)

26. CPSM recommends that the SFD work with both the Chatham and Sherman FPDs to conduct joint training exercises to assist with creating familiarity of both operations and personnel. (See pp. 124-126.)

Planning Objectives

See following discussions:

- Principal Findings, pp. 127-128.
- Current State of the Fire and Ems Delivery System, pp. 128-130.
- Fire Staffing and Deployment, pp. 132-137.
- Fire Station Relocation, pp. 138-148.
- EMS Delivery System, pp. 148-157.

27. CPSM recommends that the City of Springfield and SFD create a 5-, 10-, and 15-year strategic plan for the fire department that integrates with existing city land-use, master, capital improvement, and strategic plans.

    - The strategic plan should create a "standard of response" cover that outlines what service levels are expected when a call for service is received. Response areas should include urban, suburban, and unincorporated areas. Response time metrics should include emergency and non-emergency response profiles. (27A)
    - The capital improvement component of the strategic plan should include the plan and timeline for the relocation and replacement of stations, 6, 7, 8, and 9 and the consolidation of Stations 4 and 10. (27B)
    - The capital improvement component of the strategic plan should include the plan and timeline for replacement of fire apparatus commensurate with its use and in accordance with NFPA and industry recommendations. Part of this process should include the purchase and deployment of Quints and Squads as identified in this report. (27C)
    - The capital improvement component of the strategic plan should include a plan for equipment replacement to meet existing NFPA standards on equipment replacement. This should include but not be limited to firefighter PPE, SCBA, cardiac monitors, and other high-cost items. (27D)

- Consideration should be given to a type of "lease-purchase" program that would stage acquisition of equipment in the department, pay the yearly "lease" fee to the manufacturer and in turn, have the option to purchase the equipment at the end of the lease term or return it for a newer model. Many agencies, such as Plymouth, Michigan, have used this process to stabilize the yearly costs of equipment replacement as well as provide the best equipment to responders and avoid large repair/maintenance costs. (27E)

28. CPSM recommends that at this time the city consider EMS Alternative 2 as presented in this report and each of its components as the best immediate option for the city to include: (Recommendation 28)

    - As part of reconfiguring the EMS response system in the city, the SFD should implement a true EMD or Priority Dispatch system of only having an ambulance respond to Alpha and Bravo or BLS criterion calls unless there is no ambulance available, then an SFD fire apparatus should respond. The SFD should continue to respond the closest available resources in fire suppression units to Charlie, Delta, and Echo, or ALS criterion calls. (28A)

    - CPSM further recommends that the City of Springfield and SFD should explore the feasibility of implementing some type of community-based mobile integrated health care or paramedicine program in an attempt to provide better service to the community, and to the extent possible, attempt to minimize the recurring demand on the service from continual and repeated use of critical resources for non-emergency responses. The city should also explore the feasibility of introducing telemedicine as part of this program and if funding for non-transport of patients would be available. (28B)

29. CPSM strongly recommends that with the majority of SFD responses being EMS related that the position of EMS Coordinator be filled ASAP independent of future decisions regarding the overall EMS delivery system.

30. CPSM recommends that as a planning objective the SFD should explore the possibility of enhancing their technological capabilities to provide increased service to the community for serious cardiac incidents such as through the iPhone PulsePoint® app or other similar programs or apps.

31. CPSM recommends that the City of Springfield explore all possible options to increase revenues that could be used to offset the cost of providing fire and EMS services to the city and FPDs, such as additional PILOT payments from the State of Illinois and other tax exempt and non-profit entities, public safety assessment for commuters, hotel tax, fire prevention fees, etc. before considering service reductions.

32. CPSM recommends as a planning objective that SFD leadership work with the firefighters bargaining unit to develop a policy for monitoring and verification of personnel who are on sick or injury leave. Examples of things that can be discussed include requiring a location where they will be for in-person verification by a chief officer, providing a doctor's note, being required to see a city-arranged doctor, and not being eligible for overtime until they have worked a regular shift after a sick call out.

33. CPSM recommends as a planning objective that once the SFD accomplishes some of the pressing strategic plan recommendations contained in this report, it should, with support from the elected officials of the City of Springfield, consider undertaking the accreditation process.

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SECTION 2. AGENCY REVIEW AND CHARACTERISTICS

DEPARTMENT OVERVIEW AND ORGANIZATIONAL STRUCTURE

The Springfield Fire Department (SFD) is responsible for providing services from four divisions:

- Operations (fire suppression, first response emergency medical services, technical rescue and Haz-Mat response, and fleet maintenance).
- Fire Safety (fire code enforcement, fire investigation, firework safety, public education and juvenile intervention, and plans review).
- Training (all department training, promotional exams, equipment testing, health and safety).
- Technical Services (information systems and equipment, data collection and reporting, radio systems and equipment, computer-aided dispatch systems).

Other programs include a department health and safety program, professional development programs, and apparatus and station design committees. As well, the SFD participates in the statewide Mutual Aid Box Alarm System (MABAS) for specialty and technical rescue response.

The SFD is led by a Fire Chief. This position serves as a member of the elected Mayor's cabinet. The organizational structure includes senior and middle manager level positions (Division Chiefs, Deputy Division Chiefs, and Battalion Chiefs), first-line supervisors, engineers, firefighters, and civilian support staff. The largest contingent of personnel in the organization is comprised of company-level officers and firefighters.

The SFD provides emergency services from twelve stations located throughout the city. Response is primarily made through twelve engine companies, three ladder companies, and various other operational support vehicles. In addition to in-city mitigation of fire and emergency service incidents, the SFD services nine unincorporated fire districts including the Illinois State Fairgrounds and the University of Illinois-Springfield. Two Battalion Chiefs (one north and one south) provide day-to-day company and station oversight, along with incident command on certain responses. As the SFD is a member of the state's Mutual Aid Box Alarm System (MABAS), it is subject to be dispatched to incidents throughout the state and potentially nationally if its services are needed.

The SFD operates with three operational shifts and works a 24/48 schedule (24 hours on/48 hours off). Because this schedule makes for an average 56-hour workweek for firefighters, and as 29 U.S.C 207(k) firefighters working in excess of 53-hours/week must be compensated for the three additional hours worked each week or scheduled off, the SFD schedules operational non-exempt personnel off to maintain the 53-hour work week.

The City of Springfield is governed under the mayor-aldermanic form of government. The elected mayor serves as the head of the government. Chapter 34 of the city's code of ordinances establishes the fire department within the office of the mayor. Under the code of ordinances, a Fire Chief is appointed by the Mayor with the consent of the City Council and serves as the head of the department. All powers and duties of the fire department are outlined and codified in Chapter 34.

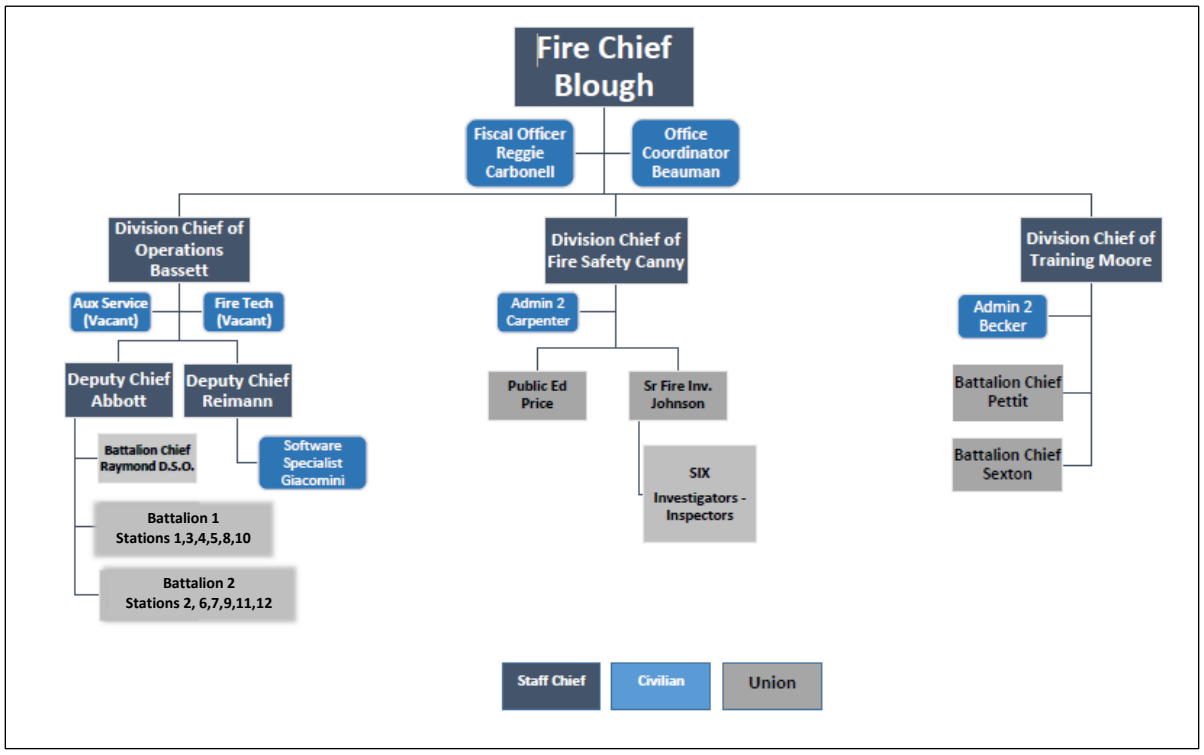
Emergency Medical Services

EMS ground transportation is provided in Springfield by three private ambulance services. The SFD responds to EMS incidents as a first responder agency. Every SFD engine company has a minimum of one person per unit trained to an advanced EMS level (EMT-Intermediate or Paramedic). Through this response, SFD can provide Advanced Life Support (ALS) skills on those patients requiring such care.

The private EMS ground transportation companies bill for transports to an Emergency Department (ED), and collect revenue for the transports. A study of the current Springfield payer mix and revenue collections from each private company would have to be conducted to determine overall available revenues for this service (this is not included in the statement of work for this report). The SFD does provide additional personnel when requested by the ground transport unit to ride along and assist with patient care. The SFD does not collect any revenue for its EMS service.

The following figure illustrates the SFD's chart of organization.

FIGURE 2-1: SFD Organizational Chart

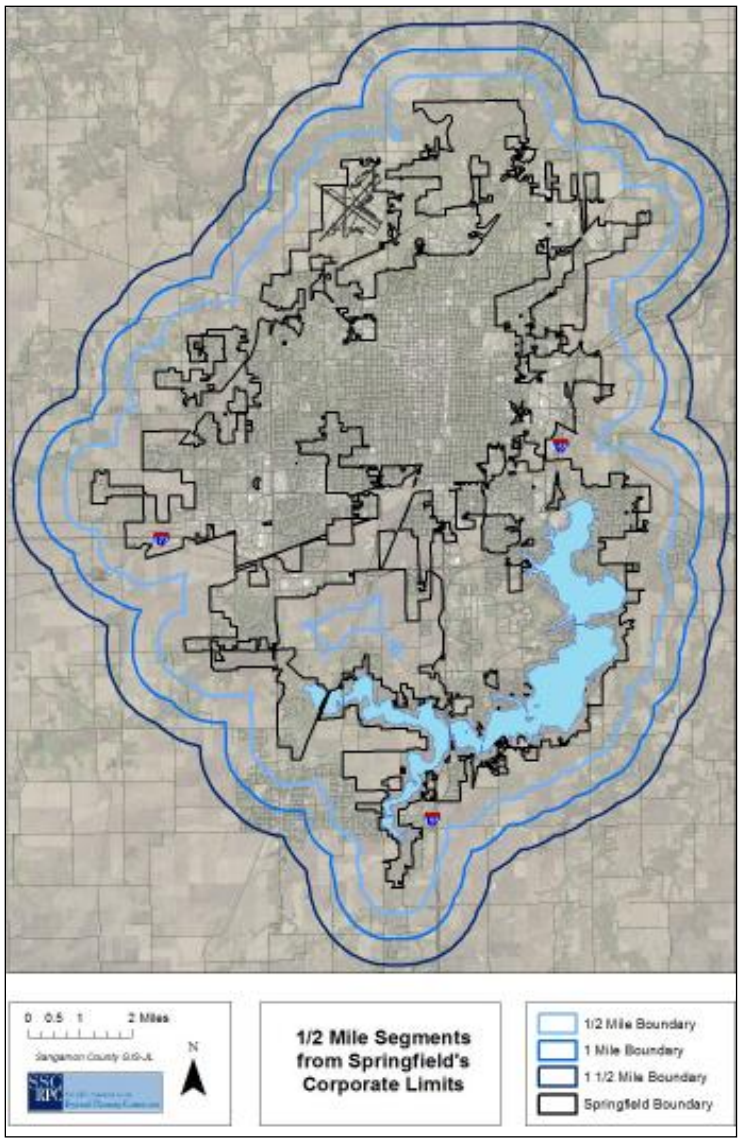


SERVICE AREA

The City of Springfield is the state capital of Illinois and also the county seat of Sangamon County. Springfield is located in the central portion of the county. The SFD provides fire and protective services within the municipal boundaries of the city and to nine unincorporated fire districts. The city boundaries encompass an area of 66 square miles of which 59.5 square miles is land area.

The following figure illustrates the municipal boundaries and unincorporated areas within the municipal boundaries of the city to which the SFD responds.

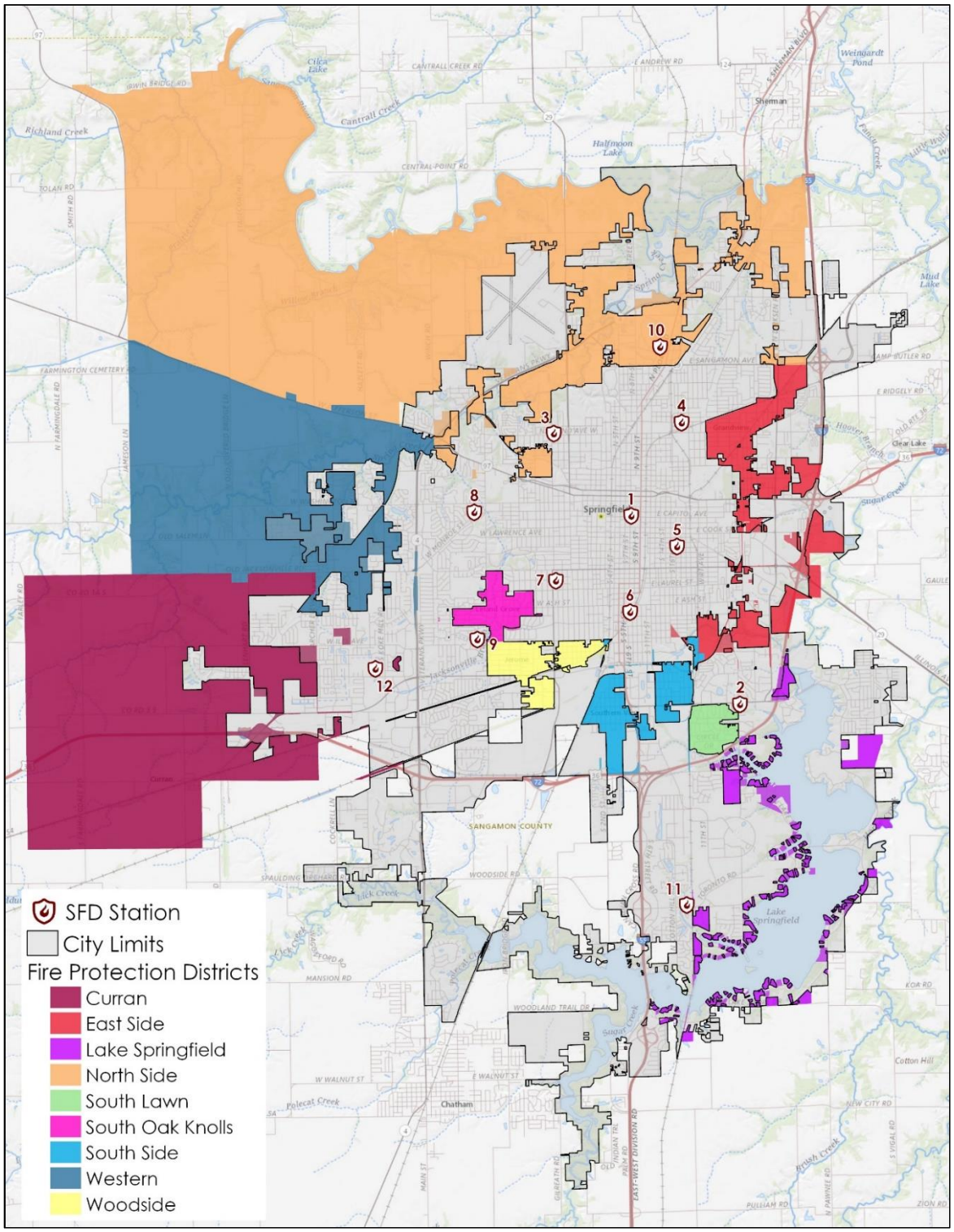
FIGURE 2-2: City of Springfield Municipal Boundary Map[1]



The next figure shows the municipal boundaries with SFD fire station locations and the fire districts to which the SFD provides service under contract.

1. 2017-2037 City of Springfield Comprehensive Plan.

FIGURE 2-3: SFD Fire Station Locations with Municipal and Fire District Response Areas



SECTION 3. FIRE DEPARTMENT PROGRAMS AND SERVICES

BUDGET

The SFD operating budgets for FY 2019 and FY 2020, the FY 2021 approved budget, and the FY 2022 requested budget are shown in the following table.

TABLE 3-1: SFD Budget, FY 2019 through FY 2022

FY 2019 Final Budget	FY 2020 Final Budget	FY 2021 Budget	FY 2022 Requested Budget
$39,586,816	$40,399,118	$41,755,113	$42,941,684

Much like every other career fire department in the nation, the SFD's budget is primarily consumed by personnel costs. This includes salary, benefit, and retirement costs, as well as other customary costs in this budget area. For the SFD, this budget area consistently represents approximately 92 percent to 94-percent of the total budget. The next largest budget areas are contractual services (largely for the operation and repair of facilities and equipment) and automotive operational/repair costs. This leaves little discretionary funding for day-to-day service delivery and other supplies, training and education, employee uniforms and protective clothing, station improvements, and overall new programs/improvements of the department.

CAPITAL ASSETS

Facilities

Fire facilities must be designed and constructed to accommodate both current and forecast trends in fire service vehicle type and manufactured dimensions. A facility must have sufficiently-sized bay doors; circulation space between garaged vehicles; departure and return aprons of adequate length and turn geometry to ensure safe response; and floor drains and oil separators to satisfy environmental concerns. Station vehicle bay areas should also consider future tactical vehicles that may need to be added to the fleet to address forecast response challenges, even if this consideration merely incorporates civil design that ensures adequate parcel space for additional bays to be constructed in the future.

Personnel-oriented needs in fire facilities must enable performance of daily duties in support of response operations. For personnel, fire facilities must have provisions for vehicle maintenance and repair; storage areas for essential equipment and supplies; space and amenities for administrative work, training, physical fitness, laundering, meal preparation, and personal hygiene/comfort; and—where a fire department is committed to minimize "turnout time"—bunking facilities.

A fire department facility may serve as a de facto "safe haven" during local community emergencies, and also serve as likely command center for large-scale, protracted, campaign emergency incidents. Therefore, design details and construction materials and methods should embrace a goal of having a facility that can perform in an uninterrupted manner despite

prevailing climatic conditions and/or disruption of utilities. Programmatic details, such as the provision of an emergency generator connected to automatic transfer switching—even going so far as to provide tertiary redundancy of power supply via a "piggyback" roll-up generator with manual transfer (should the primary generator fail)—provide effective safeguards that permit the fire department to function fully during local emergencies when response activity predictably peaks.

Personnel/occupant safety is a key element of effective station design. This begins with small details such as the quality of finish on bay floors and nonslip treads on stairwell steps to decrease tripping/fall hazards, or use of hands-free plumbing fixtures and easily disinfected surfaces/countertops to promote infection control. It continues with installation of specialized equipment such as an exhaust recovery system to capture and remove cancer-causing by-products of diesel fuel exhaust emissions. A design should thoughtfully incorporate best practices for achieving a safe and hygienic work environment.

An ergonomic layout and corresponding space adjacencies in a fire station should seek to limit the travel distances between occupied crew areas to the apparatus bays. Likewise, facility design should carefully consider complementary adjacencies, such as lavatories/showers in proximity of bunk rooms, desired segregations, and break rooms or fitness areas that are remote from sleeping quarters. Furnishings, fixtures, and equipment selections should provide thoughtful consideration of the around-the-clock occupancy inherit to fire facilities. Durability is essential, given the accelerated wear and life cycle of systems and goods in facilities that are constantly occupied and operational.

Sound community fire-rescue protection requires the strategic distribution of fire station facilities to ensure that effective service area coverage is achieved, that predicted response travel times satisfy prevailing community goals and national best practices, and that the facilities are capable of supporting mission-critical personnel and vehicle-oriented requirements and needs. Additionally, depending on a fire-rescue department's scope of services, size, and complexity, other facilities may be necessary to support emergency communications, personnel training, fleet and essential equipment maintenance and repair, and supply storage and distribution.

National standards such as NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Programs*, outlines standards that transfer to facilities such as infection control, personnel and equipment decontamination, cancer prevention, storage of protective clothing, and employee fitness. NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Firefighting and Proximity Fire Fighting*, further delineates laundering standards for protective clothing and station wear. Laundry areas in fire facilities continue to evolve and are being separated from living areas to reduce contamination. Factors such as wastewater removal and air flow need to be considered in a facility design.

The SFD operates out of twelve operational facilities strategically located throughout the city. Each station houses around-the-clock crews, 365 days a year. Nine stations house one crew and one piece of first response apparatus (an engine), while three stations house more than one crew and two primary first response apparatus (engine and truck companies). Additionally, five stations house auxiliary response rolling stock such as specialty response apparatus, which is cross-staffed with engine or truck company personnel, and trailers, reserve fire apparatus, and support vehicles. Two stations also house the on-duty Battalion Chief (district commanders) and their response vehicle. The SFD makes efficient use of apparatus bay space.

A profile of each of the SPD's fire facilities is provided in the following table.

TABLE 3-2: SFD Facility Information

Station Number	Address	Year Built	Number of Apparatus Bays
1	825 E. Capital St.	1995	4
2	2810 Stevenson Dr.	1966	1 (Double Deep)
3	801 North Grand Ave. W.	1954	1
4	1900 Converse Ave.	1954	1
5	1723 Clay St.	1954	2
6	2156 S. 9th St.	1954	2
7	1428 Glenwood Ave.	1958	1
8	2051 W. Monroe Ave.	1969	2
9	2405 S. Chatham Rd.	1974	2
10	2401 Peoria Rd.	1987	2 (Double Deep)
11	1805 Toronto Rd.	1991	2
12	2925 S. Koke Mill	1996	2

Seven SFD facilities are in excess of 50 years of age and lack sufficient space and accommodations for assigned crews and apparatus. Four facilities are 67 years old and one is 63 years old. The remaining five stations are from 25 to 47 years old. As more than 50 percent of the facilities are in excess of 50 years old, they are susceptible to issues that are inherent in older buildings; as well, they lack the space and modern amenities of contemporary public fire facilities as outlined above. The SFD has plans to replace stations 6 (67 years old) and 8 (52 years old) in the next 18 months.

Recommendation:

- CPSM recommends as a planning objective that, over a three-year period, the SFD conduct a facility assessment of all fire facilities. (Recommendation No. 1.)

This recommended assessment should entail a comprehensive inspection of fire facilities and should include all building system components for evidence of movement, deterioration, structural failure, probable useful life, need for repair and maintenance, need for replacement, and associated replacement costs. CPSM further recommends the city and department retain an engineering firm/consultant to conduct a comprehensive review of all SFD facilities, and develop several options in a Comprehensive Fire Department Facilities Plan that will guide the officials of the City of Springfield and the SFD in determining the necessity for improvements/station replacements over the next five to ten years. Included in this plan should be a budgetary and funding plan with facility prioritization, as well as what facilities are viable based on structural and mechanical system usefulness, size/space for crew accommodations and apparatus, and what facilities should be replaced.

Fleet

The provision of an operationally ready and strategically located fleet of mission-essential fire-rescue vehicles is fundamental to the ability of a fire-rescue department to deliver reliable and efficient public safety within a community.

The SFD currently operates a fleet of front-line fire apparatus as outlined in the following table.

TABLE 3-3: SFD Front-Line Fleet

Vehicle Description	Year	Age
2007 Pierce Quantum Engine	2007	14
2002 Pierce Dash (Refurb) Engine	2002	19
1999 Pierce Dash(Refurb) Engine	1999	22
2016 Pierce Arrow XT Engine	2016	5
2007 Pierce Quantum Engine	2007	14
2007 Pierce Quantum Engine	2007	14
2009 Pierce Quantum Engine	2009	12
2007 Pierce Quantum Engine	2007	14
2001 Pierce Quantum (Refurb) Engine	2001	20
2019 Pierce Enforcer Engine	2019	2
2005 Pierce Quantum Engine	2005	16
2019 Pierce Enforcer Engine	2019	2
2013 Pierce Aerial	2013	8
2013 KME Aerial	2013	8
2001 Pierce Aerial	2001	20

The SFD also has an assortment of reserve engine apparatus, specialty response apparatus, and various command and light-response vehicles to include watercraft and special equipment trailers.

The procurement, maintenance, and eventual replacement of response vehicles is one of the largest expenses incurred in sustaining a community's fire-rescue department. While it is the personnel of the SFD who provide emergency services within the community, the department's fleet of response vehicles is essential to operational success. Reliable vehicles are needed to deliver responders and the equipment/materials they employ to the scene of dispatched emergencies within the city. Maintenance is performed by department fleet mechanics.

Replacement of fire-rescue response vehicles is a necessary, albeit expensive, element of fire department budgeting that should reflect careful planning. A well-planned and documented emergency vehicle replacement plan ensures ongoing preservation of a safe, reliable, and operationally capable response fleet. A plan must also include a schedule for future capital outlay in a manner that is affordable to the community.

NFPA 1901, *Standard for Automotive Fire Apparatus*, serves as a guide to the manufacturers that build fire apparatus and the fire departments that purchase them. The document is updated every five years using input from the public/stakeholders through a formal review process. The committee membership is made up of representatives from the fire service, manufacturers, consultants, and special interest groups. The committee monitors various issues and problems that occur with fire apparatus and attempts to develop standards that address those issues. A primary interest of the committee over the years has been improving firefighter safety and reducing fire apparatus crashes.

The Annex Material in NFPA 1901 (2016) contains recommendations and work sheets to assist in decision-making in vehicle purchasing. With respect to recommended vehicle service life, the following excerpt is noteworthy:

> *"It is recommended that apparatus greater than 15 years old that have been properly maintained and that are still in serviceable condition be placed in reserve status and upgraded in accordance with NFPA 1912, Standard for Fire Apparatus Refurbishing (2016), to incorporate as many features as possible of the current fire apparatus standard. This will ensure that, while the apparatus might not totally comply with the current edition of the automotive fire apparatus standards, many improvements and upgrades required by the recent versions of the standards are available to the firefighters who use the apparatus."*

A primary impetus for these recommended service life thresholds is continual advances in occupant safety. Despite good stewardship and maintenance of emergency vehicles in sound operating condition, there are many advances in occupant safety, such as fully enclosed cabs, enhanced rollover protection and air bags, three-point restraints, antilock brakes, higher visibility, cab noise abatement/hearing protection, and a host of other improvements as reflected in each revision of NFPA 1901. These improvements provide safer response vehicles for those providing emergency services within the community, as well those "sharing the road" with these responders.

The SFD does not have a structured replacement plan for first-line fire apparatus as outlined in NFPA 1901. Because the SFD currently has in service first-line and reserve engine apparatus that are approaching or at 20 years of service, due consideration should be given to planning now to replace these vehicles.

Recommendations:

- CPSM recommends the SFD develop, over a one-year period, a fire apparatus replacement plan that includes replacement according to recommendations in accordance with NFPA 1901, Standard for Automotive Fire Apparatus. (Recommendation No. 2.)
- Planning objectives should include:
  - First-line apparatus should not exceed 15 years of service on the front line, and once they reach this age, should be replaced with a new apparatus and then rotated to reserve status. This replacement schedule should be inserted into the SFD fleet capital replacement plan.
  - Apparatus in reserve status and which have not been properly maintained as evidenced by maintenance records, or that are not operationally or roadworthy as evidenced by maintenance records, should be placed out of service.
  - Apparatus in reserve status in excess of 20 years old should comply with NFPA 1901 and be upgraded in accordance with NFPA 1912 if the department plans to continue to use this apparatus.
  - Apparatus and major apparatus components such as the motor, fire pump, aerial ladder assembly and hydraulics, chassis, and chassis components such as brakes, wheels, and steering equipment should be maintained in accordance with manufacturer and industry specifications and standards.
  - Apparatus components requiring annualized testing either fixed or portable such as fire pumps, aerial ladder and aerial ladder assemblies, ground ladders, self-contained breathing apparatus to include personnel fit-testing, and fire hose should be tested in accordance with manufacturer and industry specifications and standards.

TRAINING PROGRAMS AND PERFORMANCE IMPROVEMENT

Training is, without question, one of the most important functions that a fire department should be performing on a regular basis. One could even make a credible argument that training is, in some ways, more important than emergency responses because a department that is not well-trained, prepared, and operationally ready will be unable to fulfill its emergency response obligations and mission. Education and training are vital at all levels of fire service operations to ensure that necessary functions can be completed correctly, safely, and effectively. A comprehensive, diverse, and ongoing training program is critical to the fire department's level of success.

An effective fire department training program must cover all the essential elements of that department's core missions and responsibilities. The level of training or education required, given a set of tasks, varies with the jobs to be performed. The program must include an appropriate combination of technical/classroom training, manipulative or hands-on/practical evolutions, and training assessment to gauge the effectiveness of these efforts. Most of the training, but particularly the practical, standardized, hands-on training evolutions should be developed based upon the department's own operating procedures and operations while remaining cognizant of widely accepted practices and standards that could be used as a benchmark to judge the department's operations for any number of reasons.

Certain Occupational Safety and Health Administration (OSHA) regulations dictate that minimum training must be completed on an annual basis, covering various topics that include:

- A review of the respiratory protection standard, self-contained breathing apparatus (SCBA) refresher and user competency training, SCBA fit testing (29 CFR 1910.134).
- Blood Borne Pathogens Training (29 CFR 1910.1030).
- Hazardous Materials Training (29 CFR 1910.120).
- Confined Space Training (29 CFR 1910.146).
- Structural Firefighting Training (29 CFR 1910.156).

In addition, National Fire Protection Association (NFPA) standards contain recommendations for training on various topics such as a requirement for a minimum of 24 hours of structural firefighting training annually for each fire department member.

Since so much depends upon the ability of the emergency responder to effectively deal with an emergency, education and training must have a prominent position within an emergency responder's schedule of activities when on duty. Education and training programs also help to create the character of a fire service organization. Agencies that place a real emphasis on their training tend to be more proficient in carrying out day-to-day duties. The prioritization of training also fosters an image of professionalism and instills pride in the organization. Overall, the SFD has an excellent robust and comprehensive training program and there is a dedicated effort focused on a wide array of training activities.

The SFD Training Division is a stand-alone unit within the department; it is commanded by a Division Chief. At the time of this analysis the incumbent commander was preparing to retire so there will be a change of command/leadership. The Division Chief is assisted by two Battalion Chiefs and one civilian support staff member. The position of EMS training coordinator was vacant at the time of this analysis. Each of the training personnel have a portfolio of multiple duties and responsibilities assigned them that are related to various operations, programs, and

liaison duties. They also work closely with the department's safety officers to develop solutions and remedial programs based upon relevant factors identified in accident and injury investigations.

The SFD has a training program for fire, EMS, and technical responses that includes, but is certainly not limited to:

- Six-month new-hire academy that includes certification in Firefighter Level 1 and Emergency Medical Technician–Intermediate training.
- Haz-mat materials training.
- Vehicle Extrication, Technical Rescue (rope rescue, water response, trench collapse, confined space, building collapse), both basic and advanced.
- On-going EMS basic and continuing education training.
- Daily company in-service training.

During 2020 (despite the limitations imposed by the COVID-19 pandemic) the SFD Training Division provided more than 60,000 staff hours of training to the department, an average of 306 hours per member. ***The SFD is to be commended for this commitment to training, which CPSM considers to be a Best Practice.***

All members of the SFD are certified to a minimum of the Firefighter I, Firefighter II, and EMT-Basic levels. As will be discussed later in this section, many members have earned additional certifications. The in-service training is usually topic-specific to either teach or practice important skills and/or to allow crews to work together in simulated emergency situations.

The SFD utilizes Target Solutions as its platform for all department in-service training. Target Solutions is a robust course catalog system for fire and EMS training that can be utilized to meet all federal, state, and local public safety training mandates. Its inventory is comprised of more than 1,000 online courses. Training personnel (and really any officer of member so authorized) can post training and information materials online for personnel to reference. The training schedule is posted prominently on Target Solutions and accessible to all personnel. Target Solutions can also provide the platform for managing all training records and reports. The use of this program helps to ensure that there is a reliable and accurate database for tracking and retrieval of all department level training and for recording and tracking the status of certifications for all personnel.

By department policy, all personnel and shifts are required to complete two training drills per day. This training is intended to be a combination of the training that is assigned by the training division augmented by additional training on topics identified by the Captains and Battalion Chiefs. This has resulted in more flexibility in the training that is completed. With any good fire department training program, at least 50 percent of the drills should include manipulative (hands on) training to allow for the development of proficiency and to review critical skills.

CPSM was informed that the training standard is "difficult to meet" regarding the required 18 hours of documented training each month as required by ISO for maximum credit during an evaluation. It is clearly reasonable that some days it will be difficult to complete the required training as various time demands throughout the duty day, including emergency responses, pose a competing demand for training time. Yet in many fire departments less-than-efficient time management and even past practice can hinder attempts to provide training for on-duty personnel. We believe that this is at least partially true in Springfield. ***Every effort should be made to continue to make completion of the daily training task a priority.***

Additional daily opportunities for training can be found during related activities such as daily/weekly apparatus and equipment inspections and building pre-planning activities. Annual inspection and testing requirements such as for hose, pumps, hydrant flow testing, etc. can also provide additional training credits for personnel who participate. Training can and should also be conducted during evening hours and on weekends.

On the EMS side of operations, the training programs and requirements are primarily driven by the mandatory nature of continuing education and recertification requirements for various levels of practitioners. If individual personnel or the agency were to not keep up with required training and/or certification requirements they could lose the ability to practice or provide the prescribed levels of service.

EMS training is also conducted through the Training Division and delivered by department personnel certified to provide various levels of EMS certification. Much of the EMS training is conducted in partnership with the Center for Learning and Innovation at Memorial Medical Center. ***The SFD is to be commended for this partnership to deliver state-of-the-art EMS training, which CPSM considers to be a Best Practice.***

All levels of EMS training require continuing education credits on a multiyear cycle for recertification. Whenever possible, fire training should be tied into EMS continuing education credits, providing dual discipline benefit for personnel. As EMS incidents make up a large percentage of the department's responses, ensuring that these certifications continue to be maintained should remain a significant component and priority of the department's training focus.

One area of major concern to CPSM was the fact that the EMS Coordinator position was vacant.

EMS incidents comprise the largest percentage of calls that the SFD responds to, calling for EMS training to be a priority. The vacancy in this position leaves the department without a lead EMS instructor to coordinate and deliver critical EMS training. The other members of the Training Division possess only EMT-Basic certification, so they lack the necessary certifications to teach advanced EMS classes. Finally, the absence of the coordinator hinders the department's ability to complete quality assurance and quality improvement in EMS delivery as the coordinator is responsible for reviewing reports, completing case studies, and acting as a liaison with the resource hospital on a regular basis.

The SFD appears to be a well-educated organization, with approximately 60 percent of the department reported to have at least an associate degree, with many also having earned bachelor's degrees. This is a much higher percentage than we find in most departments. In addition, a number of members have earned their master's degree, with a few also possessing doctorate-level degrees. The members of the SFD are to be commended for this commitment to furthering their professional education.

Professional development for fire department personnel, especially officers, is also an important part of overall training. There are numerous, excellent opportunities for firefighters and officers to attend training on a wide range of topics outside of Springfield, including those offered at various state firefighting academies and at the National Fire Academy in Emmitsburg, Maryland. Beyond the practical benefits to be gained from personnel participating in outside training, encouraging personnel to earn and/or maintain various specialized certifications such as Fire Instructor or Fire Officer increases the positive professional perception of the organization and can help to demonstrate a commitment to continued excellence.

As of the time of this assessment the SFD has no formal professional development program in place. While many department officers have earned various professional certifications, both fire- and EMS-related, some as the result of mandatory training, it has primarily been through their own pursuit of professional development. Supervisors are not required to hold fire officer certifications and there is no system for professional development in anticipation of promotion.

The following tables show the number of SFD personnel who possess various practitioner and officer certifications.

TABLE 3-4: EMS Certificates Requiring Continuing Education

EMS Certificate	SFD Personnel w/Cert.
AEMT / EMTI	74
EMT - Basic	98
EMT - Paramedic	34
Lead EMS Instructor	10
ACLS	107
BLS / CPR	205
PALS	107
PHTLS	107

TABLE 3-5: Office of State Fire Marshal Certificates Requiring Continuing Education

OSFM Certificate	SFD Personnel w/Cert.
Basic Operations Firefighter	87
Advanced Technician Firefighter	57
Fire Apparatus Engineer	204
Fire Officer I	41
Company Fire Officer	16
Fire Department Incident Safety Officer	19
Fire Officer II	17
Chief Fire Officer	1
Fire Service Instructor I	92
Fire Service Instructor II	39
Fire Service Instructor III	5
Training Program Manager	3
Basic Fire Prevention Officer	5
Fire Inspector I	6
Youth Firesetter Intervention Specialist	2
Fire Inspector II	3
Public Fire and Life Safety Educator I	6

OSFM Certificate	SFD Personnel w/Cert.
Advanced Fire Prevention Officer	2
Fire Investigator	6
Arson Investigator	3
Hazardous Materials First Responder–Operations	207
Hazardous Materials Technician	41
Hazardous Materials Incident Command	26
Rescue Specialist–Confined Space	38
Trench Operations	42
Trench Technician	36
Structural Collapse Operations	37
Structural Collapse Technician	26
Vehicle and Machinery Operations	199
Vehicle and Machinery Technician	1
Rope Operations	55
Fire Service Vehicle Operator	201
Rope Technician	26
Water Operations	1

SFD officers typically provide feedback to personnel regarding their performance but there is no formal testing or skills assessments for fire training in the department. Training is a required activity in the fire service and the ability to incorporate a formal testing process as part of the learning effort is essential. EMS skills assessments, both practical and written, are regularly incorporated into EMS training. Traditionally, fire departments are reluctant to incorporate skills testing into their fire training components. However, an increasingly common way to evaluate the department's training program is through annual skills proficiency evaluations where all members of the department are required to successfully perform certain skills and/or complete standardized evolutions, either individually, or as part of a team.

The ability to monitor and record training test scores is beneficial from an overall proficiency standpoint. In addition, training scores should be incorporated into the annual performance appraisal process for both the employee, his or her supervisor, and the training staff. In addition, the concept of adding a testing process to each training evolution adds to the importance and seriousness in which these activities are carried out.

The SFD does not currently utilize a formal task book process to provide training guidance and new rank orientation. A growing number of fire departments are employing task books for personnel who aspire to (or in some cases have already been promoted to) higher rank. For the SFD, task books would be appropriate for firefighter, engineer, captain, and battalion chief. The successful completion of any task book can be considered as a prerequisite for promotion to higher rank including captain or battalion chief, or alternatively, can be a required element of the post promotional evaluation process.

The SFD is in the process of developing a 120-hour Company Fire Officer Course for members of the department. Once completed, the course will be submitted to the state Fire Marshal's Office for approval. This would equate to an approximately three-week company officer academy.

Part of this program also involves the development of a Company Fire Officer Task Book, which would be comprised of JPRs that personnel would complete following the classroom portion of the academy. Personnel would have three years to complete the task book. ***The SFD is to be commended for this endeavor and should make its implementation a priority.***

The SFD should also consider conducting a formal one- or two-week engineer (apparatus operator) academy to assist candidates with completing their task book requirements. This effort can help provide newly promoted personnel with the tools needed to operate both administratively and in field settings. The completion of the task book could also qualify individuals to assume acting engineer and officer assignments in which they receive practical experience and on-the-job training.

Beyond the establishment of requirements to achieve certain levels of certification for promotion, the department should consider the implementation of a formal professional development program for all department personnel. The program should attempt to strike an appropriate balance between technical/practical task books, simulator training, formal certifications, mentor relationship, and outside influences. Where practical, best practices identified by the NFPA, ISO, IFSTA, IFSAC, Illinois State Fire Marshal, and the Center for Public Safety Excellence (CPSE) should be incorporated.

Recommendations:

- CPSM recommends the SFD make it a priority to fill the position of EMS Training Coordinator as soon as possible for reasons delineated in this analysis. (Recommendation No. 3.)
- The SFD should make a concerted effort to send as many officers as possible to the National Fire Academy (NFA). Any officer who meets the admissions criteria should be encouraged to enroll in the academy's Executive Fire Officer Program. (Recommendation No. 4.)
- CPSM recommends the SFD make it a priority to continue to develop and budget for a company fire officer training and development program that is competency-based on National Fire Protection Association (NFPA), International Association of Fire Chiefs (IAFC), International Fire Service Training Association (IFSTA), and Illinois state fire training standards. The program should focus on contemporary fire service issues including community fire protection and emergency services delivery approaches, fire prevention practices, firefighter safety and risk management and labor/staff relations; reviewing, approving, or preparing technical documents and specifications, departmental policies, standard operating procedures and other formal internal communications; improving organizational performance through process improvement and best practices initiatives; and having a working knowledge of information management and technology systems. (Recommendation No. 5.)
- CPSM recommends the SFD develop task books for firefighter, engineer, and battalion chief, in addition to the program under development for captain. Firefighters should be required to complete their book as part of their probationary period. For other ranks, all personnel aspiring for promotion to a higher rank should be required to successfully complete all elements of that rank's task book to be eligible to participate in the formal promotional testing process. (Recommendation No. 6.)
- The SFD should continue to develop training programs that lead to the following rank-appropriate certifications becoming mandatory job requirements for supervisory and command levels within the department: (Recommendation No. 7.)
  - Captain.

- Fire Instructor I.
- Fire Officer (or Company Fire Officer) I and II.
- IMS I-300.
- Illinois Fire Inspector (so companies can perform in-service inspections).

□ Battalion Chief.

- Fire Instructor II.
- Fire Officer III and/or Chief Fire Officer.
- IMS- I-400.
- Incident Safety Officer.

□ Division Chief

- Fire Officer IV.

- CPSM recommends the SFD develop, and institute written and practical skills testing and proficiency evaluations as part of the department's comprehensive fire training program. (Recommendation No. 8.)
- The SFD should provide all companies and personnel with high-intensity training on various subjects, including periodic live fire training on at least a semi-annual basis at an appropriate location where appropriate training facilities, structures, and props are available. (Recommendation No. 9.)
- CPSM recommends that the City of Springfield should make it a high priority to provide funding for the SFD to procure an appropriate training facility where it can safely perform NFPA 1403-compliant live fire training evolutions for all personnel on at least a semi-annual basis. (Recommendation No. 10.)

COMMUNITY RISK REDUCTION PROGRAMS

Community Risk Reduction activities are important undertakings of a modern-day fire department. A comprehensive fire protection system in every jurisdiction should include, at a minimum, the key functions of fire prevention, code enforcement, inspections, and public education. Preventing fires before they occur, and limiting the impact of those that do, should be priority objectives of every fire department. Fire investigation is a mission-important function of fire departments, as this function serves to determine how a fire started and why the fire behaved the way it did, providing information that plays a significant role in fire prevention efforts. Educating the public about fire safety and teaching people appropriate behaviors on how to react should they be confronted with a fire is also an important life safety responsibility of the fire department.

Fire suppression and response, although necessary to protect property, have little impact on preventing fire deaths. Rather, it is public fire education, fire prevention, and built-in fire protection systems that are essential elements in protecting citizens from death and injury due to fire, smoke inhalation, and carbon monoxide poisoning. The fire prevention mission is of utmost importance, as it is the only area of service delivery that dedicates 100 percent of its effort to the reduction of the incidence of fire.

Fire prevention is a key responsibility of every member of the fire department, and fire prevention activities should include all personnel. On-duty personnel can be assigned the responsibility for "in-service" inspections to identify and mitigate fire hazards in buildings, to familiarize firefighters with the layout of buildings, identify risks that may be encountered during firefighting operations, and to develop pre-fire plans. On-duty personnel in many departments are also assigned responsibility for permit inspections and public fire safety education activities.

Fire prevention should be approached in a truly systematic manner, and many community stakeholders have a vested interest and/or responsibility in these endeavors. It has been estimated that 70 percent to 75 percent of all the requirements found in building/construction and related codes are related in some way to fire protection and safety. Various activities such as plan reviews, permits, and inspections are often spread among different departments in the municipal government and are often not coordinated nearly as effectively as they should be. This lack of close interaction often results in friction between personnel with overlapping authorities, and can allow important issues to "slip through the cracks." It is critical that these important functions are coordinated with similar activities in the city's building inspection or code enforcement and/or planning departments.

The Fire Safety Division in the SFD is commanded by a Division Chief. In addition to the Division Chief, the division is staffed by eleven personnel. Of these, nine are Captains, of which one is a senior arson investigator and eight are fire inspectors who also serve as fire investigators. There is also a public education officer and a civilian administrative clerk.

The SFD Fire Safety Division has a wide-ranging portfolio of duties and responsibilities that it must fulfill. These include plans review, witnessing fire prevention system tests, and ensuring code compliance through inspections regarding both new buildings while under construction, as well as ongoing maintenance inspections after the building or business is occupied. A significant percentage of these responsibilities are mandated as part of the Illinois State building, residential, and fire codes. The remainder are performed in accordance with nationally recognized standards and best practices.

At the time of this assessment the City of Springfield and SFD were utilizing the following fire prevention codes:

- The International Fire Code – 2006 edition.
- NFPA 101 Life Safety Code.
- Chapter 94 of the Municipal Code of Ordinances.

The city is also utilizing the following building related codes:

- The International Building Code.
- The International Residential Code.
- The international Existing Building Code.
- The International Property Maintenance Code.
- The National Electric Code.
- Illinois State Plumbing Code.
- International Mechanical Code.

- Illinois Accessibility Code.
- NFPA 101 Life Safety Code.
- Chapter 170 –177 of the Municipal Code of Ordinances.

From 2018 through the 2020 the Fire Safety Division conducted the following number of inspections:

- 2021 (through 6/30) 860
- 2020 1,818
- 2019 1,818
- 2018 3,309

While most fire departments experienced a significant drop in in-person inspections during the height of the COVID-19 pandemic, it is unclear why the number of SFD inspections dropped significantly from 2018 to 2019, which was pre-pandemic. With eight personnel assigned as inspectors the 2019 and 2020 totals mean each inspector averaged just 227 inspections, down from 414 in 2018. Based on the first six months of 2021, the number will drop even more this year.

There are many reasons why existing buildings should be inspected for fire code compliance. The obvious purpose is to ensure that occupants of the building are living, working, or occupying a building that is safe for them to do so. Some buildings are required to have specific inspections conducted based on the type of occupancy and the use of the buildings such as but not limited to healthcare facilities (hospitals, nursing homes, etc.), schools, restaurants, and places of assembly. These inspections are mandated by various statutes, ordinances, and codes. The inspections themselves are often limited to specific areas within the building and to specific time frames. The fire inspectors will also witness tests of required fire protection systems and equipment. Conversely, many businesses are not required to have any type of periodic fire safety inspections.

Fire inspections can also identify violations and make follow-up inspections to ensure that violations are addressed and that the fire code is enforced. In fire prevention, the term "enforcement" is most often associated with inspectors performing walk-throughs of entire facilities, looking for any hazards or violations of applicable codes. Educating the owner as to the requirements, as well as the spirit and intent, of the code can also attain positive benefits for fire and life safety.

With several thousand business located in Springfield, many of them large, along with numerous schools, multifamily residential complexes, and other hazards, CPSM could not identify a consistent or comprehensive program that ensures that all businesses and commercial occupancies receive a routine "maintenance" fire prevention inspection on a regular, periodic basis.

In many departments, on-duty firefighters can be assigned with the responsibility for "in-service" inspections to identify and mitigate fire hazards in buildings, to identify risks that may be encountered during firefighting operations, and to develop pre-fire plans (which the SFD already does). On-duty personnel in many departments are also assigned responsibility for permit inspections and public fire safety education activities. Fire department personnel are often able to recognize hazards or violations, whereas inspectors are often able to identify features of a specific property that could prove important during an emergency. Effective information sharing enhances the ability of the fire department to protect the community.

Performing complex, technical inspections can be a very time-consuming, but necessary endeavor. Nationwide, communities that have proactive fire inspection and code enforcement programs in place often have a lower incidence of fire loss because many potential fire and life safety hazards are identified and corrected before they cause or contribute to a fire.

Of course, having sufficient personnel to perform fire prevention inspections can be a costly proposition. To help offset these costs, many jurisdictions are now assessing registration or inspection fees for businesses. The fees assessed often vary widely by jurisdiction. As an example, New Jersey has enacted a uniform statewide fee structure for different types of businesses, with the annual registration fees for businesses ranging from $108 to $4,781. Fees for various permits range from $54 to $641. Kern County, Calif., has established a fee schedule that covers a wide range of permits, inspections, and services such as plans reviews. The fee schedule includes:

- Operating Permits: $500 to $520.
- Construction Permits: $35 to $1,000.
- Fireworks Permit: $325.
- Plan Review: $130 to $195.
- Special Inspections: $450 to $520 and $140/hour (minimum two hours).
- Fire Safety Inspections and Stand-bys (all two-hour minimum): $140/hour to $455/hour.
- Administrative Fees: $10 to $1,000.

Some jurisdictions also assess a reinspection fee if an inspector must make a return visit to determine if code violations have been abated.

At the time of our analysis, the SFD did not have in place any significant fees for fire prevention and safety functions, and services.

Recommendations:

- CPSM recommends that the SFD implement an in-service company inspection program at residential, office, manufacturing, and retail business occupancy types throughout the city. (Recommendation No. 11.)
- CPSM recommends that the SFD provide appropriate training in conducting routine fire prevention inspections to all field personnel, particularly company officers who will be responsible for supervising these company programs. (Recommendation No. 12.)
- CPSM recommends that the SFD complete a comprehensive review of the city's actual costs for providing fire prevention services. The review should include a full costing of providing all fire prevention services, reviewing the city's fire code(s), as well as a comparative analysis of the fees charged for similar services by other fire departments. The review should be designed to capture the full range of services provided and capture the full scope of the operational permits and certain inspections required as part of a comprehensive fire prevention program. (Recommendation No. 13.)
- CPSM recommends that to fund the SFD's fire prevention and safety activities the city should consider the adoption of registration, inspection, and/or permit fees to offset the actual costs of providing these services in the city. These fees should include inspections conducted by in-service fire companies. (Recommendation No. 14.)

One trend that is being seen in a growing number of fire departments is the replacement of many of the uniformed personnel assigned to fire prevention with civilian personnel. The use of civilian personnel could make the Fire Safety Division much more fiscally efficient to operate. Because there would still be a need for these personnel to have fire department experience so they can apply the code requirements with a practical understanding of the "hows" and "whys," these positions might be an opportunity to continue to benefit from the experience of retired personnel who are still interested in serving but in a different capacity. Should this staffing model be adopted in whole or in part, the Fire Safety Division should continue to be commanded by a Division Chief.

Recommendation:

- CPSM recommends that the SFD should evaluate the feasibility and give serious consideration to replacing uniformed personnel in the Fire Safety Division with certified civilian staff members. CPSM strongly recommends that the Fire Safety Division remains an operational unit of the SFD. (Recommendation No. 15.)

As previously mentioned, fire suppression and response, although necessary to minimize property damage, have little impact on preventing fires. Rather, public fire education, fire prevention, and built-in fire protection and notification systems are essential elements in protecting citizens from death and injury due to fire. Automatic fire sprinklers have proven to be very effective in reducing fire loss and minimizing fire deaths in residential structures. However, many communities, Springfield among them, have been reluctant to impose code provisions that require these installations. The city's current fire code, the 2009 edition of the International Fire Code, does not mandate the installation of these life safety systems.

Automatic sprinklers are highly effective elements of total system design for fire protection in buildings, including one and two-family dwellings. Sprinklers help prevent fires from reaching flashover in a compartment fire, which is key to reducing fire deaths and injuries. They save lives and property, producing large reductions in the number of deaths per thousand fires, in average direct property damage per fire, and especially in the likelihood of a fire with large loss of life or large property loss. They do so much quicker and often more effectively and with less damage than firefighters do.

> No fire safety improvement strategy has as much documented life safety effectiveness as fire sprinklers because they actually extinguish the fire or, at a minimum, hold it in check and prevent flashover, until the arrival of the fire department.

The National Fire Protection Association reports that from 2010 to 2014, in fires in all types of structures, when sprinklers were present in the fire area of a fire large enough to activate sprinklers in a building not under construction, sprinklers operated 92 percent of the time.[2] When they operated, they were effective 96 percent of the time, resulting in a combined performance of operating effectively in 88 percent of reported fires where sprinklers were present in the fire area and the fire was large enough to activate sprinklers.[3]

In homes (including apartments), wet-pipe sprinklers operated effectively 89 percent of the time. When wet-pipe sprinklers were present in the fire area in homes that were not under

2. *Sprinklers in Reported U.S. Fires during 2010-2014*. (2017). National Fire Protection Association.
3. Ibid.

construction, the fire death rate per 1,000 reported structure fires was lower by 81 percent.[4] In all structures, not just homes, when sprinklers of any type failed to operate, the reason most often given (59 percent of failures) was shut-off of the system before the fire began.[5]

The effectiveness of residential sprinklers is proven by the data. According to the National Fire Protection Association, the average cost nationally for installing automatic fire sprinklers in new, single family residential structures is estimated to be $1.35 per square foot.6 For a 2,000 square-foot home, the estimated cost would be approximately $2,700. This can be less than the cost of granite countertops or a carpeting upgrade. In addition, many homeowner insurance policies provide a discount for homes equipped with residential fire sprinklers. For these reasons and because of superior residential fire sprinkler performance, CPSM recommends the city and fire department consider a residential sprinkler requirement ordinance in all new one- and two-family dwellings.

Recommendations:

- CPSM recommends the City of Springfield consider the adoption of a more recent edition of the International Fire Code (2009 or later) and adopt a city ordinance that requires the installation of an automatic fire suppression (sprinkler) system in all new construction, including one and two-family dwellings. CPSM further recommends that the SFD develop a compelling public education program that includes discussing the significant life-saving benefits of installing residential fire sprinklers in all new one- and two-family dwellings. (Recommendation No. 16.)

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A growing development in fire prevention inspections is the use of *Remote Video Inspection* (RVI). According to the NFPA, *"RVI provides an effective alternative means for building inspection, enabling one or more parties to remotely perform an inspection of a building or building component."*[7] The NFPA has released a new infographic that emphasizes the five key considerations for an RVI inspection program: procedures, communication, technology, verification, and completion (see following figure).

§ § §

4. Ibid
5. *Sprinklers in Reported U.S. Home Fires during 2010-2014*. (2017.) National Fire Protection Association.
6. *Home Fire Sprinkler Cost Assessment*. The Fire Protection Research Foundation, 2013.
7. https://www.nfpa.org/News-and-Research/Publications-and-media/Press-Room/News-releases/2020/New-infographic-from-NFPA-highlights-remote-inspection

FIGURE 3-1: Remote Video Inspection (RVI) Components

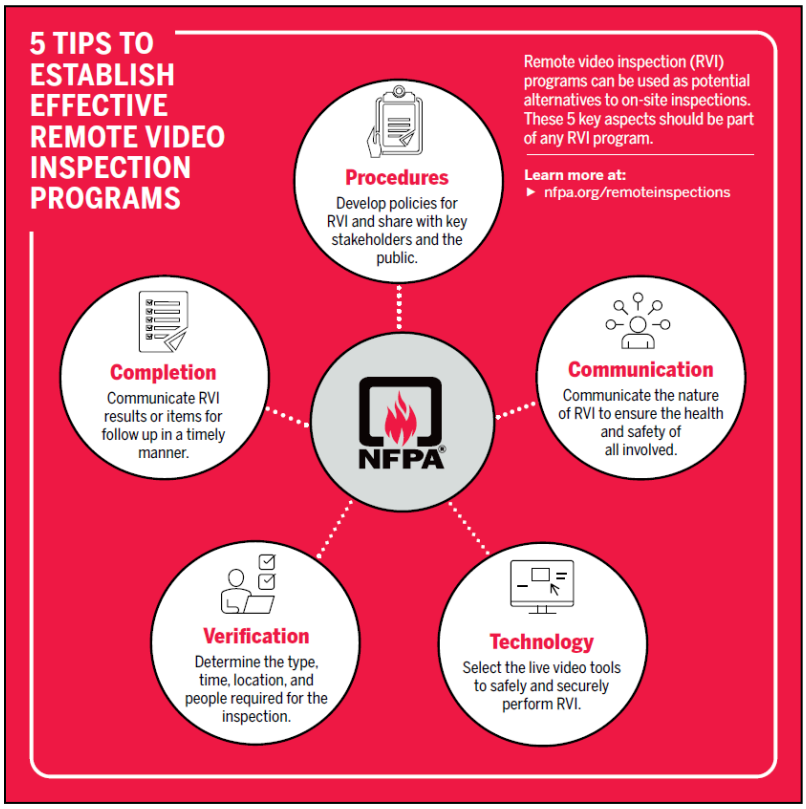


Image credit: National Fire Protection Association.

Until recently, use of RVI was limited and sporadic. The current COVID-19 pandemic and remote work conditions combined with the typical extensive workload have pushed more jurisdictions to consider alternatives to traditional inspection procedures and processes. Long term, the use of a program such as this can help any community risk reduction program better manage often unrealistic inspection workloads.

Recommendation:

- CPSM recommends that the SFD explore the feasibility of utilizing Remote Video Inspections (RIV) to assist with managing and modernizing the Community Risk Reduction fire inspection workload. (Recommendation No. 17.)

■ ■ ■ ■

The SFD has a very active public fire education program, which is an important component of an overall Community Risk Reduction program, particularly in the residential areas of the city. This effort is very commendable and results in time and resources well spent. Nearly 75 percent of all fires, fire deaths, and injuries occur in the home, an area where code enforcement and inspection programs have little to no jurisdiction. Public education is the area where the fire service will make the greatest impact on preventing fires and subsequently reducing the accompanying loss of life, injuries, and property damage through adjusting people's attitudes and behaviors regarding fires and fire safety. This program should also include the aggressive distribution and installation of smoke detectors, particularly in areas of the city with high proportions of at-risk populations.

Recommendation:

- CPSM recommends that the SFD implement a company/community level voluntary home inspection and education program that targets vulnerable populations (young, elderly, and disabled) with a goal of reducing fires and civilian casualties. (Recommendation No. 18.)

The investigation of the cause and origin of fires is also an important part of a comprehensive fire prevention system. Determining the cause of fires can help with future prevention efforts. At the time of this evaluation, Battalion Chiefs and Captains are charged with initiating the fire origin and cause determination process. When possible, they can make those determinations. When needed, particularly when the fire involves a significant loss, injury, or fatality, a fire investigator responds to perform an in-depth investigation. Based upon the number of actual fires that occurred in Springfield during the period evaluated, CPSM believes the number of investigators can be reduced to two on each shift who perform investigations as an ancillary duty.

Recommendations:

- CPSM recommends that the SFD consider restructuring how fire investigations are performed, with two investigators assigned to each shift with fire investigations as an ancillary duty. Recommended rank for the investigators should be engineer. CPSM further recommends maintaining one Senior Fire Investigator in the Fire Safety Division with the rank of Captain who would coordinate and oversee fire investigation activities. (Recommendation No. 19.)
- CPSM recommends that all SFD Battalion Chiefs and Captains should receive additional training in fire origin and cause determination and be assigned primary initial responsibility for this process. (Recommendation No. 20.)

SECTION 4. ALL HAZARDS RISK ASSESSMENT OF THE COMMUNITY

POPULATION AND COMMUNITY GROWTH

The U.S. Census Bureau estimated the 2019 City of Springfield population to be 114,230. This is a 2.4 percent decrease from the 2010 decennial population of 116,250. As the city is about 59.5-square miles in land area, the population density based on the Census Bureau population data is 1,920/square mile. Thus, Springfield has urban density.

The age and socio-economic profiles of the population can have an impact on the number of requests for fire and EMS service. Evaluation of the number of seniors and children by fire management zones can provide insight into trends in service delivery and quantitate the probability of future service requests. In a 2018 National Fire Protection Association (NFPA) report on residential fires, the following key findings were identified for the period 2011–2015:[8]

- Males were more likely to be killed or injured in home fires than females, and accounted for larger percentages of victims (57 percent of the deaths and 54 percent of the injuries).
- The largest number of deaths (19 percent) in a single age group was among people ages 55 to 64.
- Half (50 percent) of the victims of fatal home fires were between the ages of 25 and 64, as were three of every five (62 percent) of the non-fatally injured.
- One-third (33 percent) of the fatalities were age 65 or older; only 15 percent of the non-fatally injured were in that age group.
- Children under the age of 15 accounted for 12 percent of the home fire fatalities and 10 percent of the injuries. Children under the age of 5 accounted for 6 percent of the deaths and 4 percent of the injuries.
- Adults of all ages had higher rates of non-fatal fire injuries than children.
- While smoking materials were the leading cause of home fire deaths overall, this was true only for people in the 45 to 84 age group.
- For adults 85 and older, fire from cooking was the leading cause of fire death.

In Springfield the following age and socioeconomic factors should be considered when assessing and determining risk for fire and EMS preparedness and response:[9]

- Children under the age of five represent 6.1 percent of the population.
- Persons under the age of 18 represent 21.9 percent of the population.
- Persons over the age of 65 represent 17.6 percent of the population.
- Female persons represent 52.6 percent of the population.

8. M. Ahrens, "Home Fire Victims by Age and Gender", Quincy, MA: NFPA, 2018.
9. https://www.census.gov/quickfacts/springfieldcityillinois

- There are 2.20 persons per household in Springfield.
- The median household income in 2019 dollars is $54,648.
- Persons living in poverty make up 18.6 percent of the population.
- Black or African-American alone represents the 19.9 percent of the population. The remaining percentage of population by race includes White alone at 72.9 percent, American Indian or Alaska Native alone at 0.1 percent, Asian alone at 3.1 percent, two or more races at 3.5 percent, and Hispanic or Latino at 2.8 percent.

RISKS AND HAZARDS

Environmental Factors[10]

The City of Springfield is prone to and will continue to be exposed to certain environmental hazards that may impact the community. These include drought, extreme temperature (cold and hot), river flooding, thunderstorms (some severe), tornadoes, and winter storms. A detail of environmental risks include:

- Because Springfield, like all other Midwestern cities, is exposed to eastern-moving fronts, it is prone to strong thunderstorms that produce heavy winds, rain, and lightning. Accompanying these storms is the potential for tornadic activity. The Illinois tornado season spans March through May, although a tornado can occur at any time if the conditions exist to produce these weather events. Sangamon County is a high-frequency tornado area according to the Sangamon County Emergency Operations Plan.
- Flooding from heavy rain (urban flooding due to poor drainage), the melting of snow, presence of rivers and creeks, and the failure of dams or levees. Lake Springfield, Spaulding Dam, and the Sangamon River with its many tributaries, more specifically Sugar Creek, expose the city to these risks.
- Although not a high risk, Springfield is exposed to earthquakes. Tremors have been experienced in the county due to proximity to the New Madrid Fault Zone, which extends into southern Illinois, and the Wabash Valley Fault Zone, which extends into southeastern Illinois. The largest risk is interruption to natural gas lines and the electric grid from earthquakes distant to the city.
- Severe winter storms that produce high winds, snow and drifting snow, ice, extreme low temperatures, as well as power outages and carbon monoxide emergencies.
- Drought and extreme high temperatures causing dry brush, grass, and other vegetation which leads to outside brush fires.

Building and Target Hazards

A community risk and vulnerability exercise evaluates the community as a whole, and with regard to buildings, measures all buildings and the risks associated with each property and then segregates the property as either a high-, medium-, or low-hazard depending on factors such as the life and building content hazard, and the potential fire flow and staffing required to mitigate

10. Sangamon County Emergency Operations Plan

an emergency in the specific property. According to the NFPA *Fire Protection Handbook*, these hazards are defined as:

High-hazard occupancies: Schools, hospitals, nursing homes, explosives plants, refineries, high-rise buildings, and other high life-hazard (vulnerable population) or large fire-potential occupancies.

Medium-hazard occupancies: Apartments, offices, and mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces.

Low-hazard occupancies: One-, two-, or three-family dwellings and scattered small business and industrial occupancies.[11]

The construction type for residential structures in Springfield is a mix of wood frame with wood or composite siding, and wood frame with brick veneer built on slab and crawl space with some having basements.

Townhomes, condos, and apartments are also common in Springfield. Typical construction includes wood frame with wood or composite siding, wood frame with brick veneer, and ordinary (block/brick) construction. Some are high-rise structures that create vertical density. Some apartment complexes include multistory structures and/or those in a campus footprint.

Other construction types for residential structures are present in Springfield as well and may include masonry non-combustible and fire resistive. The city does have an assortment of manufactured homes as well, which are typically made of light metal/wood construction with various exterior coverings. The commercial/industrial structure building inventory is ordinary (block/brick) construction, wood frame with composite siding, and masonry non-combustible.

Springfield has the following building types:

- Single-family homes.
- Condos, lofts, townhomes.
- Apartment buildings.
- Apartments above commercial.
- Commercial/industrial structures.
- Professional business/educational structures.
- Strip malls.
- Hotel structures.
- Rooming/lodging structures.
- Assisted living/long-term care structures.
- Housing/commercial/professional business structures over 75 feet in height (high rise).
- Public education structures.

11. Cote, Grant, Hall & Solomon, eds., *Fire Protection Handbook* (Quincy, MA: National Fire Protection Association, 2008), 12.

- Public government buildings.
- Correctional institutions (Springfield Jail, Sangamon County Jail, Sangamon County Juvenile Center).
- Hospitals/medical centers.

In terms of identifying target hazards, consideration must be given to the activities that take place (public assembly, life safety vulnerability, manufacturing, processing, etc.), the number and types of occupants (elderly, youth, handicapped, imprisoned, etc.), and other specific aspects related to the construction of the structure.

Springfield has a variety of target hazards that include:

- Hospital/medical center target hazards (St. Johns Hospital, Memorial Medical Center), as well as Springfield Clinic and SIU Medical.
- Hotel target hazards (life safety). There are four major hotels, all of which are high-rise structures.
- Correctional instituion target hazard (life safety/access).
- Educational/school/public assembly target hazard (life safety).
- Mercantile/Business/Industrial (life safety, hazardous storage and or processes).
- Long-term care target hazard (life safety, vulnerable population).
- Government infrastructure target hazard (hazardous storage/processes and continuity of operations).
- Government business target hazards (life safety, continuity of operations).
- Private business target hazards (life safety).
- High-rise target hazards (life safety) of which there are thirty of mixed occupancy types and include housing units.

The city has a mix of low- and medium-risk structures that make up the majority of the target hazard risk. High-hazard building risks are noted in this section as well. These include correctional institutions, assisted/long-term care facilities, residential structures housing a vulnerable population, hospital/medical centers, residential high-rise structures, public assembly structures when occupied, and those that have hazardous materials used in processes or that are stored in large quantities.

Human-Caused Risk

Human-caused or generated risks include civil unrest, large mass gatherings, cyber-attacks, school violence, threats of violence with the potential of weapons of mass destruction use, As Springfield is the state capital and county seat, there are several state and local government buildings which could be targeted. Springfield also has two military bases within the city.

Transportation Factors

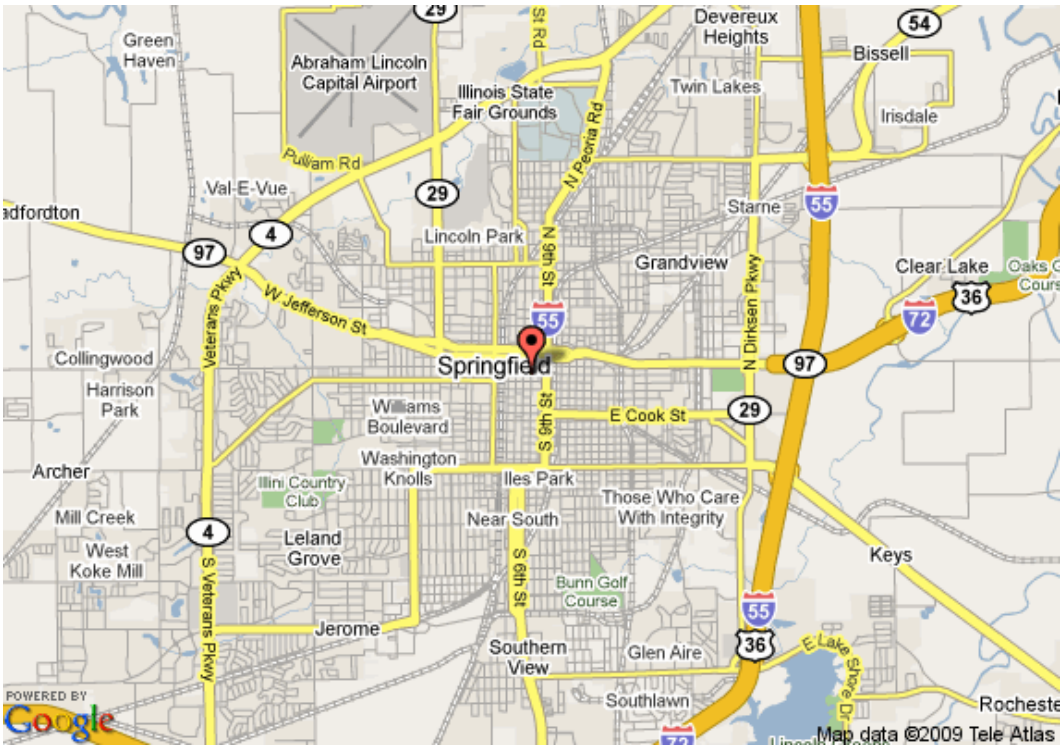
The road network in Springfield is typical of cities across the country and includes arterial streets, which carry high volumes of traffic; collector streets, which provide connection to arterial roads

and local street networks as well as residential and commercial land uses; and local streets, which provide a direct road network to property and move traffic through neighborhoods and business communities. Springfield also has limited access highways that penetrate the city boundaries (Interstates 55 and 72) and which include a series of on and off ramps, as well as state and county roads that carry high volumes of traffic in and out of the city.

The Sangamon Mass Transit District operates fixed bus routes that provide service in the city Monday through Saturday, as well as night routes until 9:45 p.m., Monday through Saturday. The fixed-route buses provide service to medical facilities, major employment centers, tourist attractions, major retail shopping centers, schools, colleges, professional buildings, the central business district, and all major points of interest.[12] Bus accidents when populated pose a mass casualty response risk if multiple riders are injured.

The road network described herein poses risks for a vehicular accident, some at medium to high speeds, as well as vehicular-versus-pedestrian risks. There are additional transportation risks since tractor-trailer and other commercial vehicles traverse the roadways of Springfield to deliver mixed commodities to businesses and residential locations. Fires involving these products can produce smoke and other products of combustion risks that may be hazardous to health.

FIGURE 4-1: Springfield Major Roads and Highways

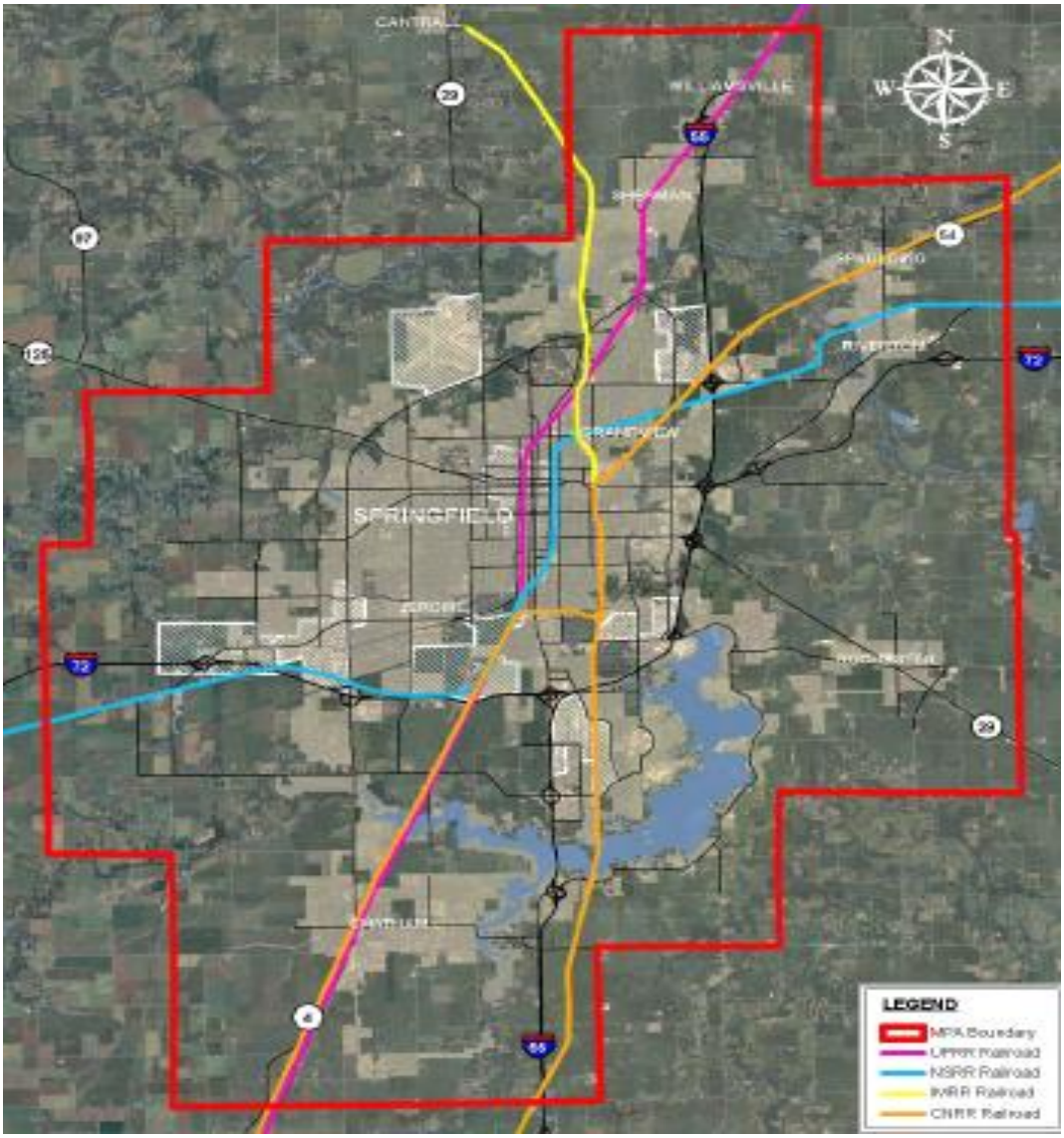


There are several active railroad lines that pass through the city, as well as the presence of active rail freight yards. Rail traffic includes passenger and freight. Active rail lines include Norfolk Southern, Union Pacific, Canadian National/Illinois Central, Illinois & Midland, Kansas City Southern, and Amtrak. Primary freight commodities include containerized consumer goods, transport of intermodal containers, grain, coal, chemicals and petroleum products, wastes, and scraps. While not all of these commodities may be considered hazardous materials, fires

12. http://www.smtd.org/

involving these commodities can produce smoke and other products of combustion risks that may be hazardous to health. Hazardous materials themselves present hazards to health risks. There are also many at-grade crossings on connector and local roads, and these create transportation risks. Other arterial streets and highways may not intersect directly with rail traffic, which helps neutralize rail/vehicular traffic accidents.

FIGURE 4-2: Springfield Rail Lines[13]



13. Economic Corridor and Freight Study, Springfield - Sangamon Regional Planning Commission, 2010

Fire and Fire-Related Risk

An indication of the community's fire risk is the type and number of fire-related incidents the fire department responds to. CPSM conducted a data analysis for this project that analyzed SFD incident responses and workload. During the period studied, the SFD responded to 6,476 fire-related calls for service. The following table details the call types and call type totals for these types of fire-related risks.

TABLE 4-1: Fire Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
False alarm	2,363	6.5	12.0
Good intent	829	2.3	4.2
Hazard	476	1.3	2.4
Outside fire	233	0.6	1.2
Public service	2,311	6.3	11.8
Structure fire	264	0.7	1.3
Fire Total	**6,476**	**17.7**	**32.9**

Key takeaways from the data in this table are:

- Fire calls for the year totaled 6,476 (33 percent of all calls when EMS responses are included), an average of 17.7 calls per day.
- False alarm calls were the largest category of fire calls at 36 percent of fire calls, an average of 6.5 calls per day.
- Structure and outside fire calls combined made up 7.7 percent of fire calls (2.5 percent of all calls), an average of 1.4 calls per day.

EMS Risk

As with fire risks, an indication of the community's pre-hospital emergency medical risk is the type and number of EMS calls to which the fire department responds. During the CPSM data analysis study period, the SFD responded to 11,466 EMS-related calls for service. The following table outlines the call types and call type totals for these types of EMS risks.

TABLE 4-2: EMS Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
Breathing difficulty	2,124	5.8	10.8
Cardiac and stroke	1,408	3.9	7.2
Fall and injury	937	2.6	4.8
Illness and other	5,140	14.1	26.1
MVA	670	1.8	3.4
Overdose and psychiatric	453	1.2	2.3
Seizure and unconsciousness	734	2.0	3.7
EMS Total	**11,466**	**31.4**	**58.3**

Key takeaways from the data in this table are:

- EMS calls for the year totaled 11,466 (58 percent of all calls), an average of 31.4 calls per day.
- Illness and other calls were the largest category of EMS calls at 45 percent of EMS calls, an average of 14.1 calls per day.
- Cardiac and stroke calls made up 12 percent of EMS calls, an average of 3.9 calls per day.
- Motor vehicle accidents made up 6 percent of EMS calls, an average of 1.8 calls per day.

Aggregately (Fire, EMS, canceled calls, and mutual aid), the department received an average of 53.9 calls per day, including 4.4 canceled calls (8 percent of all calls) and 0.2 mutual aid calls.

FIRE AND EMS DEMAND

The fire and EMS risk in terms of numbers and types of incidents is important when analyzing a community's risk, as outlined above. Analyzing where the fire and EMS incidents occur, and the demand density of fire and EMS incidents, helps to determine adequate fire management zone resource assignment and deployment. The following figures illustrate fire and EMS demand in the SFD fire management zones. Figure 4-3 illustrates fire incidents (structural and outside fires, alarm activations etc.); Figure 4-4 illustrates other types of fire-related incidents such as good intent and public service calls, which are calls for service such as smoke scares (no fire), wires down, lock outs, water leaks, etc.; Figure 4-5 illustrates the call density of false alarms; and Figure 4-6 illustrates EMS incident demand.

The following four demand maps (with current fire station locations shown) tell us that:

- Structure/outside fire-related and EMS incident demand is highest in the central portion of the city.
- Fire/false alarm demand and other types of fire incidents (hazardous conditions, service calls) is highest in the central portion of the city, with some intensity in other specific areas of the city as illustrated.

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FIGURE 4-3: Fire Incident Demand Density (Structure and Outside Fires)

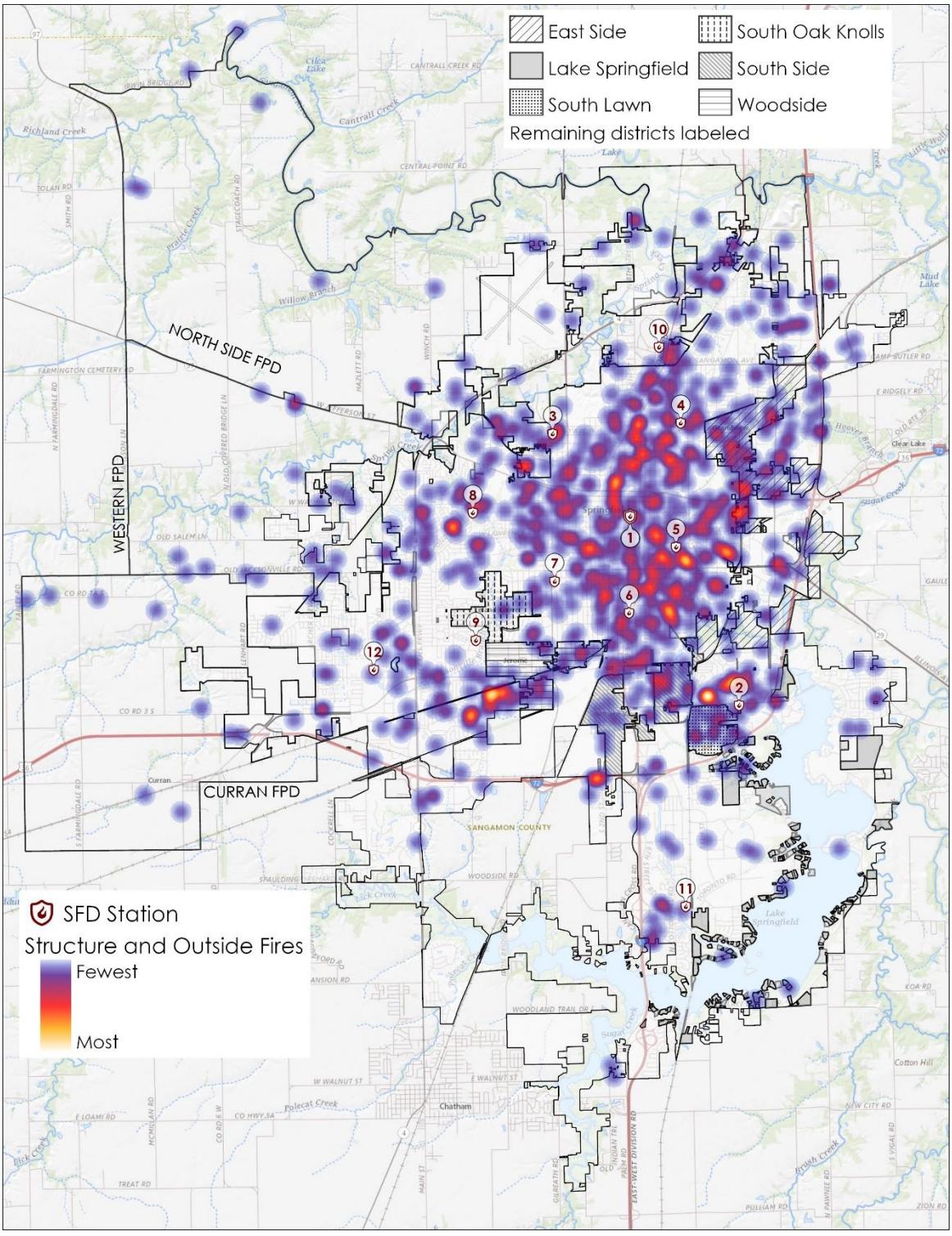


FIGURE 4-4: Other Fire-Related Incident Demand Density

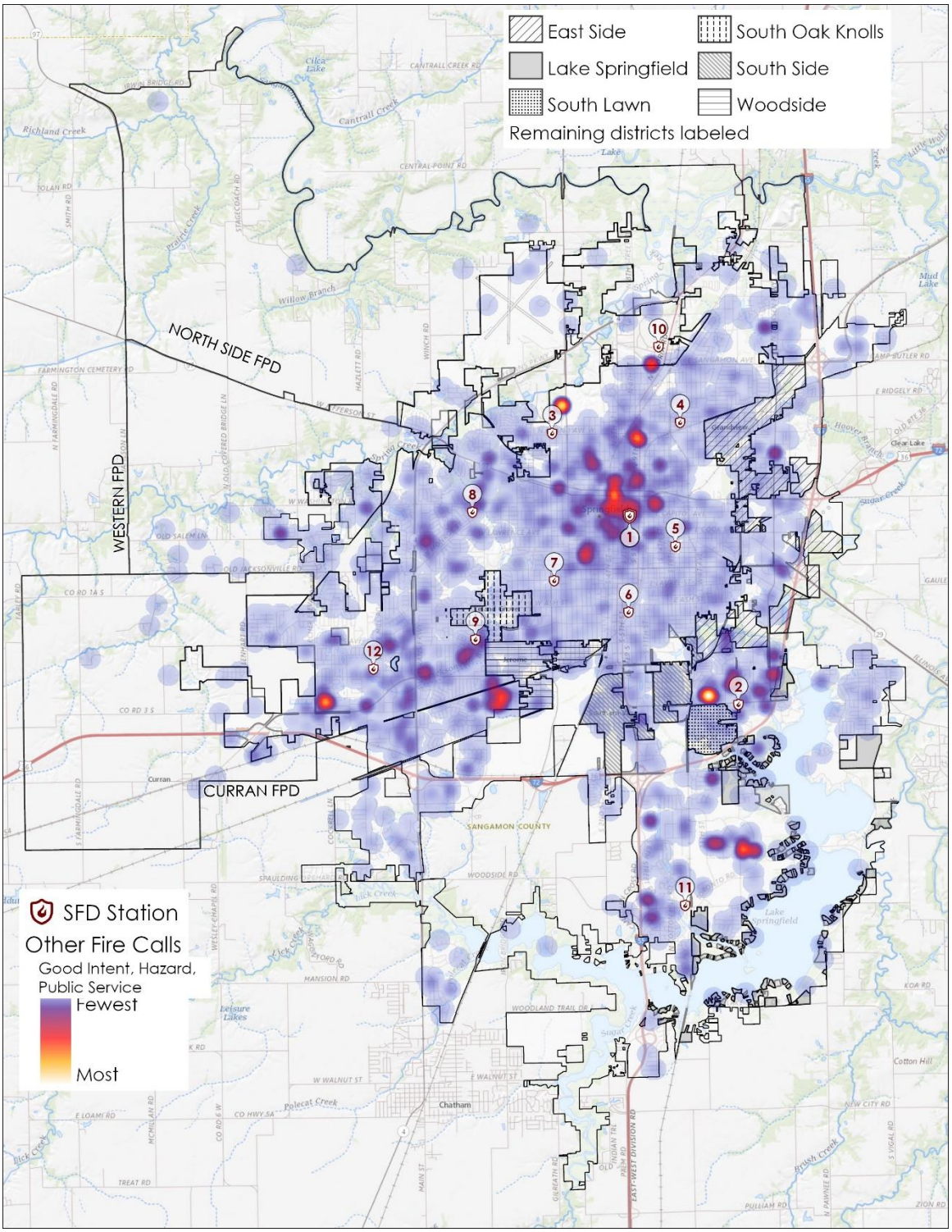


FIGURE 4-5: False Alarm Incident Demand Density

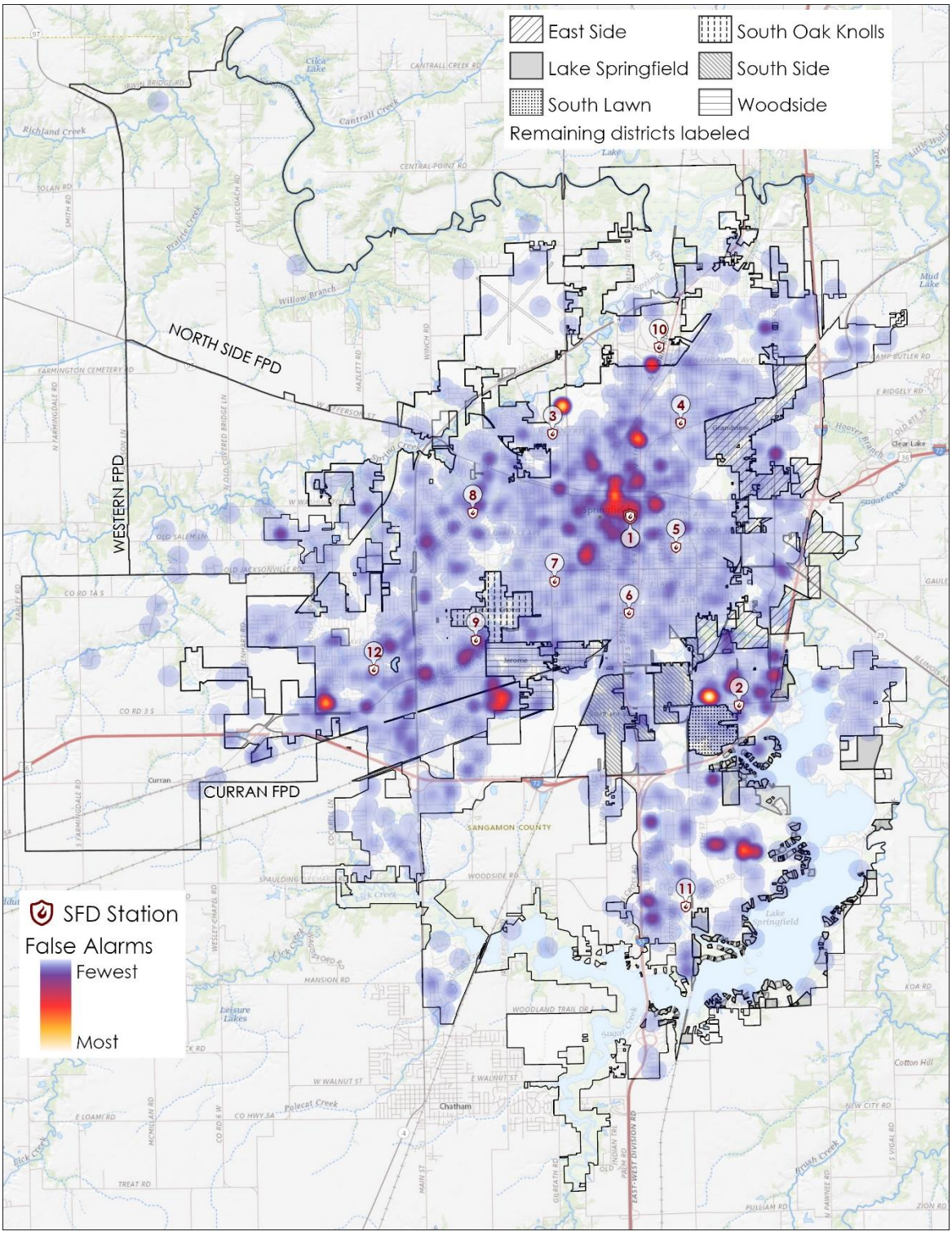
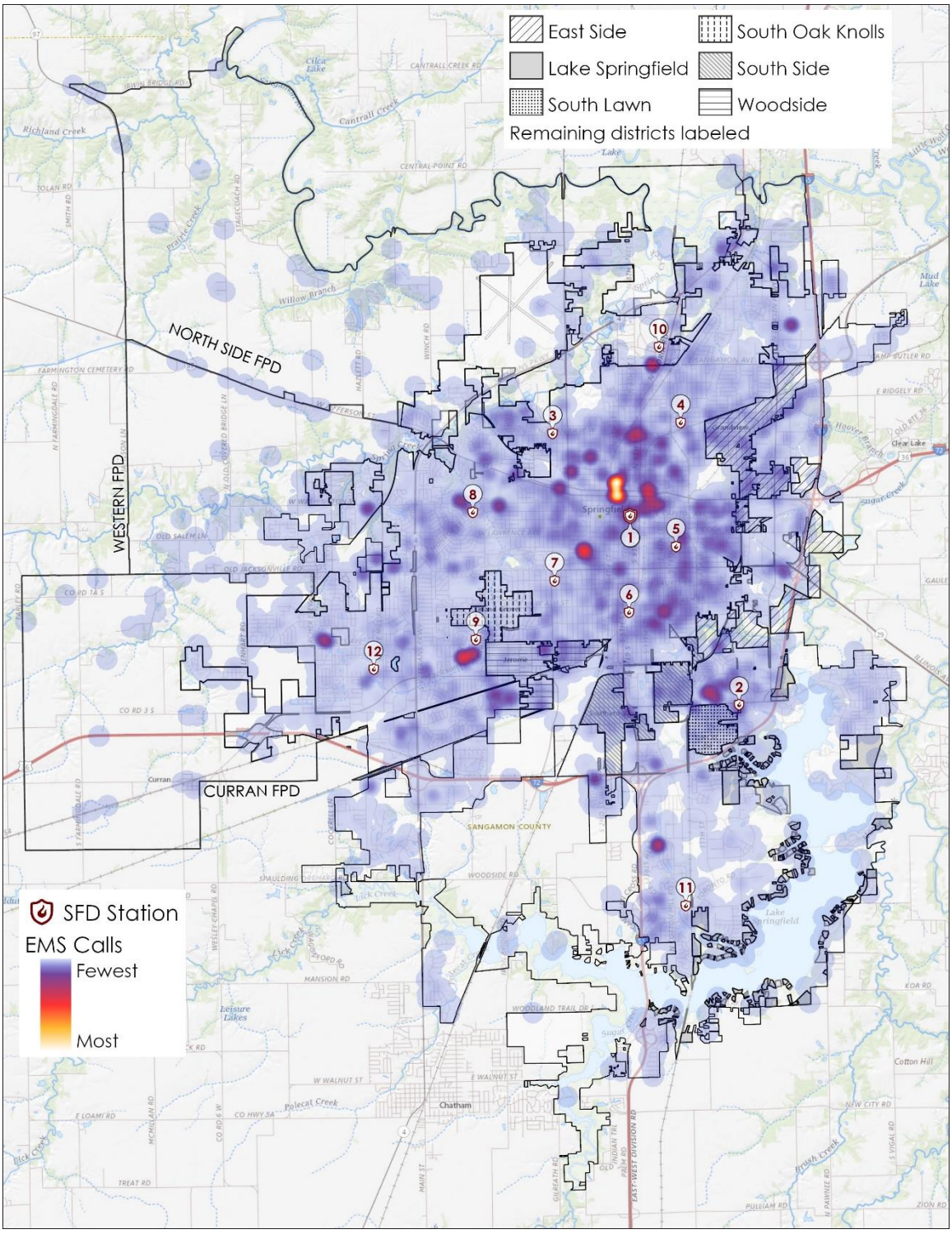


FIGURE 4-6: EMS Incident Demand Density



ISO RATING

The ISO is a national, not-for-profit organization that collects and evaluates information from communities across the United States regarding their capabilities to combat building fires. The data collected from a community is analyzed and applied to ISO's Fire Suppression Rating Schedule (FSRS) from which a Public Protection Classification (PPC™) grade is assigned to a community (1 to 10).

A Class 1 represents an exemplary community fire suppression program that includes all of the components outlined below. A Class 10 indicates that the community's fire suppression program does not meet ISO's minimum criteria. It is important to understand the PPC is not just a fire department classification, but rather a compilation of community services that include the fire department, the emergency communications center, and the community's potable water supply system operator.[14]

A community's PPC grade depends on:

- **Needed Fire Flows** (building locations used to determine the theoretical amount of water necessary for fire suppression purposes).
- **Emergency Communications** (10 percent of the evaluation).
- **Fire Department** (50 percent of the evaluation).
- **Water Supply** (40 percent of the evaluation).

The City of Springfield has an ISO rating of ***Class 1, the highest rating***. This rating was designated in April 2018. The final rating included the following credit by category:

- **Emergency Communications**: 9.64 earned credit points/10.00 credit points available.
- **Fire Department**: 41.48 earned credit points/50.00 credit points available.
- **Water Supply:** 35.22 earned credit points/40.00 credit points available.
- **Community Risk Reduction** (Fire Prevention/Inspection, Public Education, and Fire Investigation activities): 4.77 earned credit points/5.50 credit points available.

Overall, the community PPC rating yielded 90.09 earned credit points/105.50 credit points available. There was a 1.02 point diversion reduction assessed as well, which is automatically calculated based on the relative difference between the fire department and water supply scores. **90.00 points or more qualify a community for a rating of 1.**

The SFD component received significant point deficiency in the following area:

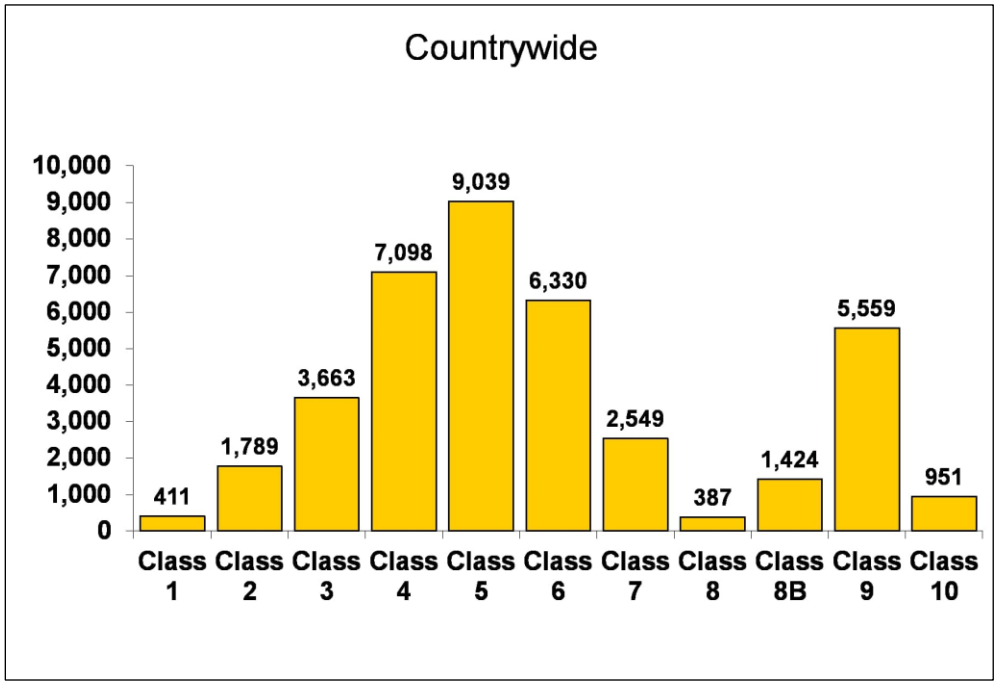
- Credit for Company Personnel: 8.30/15.00

According to the City of Springfield, April 2018 PPC Summary Report, credit for company personnel reviews the average number of on-duty firefighters and company officers available to respond to reported first alarm structure fires in the city. The on-duty strength is determined by the yearly average of total firefighters and company officers on duty considering vacations, sick leave, holidays, "Kelley" days, and other absences. Station placement, response times, and staffing will be reviewed later in this report.

14. SFD ISO PPC report; November 2019.

The following figure illustrates the dispersion of PPC ratings across the United States.

FIGURE 4-7: PPC Ratings in the United States[15]



COMMUNITY LOSS AND SAVE INFORMATION

Fire loss is an estimation of the total loss from a fire to the structure and contents in terms of replacement. Fire loss includes contents damaged by fire, smoke, water, and overhaul. Fire loss does not include indirect loss, such as business interruption.

In a 2019 report published by the National Fire Protection Association on trends and patterns of U.S. fire losses, it was determined that home fires still cause the majority of all civilian fire deaths, civilian injuries, and property loss due to fire. Key findings from this report include:[16]

- Public fire departments responded to 1,318,500 fires in 2018, virtually the same as the previous year.
- Every 24 seconds, a fire department in the United States responds to a fire somewhere in the nation. A fire occurs in a structure at the rate of one every 63 seconds, and a home fire occurs every 87 seconds.
- Seventy-four percent of all fire deaths occurred in the home.
- Home fires were responsible for 11,200 civilian injuries, or 74 percent of all civilian injuries, in 2018.

15. https://www.isomitigation.com/ppc/program-works/facts-and-figures-about-ppc-codes-around-the-country/
16. https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Fire-loss-in-the-United-States

- An estimated $25.6 billion in property damage occurred as a result of fire in 2018, a large increase, as this number includes a $12 billion loss in wildfires in Northern California.
- An estimated 25,500 structure fires were intentionally set in 2018, an increase of 13 percent over the year before.

For the five-year period of 2016 to 2020, the SFD reports the following community loss information as recorded from incidents the department responded to.

TABLE 4-3: Community Loss in Springfield, 2016–2020

Year	Loss in Dollars as Recorded by the SFD
2016	$5,384,023
2017	$5,412,480
2018	$7,194,614
2019	$4,755,882
2020	$7,369,283

RESILIENCY

Resiliency as defined by the Center for Public Safety Excellence (CPSE) in the FESSAM 9th edition is: "an organization's ability to quickly recover from an incident or events, or to adjust easily to changing needs or requirements." Greater resiliency can be achieved by constant review and analysis of the response system and focuses on three key components:

- Resistance: The ability to deploy only resources necessary to safely and effectively control an incident and bring it to termination, which is achieved through the development and implementation of critical tasking and its application to the establishment of an effective response force for all types of incidents.
- Absorption: The ability of the agency to quickly add or duplicate resources necessary to maintain service levels during heavy call volume or incidents of high resource demand.
- Restoration: The agency's ability to quickly return to a state of normalcy.

Resistance is controlled by the SFD through staffing and response protocol, and with SFD resources dependent on the level of staffing and units available at the time of the alarm.

Absorption is accomplished through initial responding units available to respond by the SFD.

Restoration is managed by SFD unit availability as simultaneous calls occur, recall of staff to staff fire units during campaign events when warranted, and efficient work on incidents for a quick return to service.

Regarding restoration, the following four tables analyze the station availability to respond to calls, and the frequency by number of hours that units are dedicated to a single or multiple incidents.

TABLE 4-4: Station Availability to Respond to Calls

Station	Calls in Area	First Due Responded	Percent Responded	First Due Arrived	Percent Arrived	First Due First	Percent First
1	1,875	1,583	84.4	1,566	83.5	1,522	81.2
2	987	784	79.4	780	79.0	747	75.7
3	866	801	92.5	798	92.1	782	90.3
4	1,384	1,306	94.4	1,301	94.0	1,285	92.8
5	1,873	1,788	95.5	1,781	95.1	1,749	93.4
6	1,199	1,045	87.2	1,043	87.0	1,018	84.9
7	2,362	1,799	76.2	1,785	75.6	1,717	72.7
8	2,073	1,407	67.9	1,386	66.9	1,324	63.9
9	1,268	988	77.9	958	75.6	916	72.2
10	1,158	1,001	86.4	997	86.1	978	84.5
11	1,817	1,519	83.6	1,510	83.1	1,478	81.3
12	1,957	1,564	79.9	1,555	79.5	1,499	76.6
Total	**18,819**	**15,585**	**82.8**	**15,460**	**82.2**	**15,015**	**79.8**

Note: For each station, we count the number of calls within its first due area where at least one SFD unit arrived. Next, we focus on units from the first due station to see if any unit responded, arrived, or arrived first.

TABLE 4-5: Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Deployed Hours
6/28/2019, 1:00 p.m. to 2:00 p.m.	11	17	4.0
8/10/2019, 4:00 p.m. to 5:00 p.m.	11	13	2.8
1/16/2019, 4:00 p.m. to 5:00 p.m.	10	14	6.0
8/15/2019, 6:00 p.m. to 7:00 p.m.	10	11	3.1
6/18/2019, 11:00 p.m. to midnight	10	11	2.8
5/9/2019, 9:00 p.m. to 10:00 p.m.	10	11	2.5
1/12/2019, 8:00 a.m. to 9:00 a.m.	9	20	4.6
4/14/2019, 4:00 a.m. to 5:00 a.m.	9	19	8.9
1/28/2019, 5:00 p.m. to 6:00 p.m.	9	16	4.0
12/26/2019, 1:00 p.m. to 2:00 p.m.	9	15	3.6

Note: Total deployed hours is a measure of the total time spent responding to calls received in the hour, and which may extend into the next hour or hours. The number of runs and deployed hours only includes SFD units.

TABLE 4-6: Call Workload by Station and Unit

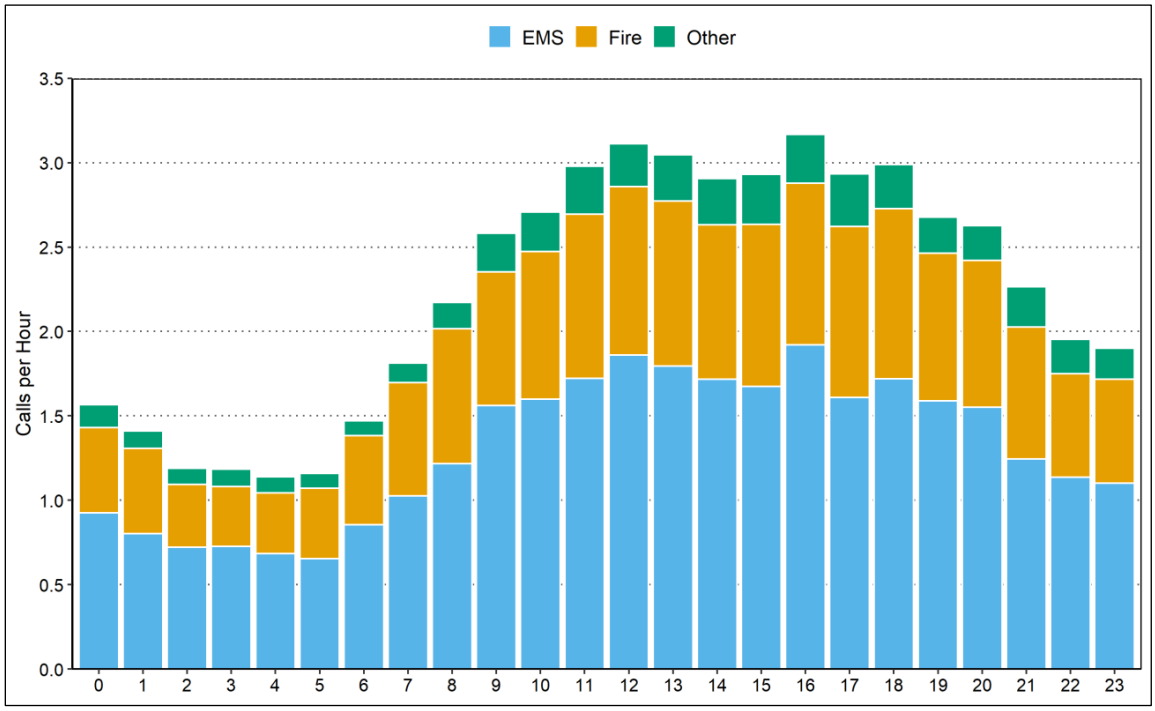
Station	Unit	Unit Type	Deployed Minutes per Run	Total Hours	Total Pct.	Deployed Minutes per Day	Total Runs	Runs per Day
1	B01	Battalion chief	21.3	347.2	4.2	57.1	976	2.7
	E01	Engine	16.1	690.4	8.4	113.5	2,576	7.1
	Haz1	Special Response	67.2	3.4	0.0	0.6	3	0.0
	Haz2	Trailer	67.2	3.4	0.0	0.6	3	0.0
	Sq1	Squad	16.3	59.7	0.7	9.8	220	0.6
	T01	Platform/truck	17.3	423.4	5.2	69.6	1,468	4.0
	Total		**17.5**	**1,527.3**	**18.6**	**251.1**	**5,246**	**14.4**
2	E02	Engine	18.8	609.3	7.4	100.2	1,948	5.3
	T02	Ladder	16.5	311.3	3.8	51.2	1,131	3.1
	Total		**17.9**	**920.6**	**11.2**	**151.3**	**3,079**	**8.4**
3	E03	Engine	**17.3**	**478.6**	**5.8**	**78.7**	**1,663**	**4.6**
4	E04	Engine	**17.1**	**646.4**	**7.9**	**106.3**	**2,262**	**6.2**
5	E05	Engine	**16.4**	**561.5**	**6.8**	**92.3**	**2,056**	**5.6**
6	B02	Battalion chief	17.7	295.6	3.6	48.6	1,003	2.7
	E06	Engine	15.3	395.3	4.8	65.0	1,555	4.3
	Total		**16.2**	**690.9**	**8.4**	**113.6**	**2,558**	**7.0**
7	E07	Engine	**16.2**	**475.9**	**5.8**	**78.2**	**1,762**	**4.8**
8	E08	Engine	**18.7**	**646.4**	**7.9**	**106.3**	**2,070**	**5.7**
9	E09	Engine	20.8	658.0	8.0	108.2	1,894	5.2
	M01	Mobile Ventilation	238.7	4.0	0.0	0.7	1	0.0
	Total		**21.0**	**662.0**	**8.1**	**108.8**	**1,895**	**5.2**
10	E10	Engine	20.9	435.8	5.3	71.6	1,251	3.4
	Haz3	Hazmat Supply	71.1	5.9	0.1	1.0	5	0.0
	Total		**21.1**	**441.7**	**5.4**	**72.6**	**1,256**	**3.4**
11	E11	Engine	**19.9**	**329.2**	**4.0**	**54.1**	**992**	**2.7**
12	E12	Engine	20.0	530.0	6.4	87.1	1,592	4.4
	T03	Truck	16.5	267.7	3.3	44.0	976	2.7
	Total		**18.6**	**797.7**	**9.7**	**131.1**	**2,568**	**7.0**
SFD	E15	Reserve Engine	15.1	0.5	0.0	0.1	2	0.0
	E18	Reserve Engine	7.4	0.1	0.0	0.0	1	0.0
	EMS1	Special Designation	20.0	25.0	0.3	4.1	75	0.2
	EMS2	Special Designation	18.1	15.4	0.2	2.5	51	0.1
	Total		**19.1**	**41.0**	**0.5**	**6.7**	**129**	**0.4**
Total			**17.9**	**8,219.2**	**100.0**	**1,351.1**	**27,536**	**75.4**

TABLE 4-7: Frequency Distribution of the Number of Calls

Calls in an Hour	Frequency	Percentage
0	1,279	14.6
1	2,093	23.9
2	2,104	24.0
3	1,413	16.1
4	910	10.4
5	540	6.2
6	259	3.0
7+	162	1.8
Total	**8,760**	**100.0**

The next figure illustrates the calls by hour of day, and shows the peak times of the day a call is likely to occur.

FIGURE 4-8: Calls by Hour of Day



Regarding the SFD's resiliency to respond to calls, analysis of these tables and figure tells us:

- On average the SFD made 75.4 runs per day.
- On average, calls had a duration of 18 minutes per run.
- On a station level, Station 1 made the most runs (5,246, or an average of 14.4 runs per day) and had the highest total annual deployed time (1,527.3 hours, or an average of 4.2 hours per day).

- On a unit level, Engine 1 made the most runs (2,576, or an average of 7.1 runs per day), and had the highest total annual deployed time (690.4 hours, or an average of 113.5 minutes per day).
- 38.5 percent of the time there was no call or a single call (no call overlap).
- 24.0 percent of the time a call was overlapped with one other call.
- 16.1 percent of the time there were three or more calls in an hour.
- 21.4 percent of the time there were 4 or more calls in an hour.
- 82.2 percent of the time the first due unit responded to calls in its first due area.
- 79.8 percent of the time the first due unit arrived first in its first due area.
- Hourly deployed time was highest during the day from 9:00 a.m. to 8:00 p.m.
- The deployed time peaked between 11:00 a.m. and 6:00 p.m. (3.0 calls per hour).
- The deployed time was lowest between midnight and 6:00 a.m.

Although 61.5 percent of the time there are overlapping SFD calls for service, on average 82.8 percent of the time, a first due SFD unit was available to respond to a call arriving in its first due fire management zone first 79.8 percent of the time. ***The SFD has resiliency in its deployment model based on its current deployment model. This may change based on the analysis that will occur in the remaining portion of this report, particularly when the report contemplates the assembling of an Effective Response Force and the critical tasks that must be completed simultaneously rather than concurrently on the fireground.***

RISK CATEGORIZATION

A comprehensive risk assessment is a critical aspect of creating standards of cover and can assist the SFD in quantifying the risks that it faces. Once those risks are known, the department is better equipped to determine if the current response resources are sufficiently staffed, equipped, trained, and positioned. In this component, the factors that drive the service needs are examined and then link directly to discussions regarding the assembling of an effective response force (EFR) and when contemplating the response capabilities needed to adequately address the existing risks, which encompasses the component of critical tasking.

The risks that the department faces can be natural or man-made and may be affected by the changing demographics of the community served. With the information available from the CPSM data analysis, the SFD, the city, and public research, CPSM and the SFD can begin an analysis of the city's risks, and can begin working towards recommendations and strategies to mitigate and minimize their effects. This section contains an analysis of the various risks considered within the SFD's service area.

Risk is often categorized in three ways: consequence of the event on the community, the probability the event will occur in the community, and the impact on the fire department. The following three tables look at the probability of the event occurring (Table 4-8) which ranges from unlikely to frequent; consequence to the community (Table 4-9), which is categorized as ranging from insignificant to catastrophic; and the impact to the organization (Table 4-10), which ranges from insignificant to catastrophic.

TABLE 4-8: Event Probability

Probability	Chance of Occurrence	Description	Risk Score
Unlikely	2%-25%	Event may occur only in exceptional circumstances.	**2**
Possible	26%-50%	Event could occur at some time and/or no recorded incidents. Little opportunity, reason, or means to occur.	**4**
Probable	51%-75%	Event should occur at some time and/or few, infrequent, random recorded incidents or little anecdotal evidence. Some opportunity, reason, or means to occur; may occur.	**6**
Highly Probable	76%-90%	Event will probably occur and/or regular recorded incidents and strong anecdotal evidence. Considerable opportunity, means, reason to occur.	**8**
Frequent	90%-100%	Event is expected to occur. High level of recorded incidents and/or very strong anecdotal evidence.	**10**

TABLE 4-9: Consequence to Community Matrix

Impact	Impact Categories	Description	Risk Score
Insignificant	Life Safety	▪ 1 or 2 people affected, minor injuries, minor property damage, and no environmental impact.	**2**
Minor	Life Safety Economic and Infrastructure Environmental	▪ Small number of people affected, no fatalities, and small number of minor injuries with first aid treatment. Minor displacement of people for <6 hours and minor personal support required. ▪ Minor localized disruption to community services or infrastructure for <6 hours. Minor impact on environment with no lasting effects.	**4**
Moderate	Life Safety Economic and Infrastructure Environmental	▪ Limited number of people affected (11 to 25), no fatalities, but some hospitalization and medical treatment required. Localized displacement of small number of people for 6 to 24 hours. Personal support satisfied through local arrangements. Localized damage is rectified by routine arrangements. ▪ Normal community functioning with some inconvenience. ▪ Some impact on environment with short-term effects or small impact on environment with long-term effects.	**6**
Significant	Life Safety	▪ Significant number of people (>25) in affected area impacted with multiple fatalities, multiple serious or extensive injuries, and significant hospitalization.	**8**

Impact	Impact Categories	Description	Risk Score
	Economic and Infrastructure Environmental	■ Large number of people displaced for 6 to 24 hours or possibly beyond. External resources required for personal support. Significant damage that requires external resources. Community only partially functioning, some services unavailable. ■ Significant impact on environment with medium- to long-term effects.	
Catastrophic	Life Safety Economic and Infrastructure Environmental	■ Very large number of people in affected area(s) impacted with significant numbers of fatalities, large number of people requiring hospitalization; serious injuries with long-term effects. General and wide-spread displacement for prolonged duration; extensive personal support required. Extensive damage to properties in affected area requiring major demolition. ■ Serious damage to infrastructure. Significant disruption to, or loss of, key services for prolonged period. ■ Community unable to function without significant support. ■ Significant long-term impact on environment and/or permanent damage.	**10**

TABLE 4-10: Impact on SFD

Impact	Impact Categories	Description	Risk Score
Insignificant	Personnel and Resources	One apparatus out of service for period not to exceed one hour.	**2**
Minor	Personnel and Resources	More than one but not more than two apparatus out of service for a period not to exceed one hour.	**4**
Moderate	Personnel and Resources	More than 50 percent of available resources committed to incident for over 30 minutes.	**6**
Significant	Personnel and Resources	More than 75 percent of available resources committed to an incident for over 30 minutes.	**8**
Catastrophic	Personnel, Resources, and Facilities	More than 90 percent of available resources committed to incident for more than two hours or event which limits the ability of resources to respond.	**10**

This section also contains an analysis of the various risks considered in the city. In this analysis, information presented and reviewed in this section (All-Hazards Risk Assessment of the Community) have been considered. Risk is categorized as Low, Moderate, High, or Special.

Prior risk analysis has only attempted to evaluate two factors of risk: probability and consequence. Contemporary risk analysis considers the impact of each risk to the organization, thus creating a three-axis approach to evaluating risk as depicted in the following figure. A contemporary risk analysis now includes probability, consequences to the community, and impact on the organization, in this case the SFD.

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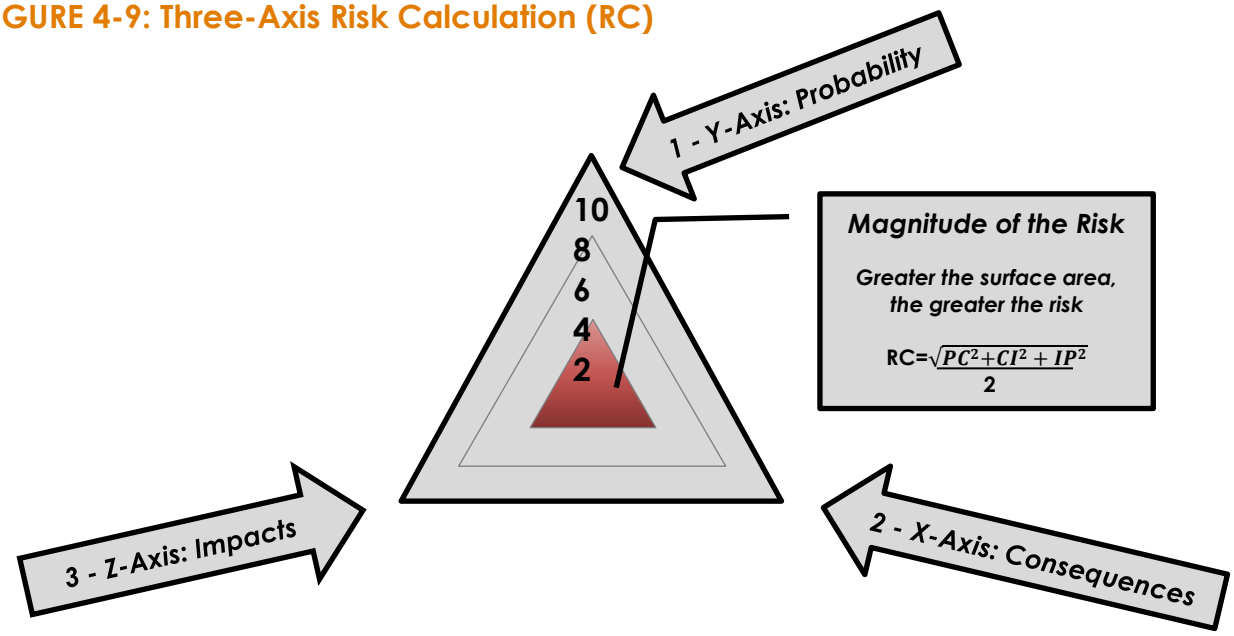
FIGURE 4-9: Three-Axis Risk Calculation (RC)



The following factors/hazards were identified and considered:

- **Demographic factors** such as age, socio-economic, vulnerability.
- **Natural hazards** such as flooding, snow and ice events, wind events, wild land fires.
- **Man-made hazards** such as rail lines, roads and intersections, target hazards.
- **Structural/building risks**.
- **Fire and EMS incident numbers and density**.

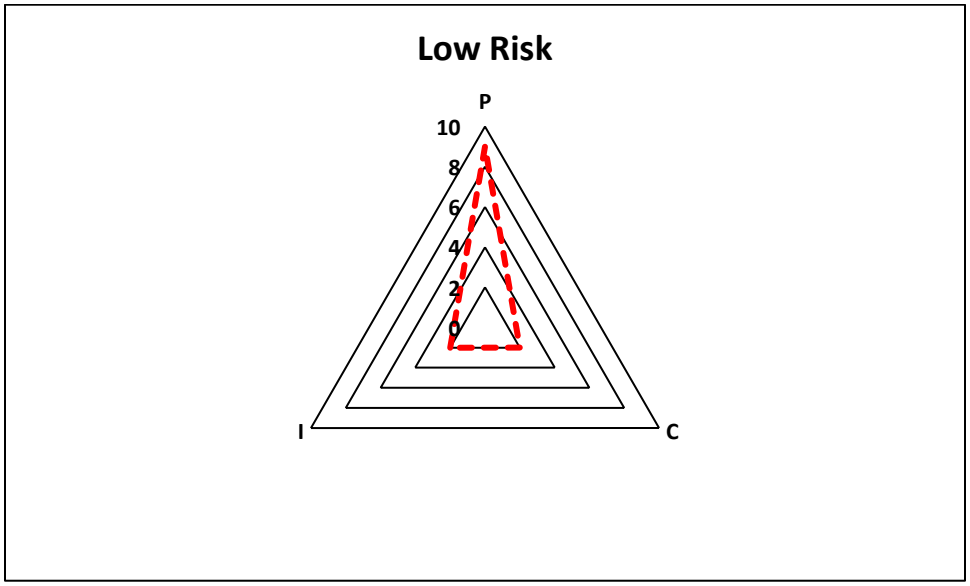
The assessment of each factor and hazard as listed below took into consideration the likelihood of the event, the impact on the city itself, and the impact on SFD's ability to deliver emergency services, which includes automatic aid capabilities as well. The list is not all inclusive but includes categories most common or that may present to the city and the SFD.

§ § §

Low Risk

- Automatic fire/false alarms.
- BLS EMS Incidents.
- Low-risk environmental event.
- Motor vehicle accident (MVA).
- Good intent/hazard/public service fire incidents with no life-safety exposure.
- Outside fires such as grass, rubbish, dumpster, vehicle with no structural/life-safety exposure.

FIGURE 4-10: Low Risk



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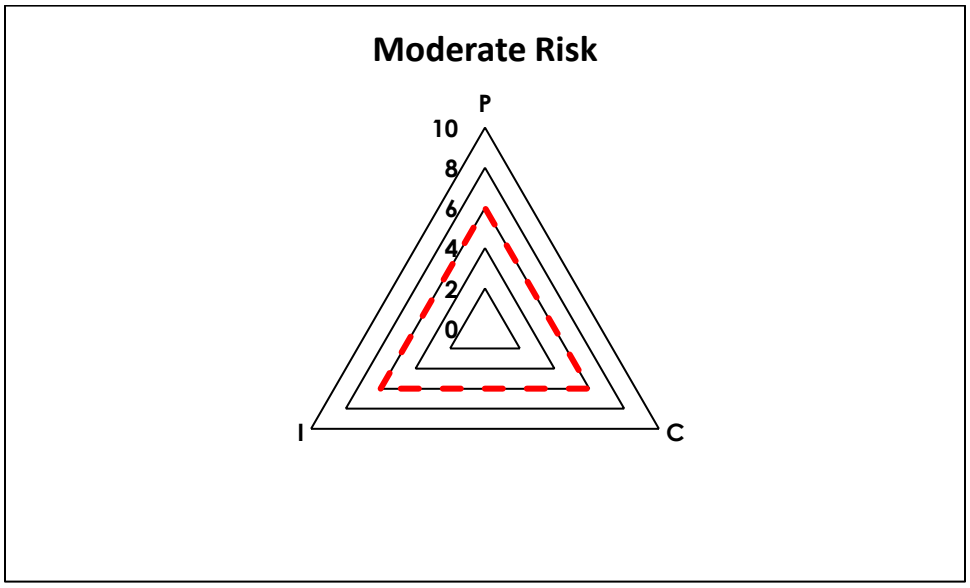
Moderate Risk

- Fire incident in a single-family dwelling where fire and smoke or smoke is visible, indicating a working fire.
- Suspicious substance investigation involving multiple fire companies and law enforcement agencies.
- ALS EMS incident.
- MVA with entrapment of passengers.
- Grass/brush fire with structural endangerment/exposure.
- Low angle rescue involving ropes and rope rescue equipment and resources.
- Surface water rescue.
- Good intent/hazard/public service fire incidents with life-safety exposure.
- Rail event with no release of product or fire, and no threat to life safety

FIGURE 4-11: Moderate Risk



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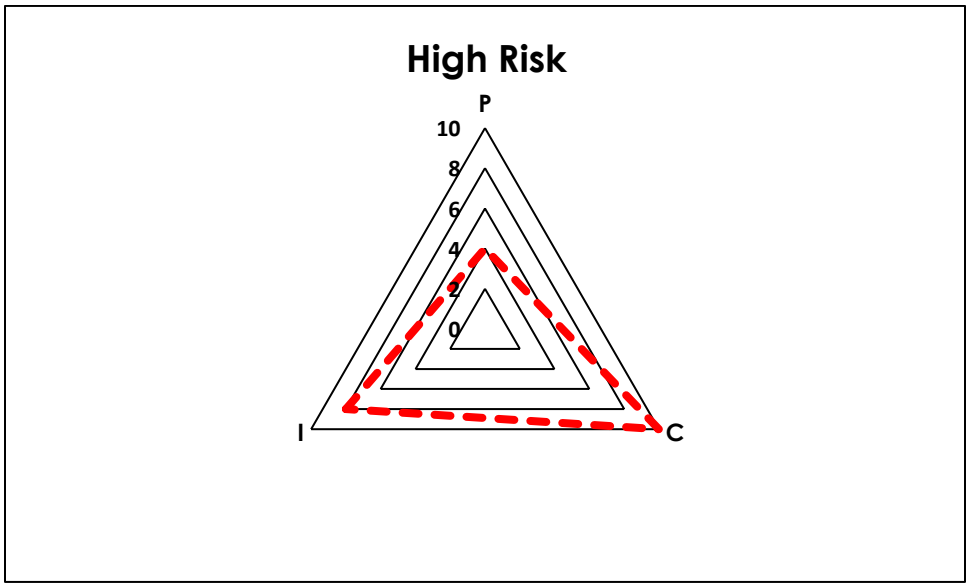
High Risk

- Working fire in a target hazard.
- Cardiac arrest.
- Mass casualty incident of more than 10 patients but fewer than 25 patients.
- Confined space rescue.
- Structural collapse involving life-safety exposure.
- High-angle rescue involving ropes and rope rescue equipment.
- Trench rescue.
- Suspicious substance incident with multiple injuries.
- Industrial leak of hazardous materials that causes exposure to persons or threatens life safety.
- Weather event that creates widespread flooding, heavy snow, heavy winds, building damage, and/or life-safety exposure.

FIGURE 4-12: High Risk



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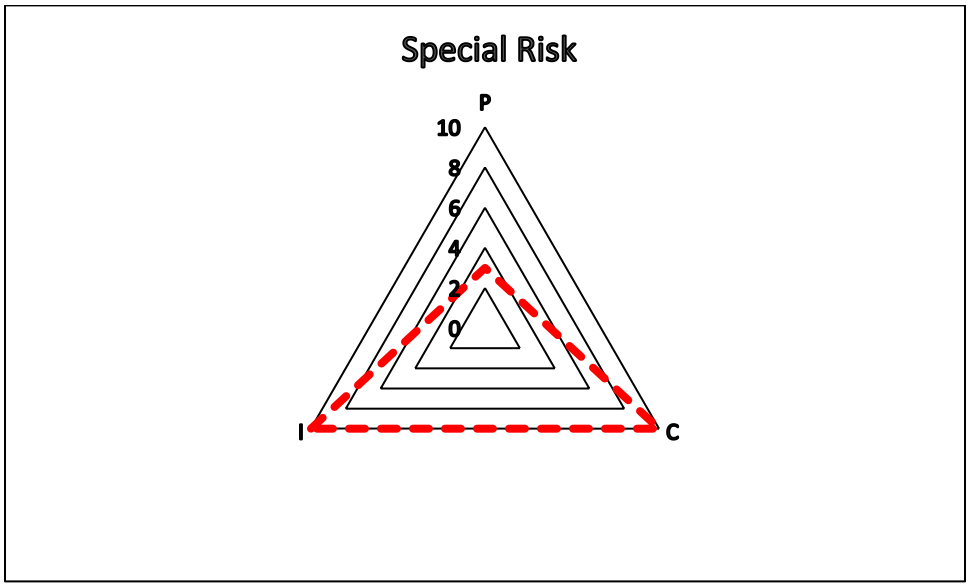
Special Risk

- Working fire in a structure of more than three floors.
- Fire at an industrial building or complex with hazardous materials.
- Fire in an occupied targeted hazard with special life-safety risks such as age, medical condition, or other identified vulnerabilities.
- Mass casualty incident of more than 25 patients.
- Rail or transportation incident that causes life-safety exposure or threatens life safety through the release of hazardous smoke or materials and evacuation of residential and business occupancies.
- Explosion in a building that causes exposure to persons or threatens life safety or outside of a building that creates exposure to occupied buildings or threatens life safety.
- Massive river/estuary flooding, fire in a correctional or medical institution, high-impact environmental event, pandemic.
- Mass gathering with threat fire and threat to life safety or other civil unrest, weapons of mass destruction release.

FIGURE 4-13: Special Risk



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SECTION 5. EMERGENCY DEPLOYMENT AND PERFORMANCE

EVALUATION OF CURRENT DEPLOYMENT AND PERFORMANCE

Response times are typically the primary measurement for evaluating fire and EMS services. Response times can be used as a benchmark to determine how well a fire department is currently performing, to help identify response trends, and to predict future operational needs. Achieving the quickest and safest response times possible should be a fundamental goal of every fire department.

However, the actual impact of a speedy response time is limited to very few incidents. For example, in a full cardiac arrest, analysis shows that successful outcomes are rarely achieved if basic life support (CPR) is not initiated within four to six minutes of the onset. However, cardiac arrests occur very infrequently; on average they are 1 percent to 1.5 percent of all EMS incidents.[17] There are also other EMS incidents that are truly life-threatening and the time of response can clearly impact the outcome. These involve cardiac and respiratory emergencies, full drownings, obstetrical emergencies, allergic reactions, electrocutions, and severe trauma (often caused by gunshot wounds, stabbings, and severe motor vehicle accidents, etc.). Again, the frequencies of these types of calls are limited.

An important factor in the whole response time question is what we term "detection time." This is the time it takes to detect a fire or a medical situation and notify 911 to initiate the response. In many instances, particularly at night or when automatic detection systems (fire sprinklers and smoke detectors) are not present or are inoperable, the detection process can be extended. Fires that go undetected and are allowed to expand in size become more destructive and are difficult to extinguish.

For the purpose of this analysis, ***response time*** is a product of three components: ***dispatch time***, ***turnout time***, and ***travel time***.

Dispatch time (alarm processing time) is the difference between the time a call is received and the time a unit is dispatched. Dispatch time includes call processing time, which is the time required to determine the nature of the emergency and types of resources to dispatch. ***Turnout time*** is when the emergency response units are notified of the incident and ends when travel time begins. ***Travel Time*** is the difference between the time the unit is en route and arrival on scene. ***Response time*** is the total time elapsed between receiving a call to arriving on scene.

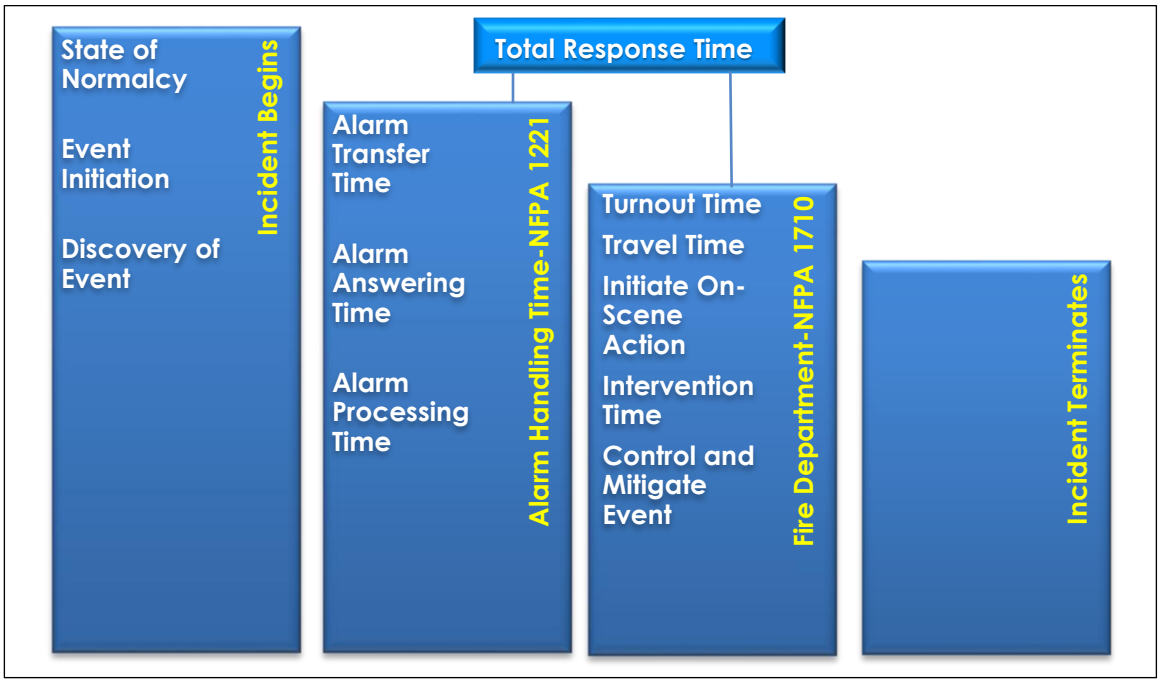
According to National Fire Protection Association (NFPA) Standard 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments,* 2020 edition (National Fire Protection Association, Quincy, Mass.), the alarm processing time or dispatch time should be less than or equal to 60 seconds 90 percent of the time. NFPA 1710 also states that turnout time should be less than or equal to 80 seconds (1.33 minutes) for fire and special operations 90 percent of the time and 60 seconds (1.0 minute) for EMS. As noted above, turnout time is the segment of total response time that the fire department has the most ability to control. Travel

17. Myers, Slovis, Eckstein, Goodloe et al. (2007). "Evidence-based Performance Measures for Emergency Medical Services System: A Model for Expanded EMS Benchmarking." *Pre-hospital Emergency Care*.

time shall be less than or equal to 240 seconds for the first arriving engine company, 90 percent of the time and, for the second due engine, 360 seconds 90 percent of the time. The standard further states the initial first alarm assignment should be assembled on scene in 480 seconds, 90 percent of the time for low/medium hazards, and 610 seconds for high-rise or high hazards. *Note that NFPA 1710 response time criterion is a benchmark for service delivery and not necessarily a CPSM recommendation*.

The following figure provides an overview of response time performance and identifies responsibility of the key components of the emergency communications center and the fire and rescue department.

FIGURE 5-1: Incident Cascade of Events



Regarding response times for fire incidents, the criterion is linked to the concept of **"flashover."** This is the state at which super-heated gasses from a fire are released rapidly, causing the fire to burn freely and become so volatile that the fire reaches an explosive state (simultaneous ignition of all the combustible materials in a room). In this situation, usually after an extended period (often eight to twelve minutes after ignition but at times as quickly as five to seven minutes), and a combination of the right conditions (fuel and oxygen), the fire expands rapidly and is much more difficult to contain. When the fire does reach this extremely hazardous state, initial firefighting forces are often overwhelmed, larger and more destructive fire occurs, the fire escapes the room and possibly even the building of origin, and significantly more resources are required to affect fire control and extinguishment.

Flashover occurs more quickly and more frequently today and is caused at least in part by the introduction of significant quantities of plastic- and foam-based products into homes and businesses (e.g., furnishings, mattresses, bedding, plumbing and electrical components, home and business electronics, decorative materials, insulation, and structural components). These materials ignite and burn quickly and produce extreme heat and toxic smoke.

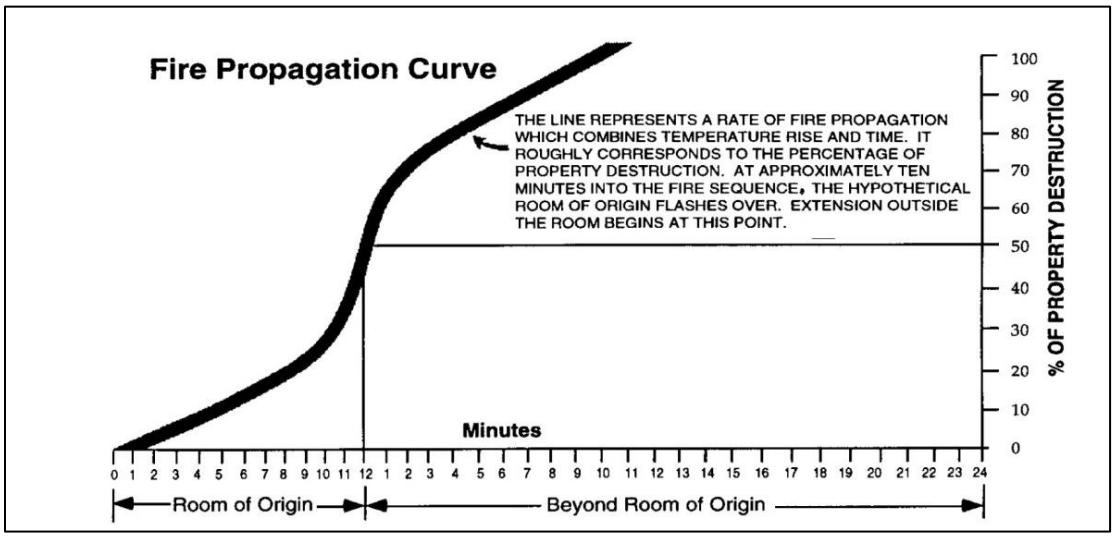
NFPA 1710 outlines recommended organization and deployment of operations by career, and primarily career fire and rescue organizations.[18] It is the benchmark standard that the United States Department of Homeland Security utilizes when evaluating applications for staffing grants under the Staffing for Adequate Fire and Emergency Response (SAFER) grant program.

As a benchmark, paragraph 4.1.2.1(3) of NFPA 1710 recommends the first arriving engine at a fire suppression incident have **a travel time of 240 seconds or less**. Paragraph 4.1.2.1(4) recommends that other than for a high-rise incident, **the entire initial response of personnel be on scene within eight minutes (480 seconds) travel time.** It is also important to keep in mind that once units arrive on scene, they will need to get set up to commence operations. NFPA 1710 recommends that units be able to commence an initial attack within two minutes of arrival, 90 percent of the time.

Although trying to reach the NFPA benchmark for travel time may be laudable, the question is, at what cost? What is the evidence that supports such recommendations? NFPA 1710's travel times are established for two primary reasons: (1) the fire propagation curve; and (2) sudden cardiac arrest, where brain damage and permanent brain death occurs in four to six minutes.

The following figure shows the fire propagation curve relative to fire being confined to the room of origin or spreading beyond it and the percentage of destruction of property by the fire.

FIGURE 5-2: Fire Propagation Curve



Source: John C. Gerard and A. Terry Jacobsen, "Reduced Staffing: At What Cost?" Fire Service Today (September 1981), 15–21.

According to fire service educator Clinton Smoke, the fire propagation curve establishes that temperature rise and time within in a room on fire corresponds with property destruction and potential loss of life if present.[19] At approximately the ten-minute mark of fire progression, the fire flashes over (due to superheating of room contents and other combustibles) and extends beyond the room of origin, thus increasing proportionately the destruction to property and

18. NFPA 1710 is a nationally recognized standard, but it has not been adopted as a mandatory regulation by the federal government or the State of Illinois. It is a valuable resource for establishing and measuring performance objectives for the City of Springfield but should not be the sole determining factor when making local decisions about the city's fire and EMS services.
19. Clinton Smoke, *Company Officer*, 2nd ed. (Clifton Park, NY: Delmar, 2005).

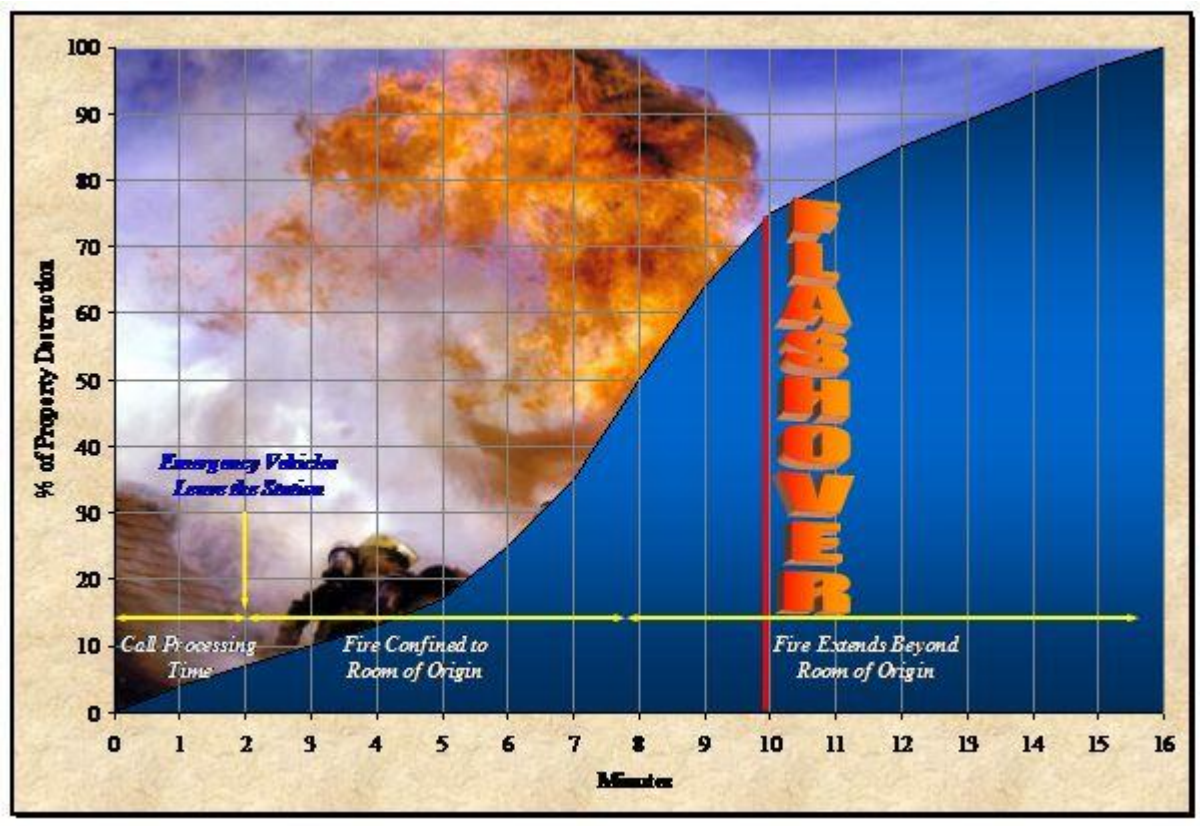
potential endangerment of life. The ability to quickly deploy adequate fire staff prior to flashover thus limits the fire's extension beyond the room or area of origin.

Regarding the risk of flashover, the authors of an International Association of Firefighters (IAFF) report conclude:

> *Clearly, an early aggressive and offensive initial interior attack on a working structural fire results in greatly reduced loss of life and property damage. Consequently, given that the progression of a structural fire to the point of "flashover" (the very rapid spreading of the fire due to super-heating of room contents and other combustibles) generally occurs in less than 10 minutes, two of the most important elements in limiting fire spread are the quick arrival of sufficient numbers of personnel and equipment to attack and extinguish the fire as close to the point of its origin as possible.*[20]

The following figure illustrates the time progression of a fire from inception through flashover. The time versus products of combustion curve shows activation times and effectiveness of residential sprinklers (approximately one minute), commercial sprinklers (four minutes), flashover (eight to ten minutes), and firefighters applying first water to the fire after notification, dispatch, response, and set up (ten minutes). It also illustrates that the fire department's response time to the fire is one of the only aspects of the timeline that the fire department can exert direct control over.

FIGURE 5-3: Fire Growth from Inception to Flashover[21]

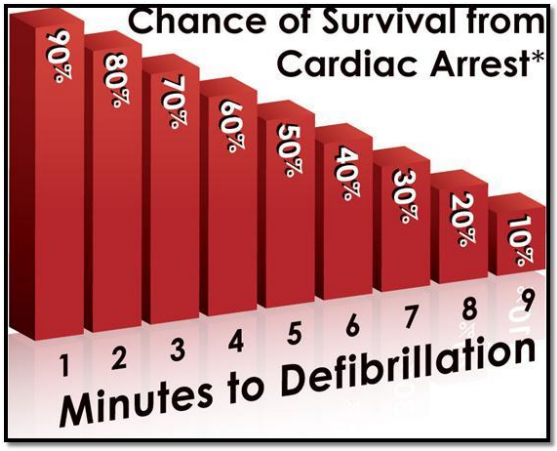


20. *Safe Fire Fighter Staffing: Critical Considerations*, 2nd ed. (Washington, DC: International Association of Fire Fighters), 5.
21. Source: Northern Illinois Fire Sprinkler Advisory Board.

EMS response times are measured differently than fire service response times. Where the fire service uses NFPA 1710 and 1720 as response time benchmarking documents, EMS' focus is and should be directed to the evidence-based research relationship between clinical outcomes and response times. Much of the current research suggests response times have little impact on clinical outcomes outside of a small segment of call types. These include cerebrovascular accidents (stroke), injury or illness compromising the respiratory system, injury or illness compromising the cardiovascular system to include S-T segment elevation emergencies, and certain obstetrical emergencies. Each require rapid response times, rapid on-scene treatment and packaging for transport, and rapid transport to the hospital.

Paragraph 4.1.2.1(7) of NFPA 1710 recommends that for EMS incidents a fire unit with first responder or higher-level trained personnel and equipped with an AED should arrive on scene within four minutes of travel time (time after call is processed, dispatched, and the unit turns out). An advanced life support (ALS) unit should arrive on scene within eight minutes travel time, provided the fire department responded first with first responder or higher-level trained personnel and equipped with an AED. According the NFPA 1710, "*This requirement is based on experience, expert consensus, and science. Many studies note the role of time and the delivery of early defibrillation in patient survival due to heart attacks and cardiac arrest, which are the most time-critical, resource-intensive medical emergency events to which fire departments respond.*" The next figure illustrates the chance of survival for a victim in cardiac arrest who does not have access to critical emergency defibrillation.

FIGURE 5-4: Cardiac Arrest Survival Probability by Minute



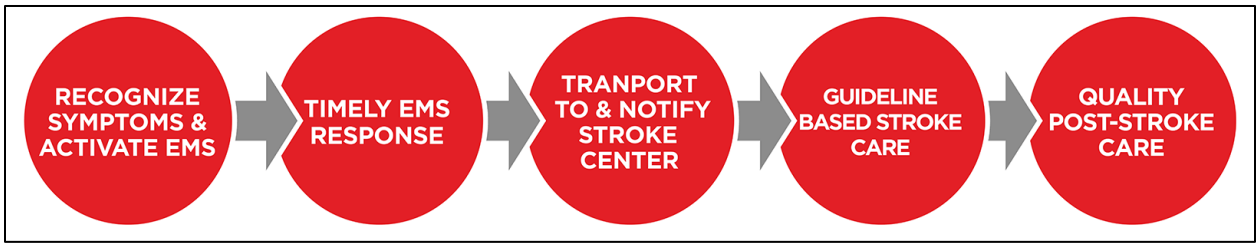
Typically, a low percentage of 9-1-1 patients have time-sensitive and advanced life support (ALS) needs. But, for those patients that do, time can be a critical issue of morbidity and mortality. For the remainder of those calling 9-1-1 for a medical emergency, though they may not have a medical necessity, they still expect rapid customer service. Response times for patients and their families are often the most important measurement of the EMS department. Regardless of the service delivery model, appropriate response times are more than a clinical issue; they are also a customer service issue and should not be ignored.

In addition, a true emergency is when an illness or injury places a person's health or life in serious jeopardy and treatment cannot be delayed. Examples include severe trauma with cardiovascular system compromise, difficulty breathing, chest pain with S-T segment elevation (STEMI), a head injury, or ingestion of a toxic substance.[22] The next figure illustrates the out-of-

22. Mills-Peninsula Health Blog, Bruce Wapen, MD.

hospital chain of survival for a stroke emergency, which is a series of actions that, when put in motion, reduce the mortality of a stroke emergency.

FIGURE 5-5: Cerebrovascular Emergency (Stroke) Chain of Survival



If a person is experiencing severe pain, that is also an indicator of an emergency. Again, the frequencies of these types of calls are limited as compared to the routine, low-priority EMS incident responses. In some cases, these emergencies often make up no more than 5 percent of all EMS calls.[23]

Cardiac arrest is one emergency for which EMS response times were initially built around. The science tells us that the brain begins to die without oxygenated blood flow at the four- to six-minute mark. Without immediate cardiopulmonary resuscitation (CPR) and rapid defibrillation, the chances of survival diminish rapidly at the cessation of breathing and heart pumping activity. For every minute without CPR and/or defibrillation, chances of survival decrease 7 to 10 percent. Further, only 10 percent of victims who suffer cardiac arrest outside of the hospital survive.[24]

The following figure illustrates the out of hospital chain of survival, which is a series of actions that, when put in motion, reduce the mortality of sudden cardiac arrest. Adequate EMS response times coupled with community and public access defibrillator programs potentially can impact the survival rate of sudden cardiac arrest victims by deploying early CPR, early defibrillation, and early advanced life support care provided in the prehospital setting.

FIGURE 5-6: Sudden Cardiac Arrest Chain of Survival

From: "Out of Hospital Chain of Survival," https://cpr.heart.org/en/resources/cpr-facts-and-stats/out-of-hospital-chain-of-survival

23. www.firehouse.com/apparatus/article/10545016/operations-back-to-basics-true-emergency-and-due-regard
24. American Heart Association. *A Race Against the Clock, Out of Hospital Cardiac Arrest*. 2014

SFD RESPONSE TIMES

There is no "right" amount of fire protection and EMS delivery. It is a constantly changing level based on such things as the expressed needs of the community, community risk, and population growth. So, in looking at response times it is prudent to design a deployment strategy around the actual circumstances that exist in the community and the fire problem that is identified to exist. The strategic and tactical challenges presented by the widely varied hazards that the department protects against need to be identified and planned for through a community risk analysis planning and management process as identified in this report. It is ultimately the responsibility of elected officials to determine the level of risk that is acceptable to their respective community. Once the acceptable level of risk has been determined, then operational service objectives can be established. Whether looking at acceptable risk, or level of service objectives, it would be imprudent, and probably very costly, to build a deployment strategy that is based solely upon response times.

For this study, and unless otherwise indicated, response times and travel times measure the first arriving unit only. The primary focus of this section is the dispatch and response time of the first arriving units for calls responded to with lights and sirens (Code 3).

According to NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments*, 2016 Edition:

- Alarm processing time or dispatch time should be less than or equal to 60 seconds 90 percent of the time.
- Turnout time should be less than or equal to 60 seconds for EMS incidents, and 80 seconds (1.33 minutes) for fire and special operations 90 percent of the time. As noted above, turnout time is the segment of total response time that the fire department has the most ability to control.
- Travel time shall be less than or equal to 240 seconds for the first arriving fire suppression or EMS unit, 90 percent of the time. The standard further states the initial full first alarm assignment for structure fires should be assembled on scene in 480 seconds, 90 percent of the time.

It should be noted that NFPA 1710 response time criterion is a nationally accepted benchmark for service delivery but not necessarily a CPSM recommendation. However, CPSM was informed that the City of Springfield desires to meet the NFPA 1710 recommended benchmarks as much as possible, and that maintaining acceptable response times are an important priority for the mayor, governing body, and citizens of the city.

In 2019, SFD responded to 19,668 non-administrative calls. Of these, 264 were structure fire calls and 233 were outside fire calls. In the response time analysis, CPSM included all calls within the primary response area of the Springfield Fire Department to which at least one non-administrative unit from SFD was dispatched and at least one unit from SFD arrived, while excluding canceled calls. In addition, calls with a total response time of more than 30 minutes were excluded. Finally, the data team focused on units that had complete time stamps, that is, units with all components recorded, so that we could calculate each segment of response time.

Based on the methodology above, CPSM excluded 138 mutual aid given calls, 1,588 canceled calls, 504 non-emergency calls, 10 calls where no units recorded a valid on-scene time, 44 calls where the first arriving unit response was greater than 30 minutes, and 478 calls where one or

more segments of the first arriving unit's response time could not be calculated due to missing or faulty data. As a result, a total of 16,906 calls are included in the response time analysis.

The following table provides the average dispatch, turnout, travel, and total response time for the first arriving unit to calls in the city.

TABLE 5-1: Average Response Time of First Arriving Unit, by Call Type

Call Type	Time in Minutes				Number of Calls
	Dispatch	Turnout	Travel	Total	
Breathing difficulty	1.4	1.3	3.5	6.2	2,086
Cardiac and stroke	1.4	1.2	3.5	6.1	1,375
Fall and injury	1.9	1.2	3.2	6.4	819
Illness and other	2.1	1.2	3.6	6.9	4,742
MVA	3.0	1.2	3.1	7.3	565
Overdose and psychiatric	2.2	1.3	3.5	7.0	440
Seizure and unconsciousness	1.3	1.2	3.3	5.8	718
EMS Total	**1.8**	**1.2**	**3.5**	**6.6**	**10,745**
False alarm	1.5	1.5	3.7	6.7	2,288
Good intent	2.1	1.4	3.9	7.4	763
Hazard	1.7	1.4	4.5	7.7	438
Outside fire	1.5	1.3	4.1	7.0	219
Public service	1.7	1.4	4.4	7.4	2,206
Structure fire	1.1	1.3	2.9	5.4	247
Fire Total	**1.6**	**1.4**	**4.0**	**7.1**	**6,161**
Total	**1.8**	**1.3**	**3.7**	**6.7**	**16,906**

Analysis of the data in this table tells us:

- The average dispatch time for all calls was 1.8 minutes.
- The average turnout time for all calls was 1.3 minutes.
- The average travel time for all calls was 3.7 minutes.
- The average total response time for all calls was 6.7 minutes.
  - The average total response time was 6.6 minutes for EMS calls and 7.1 minutes for fire calls.
  - The average total response time was 7.0 minutes for outside fires and 5.4 minutes for structure fires.

A more conservative and stricter measure of total response time is the 90th percentile measurement, that is, 90 percent of calls had a response time at or below a given number. The following table includes the 90th percentile times for dispatch, turnout, travel, and total response time to calls in Springfield, broken down by call type. The table shows a 90th percentile response time of 9.8 minutes, which means that 90 percent of the time a call had a response time of no more than 9.8 minutes.

TABLE 5-2: 90th Percentile Response Time of First Arriving Unit, by Call Type

Call Type	Time in Minutes				Number of Calls
	Dispatch	Turnout	Travel	Total	
Breathing difficulty	2.2	2.1	5.6	8.6	2,086
Cardiac and stroke	2.3	2.0	5.4	8.4	1,375
Fall and injury	3.1	1.9	5.3	9.0	819
Illness and other	3.4	2.1	5.9	10.0	4,742
MVA	5.4	1.9	5.4	11.3	565
Overdose and psychiatric	3.9	2.1	5.4	10.2	440
Seizure and unconsciousness	2.2	2.0	5.1	8.0	718
EMS Total	**3.0**	**2.0**	**5.6**	**9.3**	**10,745**
False alarm	2.4	2.4	6.6	10.0	2,288
Good intent	3.4	2.2	6.7	11.2	763
Hazard	2.8	2.3	8.0	11.7	438
Outside fire	2.6	2.2	7.5	11.1	219
Public service	2.7	2.3	7.3	10.8	2,206
Structure fire	2.1	2.1	4.8	7.6	247
Fire Total	**2.7**	**2.3**	**6.9**	**10.5**	**6,161**
Total	**2.9**	**2.1**	**6.1**	**9.8**	**16,906**

Observations that can be derived from data in the table tell us:

- 90th percentile dispatch time was 2.9 minutes. **Both fire (2.7 minutes) and EMS (3.0 minutes) dispatching times are well above the recommended NFPA benchmark. At just under three minutes for fire, and three minutes for EMS, this is totally inadequate and needs to be addressed.**
- **90th percentile turnout time was 2.1 minutes and well above the NFPA 1710 benchmark of 1.0 minutes for EMS and 1.33 minutes for fire.** This is equally inadequate and the one aspect of total response time the fire department has the most direct control over.
- Aggregate fire and EMS 90th percentile travel time was 6.1 minutes (well above the NFPA 1710 benchmark). In addition to the above concerns regarding dispatch and turnout times, the extended 90th percentile travel time is most likely also partially a result of some significant areas of the city, mainly around the outer perimeter of the city, along with several of the large fire protection districts, that are outside of the 240-seconds first unit travel time benchmark.
- 90th percentile total response time for all calls was 9.8 minutes, significantly exceeding the NFPA 1710 benchmarks of 6.0 and 6.33 minutes, respectively.
- 90th percentile response time was 9.3 minutes for EMS calls and 10.5 minutes for fire calls.
- 90th percentile response time was 11.1 minutes for outside fires and 7.6 minutes for structure fires.

The following table compares 2019 and 2020 average dispatch, turnout, travel, and total response time for calls in SFD's jurisdiction. The subsequent table compares the 90th percentile response time components for the same two years.

TABLE 5-3: Comparison of Average Response Time of First Arriving SFD Unit in 2019 and 2020

Call Type	2019				2020			
	Time in Minutes				Time in Minutes			
	Dispatch	Turnout	Travel	Total Response	Dispatch	Turnout	Travel	Total Response
EMS Total	**1.8**	**1.2**	**3.5**	**6.6**	**1.8**	**1.3**	**3.8**	**6.9**
Structure Fire	1.1	1.3	2.9	5.4	0.9	1.3	2.7	4.9
Outside Fire	1.5	1.3	4.1	7.0	1.4	1.4	4.0	6.9
Other Fire	1.7	1.4	4.1	7.2	1.5	1.4	4.1	7.0
Fire Total	**1.6**	**1.4**	**4.0**	**7.1**	**1.5**	**1.4**	**4.0**	**6.9**
Total	**1.8**	**1.3**	**3.7**	**6.7**	**1.7**	**1.3**	**3.9**	**6.9**

TABLE 5-4: Comparison of 90th Percentile Response Time of First Arriving SFD Unit in 2019 and 2020

Call Type	2019				2020			
	Time in Minutes				Time in Minutes			
	Dispatch	Turnout	Travel	Total Response	Dispatch	Turnout	Travel	Total Response
EMS Total	**3.0**	**2.0**	**5.6**	**9.3**	**3.0**	**2.1**	**6.2**	**9.9**
Structure Fire	2.1	2.1	4.8	7.6	1.7	2.0	4.4	6.6
Outside Fire	2.6	2.2	7.5	11.1	2.5	2.1	7.0	10.5
Other Fire	2.7	2.3	7.0	10.6	2.5	2.3	6.8	10.2
Fire Total	**2.7**	**2.3**	**6.9**	**10.5**	**2.5**	**2.2**	**6.8**	**10.1**
Total	**2.9**	**2.1**	**6.1**	**9.8**	**2.8**	**2.2**	**6.4**	**10.0**

Observations that can be derived from data in these tables tell us:

- The average response times of 2019 and 2020 did not change significantly.
- The 90th percentile response time for structure fires decreased by 1 minute from 2019 to 2020.
- The 90th percentile total response times of 2019 and 2020 did not change significantly.

The call processing (at dispatch) and turnout (in the station) times for the SFD are much higher than recommended by NFPA 1710 benchmarks. The latter time is the one area where the fire department has the most control over and can serve to reduce overall response times.

Recommendation:

- CPSM recommends that as a planning objective the SFD should take steps to definitively improve both the dispatch time and incident turnout times for both fire and EMS incidents in order to reduce overall response times to emergency incidents. (Recommendation No. 21.)

RESPONSE TIMES BY FIRE MANAGEMENT ZONES

Travel time is key to understanding how fire and EMS station location influences a community's aggregate response time performance. Travel time can be mapped when existing and proposed station locations are known. The location of responding units is one important factor in response time; reducing response times, which is typically a key performance measure in determining the efficiency of department operations, often depends on this factor. The goal of placement of a single fire station or creating a network of responding fire stations in a single community is to optimize coverage with short travel distances, when possible, while giving special attention to natural and manmade barriers, and avoiding response routes that can create response-time problems.[25] This goal is generally budget-driven and based on demand intensity of fire and EMS incidents, which for this report were mapped earlier.

As already discussed, the SFD responds from twelve stations. As also discussed above, NFPA 1710 outlines national consensus travel time benchmarks of less than or equal to 240 seconds for the first arriving engine company 90 percent of the time and the arrival of the second due engine in 360 seconds, 90 percent of the time. NFPA further outlines that the initial first alarm assignment should be assembled on scene in 480 seconds, 90 percent of the time, for low/medium hazards and 610 seconds for high-rise or high hazards. Hazards are outlined above as well in the community risk analysis section.

This section expands the discussion on the travel times outlined above, depicting how travel times of 240-, 360-, 480-, and 610-seconds look when mapped from the current fire station locations. Illustrating response time is important when considering the location from which assets should be deployed. When historic demand is coupled with risk analysis, more informed decisions can be made about station locations. The following figures use GIS mapping to illustrate 240-second, 360-second, 480-second, and 610-second travel time bleed estimates, utilizing the existing street network from each current SFD station.

The GIS data for streets includes speed limits for each street segment and allows for "U-turns" for dead-end streets and intersections. This analysis is not all-inclusive as it does not contemplate traffic, weather, and such things as road obstructions caused by construction, public transportation movement, and the like.

It is, however, important to note that while GIS-drawn, theoretical travel times do reflect favorably on the adequacy of station facilities and their corresponding locations within the city to support efficient fire and EMS response. Keep in mind, the benefits of favorable travel time findings are only meaningfully realized when apparatus can be predictably staffed for response and the department has aggressive turnout times.

The following table lists the locations of the city's fire stations and the staffed resources deployed from each.

25. NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments, 2010 Edition, 122.

TABLE 5-5: Deployed Resources from Springfield Fire Department Station Locations

Station	Address	Staffed Operational Units	Specialty Units/Functions
Station 1	825 E. Capital St.	Engine 1 Truck 1 Battalion 1	Squad 1 Rescue 1 HM-2
Station 2	2810 Stevenson Dr.	Engine 2 Truck 2	Marine 1
Station 3	801 North Grand Ave. W.	Engine 3	1
Station 4	1900 Converse Ave.	Engine 4	1
Station 5	1723 Clay St.	Engine 5	Fire Investigation Unit
Station 6	2156 S. 9th St.	Engine 6 Battalion 2	
Station 7	1428 Glenwood Ave.	Engine 7	1
Station 8	2051 W. Monroe Ave.	Engine 8	Engine 18
Station 9	2405 S. Chatham Rd.	Engine 9	MVU
Station 10*	2401 Peoria Rd.	Engine 10	Brush 1 Dive 3 HM-3 Air Trailer Foam Trailer
Station 11	1805 Toronto Rd.	Engine 11	Dive 1 Dive 2
Station 12	2925 S. Koke Mill	Engine 12 Truck 3	

Note: Station 10 is located outside of the city on the Illinois State Fairground.

The SFD provides fire and protective services within the municipal boundaries of the city and to nine fire districts located in unincorporated areas of Sangamon County. Some of these unincorporated areas are "islands" surrounded by the city. The city boundaries include an area of 66 square miles of which approximately 59.5 square miles is land area.

The next figure illustrates the city's municipal boundaries, fire station locations, and the fire districts served by the SFD. The subsequent figure illustrates the first due area of each city fire station along with response districts within those first due areas.

FIGURE 5-7: SFD Fire Station Locations with Municipal and Fire District Response Areas

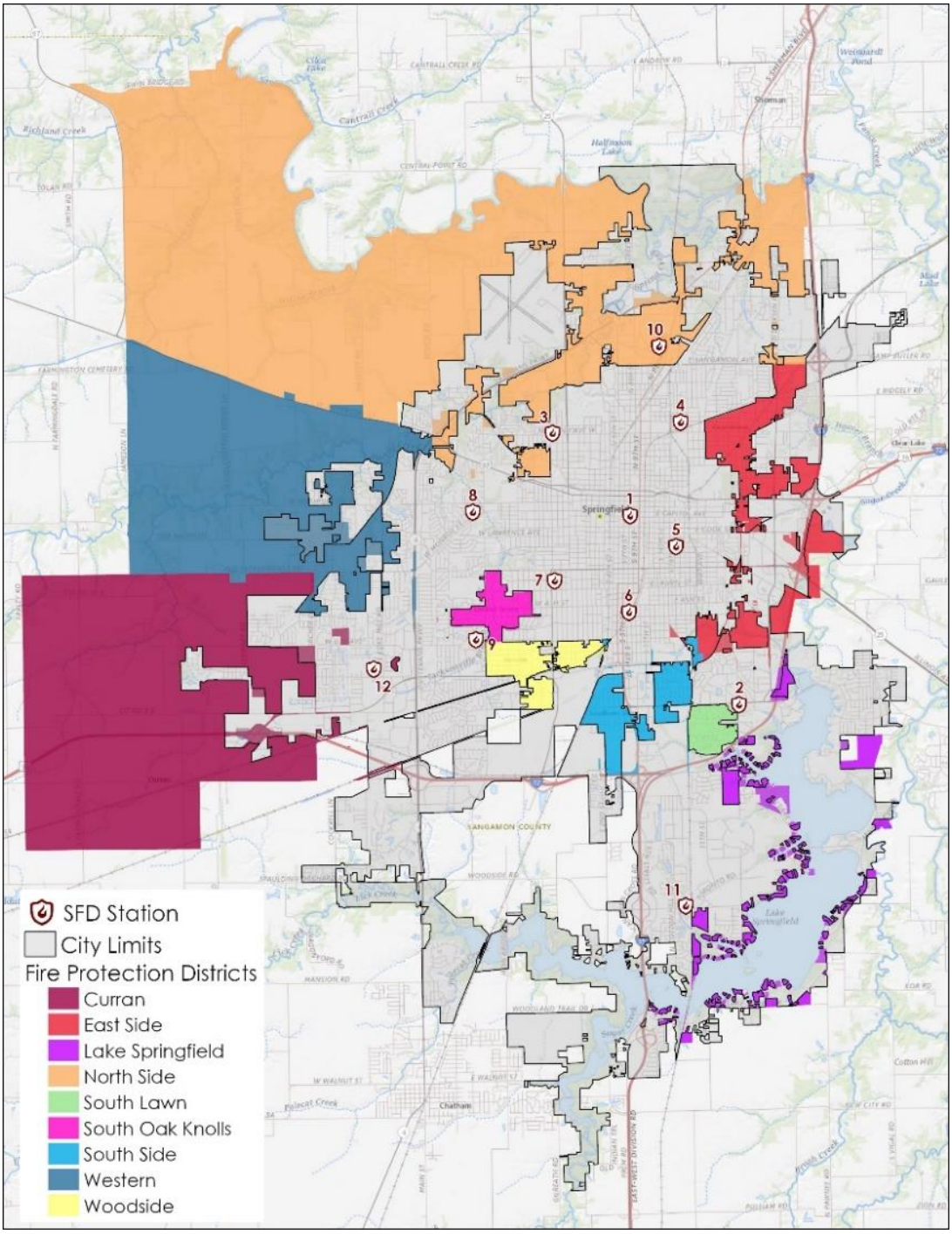
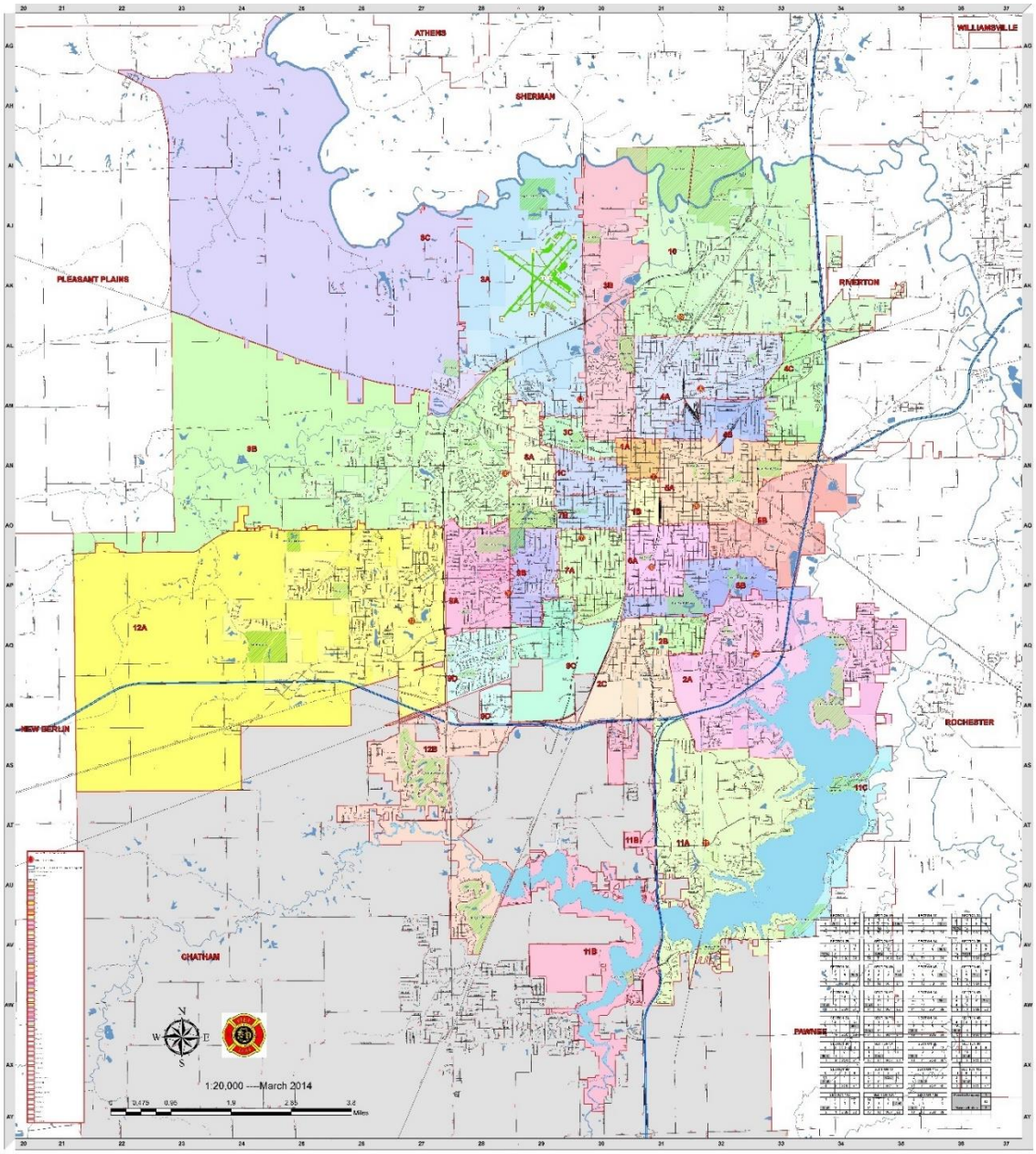


FIGURE 5-8: SFD Fire Station Locations with First Due Response Areas



In a 2011 *Performance Measurement Data Report* on fire and EMS, ICMA tabulated survey information from 76 municipalities with populations ranging from 25,000 to 100,000 people. In this grouping the average fire station service area was 11 square miles.[26] The median service area for this grouping of communities was 6.67 square miles per fire station.[27] The SFD protects a diverse, urban community of 66 square miles. Based upon the city's area, this equates to a

26. Comparative Performance Measurement, FY 2011 Data Report - Fire and EMS, ICMA Center for Performance Measurement, August 2012.
27. Ibid.

service area of 5.5 square miles for each of the twelve current city stations from which fire suppression units are deployed.

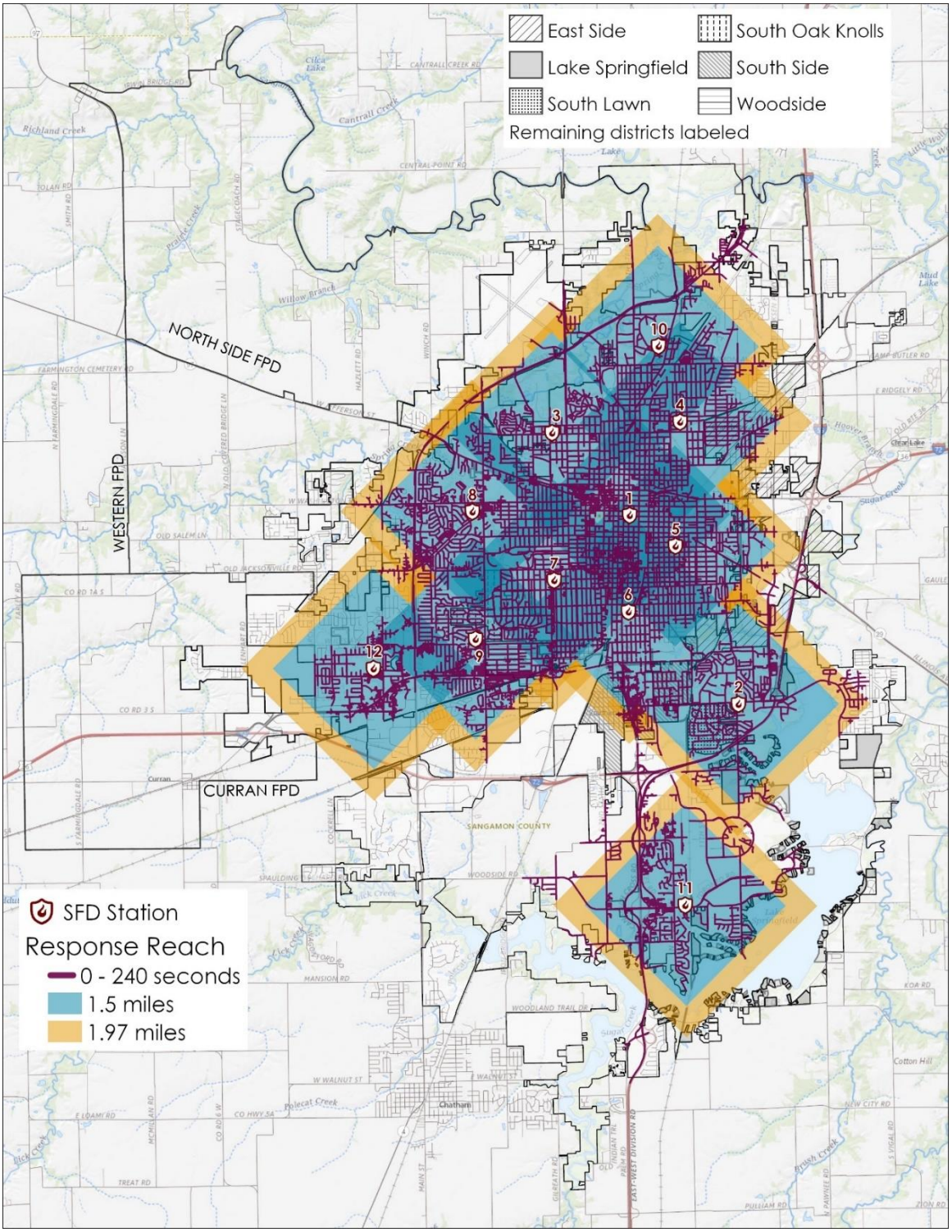
NFPA and ISO have established different indices in determining fire station distribution. The ISO Fire Suppression Rating Schedule, section 560, indicates that first-due engine companies should serve areas that are within a 1.5-mile travel distance. The placement of fire stations that achieves this type of separation creates service areas that are approximately 4.5 square miles in size, depending on the road network and other geographical barriers (rivers, lakes, railroads, limited access highways, etc.). NFPA references the placement of fire stations in an indirect way. It recommends that fire stations be placed in a distribution that achieves the desired minimum response times. NFPA Standard 1710, section 4.1.2.1(3) and (6), suggests an engine placement that achieves a 240-second (four-minute) travel time for the first arriving unit. Using an empirical model called the "piece-wise linear travel time function" the Rand Institute has estimated that the average emergency response speed for fire apparatus is 35 mph. At this speed, the distance a fire engine can travel in four minutes is approximately 1.97 miles.[28] A polygon based on a 1.97-mile travel distance results in a service area that, on average, is 7.3 square miles.[29]

It is important to make several notes regarding the polygon models and the associated travel distances and times. First, the model often assumes that resources are distributed equally throughout the service area, which is generally not the case. In addition, the road network, and geographical barriers such as a railroad or limited access highways, can impact the distance that units can cover over the same amount of time. That said, the formulas do provide a useful reference when attempting to benchmark travel distances and response times.

The following figure illustrates 1.5- and 1.97-square mile polygons, along with 240-second travel time bleeds around each SFD station. There is significant overlap in the station coverage areas, particularly in the older areas of Springfield in and around downtown. This situation is not uncommon in developed urban areas where fire can spread rapidly, and being able to rapidly assemble an effective response force to handle all of the crucial tasks necessary for fire suppression is mission critical. There is only limited overlap between station 12 and other response areas. Stations 2 and 11 illustrate what an optimal situation would look like if all stations could be ideally located with no overlap between their respective response areas.

28. University of Tennessee Municipal Technical Advisory Service, Clinton Fire Location Station Study, Knoxville, TN, November 2012. p. 8.
29. Ibid., p.9

FIGURE 5-9: SFD Station Locations, Showing 1.5- and 1.97-Square Mile Response Area Polygons



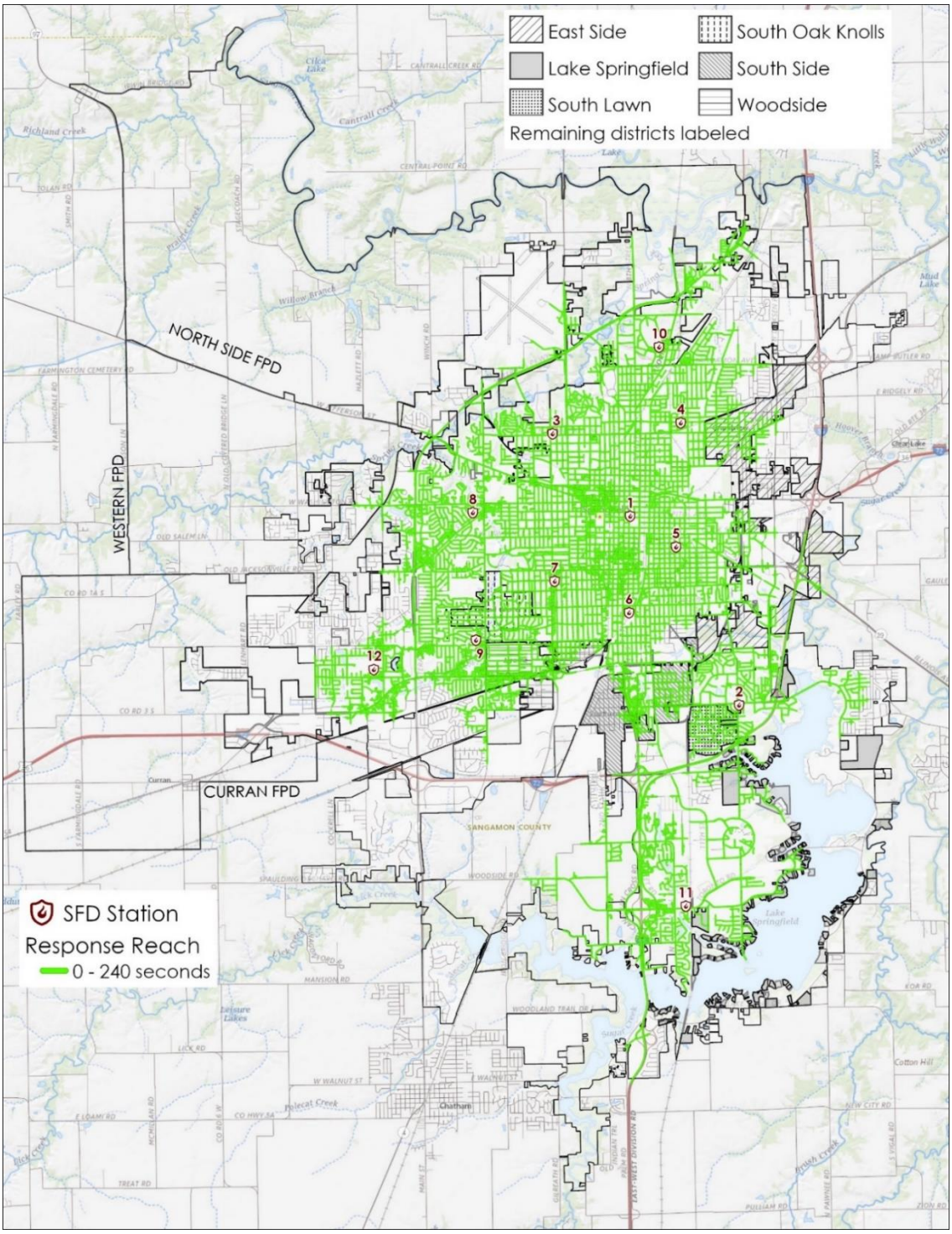
Illustrating response time is important when considering the location from which assets should be deployed. When historic demand is coupled with risk analysis, a more informed decision can be

made. The following figure uses GIS mapping to illustrate 240-second travel time bleed estimates, utilizing the existing street network from each current SFD station. As currently deployed, the majority of the City of Springfield appears to fall within the first unit travel time benchmark of 240 seconds. In the more developed urban core of the city, there are locations where there is an overlap of this benchmark response time as the stations are situated closer together. This is not unusual as station location criterion have changed drastically over the years.

Conversely, there are some areas of the city, mainly around the outer perimeter of the city, along with several of the large fire protection districts, that are outside of the 240-seconds travel time benchmark. Some of these areas, particularly in the southern and southwestern areas of the city, are experiencing growth and development which will invariably increase requests for service into those neighborhoods. While the use of automatic aid, which will be discussed later, can help significantly in these areas, it does not provide an overall solution to this challenge.

One of the key decisions the leadership of the City of Springfield will need to make going forward is if the city's goal is to continue to have the department meet recommended response time benchmarks for the first unit on location time. If so, there will likely need to be long-term revisions made to the deployment configuration to continue to achieve that target, particularly as the city continues to grow and develop.

FIGURE 5-10: SFD 240-Seconds Travel Time Bleeds from SFD Stations



The benchmark NFPA 1710 standard recommends that for structure fire responses the second engine should arrive on the scene within 360 seconds of travel time, while the entire first alarm assignment of resources and personnel for most types of occupancies (excluding high-risk and high-rise incidents) be on the scene within 480 seconds of travel time. The following figure illustrates the 360-seconds travel time bleed estimates utilizing the existing street network from

each current SFD station. While there are a few pockets of the city that are not within a travel time of 360 seconds, these are mostly in areas that are not developed and outside of the existing street network.

FIGURE 5-11: SFD 360-Seconds Travel Time Bleeds from SFD Stations

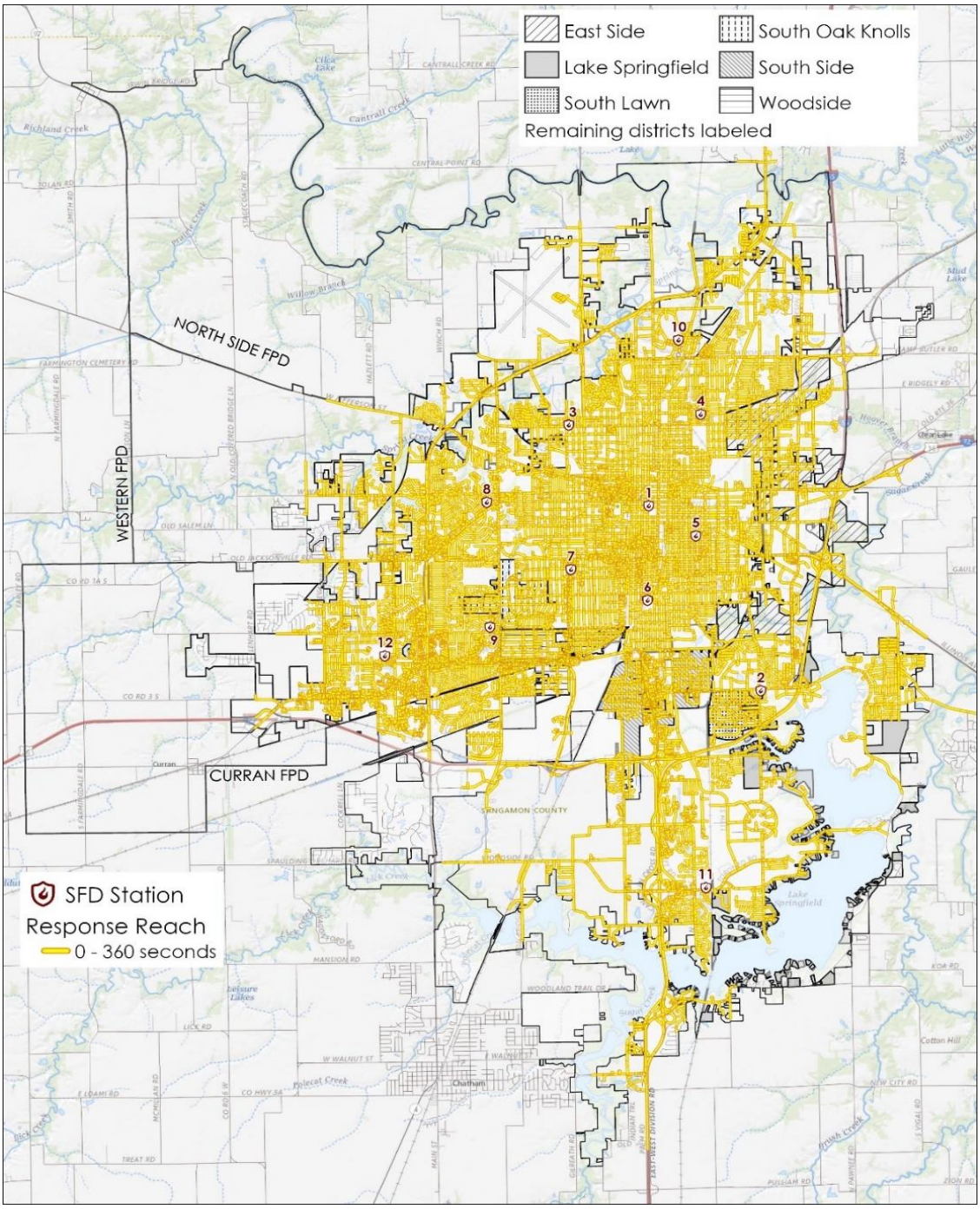
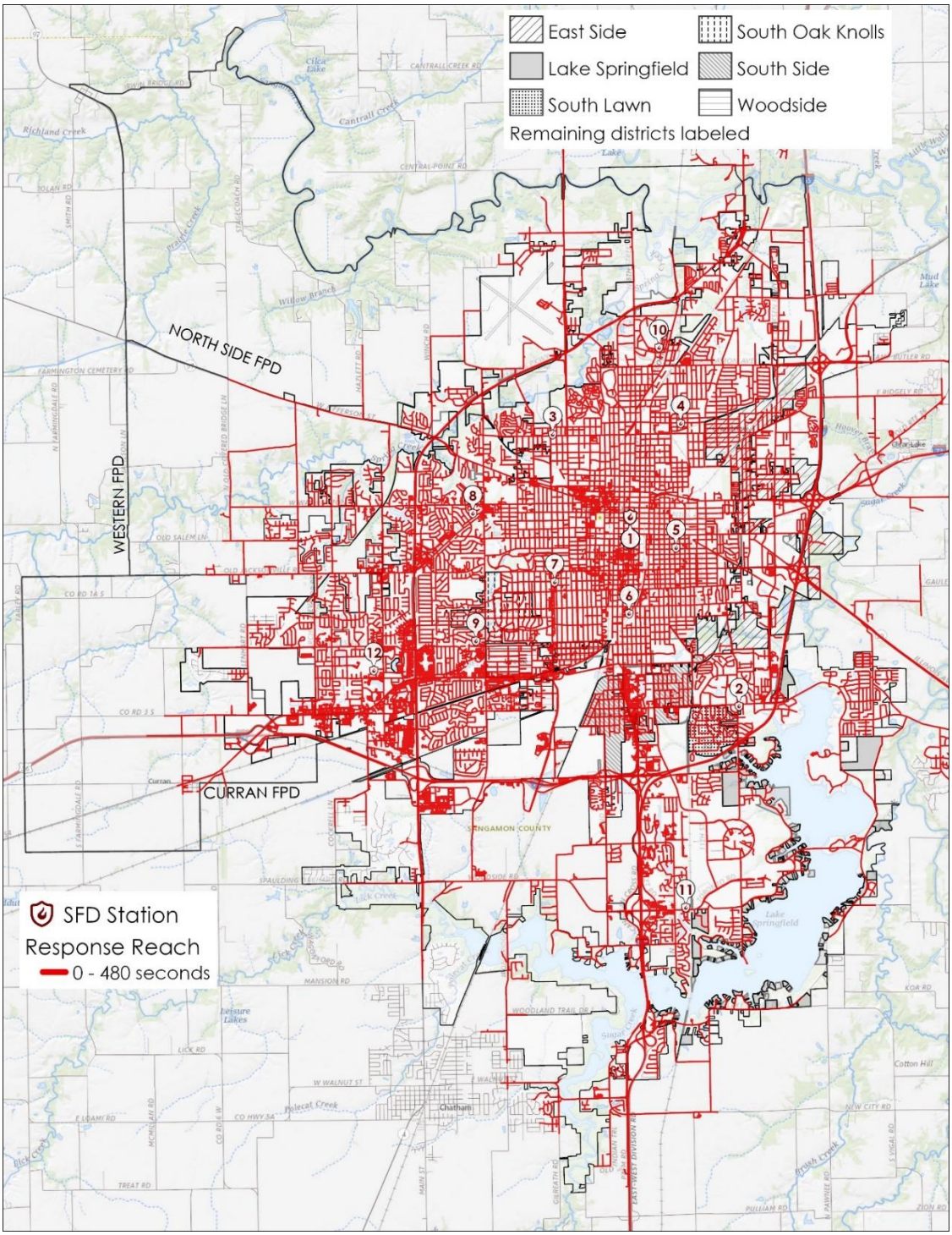


Figure 5-12 illustrates the 480-seconds travel time bleeds. The entire city is within a travel time of 480 seconds and in some areas this extends into surrounding areas of the county. Although they

are primarily rural in character and have limited road networks and calls, large parts of the Curran, Western, and North Side FPDs remain outside of even 480 seconds of travel time.

FIGURE 5-12: SFD 480-Seconds Travel Time Bleeds from SFD Stations

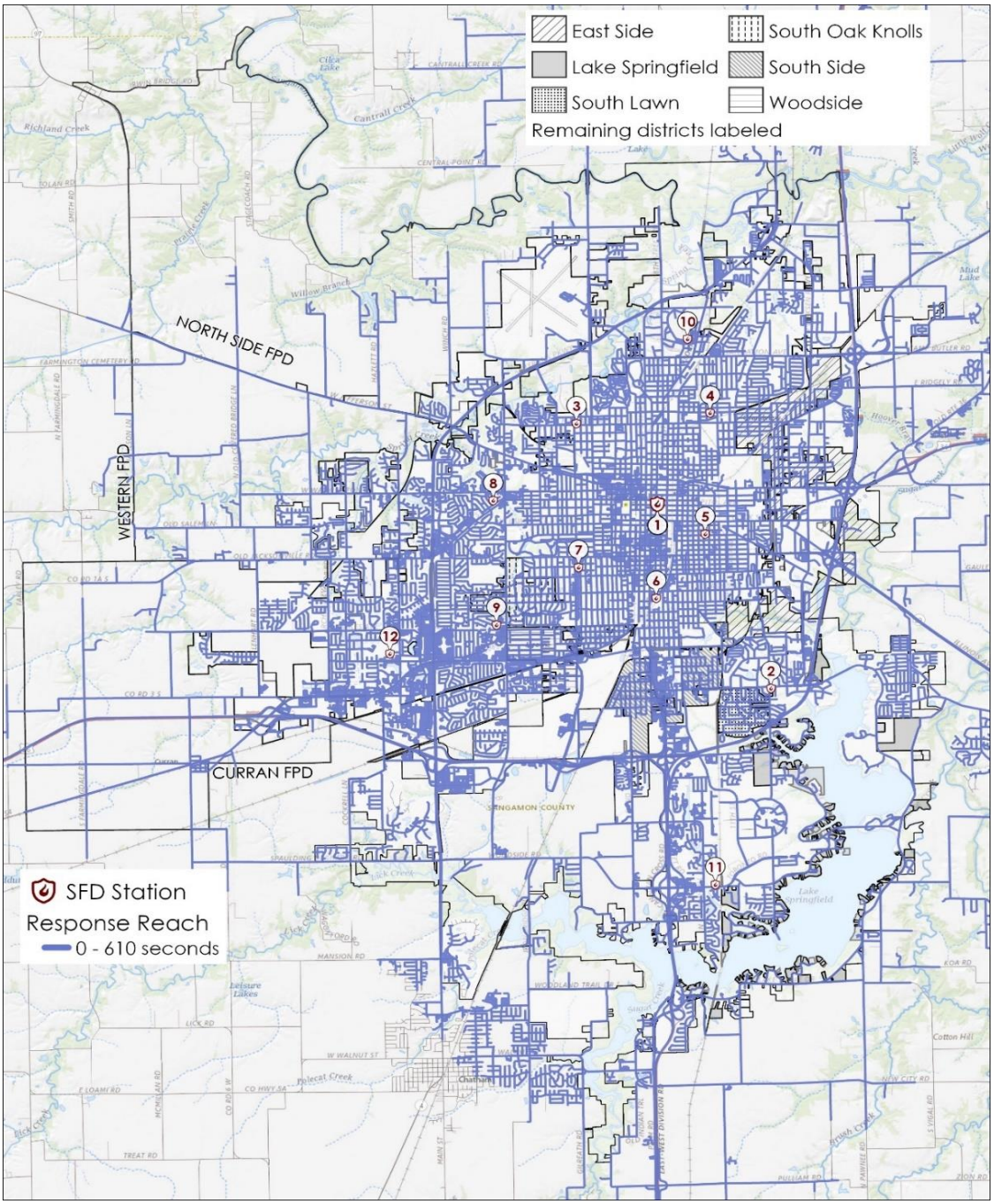


Finally, the NFPA 1710 standard recommends that for high-hazard and high-rise structure fire responses the entire first alarm assignment of resources and personnel should be on the scene

within 610 seconds of travel time. The following figure illustrates the 610-seconds travel time bleed estimates utilizing the existing street network from each SFD station.

Although the 610-seconds travel time benchmark is primarily targeted at the full first alarm response for fires in high-hazard and high-rise buildings, in this case it can also help to illustrate some of the potential response travel times to the more remote areas of the SFD's coverage area. In this case, the entire SFD response area, except for the most remote part of the North Side FPD, is within 610 seconds of travel time from a SFD station.

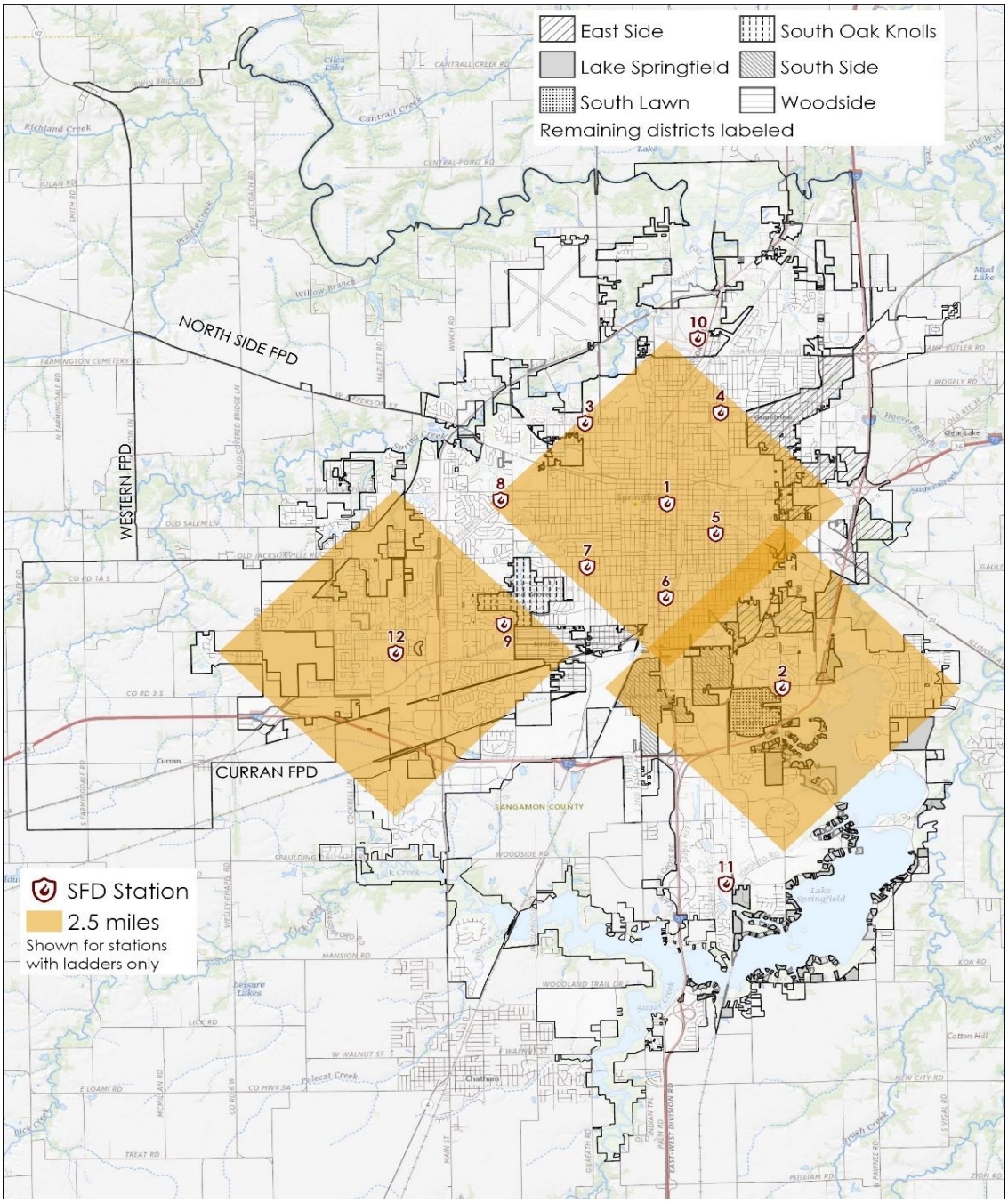
FIGURE 5-13: SFD 610-Seconds Travel Time Bleeds from SFD Stations



The ISO Fire Suppression Rating Schedule also indicates that first-due ladder companies should serve areas that are within a 2.5-mile travel distance. The placement of fire stations that achieves this type of separation creates service areas that are approximately 6.25 square miles in size, depending on the road network and other geographical barriers.

The following figure illustrates 2.5 mile-square polygons around SFD stations 1, 2, and 12, from which ladder trucks are deployed.

FIGURE 5-14: SFD Ladder Company Station Locations Showing 2.5-Mile Square Response Area Polygons



The following table breaks down the average dispatch, turnout, travel, total response times, and 90th percentile response times by each fire protection district serviced by SFD, including the City of Springfield, for EMS and fire calls, respectively.

TABLE 5-6: Average Response Time of First Arriving Unit, by Fire Protection District

Call Type	Fire Protection District	Time in Minutes					Number of Calls
		Dispatch	Turnout	Travel	Response Time	90th Percentile Response Time	
EMS	Curran	3.3	1.3	5.8	10.4	18.0	35
	East Side	1.6	1.2	3.9	6.8	9.2	379
	Lake Springfield	1.9	1.1	5.2	8.2	12.2	50
	North Side	1.6	1.1	4.3	7.0	11.7	283
	South Lawn	1.7	1.1	2.9	5.7	7.6	82
	South Oak Knolls	1.7	1.2	3.1	6.1	7.9	34
	South Side	1.7	1.1	3.8	6.7	9.2	219
	Springfield (City)	**1.9**	**1.2**	**3.4**	**6.5**	**9.2**	**9,293**
	Western	2.0	1.3	5.6	8.8	12.8	113
	Woodside	1.7	1.2	3.8	6.7	8.9	257
	Subtotal	**1.8**	**1.2**	**3.5**	**6.6**	**9.3**	**10,745**
Fire	Curran	1.6	2.0	7.3	10.9	14.3	16
	East Side	1.6	1.2	4.6	7.4	10.9	157
	Lake Springfield	1.9	1.1	5.7	8.7	13.1	20
	North Side	1.5	1.5	5.4	8.5	14.6	126
	South Lawn	1.4	1.1	3.7	6.2	9.0	65
	South Oak Knolls	1.5	1.2	4.2	6.8	8.7	23
	South Side	1.6	1.3	5.3	8.2	11.5	119
	Springfield (City)	**1.6**	**1.4**	**3.9**	**6.9**	**10.2**	**5,437**
	Western	1.9	1.4	7.2	10.6	14.0	91
	Woodside	1.8	1.4	4.7	7.9	10.9	107
	Subtotal	**1.6**	**1.4**	**4.0**	**7.1**	**10.5**	**6,161**
Total		**1.8**	**1.3**	**3.7**	**6.7**	**9.8**	**16,906**

Conclusions that can be derived from the data in this table are:

- Average response times varied significantly between fire protection districts.
- Overall, the average response time was fastest to South Lawn at 5.7 minutes for EMS calls and 6.2 minutes for fire calls. This was 0.8 minutes faster (48 seconds) for EMS calls and 0.7 minutes faster (42 seconds) for fire calls than the city proper.
- The average response time was slowest to Curran.
- The average response time within the City of Springfield was slightly faster than the overall average.

- 90th percentile response times also varied significantly among fire protection districts.
- Overall, the 90th percentile response time was fastest to South Lawn at 7.6 minutes for EMS calls and South Oak Knolls at 8.7 minutes for fire calls. This was 1.6 minutes faster for EMS calls and 1.5 minutes faster for fire calls than the city proper. However, the limited number of calls in these areas can have an impact their average.
- The 90th percentile response time was slowest to Curran for EMS incidents and to North Side for fire calls.
- The 90th percentile response time within the City of Springfield was slightly faster than the overall 90th percentile, at 0.1 minutes (6 seconds) for EMS incidents and 0.3 minutes (18 seconds) for fire calls.

The table also displays the dispatch and turnout time issues as discussed earlier, both of which need to be a focus for improvement department-wide.

Th department must consider all of the fire management zone variables that assist or hamper response times to include how and where personnel and companies are located, and how quickly they can arrive on scene, which play major roles in controlling and mitigating emergencies.

STAFFING LEVELS AND STAFFING PATTERNS

The staffing of fire and EMS companies is a never-ending focus of attention among fire service and governmental leadership. While NFPA 1710 and OSHA provide guidelines (and to some extent the law, specifically OSHA in OSHA states) as to the level of staffing and response of personnel, the adoption of these agency documents varies from state to state and department to department. NFPA 1710 addresses the recommended staffing in terms of specific types of occupancies. The needed staffing to accomplish the critical tasks for each specific occupancy are determined to be the Effective Response Force (ERF). The ERF for each of these occupancies is detailed in NFPA 1710 (2020 edition), section 5.2.4, Deployment.

The fire service has experienced tremendous technological advances in equipment, procedures, and training over the past 50 years. Better personal protective equipment (PPE), the widespread use of self-contained breathing apparatus (SCBA), large diameter hose, better and lighter hand lines and nozzles, and thermal imaging cameras are just a few of the numerous advances in equipment and procedures that have allowed firefighters to perform their duties more effectively, efficiently, safely, and with fewer personnel. However, the fact remains that the emergency scene in general, and especially the fireground involving a structure fire, is a dynamic, dangerous, frequently unpredictable, and rapidly changing environment where conditions can deteriorate very quickly and can place firefighters in extreme personal danger, particularly if there are not enough personnel on scene to handle all the critical tasks.

The operations necessary to successfully extinguish a structure fire, and do so effectively, efficiently, and safely, requires a carefully coordinated and controlled plan of action where certain operations such as venting ahead of the advancing interior hose line(s) must be carried out with a high degree of precision and timing. Multiple operations, frequently where seconds count, such as search and rescue operations and trying to cut off a rapidly advancing fire, must also be conducted simultaneously. If there are not enough personnel on the incident initially to perform all the critical tasks, some will, out of necessity, be delayed. This can result in an

increased risk of serious injury or death to building occupants and firefighters, as well as increased property damage.

Staffing and deployment of fire services is not an exact science. While there are many benchmarks that communities and management utilize in justifying certain staffing levels, there are certain considerations that are data driven and reached through national consensus that serve this purpose as well. CPSM has developed metrics it follows and recommends that communities consider when making recommendations regarding staffing and deployment of fire resources.

Staffing is one component and the type of apparatus the personnel are deployed on and from where (station locations) are the other two components that determine how fire and EMS services are delivered. Linked to these components of staffing and deployment are *eleven critical factors* that drive various levels and models from which fire and EMS departments staff and deploy. These factors are:

Fire Risk and Vulnerability of the Community: A fire department collects and organizes risk evaluation information about community risk (population and demographics; environmental; transportation; fire and EMS call demand and call types), and individual property types. Based on the rated factors, the assessment then derives a "fire risk score" and response strategy for each community risk and property type. The all-hazard community risk and community assessment is used to evaluate the community. Regarding individual property types, the assessment is used to measure all property and the risk associated with that property and then segregate the property as either a high-, medium-, or low-hazard/risk depending on factors such as the life and building content hazard, the potential fire flow, and the staffing and apparatus types required to mitigate an emergency in the specific property. The factors such as fire protection systems are considered in each building evaluation. Included in this assessment should be both a structural and nonstructural (weather, wildland-urban interface, transportation routes, etc.) analysis. All factors are then analyzed and the probability of an event occurring, the impact on the fire department, and the consequences on the community are measured and scored.

Population, Demographics, and Socioeconomics of a Community: Population and population density drives calls for local government service, particularly public safety. The risk from fire is not the same for everyone, with studies telling us age, gender, race, economic factors, and what region in the country one might live in contribute to the risk of death from fire. Studies also tell us these same factors affect demand for EMS, particularly population increase and the more frequent use of hospital emergency departments as many uninsured or underinsured patients rely on EDs for their primary and emergency care, utilizing prehospital EMS transport systems as their entry point.

Call Demand: Demand is made up of the types of calls to which units are responding and the location of the calls. This drives workload and station siting considerations. Higher population centers with increased demand require greater resources.

Workload of Units: The types of calls to which units are responding and the workload of each unit in the deployment model. This defines what resources are needed and where; this links to demand and station location, or in a dynamic deployed system, where to post units.

Travel Times from Fire Stations: Analyzes the ability to cover the fire management zone/response area in a reasonable and acceptable travel time when measured against national benchmarks. Links to demand and risk assessment.

NFPA Standards, ISO, OSHA requirements (and other national benchmarking).

EMS Demand: Community demand; demand on available units and crews; demand on non-EMS units responding to calls for service (fire/police units); availability of crews in departments that utilize cross-trained EMS staff to perform fire suppression.

Critical Tasking: On-scene capabilities to control and mitigate emergencies is determined by staffing and deployment of certain resources for low-, medium-, and high-risk responses. Critical tasking is the individual or team level task that is required to be performed by on-scene personnel based on the type of incident the firefighting and EMS force is responding to. These are department-developed and measured against national benchmarks. Links to risk and vulnerability analysis.

Effective Response Force: The ability of the jurisdiction to assemble the necessary personnel on the scene to perform the critical tasks necessary in rapid sequence to mitigate the emergency. The speed, efficiency, and safety of on-scene operations are dependent upon the number of firefighters performing the tasks. If fewer firefighters are available to complete critical on-scene tasks, those tasks will require more time to complete.

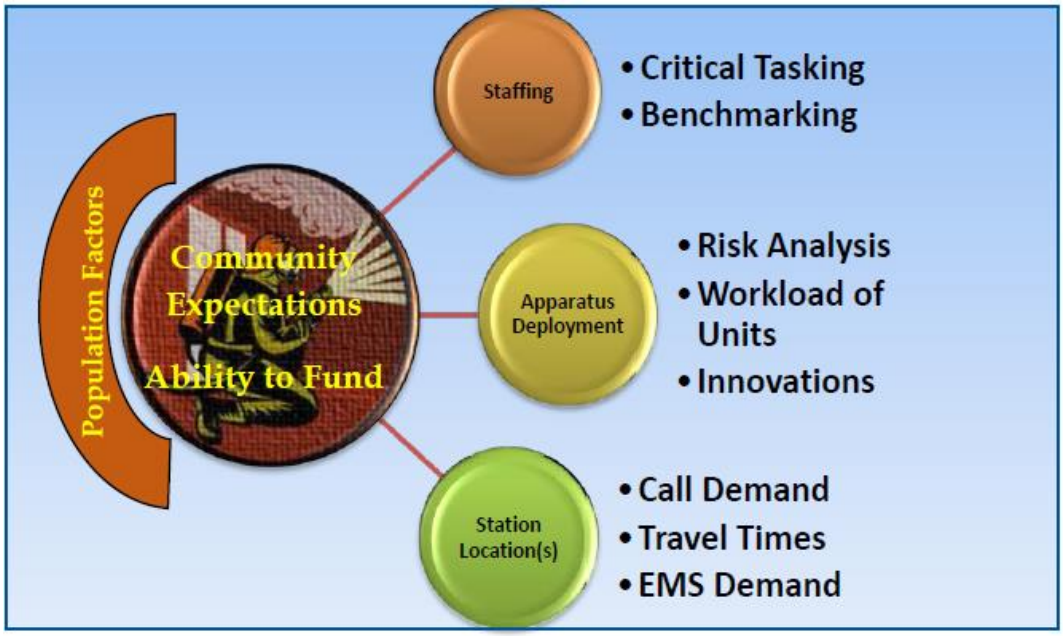
Innovations in Staffing and Deployable Apparatus: The fire department's ability and willingness to develop and deploy innovative apparatus (combining two apparatus functions into one to maximize available staffing, as an example). Deploying quick response vehicles (light vehicles equipped with medical equipment and some light fire suppression capabilities) on those calls (typically the largest percentage) that do not require heavy fire apparatus.

Community Expectations: The gathering of input and feedback from the community, then measuring, understanding, and developing goals and objectives to meet community expectations.

Ability to Fund: The community's ability and willingness to fund all local government services and understanding how the revenues are divided up to meet the community's expectations.

These factors are further illustrated in the following figure.

FIGURE 5-15: Staffing and Deploying Fire and EMS Departments



While each component presents its own metrics of data, consensus opinion, and/or discussion points, aggregately they form the foundation for informed decision-making geared toward the implementation of sustainable, data- and theory-supported, effective fire and EMS staffing and deployment models that fit the community's profile, risk, and expectations. The City of Springfield had not completed a comprehensive analysis of all these elements prior to this study. However, part of CPSM's analysis involved the completion of a basic community fire risk and target hazard analysis.

The SFD currently has an authorized staff of 209 sworn/uniformed emergency response personnel. Of these, 190 are assigned to field operations and are primarily responsible for the delivery of both fire and EMS services, The remaining 19 uniformed personnel perform a variety of administrative and support functions as their primary responsibility. The department also employs five non-uniformed support personnel, primarily civilian office staff.

The department delivers field operations and emergency response services through a clearly defined division of labor that includes middle managers (Battalion Chiefs), first-line operational supervisors (Captains), technical specific staff (fire apparatus drivers/operators), and firefighters. The city is divided into two operational battalions, north and south, each commanded daily by a Battalion Chief. Field personnel work a three-platoon, 50.4-hours average work week that is comprised of 24-hour long duty days. Personnel work 24 hours on duty, followed by 48 hours off duty. Every tenth duty day is assigned as a Kelly Day, an additional day off, which reduces the average work week below the Fair Labor Standards Act (FLSA) overtime threshold for firefighters of 53 hours per week.

The SFD operates out of twelve stations, staffing twelve engines, three ladders, and two command vehicles. When staffing permits, a squad is also placed in service at station 1. The department also has several specialty units such as a dive unit, marine unit, and hazardous materials response unit along with several other staff and utility vehicles. In addition, the department maintains three reserve engines, one reserve ladder, and two reserve rescues.

When fully staffed, and with the current resource deployment, each of the department's three shifts should optimally have a minimum of 64 personnel on duty each day. This would consist of two Battalion Chiefs, 17 Captains (which includes two Battalion Chief aides), and 45 firefighters. This would allow each fire suppression company to be adequately staffed with four personnel. However, at the time of this study, minimum on-duty staffing was 49 personnel, with the engines and ladders all staffed with three personnel consisting of an officer and two firefighters. This staffing level can result in reduced operational effectiveness and efficiency, particularly during the critical early minutes of a fire incident. It can also have an impact on firefighter safety. When the number of personnel on duty falls below 49, overtime is utilized to bring it back to that level.

The following table shows SFD station/unit staffing.

TABLE 5-7: Normal SFD Staffing/Deployment Model

Unit	Normal Staffing
Station 1	
Engine 1	1 Captain, 2 Firefighters
Truck 1	1 Captain, 2 Firefighters
Battalion 1	1 Battalion Chief, 1 Captain
Station 2	
Engine 2	1 Captain, 2 Firefighters
Truck 2	1 Captain, 2 Firefighters
Station 3	
Engine 3	1 Captain, 2 Firefighters
Station 4	
Engine 5	1 Captain, 2 Firefighters
Station 6	
Engine 6	1 Captain, 2 Firefighters
Battalion 2	1 Battalion Chief, 1 Captain
Station 7	
Engine 7	1 Captain, 2 Firefighters
Station 8	
Engine 8	1 Captain, 2 Firefighters
Station 9	
Engine 9	1 Captain, 2 Firefighters
Station 10	
Engine 10	1 Captain, 2 Firefighters
Station 11	
Engine 11	1 Captain, 2 Firefighters
Station 12	
Engine 12	1 Captain, 2 Firefighters
Truck 3	1 Captain, 2 Firefighters

Like many urban fire departments, and particularly those such as Springfield that protect state capitols and are fiscally challenged, the SFD has not been able to maintain its authorized staffing levels for several years. As of the field visit for this study in summer 2021, the department had 22 vacancies in the Operations Division, which included seven personnel on light duty and three personnel on long-term military leave. Several additional personnel are projected to retire in the latter part of 2021 and early 2022.

All members of the department are entitled to various types of leave, including vacation, personal, sick, injured on duty, and military (if applicable). Additional temporary vacancies are created by personnel who are attending various types of training or participate in other endeavors such as the members of state task forces.

Leave allotments to individual members, and the leave allowances per shift are specified in the current collective bargaining agreement between the city and Springfield Firefighters, Local 37 of the International Association of Firefighters. Personal time off allowance per shift/per day

includes 5/6 vacation day slots, 2 personal day slots, along with comp time and other accrued/allowed benefit time.

One of the types of leave that often contributes to vacancies in the on-duty strength of a fire department is the use of unscheduled sick leave, or in the context of concern over it, misuse or even abuse of unscheduled sick leave. While personnel should have the right to use sick leave when they are legitimately unable to perform their duties due to illness or injury, or for other accepted uses as spelled out in the collective bargaining agreement and/or department policy, they do not have the right to just consider it to be another bank of leave hours that they can use whenever it is convenient for them. While there were some differences of opinion among various stakeholders regarding whether there is a sick leave abuse problem in the SFD, this is an issue that the department leadership should monitor closely and enact measures to investigate and take appropriate action against personnel who misuse or abuse this type of leave. Injured-on-duty leave should also be monitored for the same reasons.

While not every hour of leave taken by a department member results in the need to back fill, or hire back to fill that position, with staffing already low, most of the time this is the case. The SFD does have "floating" Captains who fill officer vacancies as needed. They also staff a two-person squad at Station 1 when the daily staffing level is at 51 or above. However, when staffing falls below that number, these personnel are detailed to other stations to maintain minimum staffing. Once the staffing level falls below 49, the department uses overtime "hire back" personnel to maintain 49 on duty.

While the COVID-19 pandemic created and continues to create some unique staffing challenges for many fire departments, including Springfield, the number of vacant positions in the SFD suggests that the use of significant overtime would still be a regular occurrence in order to maintain staffing even in more "normal" times. In addition to the financial implications to the municipality of the need for personnel to work additional overtime shifts, there is growing evidence to suggest there are very real health and safety implications for firefighters as well, and which could end up having tragic consequences.

Chief Don Abbott is a well-known fire service leader, author, and instructor who is regarded as a leading authority regarding MAYDAY facts in the fire service in North America. Chief Abbott's analysis of data submitted to him by career fire departments noted a 35 percent increase in MAYDAYS during a 13-week period from March through June 2020. This was during the initial surge of the COVID-19 pandemic as well as during social issues and related civil emergencies. Based upon interviews conducted with 156 personnel (primarily those firefighters who transmitted the MAYDAY) Chief Abbot identified some trends, several of which have applicability to many departments, Springfield included. These are:

1). **Lack of control over excessive overtime**, relaxing the rules because of civil, COVID, or related situations and conditions. One incident noted was where a firefighter had a MAYDAY during his 71st straight hour of being on duty**.**

2). **There have been several MAYDAYS (39 percent) where crews were working short-handed.**

3). 81 percent occurred between 9:00 p.m. and 6:00 a.m.

4). **77 percent occurred during an overtime shift, 43 percent while working a 24 hour + hour shift.**

5). Average number of runs prior to MAYDAY (24-hour period) were 16 runs/or standby on protest rallies (low 9 runs / high 26 in 24 hours).

6). **37 percent of the MAYDAY victims reported working short a crew member.**

7). 15 percent reported they did not remember the dispatch information (address, reason for the run).

8). 37 percent reported using more air than normal.

9). THE NUMBER ONE cause of a MAYDAY was becoming lost or separated from a hose line.

10). **43 percent reported difficulty sleeping during their overtime shift.**

11). Overtime ranged from working 48 hours (36%), 60 hours (23%), and 72 hours (17%) straight.

The critical message here related to staffing practices, and personnel working extended amounts of overtime to fill vacancies, is that while each community challenge is different, and Springfield is no exception, the fact is that firefighters require adequate rest (on and off duty) to ensure they are physically and mentally prepared for duty. Thus, adequate staffing must be planned for in advance based upon the unique needs of the community.

Staffing and deployment options for the city and the SFD are discussed in additional detail later in this section of the report.

FIRE AND EMS OPERATIONS AND RESPONSE METRICS

Fire, rescue, and emergency medical system (EMS) incidents, and the fire department's ability to respond to, manage, and mitigate them effectively, efficiently, and safely, are mission-critical components of the emergency services delivery system. In fact, fire, rescue, and EMS operations provide the primary, and certainly most important, basis for the very existence of the fire department.

Nationwide, fire departments are responding to more EMS calls and fewer fire calls, particularly fire calls that result in active firefighting operations by responders. This is well documented in both national statistical data as well as CPSM fire studies. Improved building construction, code enforcement, automatic sprinkler systems, and aggressive public education programs have contributed to a decrease in serious fires in many communities and, more importantly, fire deaths among civilians. However, these trends are not as evident in older, densely developed northeastern cities, particularly those that struggle with a high percentage of their population comprised of at-risk groups socio-economically.

These trends and improvements in the overall fire protection system notwithstanding, fires still do occur, occur with greater frequency in older, poorer urban areas, and the largest percentage of those occur in residential occupancies where they place the civilian population at risk. Although they occur with less frequency than they did several decades ago, when they occur today, they grow much quicker and burn more intensely than they did in the past. As will be discussed next, it is imperative that the fire department is able to assemble an ***effective response force* (ERF)** within a reasonable time period in order to successfully mitigate these incidents with the least amount of loss possible.

NFPA 1710

NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments*, 2020 edition (National Fire Protection Association, Quincy, Mass.) outlines organization and deployment of operations by career, and primarily career, fire and rescue

organizations.[30] It is the benchmark standard that the U.S. Department of Homeland Security utilizes when evaluating applications for staffing grants under the Staffing for Adequate Fire and Emergency Response (SAFER) grant program. The ability to get enough personnel, along with appropriate apparatus, to the scene of a structure fire is critical to operational success and firefighter safety. Accomplishing this within the eight-minute time frame specified in NFPA 1710 is an important operational benchmark.

National Fire Protection Association (NFPA) standards are consensus standards and not the law. Many cites and countries strive to achieve these standards to the extent possible without generating an adverse financial impact to the community. Cities and communities must decide on the level of service they can deliver based on several factors as discussed herein, including budgetary considerations. Questions of legal responsibilities are often discussed in terms of compliance with NFPA standards. Again, these are national consensus standards, representing best practices and applied science and research.

NFPA 1710 was the first organized approach to defining levels of service, deployment capabilities, and staffing levels for substantially career departments. Research work and empirical studies in North America were used by NFPA committees as the basis for developing response times and resource capabilities for those services as identified by the fire department.[31]

According to NFPA 1710, a fire department should base its capabilities on a formal all-hazards community risk assessment, as discussed earlier in this report, and taking into consideration:[32]

- Life hazard to the population protected.
- Provisions for safe and effective firefighting performance conditions for the firefighters.
- Potential property loss.
- Nature, configuration, hazards, and internal protection of the properties involved.
- Types of fireground tactics and evolutions employed as standard procedure, type of apparatus used, and results expected to be obtained at the fire scene.

According to NFPA 1710, if a community follows this standard, engine companies shall be staffed with a minimum of four on-duty members[33] and ladder companies shall be staffed with *five* and six based on geographical isolation and tactical hazards.[34] This staffing configuration is designed to ensure a fire department can complete the critical tasking necessary on building fires and other emergency incidents simultaneously rather that consecutively, and efficiently assemble an effective response force. ***While CPSM is not necessarily recommending the City of Springfield follow this standard, as this is a local jurisdictional decision, CPSM does support NFPA staffing and deployment of resources benchmarking regarding the assembling of an adequate Effective Response Force to control and mitigate the emergencies to which the SFD responds.***

30. NFPA 1710 is a nationally recognized standard, but it has not been adopted as a mandatory regulation by the federal government or the State of Illinois. It is a valuable resource for establishing and measuring performance objectives for the City of Springfield but should not be the sole determining factor when making local decisions about the city's fire and EMS services.
31. NFPA, Origin and Development of the NFPA 1710, 1710-1
32. NFPA 1710, 5.2.1.1, 5.2.2.2
33. NFPA 1710, 5.2.3.1.1
34. NFPA 1710, 5.2.3.1.2, 5.2.3.1.2.1.,5.2.3.2.2.,5.3.2.3.2.2.1

Code of Federal Regulations, NFPA 1500, and Two-In/Two Out

Another consideration, and one that links to critical tasking and assembling an Effective Response Force, is that of two-in/two-out regulations. Essentially, prior to initiating any fire attack in an immediately dangerous to life and health (IDLH) environment [with no confirmed rescue in progress], the initial two-person entry team shall ensure that there are sufficient resources on-scene to establish a two-person initial rapid intervention team (IRIT) located outside of the building.

This critical tasking model has its genesis with the Occupational Safety and Health Administration, specifically 29 CFR 1910.134(g)(4).

CFR 1910.134: Procedures for interior structural firefighting. The employer shall ensure that:

(i) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

(ii) At least two employees are located outside the IDLH atmosphere; and

(iii) All employees engaged in interior structural firefighting use SCBAs.[35]

According to the standard, one of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

NFPA 1500, *Standard on Fire Department Occupational Health, Safety, and Wellness,* 2018 Edition has similar language as CFR 1910.134)g)(4) to address the issue of two-in/two-out, stating *the initial stages of the incident where only one crew is operating in the hazardous area of a working structural fire, a minimum of four individuals shall be required consisting of two members working as a crew in the hazardous area and two standby members present outside this hazard area available for assistance or rescue at emergency operations where entry into the danger area is required.*[36]

NFPA 1500 also speaks to the utilization of the two-out personnel in the context of the health and safety of the firefighters working at the incident. *The assignment of any personnel including the incident commander, the safety officer, or operations of fire apparatus, shall not be permitted as standby personnel if by abandoning their critical task(s) to assist, or if necessary, perform rescue, this clearly jeopardizes the safety and health of any firefighter working at the incident.*[37]

In order to meet CFR 1910.134(g)(4), and NFPA 1500, the SFD must utilize two personnel to commit to interior fire attack while two firefighters remain out of the hazardous area or immediately dangerous to life and health (IDLH) area to form the IRIT, while attack lines are charged and a continuous water supply is established.

However, NFPA 1500 allows for fewer than four personnel under specific circumstances. It states: *Initial attack operations shall be organized to ensure that if on arrival at the emergency scene, initial attack personnel find an imminent life-threatening situation where immediate action could*

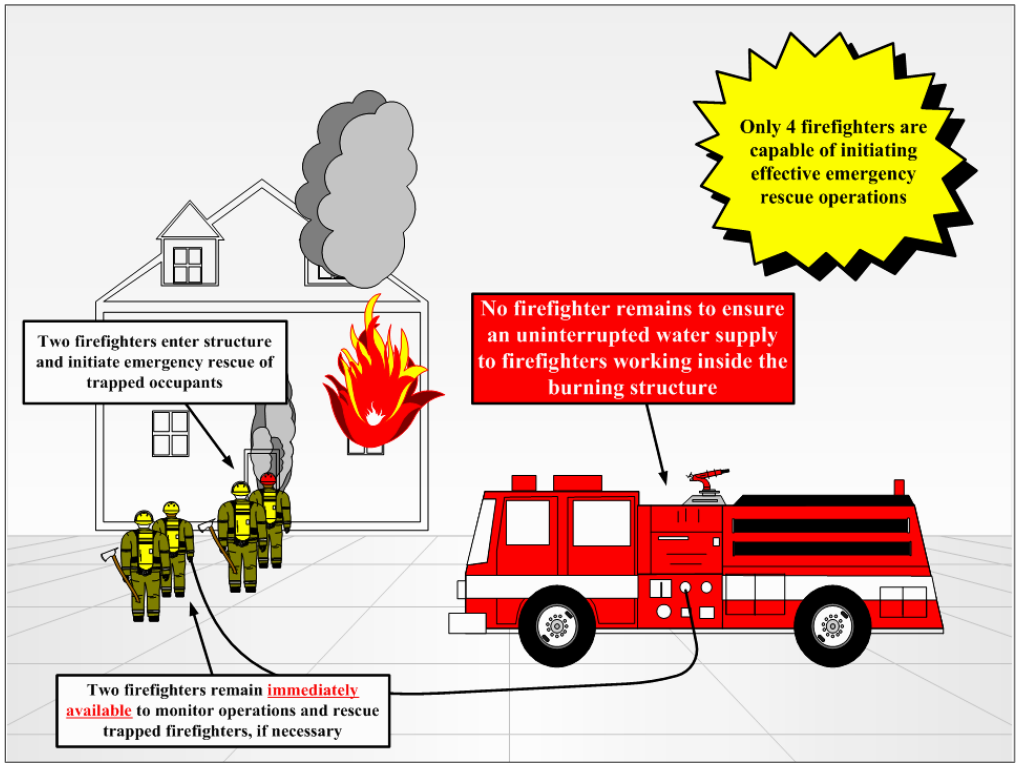
35. CFR 1910.134 (g) 4
36. NFPA 1500, 2018, 8.8.2.
37. NFPA 1500, 2018, 8.8.2.5.

prevent the loss of life or serious injury, such action shall be permitted with fewer than four personnel.[38]

CFR 1910.134(g)(4) also states that nothing in section (g) is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.[39]

It is also important to note that the OSHA standard (and NFPA 1710) specifically references "interior firefighting." Firefighting activities that are performed from the exterior of the building are not regulated by this portion of the OSHA standard. However, in the end, the ability to assemble adequate personnel, along with appropriate apparatus, on the scene of a structure fire, is critical to operational success and firefighter safety.

FIGURE 5-16: Two-In/Two-Out Interior Firefighting Model*



Note: *Four-person staffing, with single engine arrive at scene, or
Two 2-person staffed units (engine/engine; engine/ambulance) arrive at scene.

It was consistently reported to CPSM that the SFD does try to follow the provisions of the OSHA Two-In/Two-Out regulation regarding waiting to initiate an interior fire attack until four personnel are assembled when there are no rescues to be made. The fact that other units usually arrive quickly to assist is also an important consideration. The department is to be commended for this adherence.

Critical Tasking and Effective Response Force

Critical tasks are those activities that must be conducted in a timely manner by responders at emergency incidents to control the situation and stop loss. Critical tasking for fire operations is

38. NFPA 1500, 2018 8.8.2.10.
39. CFR 190.134, (g).

the minimum number of personnel needed to perform the tasks required to effectively control a fire. The same is true for EMS as there are specific patient care tasks that must be completed in succession and often together to support positive prehospital care. The specific number of people required to perform all the critical tasks associated with an identified risk is referred to as an ***Effective Response Force*** (**ERF**). The goal is to deliver an ERF within a prescribed time frame. NFPA 1710, as a nationally recognized consensus standard on staffing and deployment for career fire departments, provides a benchmark for ERF.[40]

To effectively respond to and mitigate requests for emergency services, an agency must have a thorough understanding of its community's risk factors, both fire and EMS. Once identified and understood, each category or level of risk is associated with the necessary resources and actions required to mitigate it. This is accomplished through a critical task analysis. The exercise of matching operational asset deployments to risk, or critical tasking, considers multiple factors including national standards, performance measures, and the safety of responders.

During fire incidents, to be effective, critical tasking must assign enough personnel so that all identified functions can be performed simultaneously. However, it is important to note that secondary support functions may be handled by initial response personnel once they have completed their primary assignment. Thus, while an incident may end up requiring a greater commitment of resources or a specialized response, a properly executed critical task analysis will provide adequate resources to immediately begin bringing the incident under control.

The Center for Public Safety Excellence (CPSE) has also established benchmarks regarding staffing and deployment. CPSE sets standards for agencies seeking and achieving accreditation through the Commission on Fire Accreditation International (CFAI). CFAI uses standards set forth in the *Community Risk Assessment Manual: Standards of Cover*, 6th edition, to provide guidance in staffing and deployment to agencies desiring accreditation through Core Competencies.

Core Competency 2C.4 requires that "*the agency conduct a critical task analysis of each risk category and risk class to determine the first due and effective response force capabilities, and to have a process in place to validate and document the results.*" The process considers the number of personnel needed to perform the necessary emergency scene operations. Completion of the process also helps to identify any gaps in the agency's emergency scene practices.

Regarding the implementation of an ERF and its aggregate effect on fireground operations, there has been much research done by several fire departments on the effects of various staffing levels. These studies have consistently confirmed that company efficiency and effectiveness decrease substantially and injuries increase when company staffing falls below four personnel. A comprehensive yet scientifically conducted, verified, and validated study titled *Multiphase Study on Firefighter Safety and the Deployment of Resources* was performed by the National Institute of Standards and Technology (NIST) and Worcester Polytechnic Institute (WPI), in conjunction with the International Association of Fire Chiefs, the International Association of Fire Fighters, and the Center for Public Safety Excellence. For the first time, quantitative evidence has been produced regarding the impact of crew size on accomplishing critical tasks. Additionally, continual research from UL has provided tactical insights that shed further light on the needs related to crew size and firefighter safety. This body of research includes:

40. It is important to note that compliance with NFPA 1710 has not been mandated in the State of Illinois or by the federal government. It is considered a "best practice" that fire departments strive to achieve.

- An April 2010 report on *Residential Fireground Field Experiments* from the National Institute of Standards and Technology (NIST).
- A December 2010 report on the *Impact of Ventilation on Fire Behavior in Legacy and Contemporary Residential Construction* (UL).
- An April 2013 report on *High-Rise Fireground Field Experiments* from the National Institute of Standards and Technology (NIST-HR).

Additional collaborative efforts such as the Governor's Island (July 2012) and Spartanburg Burns (January 2013) continue to expand upon and reinforce the findings of NIST and UL.

As stated, some of these studies' findings have a direct impact on the exercise of critical tasking. For example, as UL studied the impact of ventilation on fire behavior, it was able to obtain empirical data about the effect of water application on fire spread and occupant tenability. The research clearly indicates that the external application of a fire stream, especially a straight stream, does not "push fire" or decrease tenability in any adjacent rooms. Therefore, during the deployment of resources for the critical task of fire attack, consideration must be given to the option of applying water to the fire from the exterior when able. This approach enables a fire attack that can begin prior to the establishment of an IRIT as well as decreases the time to getting water on the fire, which has the greatest impact on occupant survivability.

The NIST studies examined the impact of crew size and stagger on the timing of fireground task initiation, duration, and completion. Although each study showed crew size as having an impact on time-to-task, consideration must be given to what tasks were affected and to what extent. For example, four-person crews operating at a low-hazard structure fire completed all fireground tasks (on average) 5.1 minutes or 25 percent faster than three-person crews.

- Four-person firefighting crews were able to complete 22 essential firefighting and rescue tasks in a typical residential structure 30 percent faster than two-person crews and 25 percent faster than three-person crews.
- The four-person crews were able to deliver water to a similar sized fire 15 percent faster than the two-person crews and 6 percent faster than three-person crews, steps that help to reduce property damage and reduce danger/risks to firefighters. The latter time represents a 34-second difference.
- Four-person crews were able to complete critical search and rescue operations 30 percent faster than two-person crews and 6 percent faster than three-person crews. The latter time represents a 23-second difference. The "rescue time" difference from a four-person to a three-person crew is seven seconds.

When considering critical tasking for the deployment of an ERF for fire suppression operations, the SFD will be able to handle most incidents with just its own resources. For larger, more significant, or complex incidents, the department will need to consider resources from surrounding automatic and mutual aid partners. However, being primarily comprised of volunteer organizations, the availability of surrounding departments to provide a sufficient number of properly trained, fully qualified firefighters for a major fire may be an option that has limited operational value.

It is also unlikely that the SFD would be capable of handling two simultaneous or significantly overlapping major structure fires. It is also important to note that the impact of crew size as it relates to high-risk categories is greater than its low-risk implications and should be considered when staffing units that cover a greater amount of risk. As SFD's engine and truck companies are

staffed with just three personnel, this will ultimately present some significant operational challenges and concerns (as it does in many other communities that utilize similar staffing models).

From a practical standpoint, staffing engines and ladders with three personnel rather than four forces the captain to be actively involved in hands-on tasks such as stretching a line or raising a ladder, rather than performing size-up and other important initial fireground actions. Captains are working supervisors. They form an integral part of their company, and it is often necessary for them to assume hands-on involvement in operations, particularly with companies that are minimally staffed, while simultaneously providing oversight and direction to their personnel (incident command functions). During structure fires and other dangerous technical operations, it is imperative that these officers accompany and operate with their crew to monitor conditions, provide situation reports, and assess progress toward incident mitigation. During structure fires they operate inside of the fire building. Captains need to be able to focus on the completion of specific tasks that have been assigned to their respective companies, such as interior fire attack, rescue, ventilation, and/or water supply.

When engine companies are staffed with three rather than four personnel, the Captain often needs to either function as the nozzle person while the other firefighter backs him/her up and helps with advancing the line, or, if the roles are reversed and the Captain is assisting with line advancement they cannot monitor the conditions at the nozzle—and closest to the fire—as they should. Ideally, one firefighter should be the nozzle operator, the captain should be right alongside of, or behind the nozzle, providing direction and evaluating conditions, and the third firefighter can be further back assisting with advancing the line. This is particularly important for fires on the second and third floors of buildings where the lines must frequently be advanced up narrow and winding stairways. When short staffed in fire conditions such as this, two companies often must be deployed to get a single line in service, which can then impact the completion of additional critical tasks.

CPSM advocates structural fire tactics and strategies that are both safe and effective, but sometimes staffing levels can make that dual goal difficult to achieve. Initiating offensive operations with fewer than four firefighters will place firefighters at a high level of risk; delaying operations until additional staffing arrives places occupants in greater danger and can increase property damage.

Ultimately overall, on-duty fire department staffing is a local government decision. It is also important to note that the OSHA standard (and NFPA 1500/1710/1720) specifically references "interior firefighting." Firefighting activities that are performed from the exterior of the building are not regulated by this portion of the OSHA standard. However, **in the end, the ability to assemble adequate personnel, along with appropriate apparatus to the scene of a structure fire, is critical to operational success and firefighter safety**. How and where personnel and resources are located and how quickly they can arrive on scene play major roles also.

All of these factors must be taken into consideration as Springfield reaches consensus on the acceptable community fire safety risk level, affordable levels of expenditure for fire protection, and appropriate levels of staffing. The city will need to consider the cost-benefit of various deployment strategies, such as continuing the current staffing and deployment model, or adopting a different one based upon options presented within this report.

For the SFD, emergency responses are based on caller information provided to dispatchers at the Sangamon County Central Dispatch System (SCCDS); responses depend on the nature and type of call for service. The dispatch center provides dispatch services to 22 police departments, 17 fire departments, and three private ambulance companies that also provide 9-1-1 transport

services. The SCCDS is the public safety answering point (PSAP) for the city. SFD details out its response procedures through a response plan in the dispatch center. This response plan covers both high- and low-frequency incidents that range from low to high risk. Structure fire responses represent the type of high-risk/low-frequency incidents that present the greatest challenges.

For any given emergency to which SFD responds, there are critical tasks that must be completed. These tasks can range from the immediate rescue of trapped occupants within a burning structure to vehicle or water rescue when needed. A set of critical tasks have been developed in an effort to identify what resources are needed for each incident type. SFD has developed response matrixes detailing the initial levels of response for varying incident types. The following critical task analysis was performed independent of these policies; however, a comparison is provided.

The intent of the risk management process is for the department to develop a standard level of safety while strategically aligning its resources with requests for service. Thus, the critical tasking presented herein will consider the EFR in relation to either a low-, moderate-, or high-risk classification.

Critical tasking has been identified for the following incident types:

- Structure Fire–Low Risk.
- Structure Fire–Moderate Risk.
- Structure Fire–High Risk.
- Structure Fire–High-Rise.
- Vehicle Fire.
- Outside Fire Grass/Brush/Rubbish Fire.
- Fire Alarm–Low Risk.
- Fire Alarm–Moderate Risk.
- Fire Alarm–High Risk.
- Motor Vehicle Crash–No Entrapment.
- Motor Vehicle Crash–With Entrapment.
- Natural Gas Leak–Interior and Exterior.
- Hazardous Materials Incident.
- Water Rescue Incident.
- Technical Rescue Incident.

SFD utilizes a standard alarm assignment for most reported structure fire responses. An initial response to this type of incident includes the following:

- 4 engines, 12 total staff.
- 2 trucks, 6 total staff.
- 1 battalion chief, 2 total staff.

This response matrix places 20 personnel on the scene assuming that the SFD engines and trucks are staffed each with three personnel.

Once the incident has smoke showing, or is determined to be a "working fire," and the alarm is made a **Code 1** then the Department Safety Officer (DSO) and Staff Duty Officer (SDO) who will be a division/deputy chief or higher, are notified.

If the alarm is upgraded to a **Code 2** the following additional resources are dispatched:

- 2 engines, 6 total staff.
- 1 battalion chief, 2 total staff.

This would bring staffing to 28 personnel, however, since they are not dispatched at the time of initial dispatch their arrival will be delayed. At this point all staff personnel are notified.

Code 3 alarms will have the following additional resources dispatched:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.

This will bring staffing on the scene up to 37 personnel.

At least one ambulance with two personnel will also be dispatched to each fire incident. However, the ambulance personnel can only provide medical care, not engage in firefighting operations, so they cannot be included in the number of personnel available for firefighting operations.

The following discussion and tables will outline how critical tasking and assembling an effective response force is first measured in NFPA 1710 and how the SFD is benchmarked against this standard.

The initial full alarm assignment to a structural fire in a typical 2,000 square-foot, two-story, single-family dwelling without a basement and with no exposures must provide for a minimum of 16 members (17 if an aerial device is used). The following figure illustrates this and the subsequent table outlines the critical task matrix.

FIGURE 5-17: Effective Response Force for Single-Family Dwelling Fire

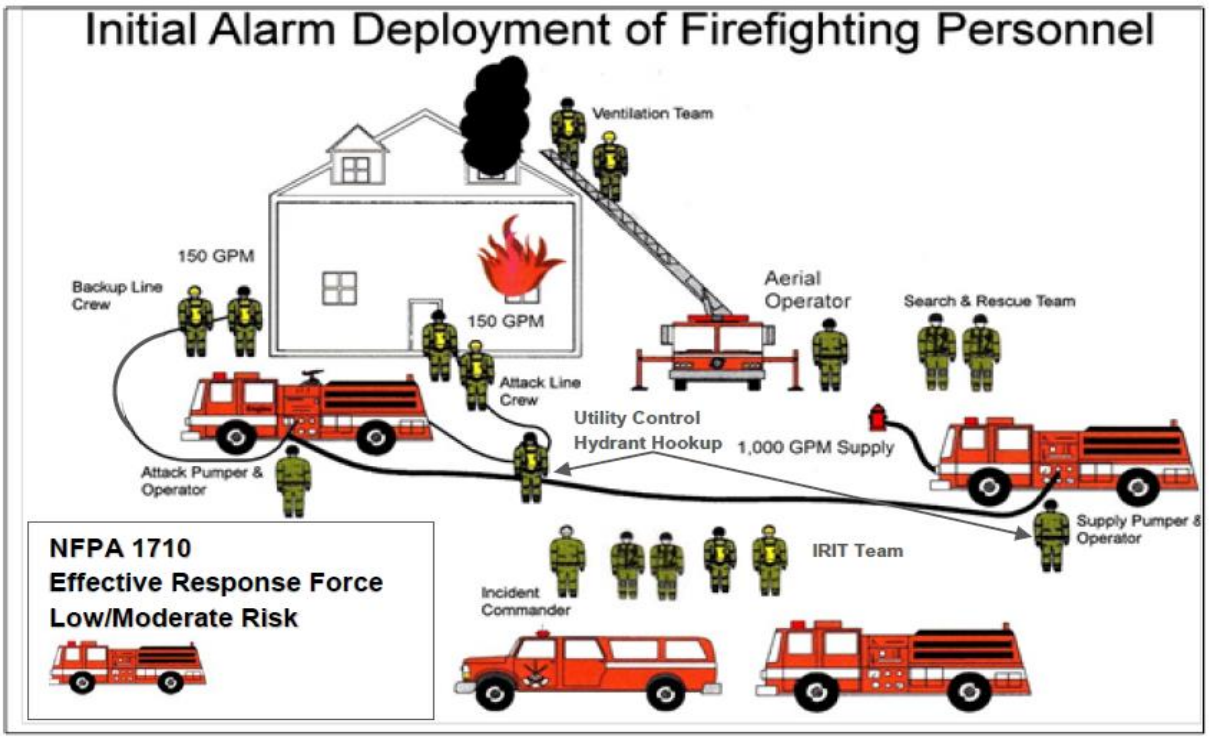


TABLE 5-8: Effective Response Force for Single-Family Dwelling Fire

Critical Tasks	Personnel
Incident Command	1
Continuous Water Supply	1
Fire Attack via Two Handlines	4
Hydrant Hook Up - Forcible Entry - Utilities	2
Primary Search and Rescue	2
Ground Ladders and Ventilation	2
Aerial Operator if Aerial is Used	1
Establishment of IRIC (Initial Rapid Intervention Crew)	4
Total Effective Response Force	**16** (17 If aerial is used)
SFD Initial Effective Response Force	**20**

These tasks meet the minimum requirements of NFPA 1710 for the initial full alarm assignment to a typical low-risk, 2,000 square-foot, two-story residential structure fire. These are the proverbial "bread and butter" structural fire incidents that fire departments respond to, and which are, by far, the most common type of structure fire. Personnel requirements for fires involving large, more complex structures such as commercial or industrial facilities or multifamily residential occupancies will require a significantly greater commitment of personnel.

It should be noted at this point that at least a portion of the building risk in Springfield does not fit into this type of "typical" residential structure. Our observation was that many of the detached

residential units are large, multistory and multifamily types of occupancies (see following figure). In these types of structures, the fire challenges are going to be much more complex and conducive to rapid fire spread through such areas as attics and basements. Fire extension between closely spaced, wood-frame dwellings is also a significant concern. For this reason, a significant percentage of Springfield's residential occupancies expand to the moderate risk category.

FIGURE 5-18: Typical Springfield 2.5-Story Wood Frame Residential Fires

The 2020 edition of NFPA 1710 recommends a minimum of 27/28 personnel on the initial response for fires involving moderate hazard garden-style apartments and strip shopping centers (see following table).

TABLE 5-9: Structure Fire – Moderate Risk

Critical Task	Needed Personnel
Incident Command	2
2 – Independent Water Supply Lines/Pump Operators	2
Fire Attack via Three Handlines	6
Support Firefighter for each Handline	3
2 - Search and Rescue Teams	4
2 - Ground Ladders and Ventilation Teams	4
Aerial Operator (if Aerial is Used)	1
Rapid Intervention Team (1 Officer/3 Firefighters)	4
EMS/Medical	2
Effective Response Force	**27/28**
SFD Initial Response Provided	**20**

The following table identifies critical tasking for fires involving high-risk structures such as hospitals, nursing homes, and assisted living facilities.

TABLE 5-10: Structure Fire – High Risk

Critical Task	Needed Personnel
Incident Command	2
2 – Independent Water Supply Lines/Pump Operators	2
Investigation/Initial Fire Attack Line	3
Backup Line	3
Secondary Attack Line	3
3 - Search/Rescue Teams	6
2 – Ground Ladder and Ventilation teams	4
Water Supply/Fire Department Connection	2
Aerial Operators (if Aerials are Used)	2
Safety/Accountability	2
Rapid Intervention Team (1 Officer/3 Firefighters)	4
EMS/Medical	4
Effective Response Force	**35/37**
SFD Initial Response Provided	**20**

Based upon needed personnel for establishment of an ERF, and due to Springfield's unique risks as an older, densely populated urban community, while also operating all units with three personnel, consideration should be given to an initial response for all reported **moderate** and **high-risk** structure fires of:

- 6 engines, 18 total staff.
- 2 trucks, 6 total staff.
- 2 battalion chiefs, 4 total staff.

If all units are staffed with three personnel, this would provide an initial response of **28 personnel**.

Since they are relatively rare occurrences, for fires that require additional resources and personnel, Springfield should consider the following option for second (or greater) alarms.

- 4 engines, 12 total staff.
- 2 trucks, 6 total staff.
- 2 battalion chiefs, 2 total staff (with BC aid-4).

This option would require response of at least one ladder from either Chatham or Sherman FDs. This option would provide at least 20 to 22 additional personnel, assuming the fire units are all staffed with three personnel. Additional personnel returning to work on a recall of off-duty personnel could staff additional units and respond if necessary. It is anticipated that additional Springfield chief officers would also respond; they could assist at the fire or provide city coverage.

It should be stressed that the large responses of apparatus that CPSM is recommending to establish an ERF based upon the hazard of the occupancy type (low, medium and high hazard) is intended for instances where the caller(s) are reporting visible smoke or fire within the building.

As part of a risk management strategy, for incidents within structures such as an appliance, a heater, a sparking electrical outlet, an odor or smoke, etc., consideration should be given to the initial dispatch of a "Tactical Box" comprised of:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.

If additional information is received indicating an active fire in progress, the assignment can then be upgraded to a "Full Box."

Fires involving high-rise structures, which are generally considered to be any building more than six stories in height or more than 75 feet tall, present fire departments with significant operational challenges, particularly in buildings that are not equipped throughout with automatic fire suppression systems. The City of Springfield has a total of 30 buildings that meet this classification including one that is 30 stories in height. The city also has multiple additional buildings that are between four and six stories in height, which can present some of the same challenges in an emergency as a high-rise building. The following figure provides a view of a number of these types of buildings in the city.

FIGURE 5-19: View of High-rise Buildings in Springfield

The following table breaks down the occupancies of the city's high-rise buildings.

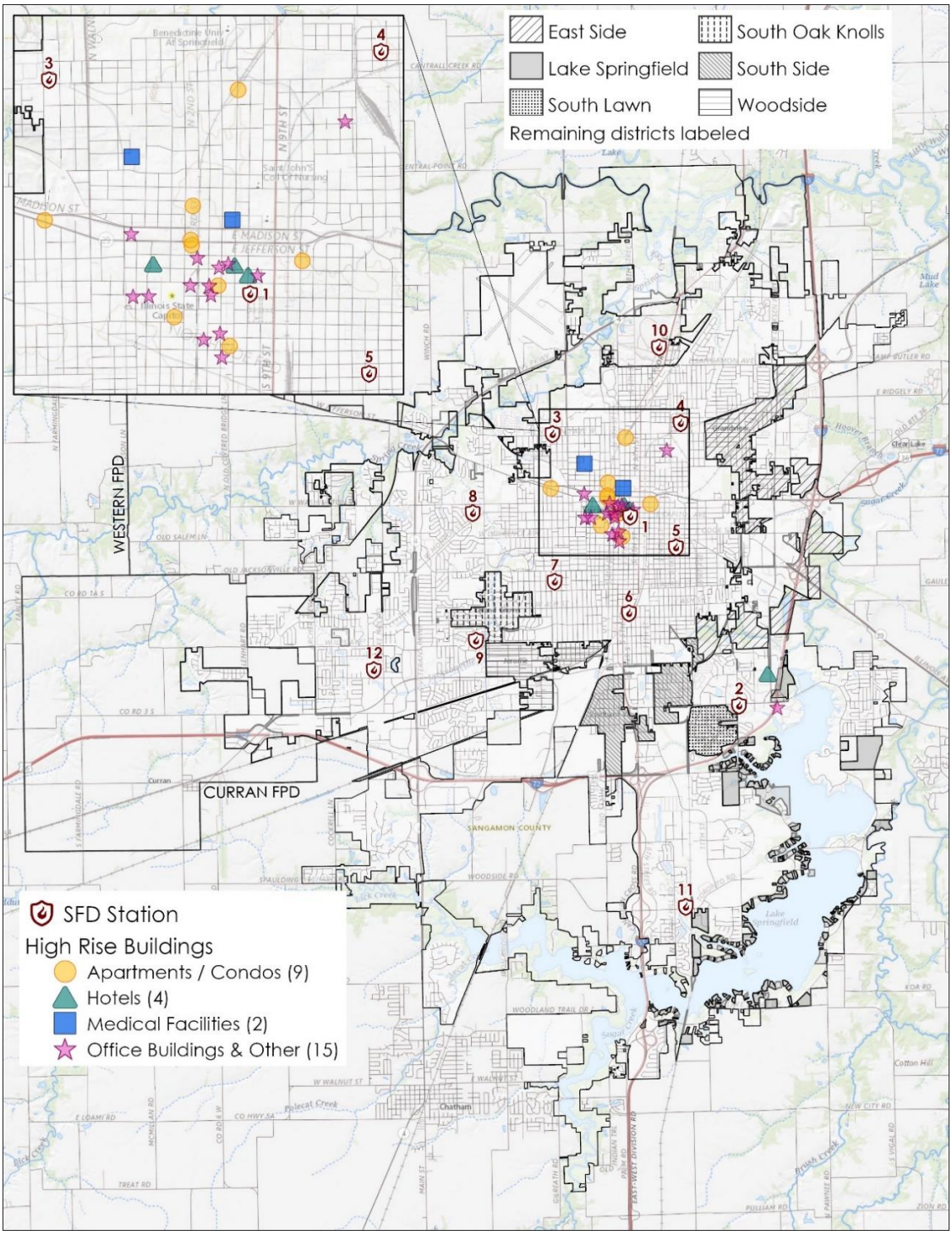
TABLE 5-11: Springfield High Rises by Occupancy Type

Occupancy Type	Number of Buildings
Office	15
Apartments	9
Medical	2
Hotel	4
Total	**30**

The 2020 edition of NFPA 1710 recommends a minimum of 42/43 personnel on the initial response for fires involving high-rise buildings. These personnel should arrive on location within a 10-minute

(600 second) travel time. Some chief officers with considerable high-rise fire experience suggest that the actual number of personnel needed for a significant high-rise fire will be around 100 firefighters within about 30 minutes.

FIGURE 5-20: Springfield High-Rise Locations



The following table identifies critical tasking for a high-rise fire.

TABLE 5-12: Structure Fire – High Rise

Critical Tasks	Personnel
Incident Command	2
Continuous Water Supply	1 FF for continuous water; if fire pump exists, 1 additional FF required.
Fire Attack via Two Handlines	4
One Handline above the Fire Floor	2
Establishment of IRIC (Initial Rapid Intervention Crew)	4
Primary Search and Rescue Teams	4
Entry Level Officer with Aide near entry point of Fire Floor	2
Entry Level Officer with Aide near the entry point above the Fire Floor	2
Two Evacuation Teams	4
Elevator Operations	1
Safety Officer	1
FF Two Floors below Fire to Coordinate Staging	1
Rehabilitation Management	2
Officer and FFs to Manage Vertical Ventilation	4
Lobby Operations	1
Transportation of Equipment below Fire Floor	2
Officer to Manage Base Operations	1
Two ALS Medical Care Teams	4
Total Effective Response Force	**42** (43 If building is equipped with pump)

Based upon needed personnel for establishment of an ERF for high-rise fires, while also taking into account that all SFD units operate with three personnel, consideration should be given to an initial response for a reported fire in a high-rise of:

- 9 engines, 27 total staff.
- 3 trucks, 9 total staff.
- 2 battalion chiefs, 4 total staff.

If all units are staffed with three personnel, the initial response would be **40 personnel**. While this initial response may be viewed as excessive, there is an adage regarding staffing and apparatus that "it is better to have them responding and not need them, then to need them and not have them." If the first arriving units determine that the incident is minor in nature, units that will not be needed can quickly be returned to service.

Initial SFD response to vehicle fires is one engine for most incidents. Once on scene the officer may special call additional companies based on vehicle type (semi-truck, RV, etc.).

Initial response to outside grass/brush fires is a single engine company. Once the company is on scene the officer may special call Brush 1 (or additional needed resources), which would respond with E10.

Initial response to outside trash/rubbish fires is one engine company.

TABLE 5-13: Vehicle Fire

Critical Task	Needed Personnel No Exposures	Needed Personnel With Exposures/Life Hazards*
Incident Command	1	1
Pump Operator	1	1
Fire Attack Line	2	2
Backup Line/Secondary Attack Line	-	2
Water Supply	-	1
Check Fire Extension	-	2
Effective Response Force	**4**	**9**
SFD Response Provided	**3**	**3**

Note: *A reasonable alternative in this scenario is the dispatch/response of an initial first alarm structural fire assignment, or at a minimum, a "tactical box" of two engines, one truck, and one battalion chief. The same type of enhanced response assignment should also be considered for semi-trucks, buses, trains, etc.

TABLE 5-14: Outside Fire – Grass/Brush/Rubbish

Critical Task	Needed Personnel
Incident Command	1
Pump Operator	1
Fire Attack Line	2
Effective Response Force	**4**
SFD Response Provided	**3**

The SFD dispatches different assignments to automatic fire alarm systems based on the type of occupancy. These range from a response of one engine in a cold response (no lights/sirens) for single family residential alarms to one engine, one ladder, and one battalion chief for all other types of occupancies. These types of responses need to be considered in the context of risk assessment and management. On one hand, consideration must be given to the potential risks, hazards, and even investigative complexity associated with various types of occupancies. Conversely, data and experience show that these system activations are rarely for an actual fire incident, and of those that are, they are often backed up by a phone call reporting a fire.

TABLE 5-15: Fire Alarm System – Low Risk

Critical Task	Needed Personnel
Incident Command	1
Investigation	3
Effective Response Force	**4**
SFD Response Provided	**3**

Based upon needed personnel for an ERF for a low-risk fire alarm system, consideration should be given to maintaining the current initial response of:

- 1 engine, 3 total staff.

TABLE 5-16: Fire Alarm System – Moderate Risk

Critical Task	Needed Personnel
Incident Command	1
Pump Operator	1
Investigation	4
Forcible Entry/Ventilation (if necessary)	2
Effective Response Force	**8**
SFD Response Provided	**8**

Based upon needed personnel for an ERF for a moderate risk fire alarm system, consideration should be given to maintaining the current initial response of:

- 1 engine, 3 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.

TABLE 5-17: Fire Alarm System – High-Risk/High-Rise

Critical Task	Needed Personnel
Incident Command	1
Pump Operator	1
Water Supply/Fire Department Connection	1
Investigation	4
Search and Rescue (if necessary)	2
Annunciator Panel	2
Effective Response Force	**11**
SFD Response Provided	**8**

Based upon needed personnel for an ERF for a high-risk/ high-rise fire alarm system, consideration should be given to an initial response of:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.

SFD response to a motor vehicle crash with no potential/reported entrapment includes the following resources:

- 2 engines, 6 total staff.
- 1 truck (only on interstate highways), 3 total staff.

TABLE 5-18: Motor Vehicle Crash – No Entrapment

Critical Task	Needed Personnel
Incident Command	1
Hazard Abatement	1
Patient Evaluation/Care	2
Effective Response Force	**4**
SFD Response Provided	**6/9***

Note: *Does not include EMS personnel.

SFD response to a motor vehicle accident with potential/reported entrapment includes the following resources:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.

TABLE 5-19: Motor Vehicle Crash – With Entrapment

Critical Task	Needed Personnel
Incident Command	1
Pump Operator	1
Scene Protection Line	2
Hazard Abatement	2
Patient Extrication	4
Patient Evaluation/Care	4
Effective Response Force	**14**
SFD Response Provided	**11***

Note: *Does not include EMS personnel.

SFD response to both interior and exterior gas leak includes the following resources:

- 1 engine, 3 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.

TABLE 5-20: Natural Gas Leak – Interior and Exterior

Critical Task	Needed Personnel
Incident Command	1
Investigation/Air Monitoring	2
Pump Operator/Water Supply (If needed)	1
Protection Line (If needed)	2
Forcible Entry, Utility Control, Ventilation	2
Search and Rescue (If needed)	2
Establishment of an IRIT	2
Effective Response Force	**12**
SFD Response Provided	**8**

Based upon needed personnel for an ERF for a natural gas leak, consideration should be given to an initial response of:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.

SFD initial response to a possible hazardous materials incident includes the following resources:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.
- Squad 1, HM2, HM3, 4 total staff.

TABLE 5-21: Hazardous Materials Incident

Critical Task	Needed Personnel
Incident Command/Safety	2
Entry Team (Haz. Mat. Technician)	2
Back-up Team (Haz. Mat. Technician)	2
Decontamination Personnel	4
Research (Haz. Mat. Technician)	1
Support Personnel	6
Medical	2
Effective Response Force	**19**
SFD Response Provided	**15-17***

Note: *Does not include EMS personnel.

SFD initial response to a water rescue incident includes the following resources:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.
- Engine 11 with Dive 1 and Dive 2, 3 total staff.

TABLE 5-22: Water Rescue Incident

Critical Task	Needed Personnel
Incident Command	1
Rescue Team (Technical Rescue Technician)	2
Back-up Team (Technical Rescue Technician)	2
Shore Support	6
Safety	1
Medical	2
Effective Response Force	**13**
SFD Response Provided	**14***

Note: *Does not include EMS.

SFD initial response to a technical rescue incident includes the following resources:

- 2 engines, 6 total staff.
- 1 truck, 3 total staff.
- 1 battalion chief, 2 total staff.
- Rescue 1, Rescue 2-2, 3 total staff.

TABLE 5-23: Technical Rescue Incident

Critical Task	Needed Personnel
Incident Command	1
Rescue Team (Technical Rescue Technician)	4
Back-up Team (Technical Rescue Technician)	4
Support	8
Safety	1
Accountability	2
Medical	2
Effective Response Force	**22**
SFD Response Provided	**14***

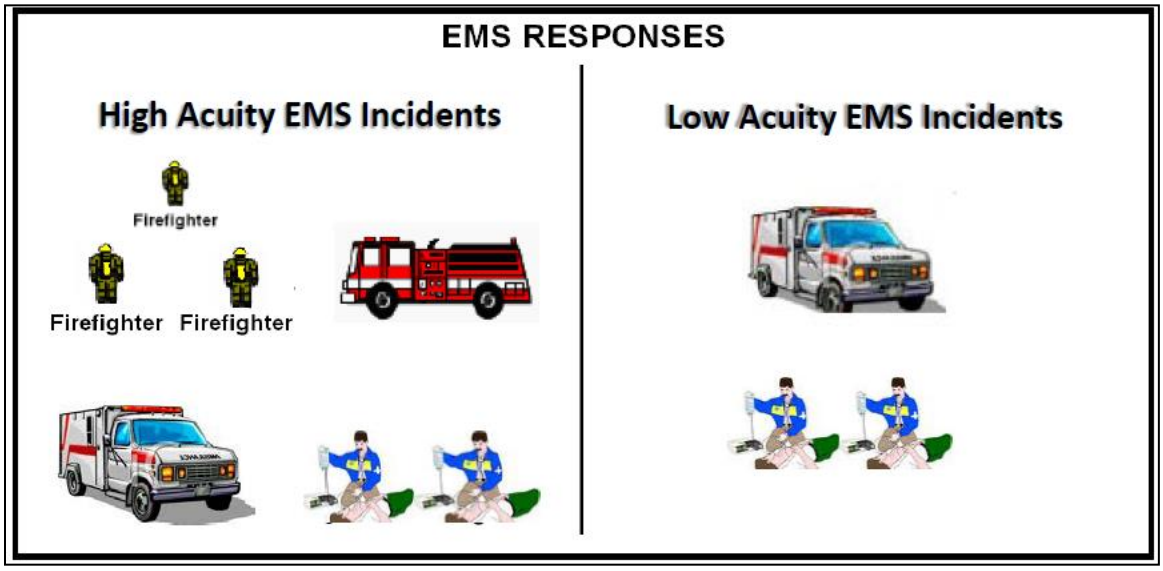
Note: *Does not include EMS personnel and other SFD technical rescue personnel.

Establishing an ERF for medical emergencies is significantly less labor intensive than it is for fire incidents. NFPA 1710 provides guidance regarding staffing levels for units responding to EMS incidents; however, the provision does not specify a minimum staffing level for EMS response units. Instead, section 5.3.32 of the standard states: *"EMS staffing requirements shall be based on the minimum levels needed to provide patient care and member safety."* It further recommends that resources should be deployed to provide *"for the arrival of a first responder with AED within a 240-second travel time to 90 percent of the incidents," and, "when provided, the fire department's EMS for providing ALS shall be deployed to provide for the arrival of an ALS unit within a 480-second travel time to 90 percent of the incidents provided a first responder with AED or BLS unit arrived in 240 seconds or less travel time."*

EMS calls are typically managed with fewer personnel, and most EMS calls can be handled with a single ambulance staffed with two personnel. In the call-screening process, those calls that require additional personnel are typically identified at the dispatch level and additional personnel can be assigned when needed. These types of incidents could include cardiac and respiratory arrest, unconscious persons, and other incidents where the initial call seems to indicate a severe and imminent threat to life.

NFPA 1710 suggests for these types of emergencies that "*personnel deployed to ALS emergency responses shall include a minimum of two members trained at the emergency medical technician–paramedic level and two members trained at the emergency medical technician–basic level arriving on scene within the established travel time.*" However, these types of emergencies constitute a small percentage of overall EMS incidents as identified herein.

FIGURE 5-21: Typical EMS ERF



FIRE OPERATIONS

With a population density estimated to be around 1,875 people per square mile, Springfield is an urbanized city. Multiple areas in the city area have older, multistory structures sited closely together, in many cases directly abutting, or even interconnecting with each other. Many of these structures date to the later part of the 19th and early years of the 20th century; however, some historic structures date back as far as the early to mid-19th century. Interspersed throughout the city are newer and refurbished buildings and facilities. Outside of the central core of the city the structures reflect the era in which they were built as the city grew and developed.

Much of the city's house stock is comprised of older, wood frame dwelling units that are susceptible to rapid fire spread particularly when they are spaced closely together. In this environment, if a fire grows to an area more than 2,000 square feet, or extends beyond the building of origin, initial response personnel will be taxed beyond their available resources and additional buildings can quickly become involved as the fire spreads in multiple directions. From this perspective it is critical that enough SFD units respond quickly and initiate extinguishment efforts as rapidly as possible after notification of an incident. It is, however, difficult to determine

in every case the effectiveness of the initial response in limiting the fire spread and fire damage. Many variables will impact these outcomes, including:

- The time of detection, notification, and ultimately response of fire units.
- The age and type of construction of the structure. Being primarily a community in which much of the development occurred many years ago, the maintenance and condition of structures in Springfield will be a consideration and part of the risk benefit analysis the Battalion Chiefs must undertake at fire incidents.
- The presence of any built-in protection (automatic fire sprinklers) or fire detection systems.
- The contents stored in the structure and its flammability.
- The presence of any flammable liquids, explosives, or compressed gas canisters.
- Weather conditions and the availability of water for extinguishment.

Subsequently, in those situations in which there are extended delays in the extinguishment effort or the fire has progressed sufficiently upon arrival of fire units, there is actually very little that can be done to limit the extent of damage to the entire structure and its contents. In these situations, suppression efforts may need to focus on the protection of nearby or adjacent structures (exterior exposures) with the goal being to limit the spread of the fire beyond the building of origin, and sometimes the exposed building. This is often termed protecting exposures. When the scope of damage is extensive, and the building becomes unstable, firefighting tactics typically move to what is called a defensive attack, or one in which hose lines and more importantly personnel are on the outside of the structure and their focus is to merely discharge large volumes of water until the fire goes out. In these situations, the ability to enter the building is very limited and if victims are trapped in the structure, there are very few safe options for making entry.

Today's fire service is actively debating the options of interior firefighting vs. exterior firefighting. These terms are self-descriptive in that an ***interior fire attack*** is one in which firefighters enter a burning building in an attempt to find the seat of the fire and from this interior position extinguish the fire with limited amounts of water. An ***exterior fire attack***, also sometimes referred to as a ***transitional attack***, is a tactic in which firefighters initially discharge water from the exterior of the building, either through a window or door and knock down the fire before entry in the building is made. The concept is to introduce larger volumes of water initially from the outside of the building, cool the interior temperatures, and reduce the intensity of the fire before firefighters enter the building. A transitional attack is most applicable in smaller structures, typically single-family, one-story detached units which are smaller than approximately 2,500 square feet in total floor area. For fires in larger structures, the defensive-type, exterior attacks generally involve the use of master streams capable of delivering large volumes of water for an extended period of time.

Recent studies by UL have evaluated the effectiveness of interior vs. exterior attacks in certain simulated fire environments. These studies have found the exterior attack to be equally effective in these simulations.[41] This debate is deep-seated in the fire service and traditional tactical measures have always proposed an interior fire attack, specifically when there is a possibility that victims may be present in the burning structure. The long-held belief in opposition to an exterior

41. "Innovating Fire Attack Tactics," U.L.COM/News Science, Summer 2013.

attack is that this approach may push the fire into areas that are not burning or where victims may be located. The counterpoint supporting the exterior attack centers on firefighter safety.

FIGURE 5-22: SFD Structure Fire: May 2021

The exterior attack limits the firefighters from making entry into those super-heated structures that may be susceptible to collapse. From CPSM's perspective, there is at least some likelihood that a single SFD crew of three personnel will encounter a significant and rapidly developing fire situation. This situation can occur during times of high incident activity when other units may be committed on other emergencies, or in fringe areas of the city where other units responding to the incident may have longer response times to arrive on the scene and may all be coming from the same direction. These situations can also occur due to incorrect information provided to the dispatch center by the initial 9-1-1 caller, or because of incidents that begin as an investigation of an automatic fire alarm system.

It is prudent, therefore, that the SFD build at least a component of its training and operating procedures around the tactical concept of the exterior fire attack when the situation warrants such an approach. In addition, with engine companies currently staffed with three personnel, unless there is a potential life hazard concern of trapped occupants, engines arriving on scene first—and with no other companies immediately available—will be limited to initiating these tactics until the arrival of additional units and personnel.

Recommendations:

- The SFD should build at least a portion of its training regimens and tactical strategies around the exterior or transitional attack for when the fire scenario and the number of available units/responding personnel warrant this approach. (Recommendation No. 22.)
- In acknowledgement of the fact that SFD engines operate in a minimal staffing mode and recognizing the potential for rapid fire spread particularly in the more densely developed areas of the city, the SFD should equip all its apparatus with the appropriate appliances and hose as described herein. It should develop standardized tactical operations that will enable arriving crews to quickly deploy high-volume fire flows of 1,200 to 1,500 gallons per minute (if the water supply will permit this), utilizing multiple hose lines, appliances, and master stream devices. This flow should be able to be developed within four to five minutes after arrival of an apparatus staffed with three personnel. (Recommendation No. 23.)

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The ability to quickly develop an adequate and sustainable water supply is key to successful mitigation of almost every fire incident. Springfield has a good municipal water supply system for fire department use. However, as in many older cities the system is more than a century old and experiences occasional maintenance issues. In addition, several of the Fire Protection Districts that the SD protects do not have municipal water systems, and this requires that water needed for firefighting be trucked in. If a sufficient water supply cannot be established, this can certainly slow and hamper initial firefighting operations.

As currently staffed, the SFD should be able to handle most of the fires it encounters without the need for automatic or mutual aid. However, as has been mentioned previously, the city's engine companies being staffed with three personnel rather than four will limit their tactic options until the arrival of additional resources and personnel. Fire incidents in larger structures often require additional personnel and resources to successfully mitigate.

Critical staffing necessary to successfully mitigate various types of incidents has been discussed in detail earlier in this section of the report. In most cases, fires occurring when there are no other incidents in progress (which would reduce the immediately available number of personnel), and the fire department can arrive at the fire incident and take definitive action to mitigate the situation prior to flashover occurring, will impact how effectively and quickly incidents can be mitigated. If flashover has occurred, holding the fire to the building of origin is highly achievable as well.

A critical component of the incident command system is the establishment of the role of safety officer to monitor conditions at fires and emergency incident scenes to ensure that appropriate safety procedures are being followed. The incident safety officer is an important member of the incident command team. The safety officer works directly under and with the incident commander to help recognize and manage the risks that personnel take at emergencies.

The concept of a command team recognizes that there is a shared responsibility for the proper and safe performance of personnel operating on the emergency scene. The fact is that one of the roles that the safety officer needs to play is that of challenging and confirming the incident commander's actions. The safety officer should be included in the development and monitoring of the incident action plan. In simple terms, the incident commander and the safety officer command team provide a system of checks and balances designed to keep all personnel on the emergency scene safe. Once the incident action plan is established, the safety officer monitors the plan for effectiveness and efficiency.

Fire departments in the Phoenix, Ariz., metro area are leaders in this regard and place a high priority on the assignment of a qualified officer to fill the safety officer position during a wide range of incidents. According to Phoenix Regional Standard Operating Procedures *"Incident Safety Officer System,"* for most incidents, the safety officer provides the following functions:

- Incident recon.
- Assess the risk/benefit of operations.
- Assess and address safety concerns on the incident scene.
- Communicate and report safety issues to command.
- Intervene as necessary to provide for safety.

During larger scale incidents, the safety officer reviews the incident action plan and specific details of the safety plan. As appropriate, the safety officer confirms that a safety plan is in effect, reviews it, and provides recommendations. The incident commander may request that the safety officer develop a proposed safety plan and recommendations for command.

Beyond the specific emphasis on safety, the role of incident commander is a dynamic and highly stressful position with numerous critical responsibilities that must be handled simultaneously and in a time-critical manner.

In the Phoenix area, multiple fire departments utilize Field Incident Technicians (FIT), or Battalion Safety Officers (BSO) paired with a Battalion Chief as part of a permanent incident

management team. These are company level officers, so in the case of Springfield, these would be Captains working in tandem with the command level officer, a Battalion Chief. This is a concept that the SFD has adopted so as to provide for more effective, efficient, and safer incident command operations. **The SFD is to be commended for the use of FIT/BSO personnel, which CPSM considers to be a Best Practice.**

When teamed with a battalion chief, in addition to normal safety officer functions, the FIT/BSO also fulfills the following roles and responsibilities:

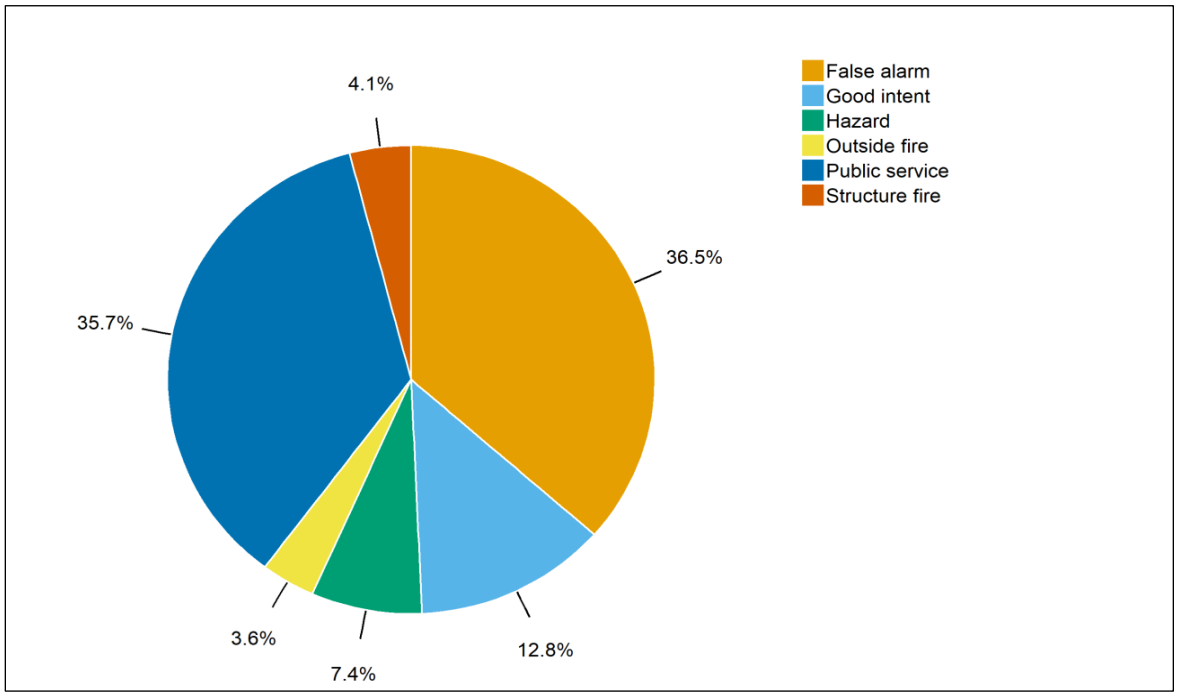
- Assist with managing the incident.
- Define, evaluate, and recommend changes to the incident action plan.
- Provide direction on tactical priorities and specific critical fireground factors.
- Become the Incident Safety Officer.
- Manage personnel accountability on the incident.
- Evaluate the need for additional resources.
- Assign logistics responsibilities.
- Assist with the tactical worksheet for control and accountability.
- Evaluate the fireground organization and span of control.
- Assist with personnel air management.
- Manage crew work/rest cycles and rehab.
- Other duties as necessary.

The following table and figure show the fire call totals for the 12-month period evaluated by CPSM, including number of calls by type, average calls per day, and the percentage of calls that fall into each call type category. During the year studied, SFD responded to 19,668 calls, an average of 53.9 calls per day, including 4.4 canceled calls and 0.2 mutual aid calls. Of these, 6,476 were fire calls, of which 264 were structure fire calls and 233 were outside fire calls. Fire call types were 32.9 percent of the total calls for service, a somewhat higher percentage than we normally see in departments that are heavily involved in the provision of EMS services in their community. Actual fire calls (structural and outside) were 2.5 percent of the overall calls for service (approximately 1.4 calls per day or one actual fire-type incident every 17.1 hours). The 497 actual fires represent 7.6 percent of the fire-related incidents. False alarms, public service, and good intent calls represent the largest percentage of fire-type calls for service. This experience is typical in CPSM data and workload analyses of other fire departments.

TABLE 5-24: Fire Calls by Type and Number, and Percent of All Calls

Call Type	Number of Calls	Calls per Day	Call Percentage
False alarm	2,363	6.5	12.0
Good intent	829	2.3	4.2
Hazard	476	1.3	2.4
Outside fire	233	0.6	1.2
Public service	2,311	6.3	11.8
Structure fire	264	0.7	1.3
Fire Total	**6,476**	**17.7**	**32.9**

FIGURE 5-23: Fire Calls by Type and Percentage



The data in this table and figure tell us that:

- Fire calls for the year totaled 6,476 (32.9 percent of all calls), an average of 17.7 per day.
- Structure and outside fires combined for a total of 497 calls during the year, an average of 1.4 calls per day or one actual fire-type incident every 17.1 hours. These accounted for 7.6 percent of fire calls and 2.5 percent of total calls.
- A total of 264 structure fire calls accounted for 4.1 percent of the fire calls.
- A total of 233 outside fire calls accounted for 3.6 percent of the fire calls.
- False alarm calls made up the highest percentage fire category calls at 36.5 percent. This was an average of 6.5 calls per day and 12 percent of total calls.
- The second highest number of calls was public service calls, at 35.7 percent of fire calls.

An additional analysis of fire response was conducted regarding the workload of incident types. The following table shows that the largest percentage of fire responses (88.8 percent) lasted less than 30 minutes. This suggests that most fire incidents were relatively minor in nature. However, it can also suggest that a rapid and adequate response by the fire department allowed the incident to be mitigated before it escalated into a larger, more serious situation. The second largest amount of fire responses (8.0 percent) lasted 30 minutes to an hour. Just 2.6 percent of fire incidents lasted between one and two hours, while 0.6 percent were two hours or longer in duration. These longer incidents would indicate more significant events. Overall, the SFD has about 17 fire incidents per month—3.9 per week or about 0.6 per day—which last longer than one hour.

TABLE 5-25: Fire Calls by Type and Durations

Call Type	Less than 30 Minutes	30 Minutes to One Hour	One to Two Hours	More Than Two Hours	Total
False alarm	2,185	160	18	0	2,363
Good intent	776	47	6	0	829
Hazard	314	111	40	11	476
Outside fire	175	40	17	1	233
Public service	2,209	90	10	2	2,311
Structure fire	92	73	76	23	264
Fire Total	**5,751**	**521**	**167**	**37**	**6,476**

The following figure shows the workload of fire responses by number of units that arrived on scene to these incident types.

TABLE 5-26: Calls by Number of Units Arriving – Fire

Call Type	Number of Units				Total Calls
	One	Two	Three	Four or More	
False alarm	1,677	421	249	16	2,363
Good intent	735	34	13	47	829
Hazard	332	37	71	36	476
Outside fire	196	16	12	9	233
Public service	2,230	57	19	4	2,310
Structure fire	15	38	35	176	264
Fire Total	**5,185**	**603**	**399**	**288**	**6,475**

The data in this table tells us that:

- On average, 1.4 units arrived at each fire call.
- For fire calls, one unit arrived 80.0 percent of the time, two units arrived 9.3 percent of the time, three units arrived 6.2 percent of the time, and four or more units arrived 4.4 percent of the time.
- For outside fire calls, three or more units arrived 9.0 percent of the time.
- For structure fire calls, three or more units arrived 79.9 percent of the time. An average of 5.0 units arrived at a structure fire call.

TABLE 5-27: Annual Runs and Deployed Time by Run Type

Call Type	Deployed Minutes per Run	Annual Hours	Percent of Total Hours	Deployed Minutes per Day	Annual Runs	Runs per Day
False alarm	12.9	1,096.6	13.3	180.3	5,120	14.0
Good intent	13.4	316.4	3.8	52.0	1,416	3.9
Hazard	27.0	445.7	5.4	73.3	990	2.7
Outside fire	20.8	143.2	1.7	23.5	413	1.1
Public service	14.6	617.2	7.5	101.5	2,533	6.9
Structure fire	39.8	1,197.6	14.6	196.9	1,806	4.9
Fire Total	**18.7**	**3,816.7**	**46.4**	**627.4**	**12,278**	**33.6**

Analysis of the data found in this table tells us that:

- Fire runs accounted for 46 percent of the total department workload. In other words, although fire calls accounted for just about one-third of incidents, they accounted for nearly one-half the total hours that units were deployed.
- The average deployed time for fire runs was 18.7 minutes. The deployed time for all fire runs averaged 10.5 hours per day.
- There were 2,219 runs for structure and outside fire calls combined, with a total workload of 1,340.9 hours. This accounted for 16 percent of the total department workload.
- Accounting for 12 engines and 3 ladder trucks operating for a total of 131,400 hours annually, structure and outside fire calls amounted to 1.02 percent of available time.

Of the 497 fires in Springfield, both structure and outside, 178 (35.8 percent) resulted in no reported loss. Two hundred sixty-two fires (52.7 percent) reported damage of under $25,000. This includes 87 outside fires and 175 structure fires. Fifty-seven fires (11.5 percent) comprised of 51 structure fires and six outside fires saw damage in excess of $25,000 each.

The following two tables break down the loss due to fire in Springfield during the period analyzed.

TABLE 5-28: Total Fire Loss Above and Below $25,000

Call Type	No Loss	Under $25,000	$25,000 plus
Outside fire	140	87	6
Structure fire	38	175	51
Total	**178**	**262**	**57**

TABLE 5-29: Content and Property Loss – Structure and Outside Fires

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Outside fire	$765,781	90	$337,625	33
Structure fire	$2,678,431	186	$860,148	174
Total	**$3,444,212**	**276**	**$1,197,773**	**207**

Other information derived from the fire loss data for Springfield includes:

- Out of 264 structure fires, 186 recorded property losses, with a combined $2,678,431 in losses.
- 174 structure fires recorded content losses, with a combined $860,148 in losses.
- The average total loss for all structure fires was $15,657.
- The highest total loss for a structure fire was $220,000.
- Out of 233 outside fires, 90 recorded property losses, with a combined $765,781 in losses.
- 33 outside fires recorded content losses, with a combined $337,625 in losses.
- The average total loss for outside fires with loss was $11,865.
- The highest total loss for an outside fire was $600,000.

In terms of fire loss comparisons nationwide for structure fires, the NFPA estimates that in 2020, the average community in the United States with a population between 100,000 and 249,999 had an average of 3.4 actual fires per 1,000 residents. For Springfield, this would equate to approximately 388 actual fires. With the number of actual fires amounting to 497, Springfield's fire experience is 28 percent greater than average for its population size. Overall, the average fire department in communities with this size range averaged 191 fires. While Springfield's fire loss is relatively low compared to the risks in the community it protects, it is important to keep in mind that at any time a single fire can occur that results in millions of dollars in fire loss.

Fire Preplanning

An important part of risk management in the fire service is pre-fire planning inspections by fire companies of large, high hazard, and complex buildings in each fire response zone. Conducting pre-fire surveys by fire companies can have a significant impact on both potentially reducing structural fire loss and on reducing firefighter injuries. By improving firefighters' understanding of complex building layouts, standpipe locations, etc., as well as by identifying any structural changes and possible code violations, suppression ground activities can be improved and potential firefighter injuries avoided.

The process of identifying target hazards and pre-incident planning are basic preparedness efforts that have been key functions in the fire service for many years. In this process, critical structures are identified based on the risk they pose. Then, tactical considerations are established for fires or other emergencies in these structures. Consideration is given to the activities that take place (manufacturing, processing, etc.), the number and types of occupants (elderly, youth, handicapped, imprisoned, etc.), and other specific aspects relating to the construction of the facility or any hazardous or flammable materials that are regularly found in the building. Target hazards are those occupancies or structures that are unusually dangerous when considering the potential for loss of life or the potential for property damage. Typically, these occupancies include hospitals, nursing homes, and high-rise and other large structures. Also included are arenas and stadiums, industrial and manufacturing plants, and other buildings or large complexes.

NFPA's 1620, *Recommended Practice for Pre-Incident Planning*, identifies the need to utilize both written narrative and diagrams to depict the physical features of a building, its contents, and any built-in fire protection systems. Information collected for pre-fire/incident plans includes, but is certainly not limited to, data such as:

- The occupancy type.
- Floor plans/layouts.
- Building construction type and features.
- Fire protection systems (sprinkler system, standpipe systems, etc.).
- Utility locations.
- Hazards to firefighters and/or firefighting operations.
- Special conditions in the building.
- Apparatus placement plan.
- Fire flow requirements and/or water supply plan.
- Forcible entry and ventilation plan.

The information contained in pre-incident fire plans allows firefighters and officers to have a familiarity with the building/facility, its features, characteristics, operations, and hazards, thus enabling them to conduct firefighting and other emergency operations more effectively, efficiently, and safely. Pre-incident fire plans should be reviewed regularly and tested by periodic table-top exercises and on-site drills for the most critical occupancies.

The Springfield Fire Department has an active, ongoing pre-fire planning program that has resulted in the development of plans for a significant number of the identified target hazard structures in the city. Each company is required to do one pre-plan per quarter, so with 15 companies, each shift is doing approximately 60 pre-plans per year, or 180 department-wide. The pre-plans have traditionally been completed on paper but more recently they are being loaded into computers and the CAD system so they will be more readily available to personnel on the incident scene.

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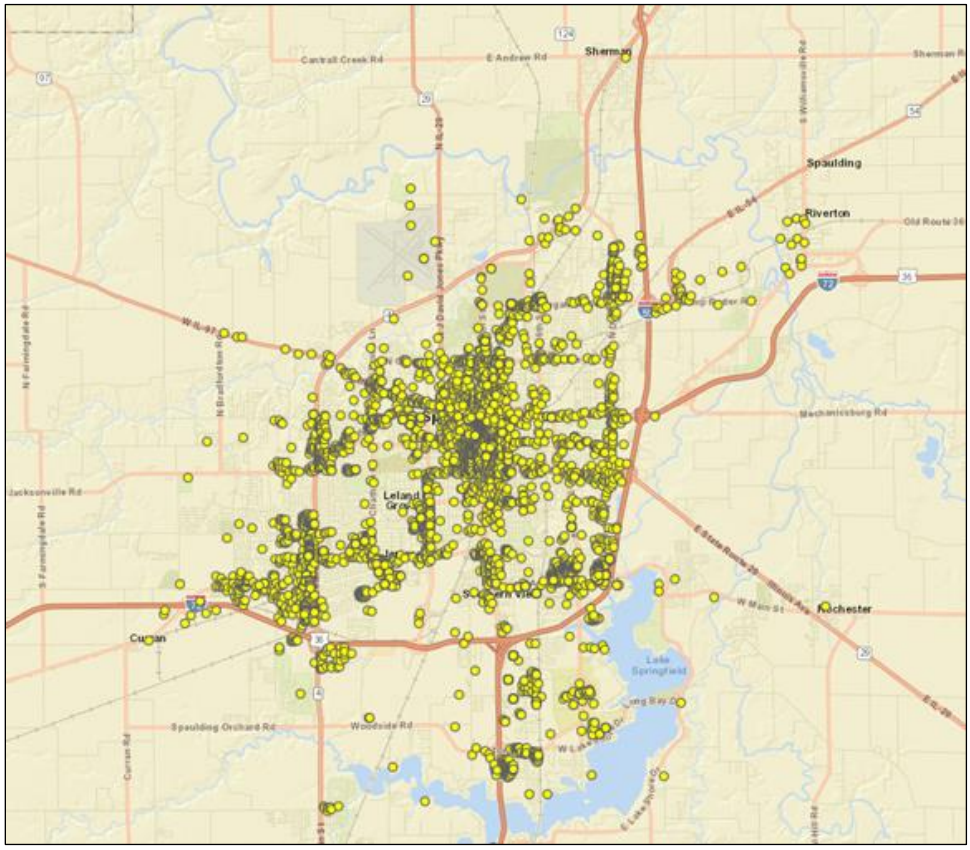
FIGURE 5-24: SFD Completed Pre-plan Locations



Recommendation:

- CPSM recommends that as a planning objective, the SFD should continue to make pre-plan development a high priority until such time as plans have been developed for all high- and medium-hazard occupancies located in the city, placing a high priority on those identified structures that are not protected by automatic sprinkler systems. (Recommendation No. 24.)

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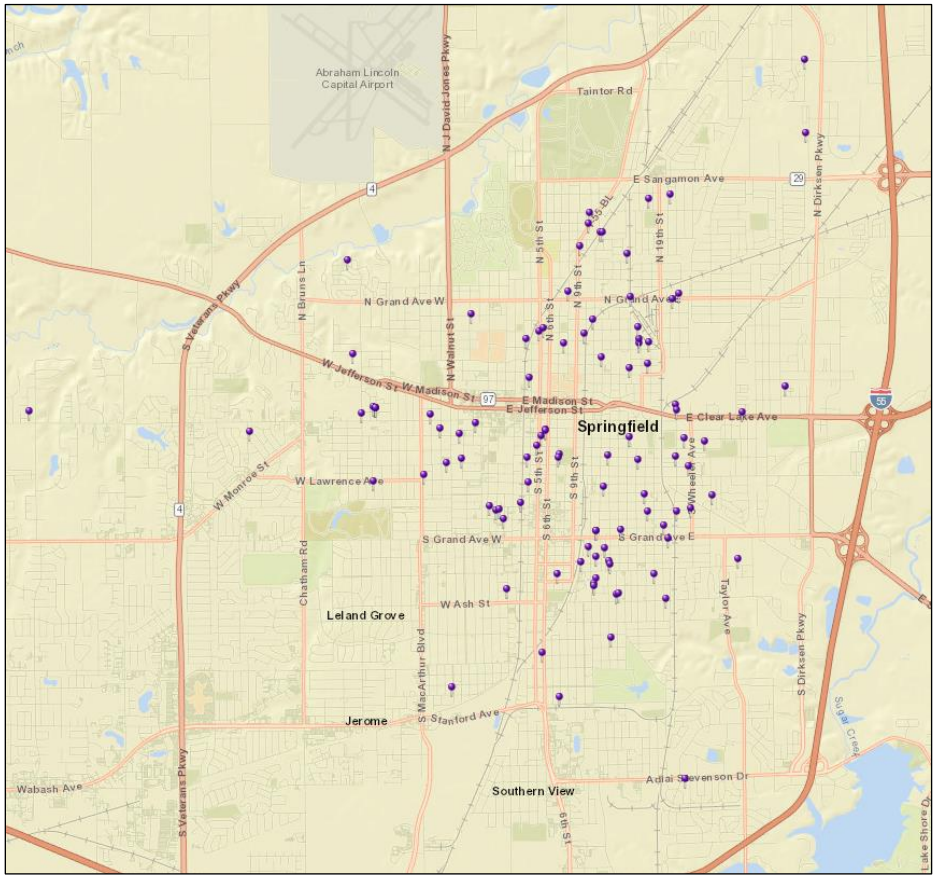
An increasingly important part of fire department risk identification, assessment, and management is the identification of unsafe structures in the city that could pose an increased, and often unnecessary, risk to firefighters during a fire situation. Once these buildings have been identified they should be marked as being unsafe. In the event of a fire, unless the fire is still a small, incipient fire, which can be extinguished quickly and safely, operations at these structures should be limited to exterior, defensive operations. The SFD has compiled an inventory of the locations of these buildings throughout the city.

FIGURE 5-25: SFD Unsafe Structures Locations



EMS OPERATIONS

Emergency medical service (EMS) operations are an important component of the comprehensive emergency services delivery system in any community. Together with the delivery of police and fire services, it forms the backbone of the community's overall public safety net. As will be noted in several sections of this report, the SFD, like most fire departments, responds to significantly more emergency medical incidents and low acuity incidents than actual fires or other types of emergency incidents.

The EMS component of the emergency services delivery system is more heavily regulated than the fire side. In addition to National Fire Protection Association (NFPA) Standard 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* (2020 edition), NFPA 450 *Guidelines for Emergency Medical Services (EMS) and Systems*, (2017 edition), provides a template for local stakeholders to evaluate an EMS system and to make improvements based on that evaluation. The Commission on Accreditation of Ambulance Services (CAAS)[42] also promulgates standards that are applicable to their accreditation process for ambulance services. In addition, the Illinois Department of Public Health, Division of Emergency Medical

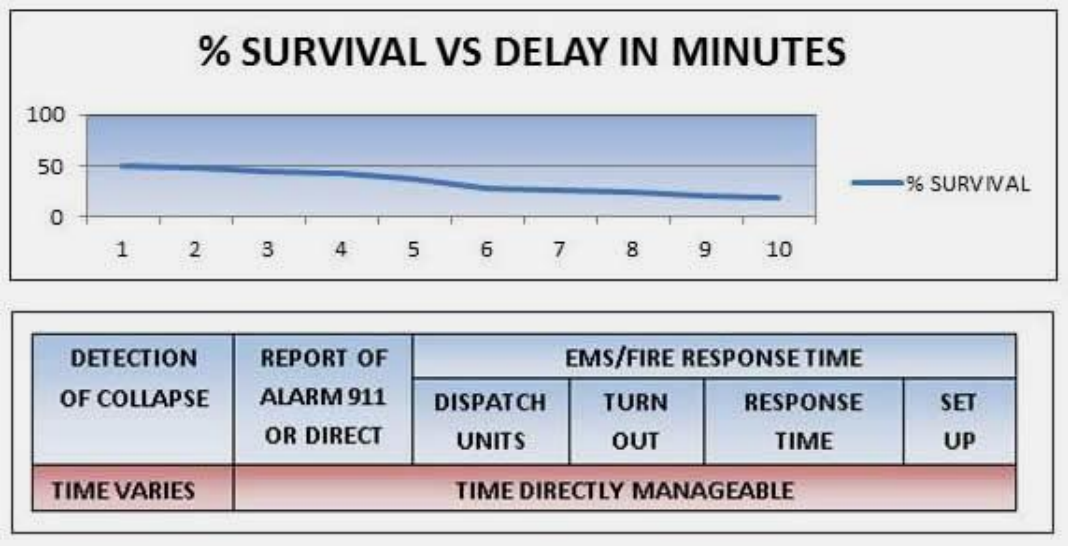
42. The Commission on Accreditation of Ambulance Services (CAAS) is an independent commission that established a comprehensive series of standards for the ambulance service industry.

Systems (EMS) & Highway Safety[43] regulates EMS agencies. Certain federal Medicare regulations are also applicable.

As a percentage of overall incidents responded to by the emergency agencies in most communities, it could be argued that EMS incidents constitute the greatest number of "true" emergencies, where intervention by trained personnel does truly make a difference, sometimes literally between life and death.

Heart attack and stroke victims require rapid intervention, care, and transport to a medical facility. The longer the time duration without care, the less likely the patient is to fully recover. Numerous studies have shown that irreversible brain damage can occur if the brain is deprived of oxygen for more than four minutes. In addition, the potential for successful resuscitation during cardiac arrest decreases exponentially with each passing minute that cardiopulmonary resuscitation (CPR), or cardiac defibrillation, is delayed (see following figure).

FIGURE 5-26: Cardiac Arrest Survival Timeline



The figure illustrates that the potential for successful resuscitation during cardiac arrest decreases exponentially, by 7 percent to 10 percent, with each passing minute that cardio-pulmonary resuscitation (CPR) or cardiac defibrillation and advanced life support intervention is delayed. The figure also illustrates few attempts at resuscitation after 10 minutes are successful.

First-tier emergency medical services (EMS) for the City of Springfield are provided at the Intermediate Life Support (ILS) first responder level by the SFD. The SFD is also responsible for the oversight of EMS operations citywide. Three private, for-profit ambulance companies, America, Life Star, and AMT/Medics First, provide the second tier (ground transport) at the ILS/ALS level. Intermediate/Advanced Life Support or I/ALS-level care refers to prehospital interventions that can be brought into the field by intermediate level emergency medical technicians (EMT-I) or paramedics. Typically, this service level includes the ability to bring much of the emergency room capability to the patient. Intermediate EMT-I personnel can administer intravenous fluids and certain drugs, manage/intubate a patient's airway, utilize the capabilities of a 12-lead cardiac monitor, and provide a vital communication link to the medical control physician who

43. https://dph.illinois.gov/topics-services/emergency-preparedness-response/ems.html

can provide specific medical direction based on the situation. Paramedics can provide more advanced interventions and additional drug therapy.

All SFD personnel are minimally trained and certified to the emergency medical technician–basic level (EMT-B). All new firefighters are required to be certified to at least the EMT-I level and a few who are paramedics. All SFD engines and the squad (when staffed) operate with EMT-I or paramedic capabilities 24/7. The three trucks only have BLS capabilities.

At the time of this study, each of the three private companies that provide transport service to the city were nominally staffing a total of six units on a 24/7 basis; they respond from their respective stations or deployment locations. All the EMS units are equipped with an automatic vehicle location (AVL) system that allows the nearest available unit to be dispatched. However, these ambulances are not necessarily dedicated just to the city; they cover the entire county. The ambulance companies are also simultaneously doing interfacility and non-emergency transports, which often reduce the number of units available for 9-1-1 coverage.

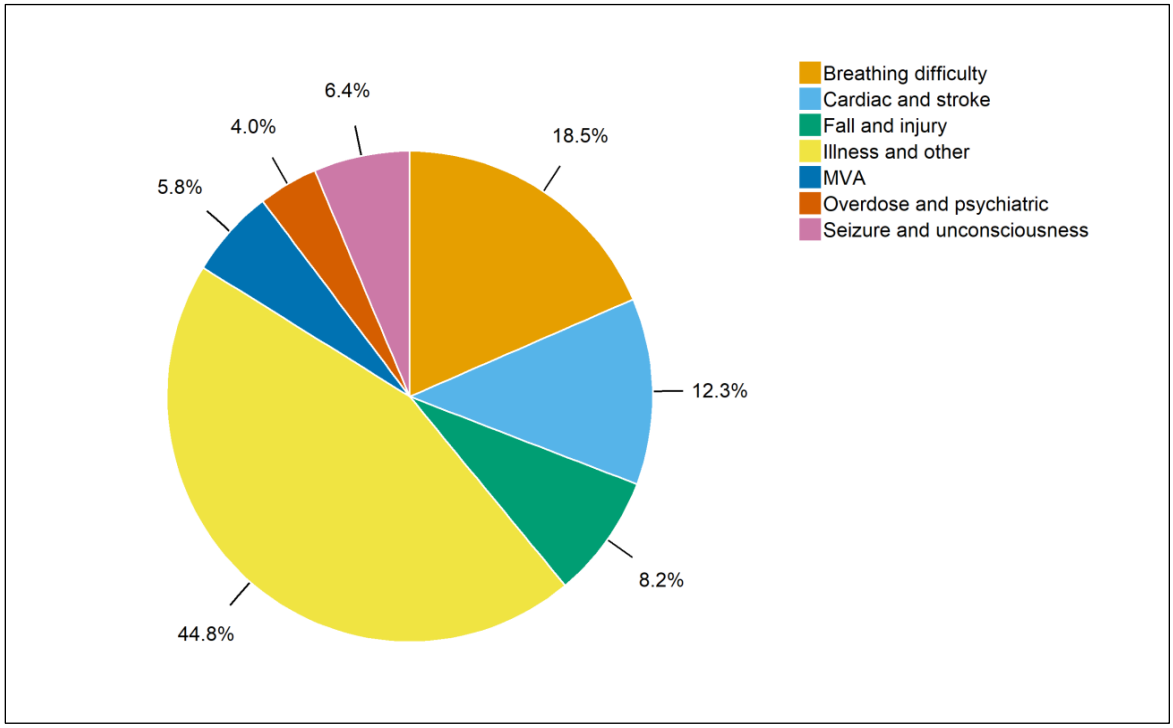
In most cases, except for critical, life-threatening emergencies, once the ambulance arrives on scene, SFD transfers patient care to the ambulance personnel. However, with critical patients such as significant trauma, serious cardiac, and other high-risk medical calls, SFD personnel often continue to assist the ambulance personnel with administering care on the way to the hospital. In addition, the SFD also provides "riders" for ALS companies from out-of-town or local ALS units when a patient's condition deteriorates while transporting to the hospital. In these cases, SFD personnel meet with the ambulance unit and assist for the remainder of the transport.

During the period analyzed for this study, the SFD responded to 11,466 EMS calls, which accounted for 58.3 percent of all incidents the department responded to. This percentage is lower than what CPSM typically sees in our studies of fire departments, which is typically between 70 percent and 80 percent of calls. Springfield is an older, urban area where there tends to be a higher number of fire-related incidents. Conversely, if false alarms, good intent, and public service calls for service that are listed under fire are factored out, it increases the percentage of workload in EMS considerably. The following table and figure show the EMS call totals for the 12-month period evaluated for this study, including number of calls by type, average calls per day, and the percentage of calls that fall into each call type category.

TABLE 5-30: EMS Calls by Type and Number, and Percent of All Calls

Call Type	Number of Calls	Calls per Day	Call Percentage
Breathing difficulty	2,124	5.8	10.8
Cardiac and stroke	1,408	3.9	7.2
Fall and injury	937	2.6	4.8
Illness and other	5,140	14.1	26.1
MVA	670	1.8	3.4
Overdose and psychiatric	453	1.2	2.3
Seizure and unconsciousness	734	2.0	3.7
EMS Total	**11,466**	**31.4**	**58.3**

FIGURE 5-27: EMS Calls by Type and Percentage



The EMS call data tells us that:

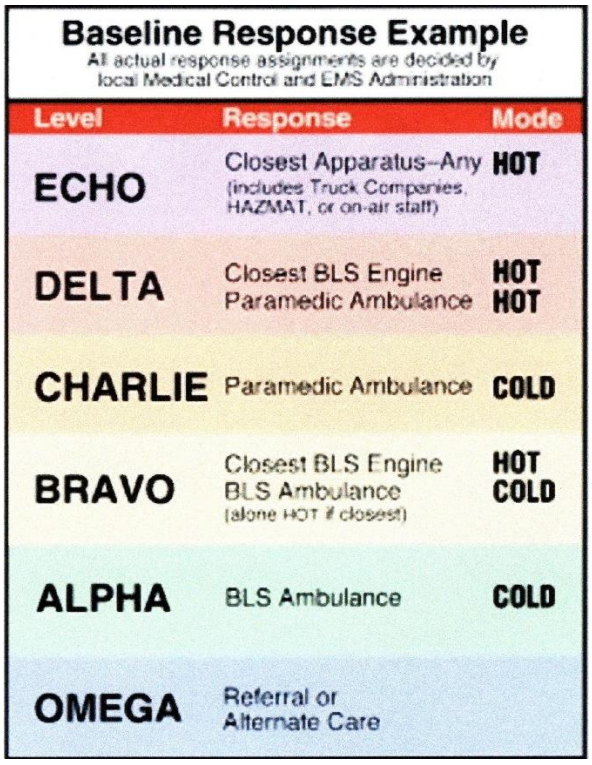
- EMS calls for the year totaled 11,466 (58 percent of all calls), an average of 31.4 calls per day.
- Illness and other calls were the largest category of EMS calls at 45 percent of EMS calls, an average of 14.1 calls per day.
- Cardiac and stroke calls made up 12 percent of EMS calls, an average of 3.9 calls per day.
- Motor vehicle accidents made up 6 percent of EMS calls, an average of 1.8 calls per day.

Regarding cardiac and related emergencies, some communities have started pilot programs that incorporate trained volunteers into the emergency medical response system. The American Heart Association continues to recognize the chain of survival by early recognition, early CPR, early defibrillation, and rapid transport. PulsePoint® is an iPhone app that can be downloaded by anyone in the community who is willing to participate in this program, enabling them to be notified when someone is having a cardiac arrest in their vicinity. Fifty-seven percent of adults in the United States say they have had CPR training. Utilizing new technology, bystander performance, and active citizen involvement can enhance the care provided to the community and potentially increase survivability.

The public safety answering point (PSAP) for 9-1-1 calls in the City of Springfield is the Sangamon County Central Dispatch System (SCCDS). The county utilizes the New World Computer-Aided Dispatch (CAD) system along with Priority Dispatch for call screening and classification; however, it is not fully triaging the calls for Emergency Medical Dispatch (EMD) to classify emergency medical calls as to their severity. In an EMD system, trained telecommunicators—using locally approved EMD guide cards—quickly and properly determine the nature and priority of the call, dispatch the appropriate response, then if necessary give the caller instructions to help treat the patient until the responding EMS unit(s) arrive(s). It also allows the dispatch of the appropriate

number and type of response units based upon the severity of the call and upon resource availability. Current practice in Springfield is for the SFD to be dispatched along with the ambulance to all EMS calls, except for those originating from a doctor's office, regardless of severity. The SCCDS indicated that it would be willing to do true EMD provided that the New World and Priority Dispatch systems have that capability. The following figure indicates a typical EMD dispatch matrix.

FIGURE 5-28: EMD Dispatch Matrix



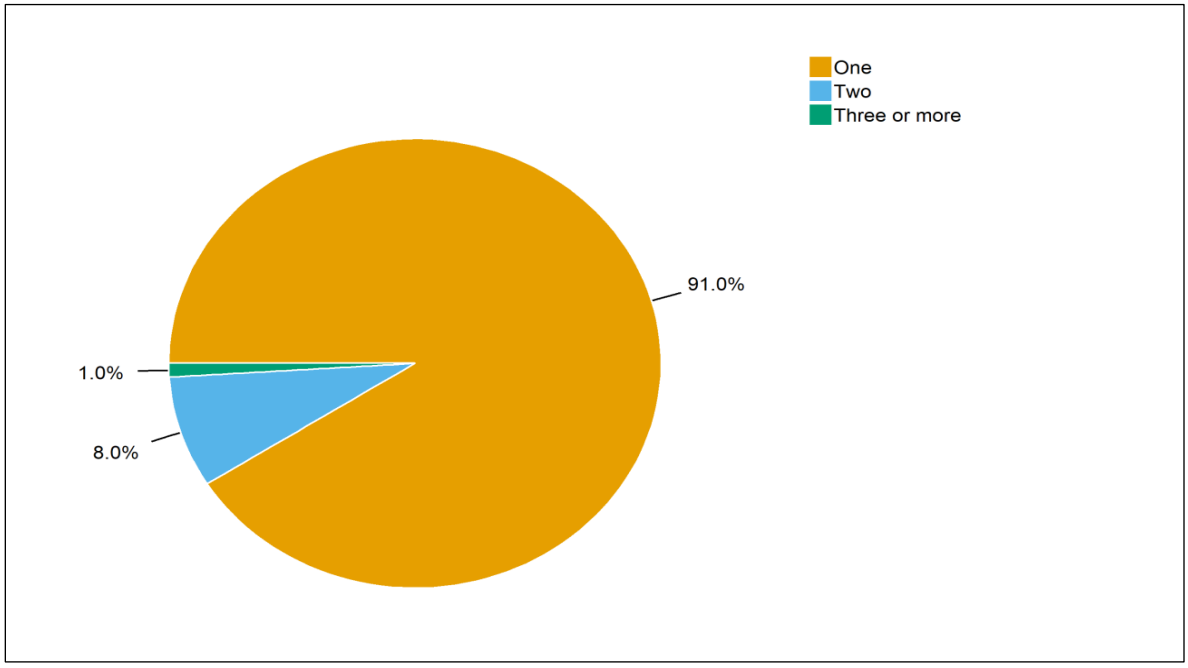
Baseline Response Example

All actual response assignments are decided by local Medical Control and EMS Administration

Level	Response	Mode
ECHO	Closest Apparatus–Any (includes Truck Companies, HAZMAT, or on-air staff)	HOT
DELTA	Closest BLS Engine Paramedic Ambulance	HOT HOT
CHARLIE	Paramedic Ambulance	COLD
BRAVO	Closest BLS Engine BLS Ambulance (alone HOT if closest)	HOT COLD
ALPHA	BLS Ambulance	COLD
OMEGA	Referral or Alternate Care	

The following figure shows the number of SFD units that arrived at various types of EMS-related incidents. This analysis does not examine the number of ambulances or units from the transport companies on a call. On average, 1.1 units arrived on the scene of each EMS call. This figure tells us that single fire unit responses to EMS incident types (91.0 percent) make up the largest EMS response workload. Two units arrived just 8.0 percent of the time and three or more units did so on 1.0 percent of incidents. The data analysis shows us that Engine 1 has the highest fire apparatus EMS response workload with 1,410 calls out of 2,576 total responses (54.7 percent). Engine 11 had the lowest fire apparatus EMS response workload with 449 calls out of 992 total responses (45.3 percent).

FIGURE 5-29: Calls by Number of SFD Units Arriving – EMS



An additional analysis of fire response was conducted regarding the workload of incident types. The following table shows that the largest amount of EMS responses (89.7 percent) lasted less than thirty minutes.

TABLE 5-31: EMS Calls by Type and Duration

Call Type	Less than 30 Minutes	30 Minutes to One Hour	One to Two Hours	More Than Two Hours	Total
Breathing difficulty	1,965	144	15	0	2,124
Cardiac and stroke	1,342	62	4	0	1,408
Fall and injury	822	100	14	1	937
Illness and other	4,584	505	48	3	5,140
MVA	504	133	30	3	670
Overdose and psychiatric	404	48	1	0	453
Seizure and unconsciousness	665	64	5	0	734
EMS Total	**10,286**	**1,056**	**117**	**7**	**11,466**

The preponderance of short-duration deployments is most likely directly related to the fact that the SFD generally provides just initial patient care or supports and assists the EMS crew and then transfers care to the transport ambulance crew. However, more than one in ten, or 10.3 percent of EMS calls, lasted more than 30 minutes. Overall, the SFD has about 3.2 EMS incidents per day that last longer than 30 minutes. The categories of incidents with the most calls longer than 30 minutes are illness and other with 1,061, an average of 2.9 per day; MVAs with 166 (0.45 per day); and breathing difficulty with 159 (0.44 per day).

In Springfield, EMS operations are referenced under Article XL in the city code. Although the fire department is ultimately responsible for the EMS delivery system, the current process allows any

company to seek a permit to operate an EMS service within the city limits. However, the code contains no provisions for performance evaluations, metric reporting, cost sharing, or any other requirements. No request for proposal (RFP) is issued and none of the companies operate under a formally awarded contract with the city. Article XL provides for "six ambulances" that have been determined to be necessary but does not further look at whether those numbers can be adjusted up or down on non-peak, overnight hours in favor of additional units during the peak periods during the daytime.

In discussions with both SFD staff and ambulance providers, we found there is an increasing number of times when non-emergency transports and other activity occupies available units and thus lowers the number of units immediately available to handle 9-1-1 transports in the city. The ambulance companies transport 100 percent of all city and county FPD calls, then bill for all procedures performed, regardless of which agency (ambulance company or SFD) performed them. The SFD usually (but not always) receives replacement for the medical supplies used on calls; however, beyond that the SFD receives no compensation from any ambulance company or receiving hospitals for the treatments it performs prior to or during transport.

CPSM's recommendations on EMS will be provided later in this section because many are dependent on other changes to the existing system.

TECHNICAL RESCUE RESPONSE

By virtue of its position as the largest fire department in the area, along with the wide range of incidents it may experience that would require much more specialized training, skills, and capabilities, the SFD has multifaceted technical incident operational capabilities. The special operations teams represent a group of firefighter personnel that in addition to their firefighting duties and training have elected to diversify and train to meet the challenges and dangers of specific rescue environments.

The department's special operations capabilities are scattered throughout the city. These capabilities include high angle, confined space, and trench collapse technical rescue capabilities, in addition to normal vehicle extrication. There is also a marine rescue unit with dive capabilities. The department also has a certified level A hazardous materials response team. All these special operations capabilities are available for response to assist on incidents throughout Sangamon and surrounding counties.

Because of the specialized, often complex, and dangerous nature of special operations, it is imperative that the personnel who engage in these endeavors are well-trained and given opportunities to maintain their skills at the highest level possible. This requires training on a regular basis. The following list indicates the number of SFD personnel who have obtained technician level training and certification in various specialty disciplines:

- Hazardous Materials Technician: 41.
- Trench Technician: 36.
- Structural Collapse Technician: 26.
- Rope Technician: 26.
- Vehicle and Machinery Technician: 1.
- Rescue Specialist–Confined Space: 38.

MUTUAL AID

Mutual aid is an essential component of almost every fire department's operation. Except for the largest cities, no municipal fire department can, or should, be expected to have adequate resources to respond to and safely, effectively, and efficiently mitigate large-scale and complex incidents. Mutual aid is shared between communities when their day-to-day operational fire, rescue, and EMS capabilities have been exceeded, and this ensures that the citizens of the communities are protected even when local resources are overwhelmed.

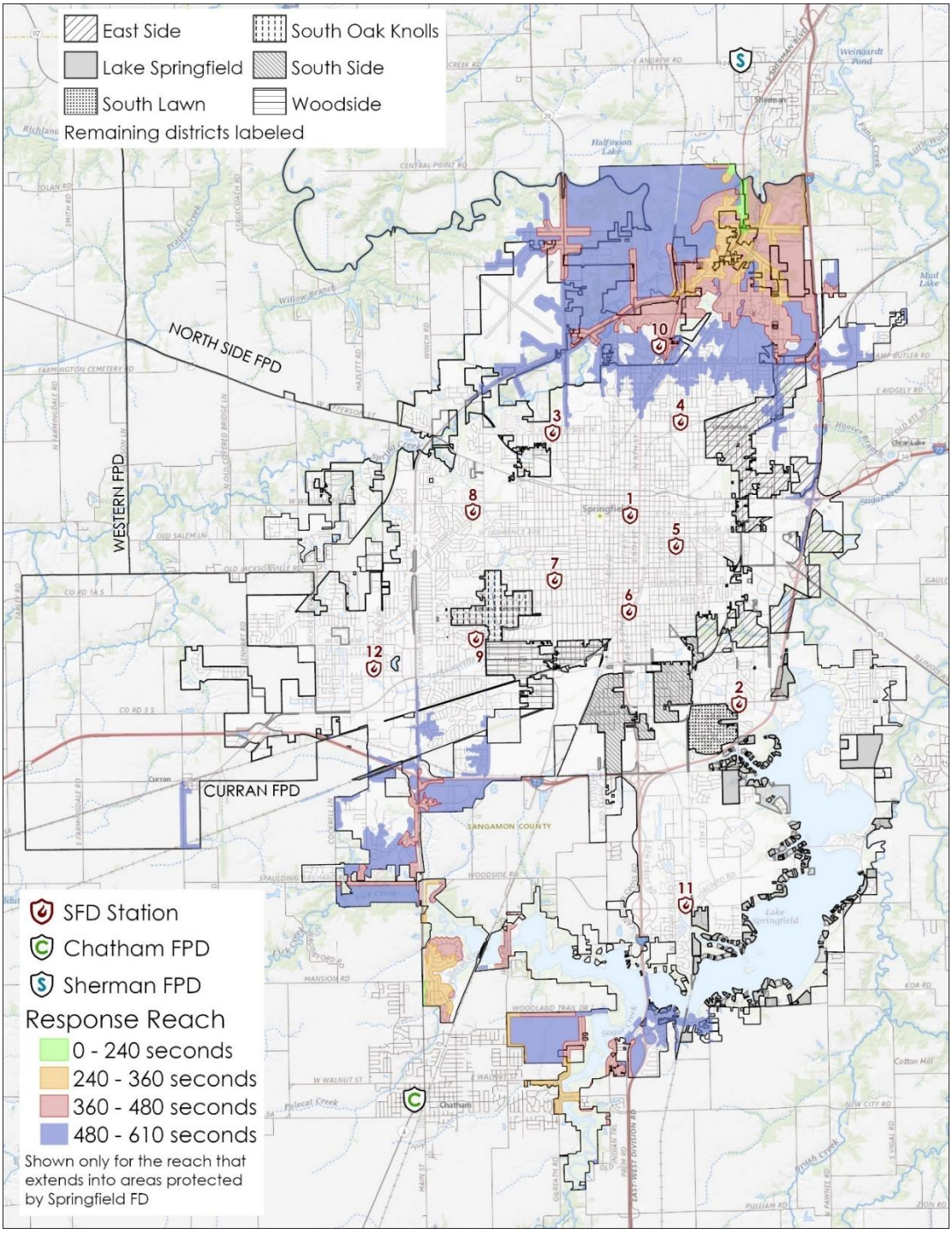
Automatic aid is an extension of mutual aid, wherein the resources from adjacent communities are dispatched to respond at the same time as the units from the jurisdiction where the incident is occurring. There are two basic principles for automatic aid, the first being that all jurisdictional boundaries are essentially erased, which allows for the closest, most-appropriate unit to respond to an incident, regardless of which jurisdiction it belongs to. The second is to provide, immediately and at the time of initial dispatch, additional personnel or resources that may be needed to mitigate the reported incident.

Automatic and mutual aid are generally provided without charge among the participants.

The SFD is a participant in the MABAS (Mutual Aid Box Alarm System), a statewide mutual aid response system for fire, EMS, and specialized incident operational teams. More locally, the SFD participates in limited automatic and mutual aid with its surrounding departments. This is primarily because of the city's somewhat isolated location and the fact that most of its surrounding departments are all-volunteer units whose availability and capabilities are often limited. However, the SFD does engage in more frequent mutual aid with both the Chatham FPD and the Sherman FPD. Both departments have small career or in-station staffs who provide 24/7 coverage and thus can better assure availability when needed.

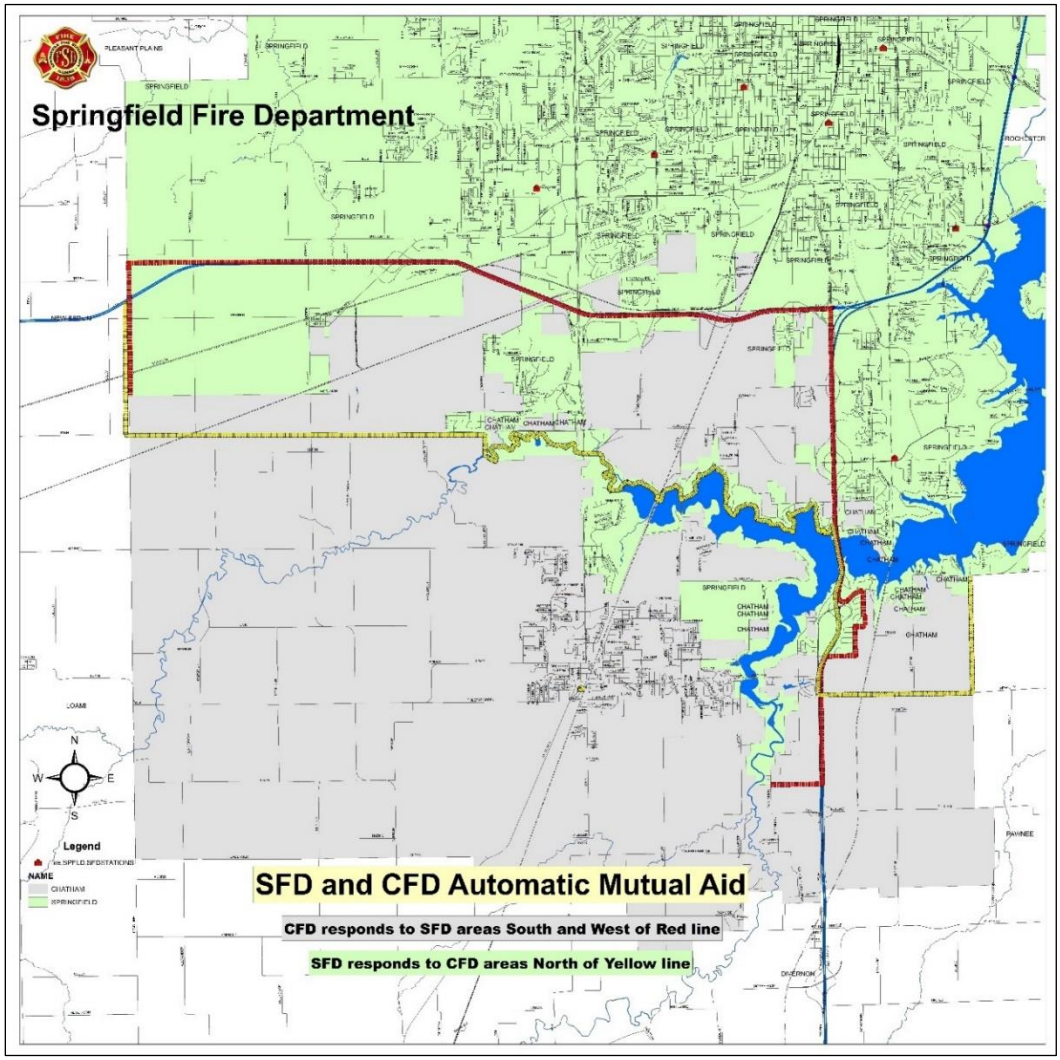
The following figure illustrates the location of SFD stations along with the location of the Chatham and Sherman stations and the response time bleeds in the City of Springfield and FPDs the SFD covers.

FIGURE 5-30: SFD, Chatham, and Sherman Station Locations with Response Time Bleeds



The SFD does engage in automatic aid for incidents located in the southwestern corner of the city and northern part of the Chatham FPD due to the proximity and response times from their respective stations. **The SFD is to be commended for the use of automatic aid into the southwest area of the city to provide improved response times, which CPSM considers to be a Best Practice.**

FIGURE 5-31: SFD and Chatham FPD Automatic Aid



Both the Chatham and Sherman chiefs expressed a willingness to provide additional mutual aid to the SFD when needed, particularly for large or significant incidents. The most likely resource these departments would provide to Springfield other than the current joint responses between the SFD and Chatham would be ladder trucks for major/multiple alarm fires. Both Chatham and Sherman informed CPSM that their departments do not train jointly with the SFD on a regular basis. Both felt that more interaction through training would be mutually beneficial.

Recommendations:

- CPSM recommends that the SFD include mutual aid from the Chatham and Sherman FPDs on their box assignments/running cards when appropriate for major/multiple alarm incidents that occur within the city. (Recommendation No. 25.)
- CPSM recommends that the SFD work with both the Chatham and Sherman FPDs to conduct joint training exercises to assist with creating familiarity of both operations and personnel. (Recommendation No. 26.)

PRINCIPAL FINDINGS: COMMUNITY RISK / CRITICAL TASKING FOR STANDARDS OF COVER

- What are normally considered to be low-risk occupancies—that is, single family dwellings—represent a significant share of the occupancy risk in Springfield. A significant part of the housing stock consists of residential units that are large, multistory, and multifamily types of occupancies. In this type of structure, the fire challenges are going to be much more complex and conducive to rapid fire spread through areas such as attics and basements. Fire extension between closely spaced, wood-frame dwellings is also a significant concern. For this reason, CPSM considers at least a portion of Springfield's residential occupancies to be more in the moderate-risk category.
- Medium-risk occupancies consist of multiple apartment complexes and multifamily dwellings. Commercial and mixed-use type occupancies that combine both commercial and residential use occupancies are located throughout the city. There are also several moderately sized industrial occupancies located throughout the city.
- The lowest number of occupancy risk sites, but those with the highest potential fire and life safety loss, are high-risk occupancies. There are two hospitals, multiple nursing homes, assisted living facilities, and schools in the city. The state capitol building could also be classified as a high-risk occupancy.
- There are 30 high-rise buildings in Springfield, and these present many more operational challenges than other types of structures. Consequently, reported fires in these buildings will require a significant commitment of personnel and should receive a larger initial response.
- In the critical tasking for structure fires, the SFD responds a higher effective response force (ERF) to low-risk calls for service when benchmarked against NFPA 1710 (low risk) and current research.
- For medium- and high-risk occupancies, and high-rise buildings, the SFD responds a lower effective response force when benchmarked against NFPA 1710 recommendations (Tables 5-9, 5-10, and 5-12). **Consideration as to the number of resources to dispatch to these types of incidents is listed after the respective tables.**
- For automatic fire alarm systems in low-risk occupancies the SFD responds with an appropriate apparatus complement but slightly less than a recommended ERF (Table 5-15).
- For automatic fire alarm systems in medium-risk occupancies the SFD responds with the recommended ERF (Table 5-16).
- For automatic fire alarm systems in high-risk occupancies the SFD responds less than a recommended ERF (Table 5-17). **Consideration as to the number of resources to dispatch to these types of incidents is included after the respective tables.**
- Of the remaining critical tasking categories not identified above, the SFD responds a greater ERF than recommended on two. While SFD responds a greater initial ERF than the critical tasking suggests may be necessary, many of these incidents can be complicated and require a large commitment of personnel and resources to mitigate successfully. As such, CPSM does not believe that any of the initial ERFs dispatched by SFD are unreasonably large and we are not recommending any reductions.
- Although risk management processes and appropriate call screening are important parts of determining the appropriate number of resources that should be initially dispatched to various

types of emergency incidents, it is also important that enough personnel and resources be initially available to handle all critical tasks in a timely manner should they need to be performed. For this reason, it is the widespread practice in the fire service to send multiple resources to incidents and which ultimately may not be utilized if the incident turns out to be a minor one that is easily mitigated. Even today, this remains a prudent approach. **It is in support of this concept that CPSM recommends modifications to the SFD's initial dispatch of resources to reported structure fire incidents.**

- Of the remaining critical tasking categories not identified above, the SFD responds with the recommended ERF to three categories of incidents and responds a smaller than recommended ERF to five.
- It should be noted that the numbers in these tables for SFD response do not reflect response by EMS personnel from the ambulance companies that can fill in EMS and patient care positions in the ERF, so once these are calculated in, the total response force may be higher.
- The SFD has implemented an important safety initiative utilizing Battalion Safety Officers (BSO) paired with a Battalion Chief as part of a permanent incident management team. This is a concept that the SFD has adopted to provide for more effective, efficient, and safer incident command operations. These are company level officers, so in the case of Springfield, these are Captains, who work in tandem with the command level officer, a Battalion Chief. **The SFD is to be commended for the use of FIT/BSO personnel, which CPSM considers to be a Best Practice.**
- At the time of this assessment the SCCDS used Priority Dispatch rather than a true EMD call screening and triaging/classification system. This results in the SFD responding to almost all medical incidents regardless of severity. This is not an optimal use of resources or personnel when many of these incidents would be classified as minor in nature.
- The SFD and the ambulance companies are facing a growing challenge with having sufficient ambulances available to provide timely response to all 9-1-1 medical calls that require a patient transport.

CURRENT STATE OF THE FIRE AND EMS DELIVERY SYSTEM

The current state of the fire and EMS delivery system in Springfield, from the operational perspective of the SFD, which includes external factors such as available staffing, risk, future city growth, development and redevelopment, available funding, and demand for service is, as analyzed and observed by CPSM, as follows:

- During this study, we observed a highly functional fire and EMS organization that strives to provide an exceptional level of service to the community and the region.
- The SFD is an excellent organization that provides a high-level of service to the city. The entire command staff work as a team to provide critical, and it appears effective, leadership to the department. Members of the department work as a team to produce a high-quality, effective, and efficient response that serves the city well. The SFD is clearly one of the better organizations that we have evaluated. It should also be noted that the department has implemented several Best Practices as noted herein.
- From all accounts, once they arrive on the scene of an emergency, SFD personnel perform their duties in an exceptional manner and can be counted upon to complete effectively and

efficiently the assignments given to them. They should be commended for their efforts and given the support they need to continue to try to be successful.

- The City of Springfield has an ISO rating of Class 1, the highest rating achievable. This rating was most recently designated in April 2018.
- The above opinions of the CPSM team notwithstanding, the SFD is confronted by many of the challenges that are facing fire service organizations across America. As the fire service has entered an all-hazards environment, the public has come to expect increased knowledge, skill, and ability from their firefighters, as well as a higher level of service and responsiveness.
- Based on the SFD's current deployment model, most of the city is within a 240 seconds of travel time for the first responding unit as recommended in NFPA 1710. In the more developed urban core of the city, there are locations where there is an overlap of this benchmark response time as the stations are situated closer together. Conversely, there are some areas of the city, mainly around the outer perimeter, along with several of the large fire protection districts, that are outside of the 240-second travel time benchmark. The city's unusual shape created by occasional annexation of additional land makes it difficult to optimally place resources for response.
- While there are a few pockets of the city that are not within 360 seconds of travel time for the second arriving engine, these are mostly in areas that are not developed and outside of the existing street network.
- The entire city is within a travel time of 480 seconds for the entire first alarm assignment for structure fire responses, and in some areas this time extends into surrounding areas of the county.
- With the current minimum staffing level of 49 personnel on duty at a time, the department's twelve engine companies and three ladders operate at what is considered to be understaffed with three personnel on each. In its most recent ISO evaluation, the SFD received significant point deficiency in *Credit for Company Personnel*, receiving only 8.30 out of 15.00 possible points.
- When responding to any incident with the potential for personnel to encounter an IDLH, units with staffing of three personnel have fewer tactical fire options until the arrival of additional personnel and resources.
- When units respond with just three personnel, the officers must assist with tasks such as stretching a line and therefore cannot properly perform duties such as initial size-up. In addition, the crews of two companies may need to be combined to accomplish tasks that a single engine should be able to perform, such as advancing a line to the upper floors of a building.
- The city averages about 1.4 actual fires per day. Although a limited number of these fires are significant, as detailed in this report, the city does have a high level of risk.
- With the current staffing on all companies, the SFD would be unable to meet NFPA 1710 recommended minimum personnel benchmarks for a second fire without the need for mutual aid if simultaneous, moderate risk or higher structure fires should occur.
- The current staffing levels necessitate the department must send a higher number of resources (engines and ladders) to assemble an ERF within an appropriate amount of time.

- The SFD provides the primary initial care and treatment for most EMS calls that occur in the city, yet it receives no revenue for the private ambulance companies which perform the transports to the hospital and then third-party bill the patient or their insurance company.
- The city does not have formal contracts with any of the three private ambulance companies that provide service to the city. As such there are no provisions for performance evaluations, metric reporting, cost sharing, or any other requirements that these companies must adhere to.
- There are an increasing number of times when non-emergency transports and other activity occupies the available ambulance transport units and thus lowers the number of units immediately available to handle 9-1-1 transports in the city. This results in SFD units spending extended periods of time committed on scene awaiting an ambulance.
- The current practice of dispatching SFD units to all medical calls except those originating from doctor's offices does not take advantage of proper call screening and classification and results in what are arguably unnecessary responses by SFD engine companies.
- Call processing (at dispatch) and turnout (in the station) times are much higher than recommended NFPA 1710 benchmarks.
- The heaviest demand for both fire and EMS services are concentrated in the areas closest to downtown Springfield.
- The first due unit was available to respond 82.8 percent of the time and arrived first on the scene of an incident 79.8 percent of the time.
- Thousands of people commute to Springfield to work each day, particularly when the legislature is in session (state workforce). In addition, thousands of others work in the city in order to be in proximity to the state government and those on state and related business, along with the medical facilities and institutions of higher learning. Estimates place these daily commuters at between 20,000 and 50,000.
- The city is the seat of Sangamon County government, which also has a major presence in the city including the county courthouse.
- The city is also the host to a federal building and U.S. Courthouse for the Central District of Illinois.
- 23.7 percent of the population of the city falls into higher risk categories of 65 years old or older (17.6 percent) and under age 5 (6.1 percent).
- Nearly one in five Springfield residents (18.6 percent) live below the poverty line.
- A significant percentage of property in the city is tax exempt. As the Illinois capital, Springfield must provide emergency services to many tax-exempt facilities but does not receive adequate funding through PILOT programs to provide them at recommended levels.
- Funding needs were prominently mentioned by many of the SFD stakeholders as a major obstacle for them moving forward. Conversely, the city has fiscal challenges that could impact its ability to provide the desired level of service.
- The city will need to make major investments in fire department capital infrastructure needs including facilities, apparatus, and equipment over the next several years.
- The city provides fire and EMS services to the Illinois State Fair which is located just outside the city. During its 11-day run in mid-August each year approximately 500,000 visit the fair.

SECTION 6. SUSTAINABILITY ALTERNATIVES

During the on-site visit in Springfield, CPSM was asked multiple times to provide recommendations for the creation of a "modern fire department." When questioned as to what this meant to the requestor, a variety of definitions for "modern" were provided by participants. These included one that operated more efficiently, one that followed NFPA 1710 regarding staffing, one that provided safety to citizens and visitors, as well as its members, more efficient station locations, one that utilized technology and so on.

There is no "right" amount of fire protection and EMS delivery for a community. It is a dynamic model based on such things as the expressed needs of the community, community risk, population growth, and ability/willingness of the community to fund the desired level of service. Providing the right amount of fire protection and EMS service, and by extension the number and status of personnel for a fire department, is based on several factors. First, the community must decide how to manage its level of risk based upon what resources it can afford to commit, and thereby avoid making the community vulnerable to an undesirable event. Fire departments also calculate risk levels for the community and their personnel in the form of a Community Risk Reduction Analysis, and Standards of Coverage (SOC). It is the responsibility of elected officials to translate community needs into reality through direction, oversight, and the budgetary process. It is their unenviable task to maximize fire and emergency medical services within the reality of the community's ability and willingness to pay, particularly in today's economic environment.

As mentioned previously, during this study, CPSM observed a highly functional fire and EMS organization that strives to provide an exceptional level of service to the community and the region. The entire command staff work as a team to provide critical and effective leadership to the department. Members of the department work in unison to produce a high-quality, effective, and efficient response that serves the city well. The SFD is clearly one of the better organizations that we have evaluated. It should also be noted that the department has implemented several best practices, as outlined herein.

The City of Springfield and SFD has earned an ISO rating of Class 1, the highest rating available, one secured by only about 400 fire departments nationwide (out of more than 40,000 rated). From all accounts, once they arrive on the scene of an emergency, SFD personnel perform their duties in an exceptional manner and can be counted upon to complete assignments effectively and efficiently. They should be commended for their efforts and given the support they need to continue to try to be successful.

In formulating our recommendations CPSM has relied on several widely accepted references for benchmarks and standards, industry best practices, as well as experience drawn from projects across the United States. These references include:

- The 9th Edition of the Fire and Emergency Service Self-Assessment Manual (FESSAM), @2015 by the Center for Public Safety Excellence Inc., Chantilly Virginia.
- Managing Fire and Emergency Services, @2012 by the International City-County Management Association, 777 N. Capitol Street NE, Washington, DC.
- National Fire Protection Association standards for deployment, EMS, safety, etc.

When considering ways to fine-tune the fire and EMS delivery system in Springfield that focusses on keeping pace with the evolving needs of the city, understanding the associated financial challenges, while still providing the outstanding service that the SFD's stakeholders now enjoy, CPSM offers several possible planning recommendation options for consideration by the city in the areas of staffing and deployment. We believe that several of these options can result in efficiencies in service delivery without loss of function. Several of these options have already been presented to the city by the fire chief. It is also important to emphasize that all SFD fire units are currently staffed with three personnel.

Alternative 1: Convert One Truck into a Quint and Close One Engine

While this option results in the elimination of an engine company at either Station 2 or Station 12, it does not result in the closure of a fire station so overall the level of fire management zone service – and initial response times - may not be impacted. There would still be a company responding from this location that can function as an engine or ladder as a Quint[44] staffed with a recommended crew of four. For fire incidents, if this unit was first due, the crew would function as an engine, for all others they would function as a truck company handling those mission critical duties including search and rescue, and ventilation. Although Quints are often touted as multifunctional vehicles—and in many respects they are—for any specific incident they are one company and can therefore perform only one job or function, that is engine **or** truck.

This option would potentially result in savings that includes personnel services and operations/maintenance of one response apparatus (engine) and will allow minimum staffing to be adjusted from 49 to 47 per shift or six overall (two per shift).

CPSM considers this alternative sensible as the city continues to examine potential efficiencies in city departments, and this alternative results in no loss of function and recommends a staffing of four on this unit. This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

Alternative 2: Convert Two Truck into Quints and Close Two Engines

While this option results in the elimination of a company at both Station 2 and Station 12, it does not result in the closure of either fire station so overall the level of service in the fire management zone – and initial response times - may not be impacted. There would still be a company responding from both locations with a recommended crew of four on each apparatus. For fire incidents, when these units are first due, the crew would function as an engine, for all others they would function as a truck company handling those mission critical duties including search and rescue, and ventilation. Although Quints are often touted as multifunctional vehicles—and in many respects they are—for any specific incident they are one company and can therefore perform only one job or function, that is engine **or** truck.

[44] A quint is a fire service apparatus that serves the dual purpose of an engine and a ladder truck. This type of fire apparatus provides the ability to perform five functions: pump, water tank, fire hose, aerial device, and ground ladders. For Springfield CPSM recommends that the quints have a minimum of a 100' aerial ladder, 1500 GPM pump, 500-gallon water tank, large diameter supply hose, and NFPA 1901 engine and ladder equipment compliments.

This option would potentially result in savings that includes personnel services and operations/maintenance of two response apparatus (engines) and will allow minimum staffing to be adjusted from 49 to 45 per shift or twelve overall (four per shift).

CPSM considers this alternative sensible as the city continues to examine potential efficiencies in city departments, and this alternative results in no loss of function and recommends a staffing of four on these units. This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

Alternative 2A: Convert Two Truck into Quints and Close Two Engines

This alternative is the same as Alternative 2, above, except that it also would increase the staffing on Truck 1 to four personnel per shift. This would put staffing at all three companies that function as truck companies at four personnel.

This option maintains the city's theme of modernization of city departments and finding efficiencies in service level delivery and achieves a level of savings in personnel services and operations/maintenance of two response apparatus (engines), and also allows minimum staffing to be adjusted from 49 to 46 per shift or nine overall (three per shift).

CPSM considers this alternative sensible as the city continues to examine potential efficiencies in city departments, and this alternative and it results in no loss of function, and, recommends a staffing level of four per shift on each Quint/aerial apparatus. This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

Alternative 3: Eliminate Battalion Safety Officers

This option does not result in the closure of any companies although it would allow minimum staffing to be reduced from 49 to 47 along with some cost savings. In long-gone eras in the fire department the Battalion Chief's aides were often referred to as drivers and did little more than that and helping the chief monitor the radio. Today, in progressive departments such as the SFD, these positions have evolved into an important incident management "team."

As discussed in more detail earlier in the report, a critical component of the incident command system is the establishment of the role of safety officer to monitor conditions at fires and emergency incident scenes to ensure that appropriate safety procedures are being followed. The incident safety officer is an important member of the incident command team. The safety officer works directly under and with the incident commander to help recognize and manage the risks that personnel take at emergencies. The concept of a command team recognizes that there is a shared responsibility for the proper and safe performance of personnel operating on the emergency scene. When teamed with a Battalion Chief, in addition to normal safety officer functions, the Captain also fulfills multiple other important roles and responsibilities on the fire ground to include continual 360 degree size-up and crew/scene accountability.

CPSM does not recommend this as an alternative because of the scene safety functions this role fulfills, which are integrated with the overall incident command system. An additional alternative to consider is, through attrition of company level Captains, replace the rank of this position with firefighter. Although not an elimination of the six Captain positions, this alternative will result in cost savings (difference between firefighter and Captain). This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

Alternative 4: Close a Station

Whenever municipalities discuss modernizing or streamlining the operations of their fire department, the subject of station closings usually occurs. Officials ask, *Do we have too many stations?* or *Could we move certain stations so that we do not need as many?* The criterion for placement of stations has evolved over the last 125 years from how far horses could run while pulling a heavy steamer to today's GIS-based travel time analysis that is based upon recommended consensus benchmarks. Also considered these days are the building and other risks in a fire management zone, as well as the fire and EMS incident demand in a particular fire management zone.

In Springfield, as in many communities, the fire stations are less than optimally located. They were often constructed based upon population and building growth, with little thought toward the future, availability of suitable land, etc. Although stations may have been correctly located when first constructed, communities often change considerably in the ensuing years, often making the location of a station operationally lacking for current needs and suggested resource deployments. This can result in uneven response districts, which can be seen with GIS mapping in Springfield. There is overlap in the response districts closer to downtown Springfield; this is normal in many communities as this is where the greatest risk and most incidents are usually located. Conversely, the more outlying areas have less overlap and there are still areas of the city that are outside of the recommended 240 seconds of travel time from the nearest station.

Closing almost any station is likely to result in uneasiness by those in the impacted area and will, in some way, negatively impact service delivery and response times at least for a portion of the response area. It can also have a domino effect on response time and incident management/mitigation to other areas by increasing travel distances and times for other companies, as well as increasing call volume. Permanently closing a station can have varying political consequences as well, as residents and business owners tend to value a certain level of protection that comes from having a staffed fire company close by that can respond quickly in the event of an emergency.

In Springfield, if there were to be a discussion regarding closing a station, Station 10 would be considered a primary candidate for the following reasons:

- Station 10 is not physically located in the city. It is located on the Illinois State Fairgrounds which lies just outside the city limits.
- Station 10 is not owned by the city. However, it is one of the newest and largest of the SFD stations.
- There were 1,158 calls in Engine 10's first due area during the period studied, which ranks 10th of the 12 first due districts.
- Engine 10 responded to 1,251 runs during the period studied, which ranked 11th of the 12 engines.

Figure 6-1 shows the current station configuration and response bleeds and diamonds with Station 10. Figure 6-2 shows a hypothetical station configuration wherein Station 10 is closed.

FIGURE 6-1: SFD Travel Time Bleeds and Diamonds with Station 10

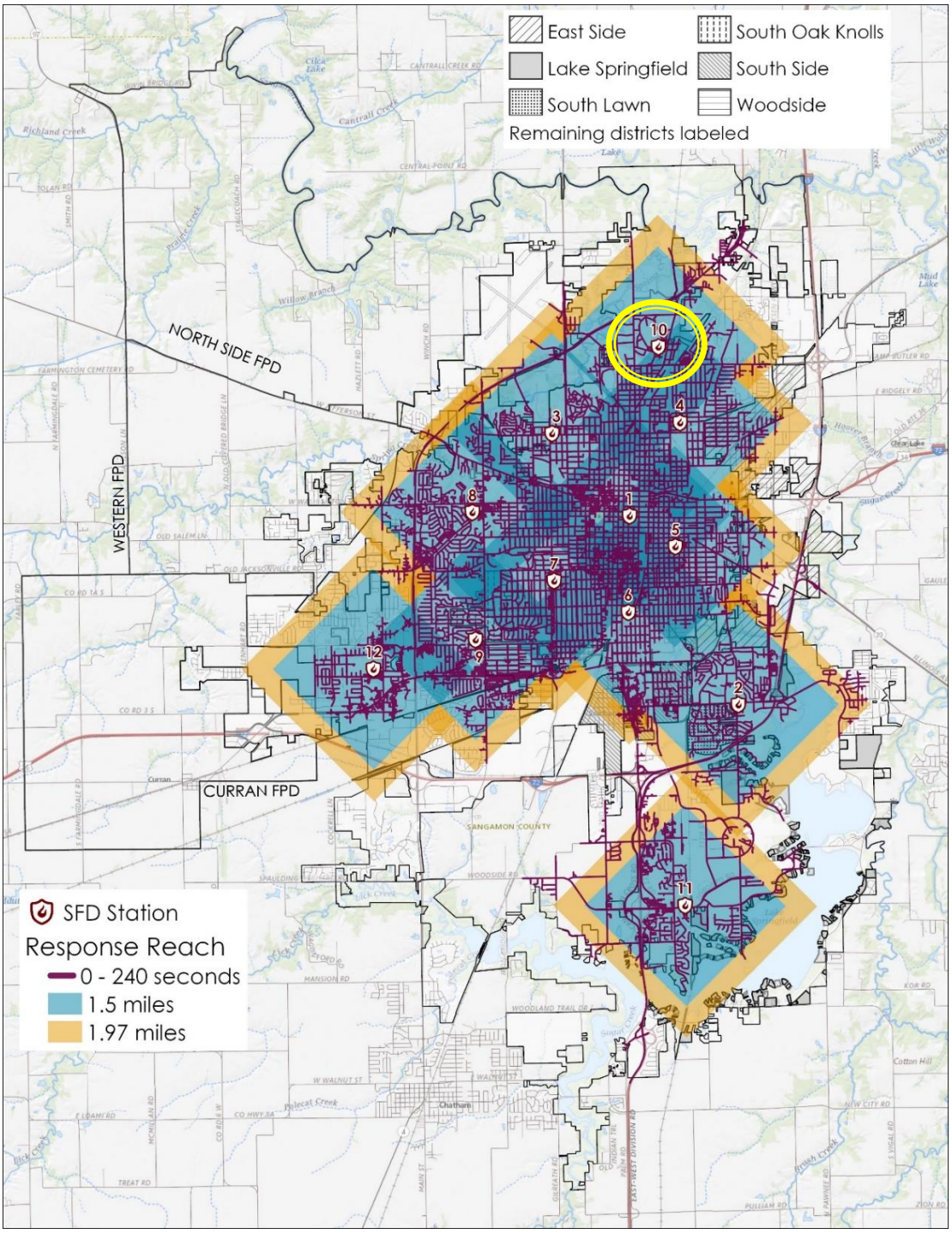
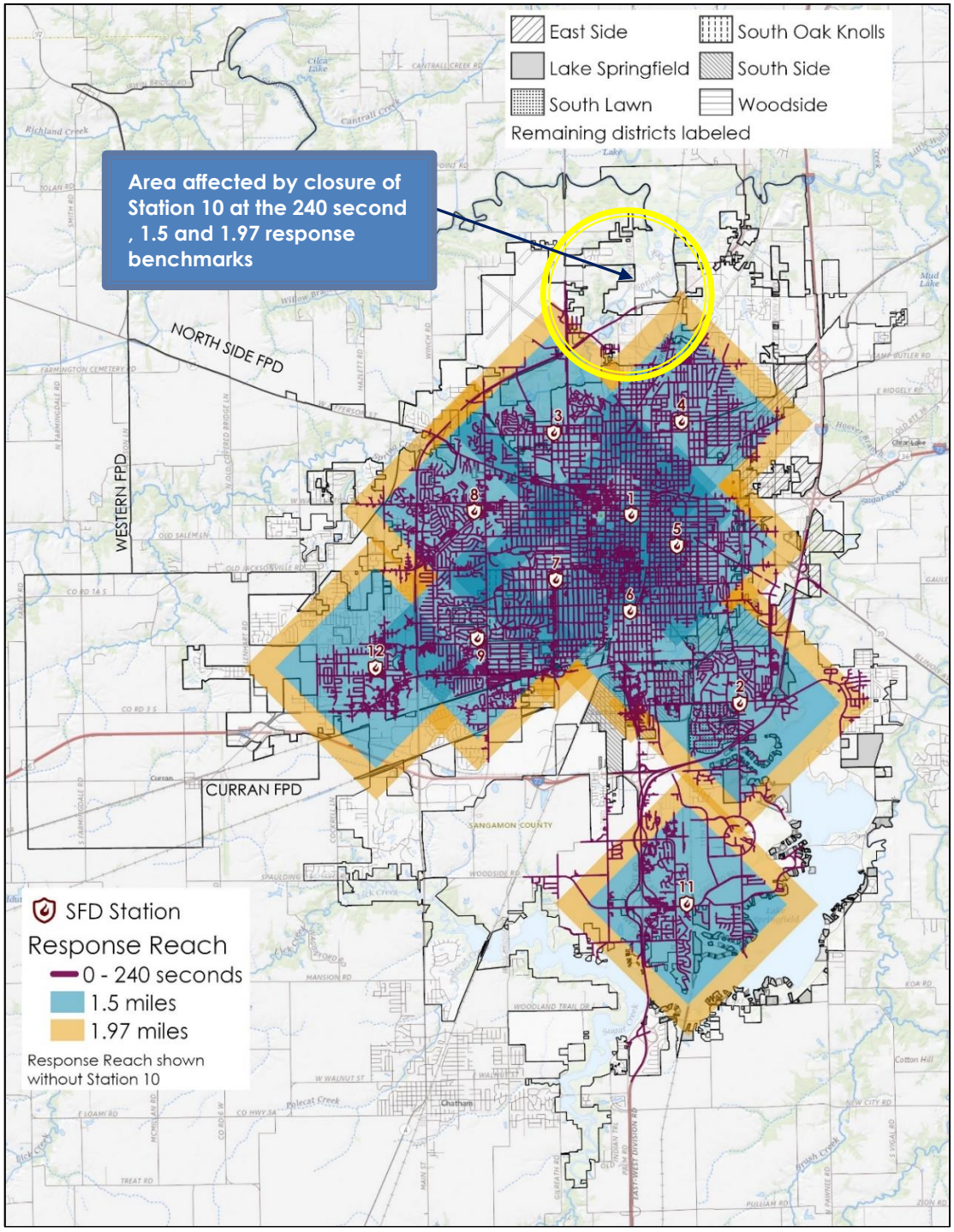


FIGURE 6-2: SFD Travel Time Bleeds and Diamonds without Station 10



Eliminating Station 10 would create a gap in the benchmark travel distances and times in the northern and northwestern areas of the city. Since this station is located near the perimeter of the SFD response area, times could be impacted even more since units that would need to pick up those responses, and multiple units responding on fire incidents, would all be responding from the same direction. This coverage gap and response time increase would become even more significant should Station 4 be relocated further to the east as discussed herein.

CPSM does not recommend this as an immediate alternative. However, this could become a future alternative once a final determination is made regarding any planned station facility realignment. This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

Alternative 5: Brownout Fire Stations/Companies as Needed

One strategy that can be deployed by city officials in lieu of permanently closing a fire station is to implement a rolling brownout. A brownout is when one of more companies are temporarily closed to reduce daily staffing and operations/maintenance costs as a stop-gap measure for budget shortfalls. An entire firehouse does not close—just certain engines or ladder companies rotating on a daily basis. Through this model, a fire station is not permanently closed.

Cities or counties often rotate browned out companies throughout the municipality so that no community is impacted more than another. These are referred to as rolling brownouts. Some cities or counties may, as an option, only brownout firehouses with two companies, such as an engine and ladder, so there's always still one company ready to roll.

While the incidence of fire or medical emergencies (for those fire departments that also respond to medical calls) may be greater in some areas of some cities, the occurrence of fires or medical emergencies is not completely predictable, which could mean a longer amount of time before crews arrive to the scene. When a fire company or station is browned out, risk increases. This includes risk to the citizens, risk to businesses owners, risk to visitors, and risk to firefighters. If the nearest fire company to a fire or medical issue is browned out, another crew will have to respond which may increase response times,

Cities or counties that consider brownouts as an alternative to reduce operating costs can benefit from looking at the decision from a perspective of risk management. Managing risk is all about probabilities, not possibilities. The decision to brown out a fire company or station should be rooted in risk management. This is where data can aid in the decision-making process.

Browning out a company, when done with deference to risk management, can be an effective way to reduce operating costs while reducing the impact of putting a company or station out of service. Browning out a company or station can reduce overtime costs by not filling vacancies primarily caused by personnel out on unscheduled sick leave. This can, in turn, prevent the permanent closure of a company or fire station and may also prevent a reduction in staff.

Browning out a fire company or a fire station, which is an alternative that is used to close a budget shortfall, does impact service levels and increases response times. However, when all other possible cost-reduction and revenue producing measures have been taken, or at least considered, brownouts are an alternative that may reduce operating costs, avoid station closings, and prevent layoffs.

CPSM recommends this option as a last resort when all other possible cost-reduction and revenue producing measures have been taken, or at least considered. If circumstances require this alternative to be implemented, the city should attempt to do so only in the stations that house more than one company (which may not be practical if alternatives above are considered and implemented). This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

FIRE STATION RELOCATIONS

The appropriate deployment of resources is critical to any fire and rescue service being able to effectively, efficiently, and safely fulfill its core public safety and fire protection/emergency medical services mission(s) within the community that it serves. One of the most important risk management decisions—how much risk they are willing to assume—that elected officials in every community must make on behalf of their constituents is how many fire and EMS resources: 1) do we need; 2) can we afford; and 3) how should they be stationed/ positioned/deployed to provide maximum benefit to the community as a whole? These are never easy decisions, especially when one considers the fact that virtually any decisions on emergency service deployment that involve moving and/or relocating a resource, even for the considerable benefit of the community as a whole, may have a negative effect on at least a small percentage of the population.

In the past 22 years the City of Springfield has undertaken two fire station location studies. The first study by Outsource Management in 1999 recommended additional stations should be constructed in the Western and Southwestern parts of the city. In addition, it was recommended the growth in the Northeast section of the city be monitored for the possible need for an additional station in that area.

In 2012, the Ludwig Group study recommended relocating Stations 3, 8, and 10. Ludwig also recommended continuing to monitor the potential need for new stations in the Northeast and Southwest areas of the city that are not served with acceptable response times.

The SFD has also studied the fire station locations and needs of the city several times, most recently updating its conclusions and recommendations in 2020.

As previously discussed in Section 3 of this report, seven SFD facilities are in excess of 50 years of age and lack sufficient space and accommodations for assigned crews and apparatus. Four of these facilities are 67 years old and one is 63 years old. As more than 50 percent of the department's facilities are in excess of fifty years old, they are subject to the issues inherent in older buildings and as well lack the space and modern amenities of contemporary public fire facilities. The lack of space in many of the stations could be a significant factor in future decisions to expand the role of the SFD in EMS patient transport.

At the time of this study, the city and SFD have plans to replace stations 6 (67 years old) and 8 (52 years old) in the next eighteen months (projected by early to mid-2023). There have also been discussions on the potential relocations of stations 4 (67 years old) and 9 (47 years old). The latter would occur after the relocation of stations 6 and 8. Finally, there has been discussion on the need for a new/additional Station 13 to cover the growing residential and commercials areas in the far southern part of the city.

As part of this study, the city asked CPSM to look at various potential station configurations that could assist with modernizing the deployment of personnel and resources while simultaneously creating possible efficiencies in the overall fire protection and first response EMS delivery system. The following figures illustrate several "what if" scenarios in which various stations are relocated (or in one case consolidated) to provide better overall deployment coverage to the city and reduce much of the current response overlaps. It is important for us to note that there are many factors that go into decisions to move, consolidate, or close fire stations. While many of those factors can be data driven as completed in this report, there are often intangibles as well. To that end, any discussions regarding which potential service delivery modifications the city may give further consideration to, particularly with regard to fire stations, should involve a wide cross section of both internal and external stakeholders, including citizens of the community.

The first map (Figure 6-3) illustrates the following:

- Station 6 relocated to the area of 2111 S. 11th St.
- Station 8 relocated to the area of 2820 W. Lawrence Ave..
- A new Station 13 located in the vicinity of 3054 Spaulding Orchard Drive.

Even though this option increases the number of stations by 1 to 13, it would not necessarily require any increase in personnel as it is anticipated that one of the companies currently deployed from Station 12 would be relocated to this station if the city elects not to convert the engine/ladder combination at station 12 to a single apparatus-Quint.

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FIGURE 6-3: Travel Time Diamonds for Relocated Stations 6 and 8, and New Station 13

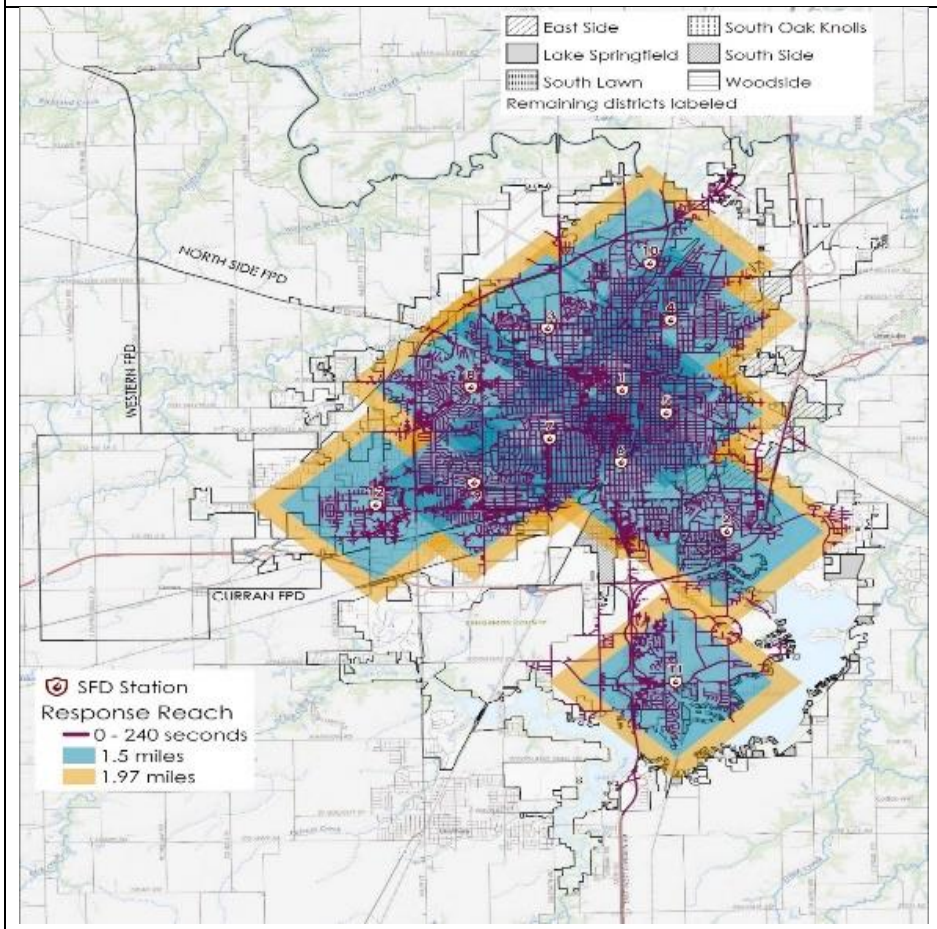
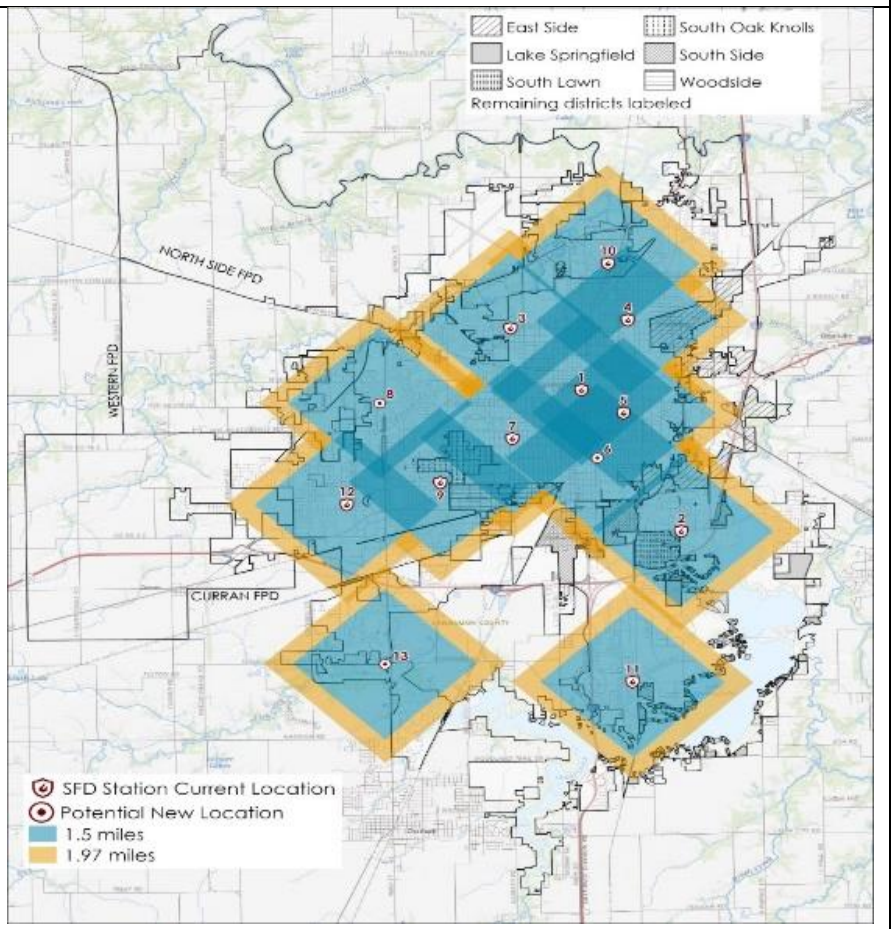
Current Station Configuration	Configuration with Stations 6 and 8 Relocated and new Station 13
	

Figure 6-4 shows the same map as Figure 6-3 but with the exception that in this scenario there is no new Station 13. Instead, the existing Station 9 is moved to the proposed Station 13 location in the vicinity of 3054 Spaulding Orchard Road. This option maintains a 12-station deployment.

FIGURE 6-4: Travel Time Diamonds for Relocated Stations 6, 8, and 9

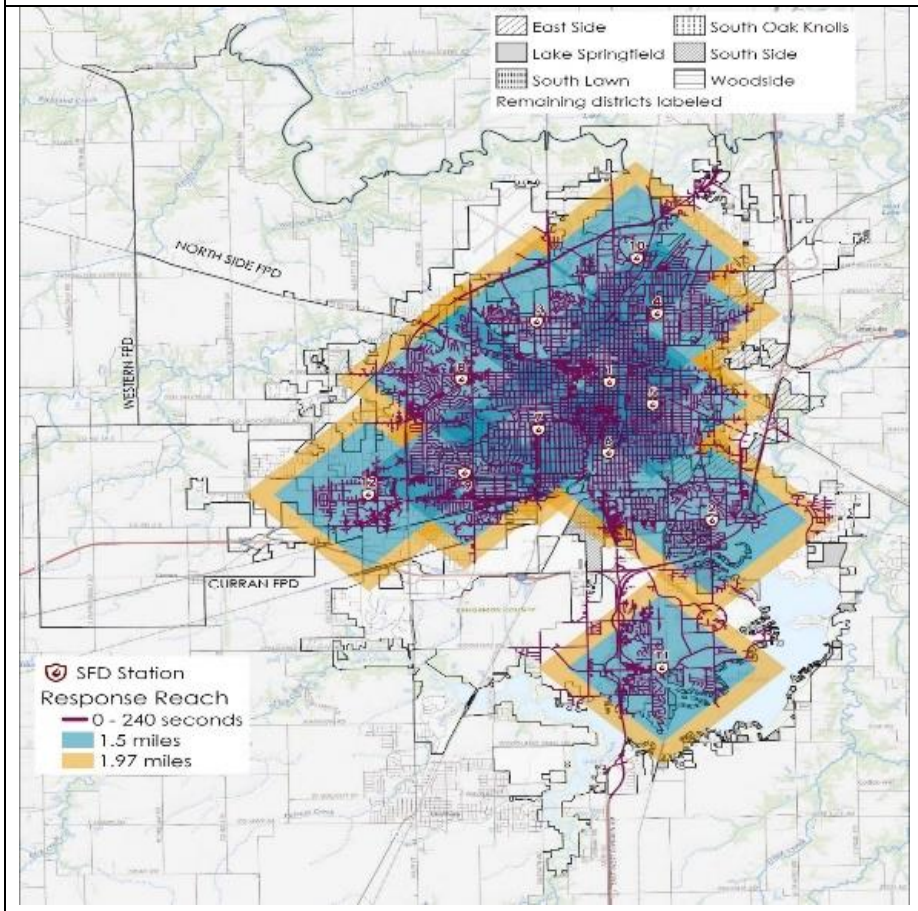
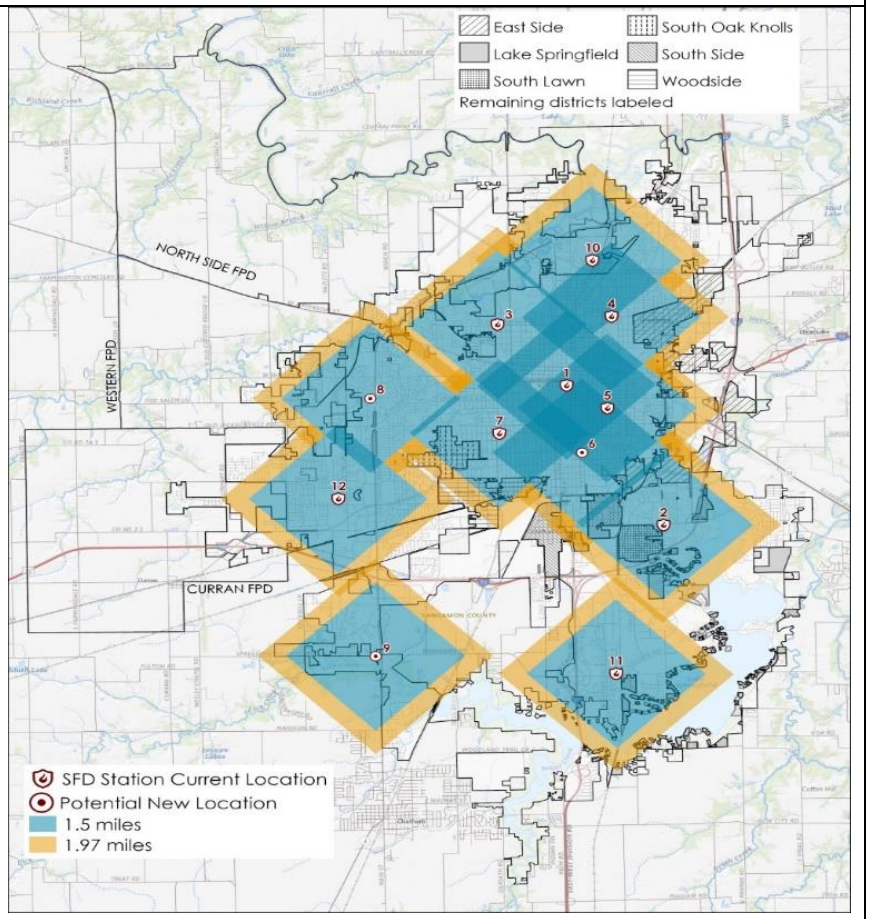
Current Station Configuration	Configuration with Stations 6, 8, 9 Relocated
	

Figure 6-5 shows the same map as Figure 6-4 but with the exception that in this scenario Station 4 and Station 5 are both also moved east from their current locations. Maintains a 12-station deployment.

FIGURE 6-5: Travel Time Diamonds for Relocated Stations 4, 5, 6, 8, and 9

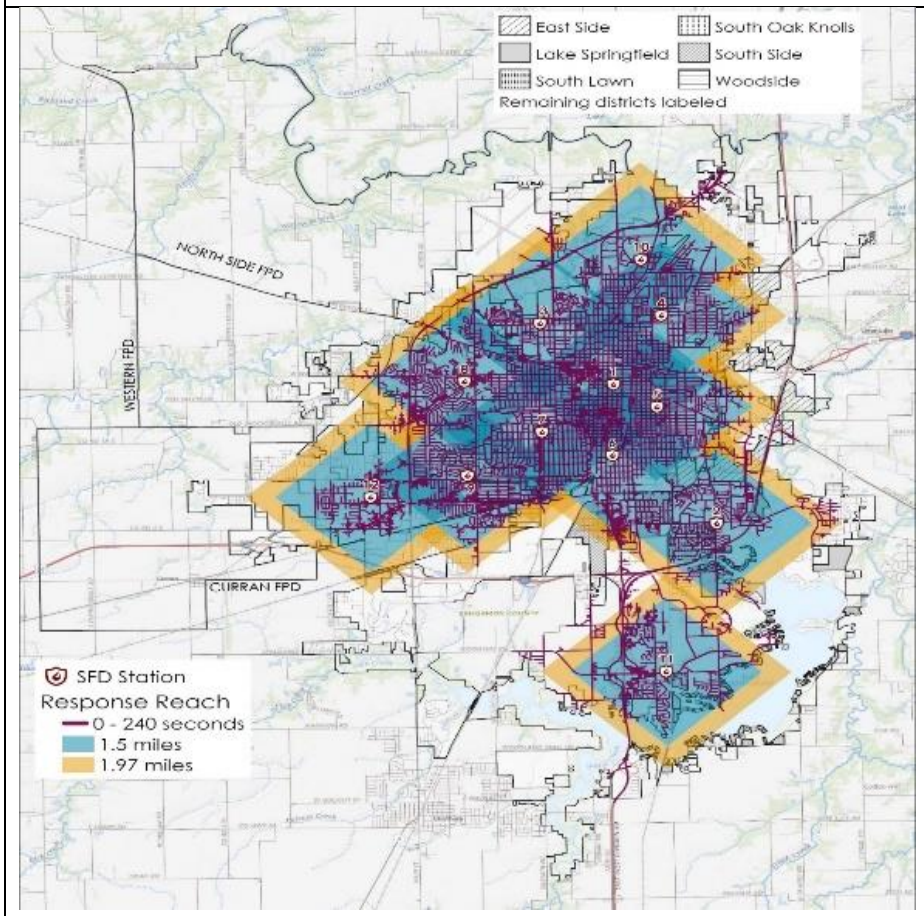
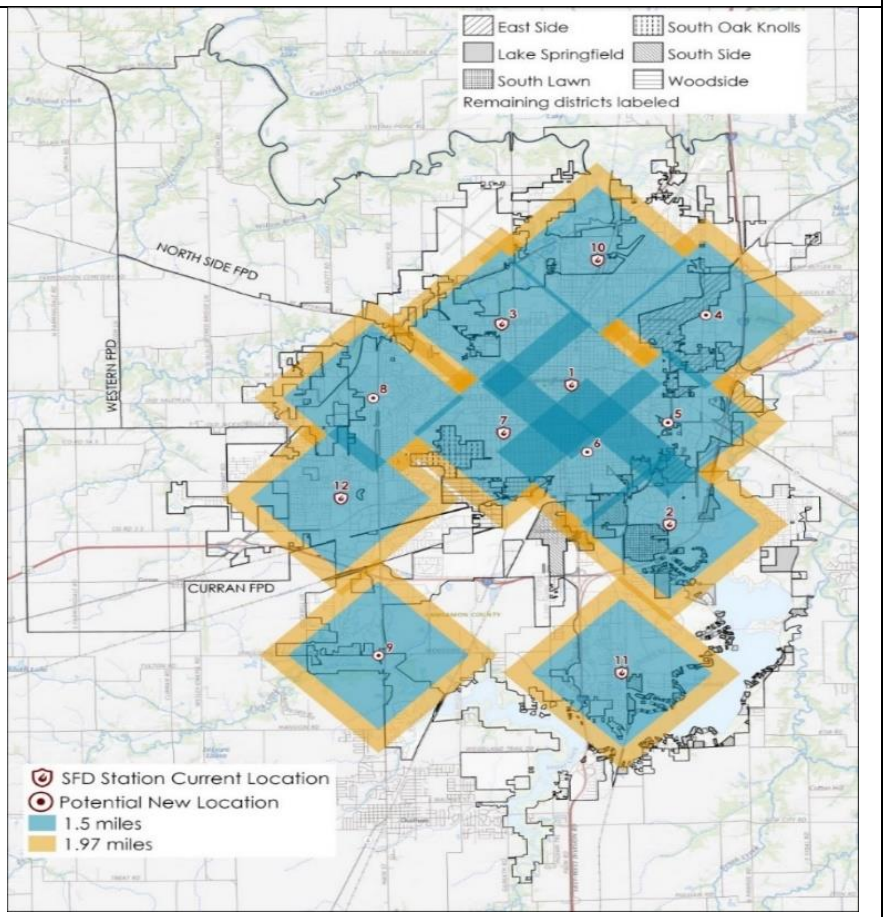
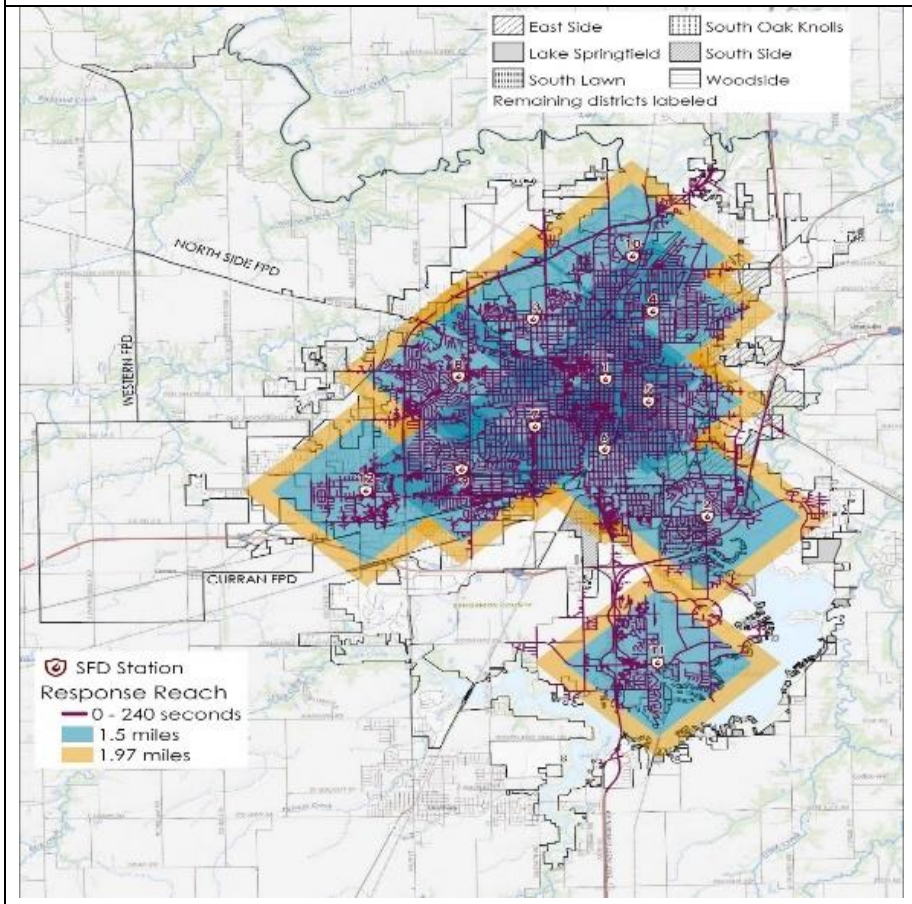
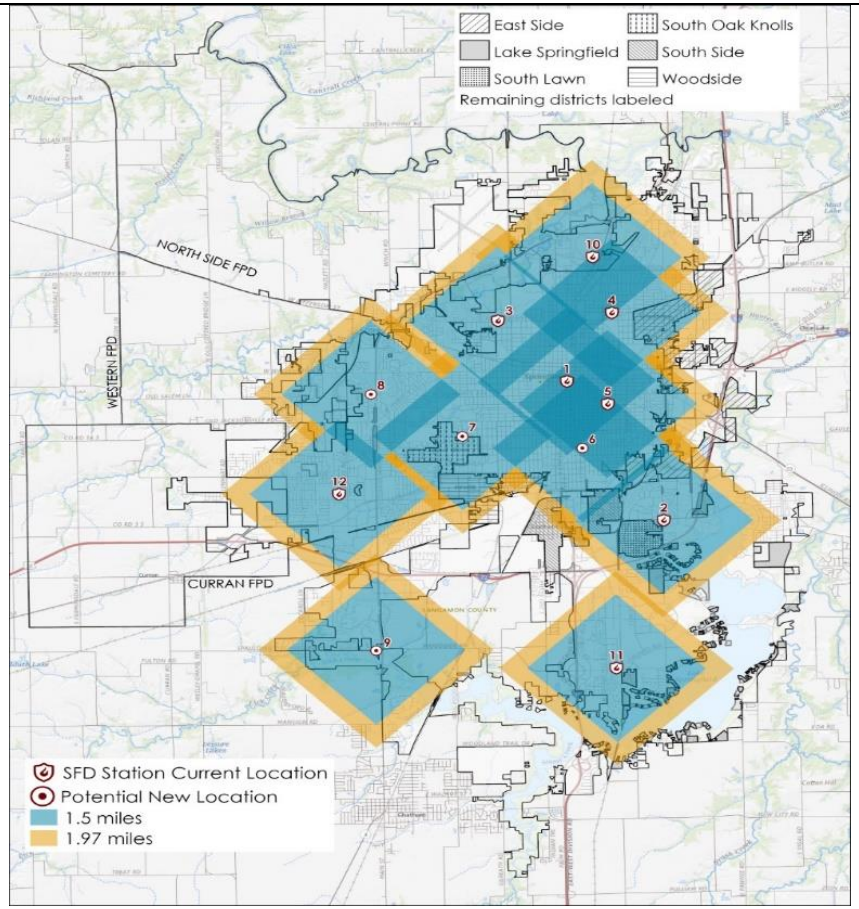
Current Station Configuration	Configuration with Stations 4, 5, 6, 8, 9 Relocated
	

Figure 6-6 shows the same map as Figure 6-4 with Stations 6, 8, and 9 all relocated. However, in this map, Station 7 is also relocated south and west of its current location to the vicinity of S. Wiggins Ave. and W. Laurel St. which keeps it within the city limits. The purpose of this relocation is to reduce some of the potential impacts of relocating Station 9. Maintains a 12-station deployment.

FIGURE 6-6: Travel Time Diamonds for Relocated Stations 6, 7, 8, and 9

Current Station Configuration	Configuration with Stations 6, 7, 8, 9 Relocated
	

In this scenario, CPSM would recommend that the SFD design an apparatus for Station 7 that has a Squad body that will allow it to function as a Rescue Engine. The engine should have a minimum of a 1500 GPM pump, a minimum of a 500- gallon water tank, carry standard SFD attack and large diameter hose compliments, along with a full complement of vehicle extrication and tactical rescue equipment. Figure 6-7 shows examples of squad apparatus. Notice the high side and additional compartments that have been added for additional equipment storage.

FIGURE 6-7: Typical Squad (Rescue Pumper) Type Apparatus

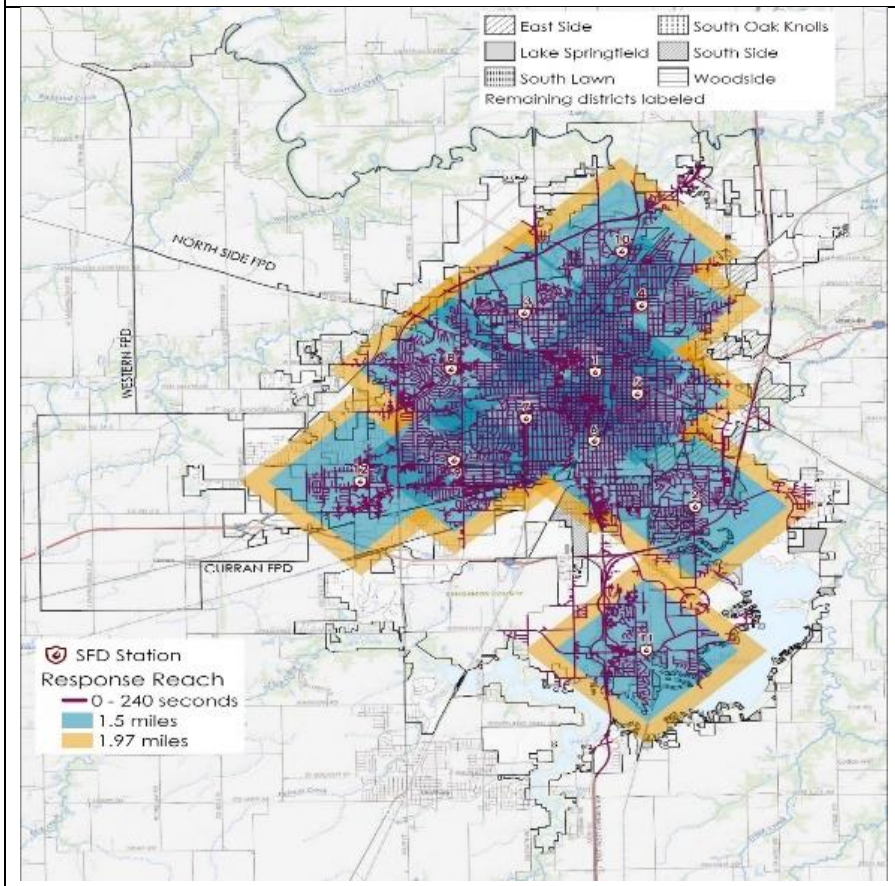
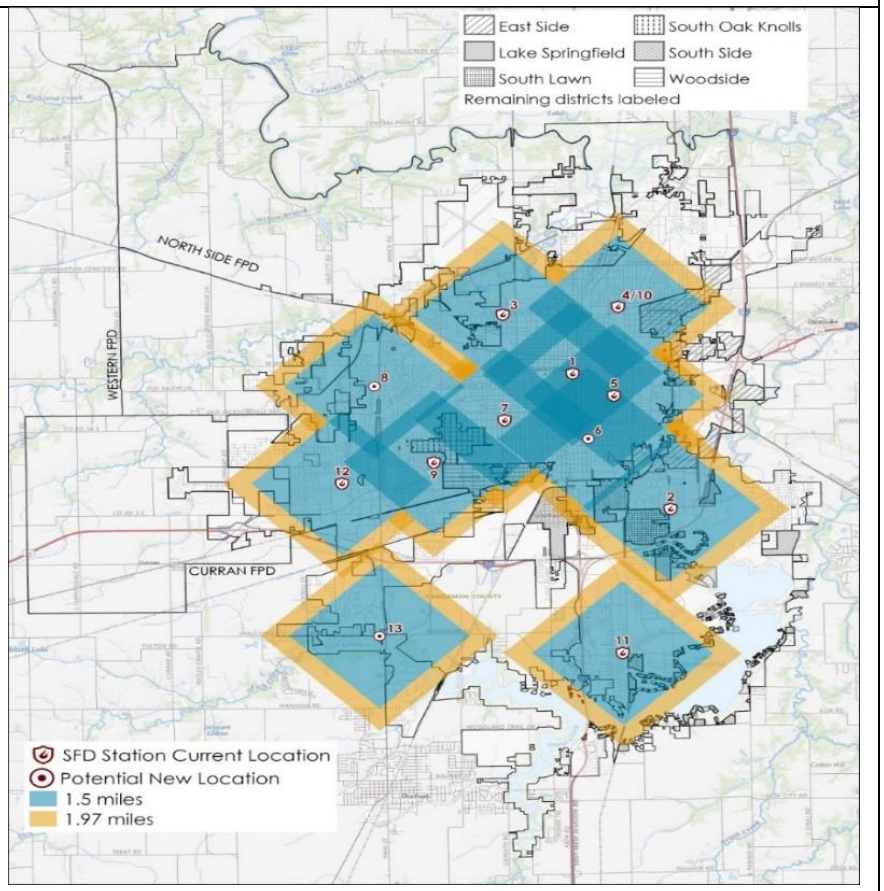
As was previously discussed in this section, in Springfield, if there were to be a discussion regarding closing a station, Station 10 would be considered a primary candidate for the following reasons:

- Station 10 is not physically located in the city. It is located on the Illinois State Fairgrounds which lies just outside the city limits.
- Station 10 is not owned by the city and the state's annual contribution to the city for staffing and operations has been declining each year. The city currently receives just a fraction of annual operating costs from the state.
- There were 1,158 calls in Engine 10's first due area during the period studied, which ranks 10th of the 12 first due districts.
- Engine 10 responded to 1,251 runs during the period studied, which ranked 11th of the 12 engines.

To that end, CPSM looked at two station configuration options that consolidate Stations 4 and 10 into a single station, at or near the location of the current Station 4. In either of these configurations, there would be an area around Station 10 where there would be longer travel distances and thus response times (Figure 6-2, page 136). Figure 6-8 illustrates a station deployment model that

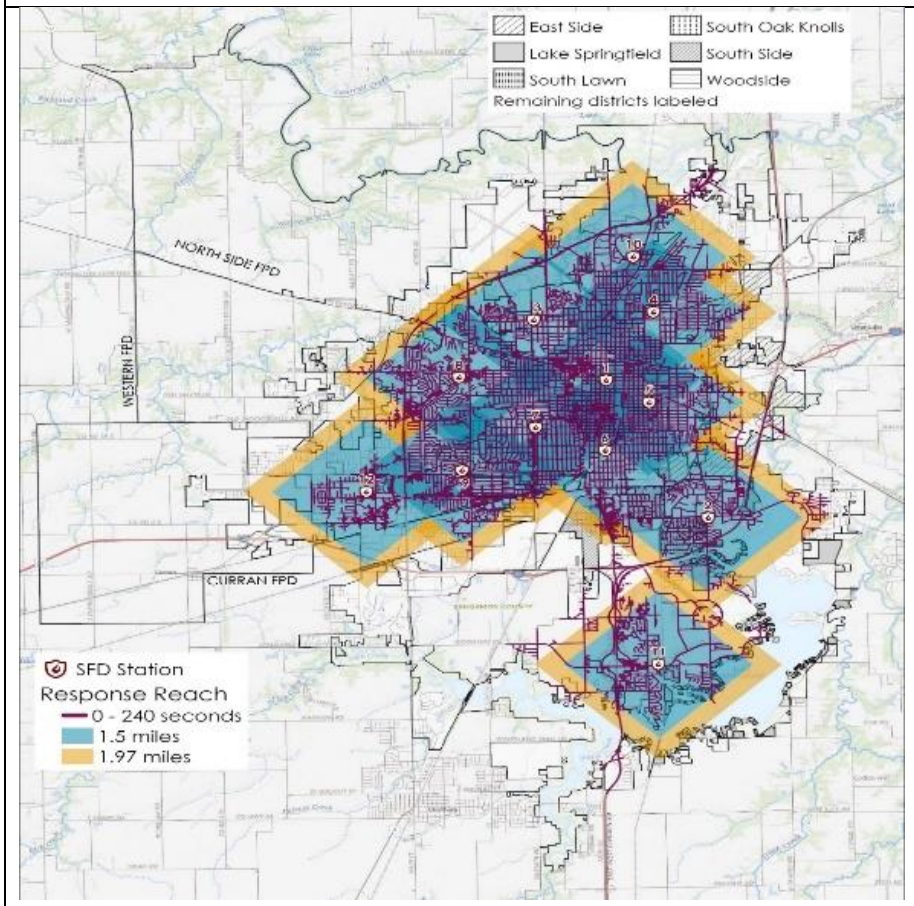
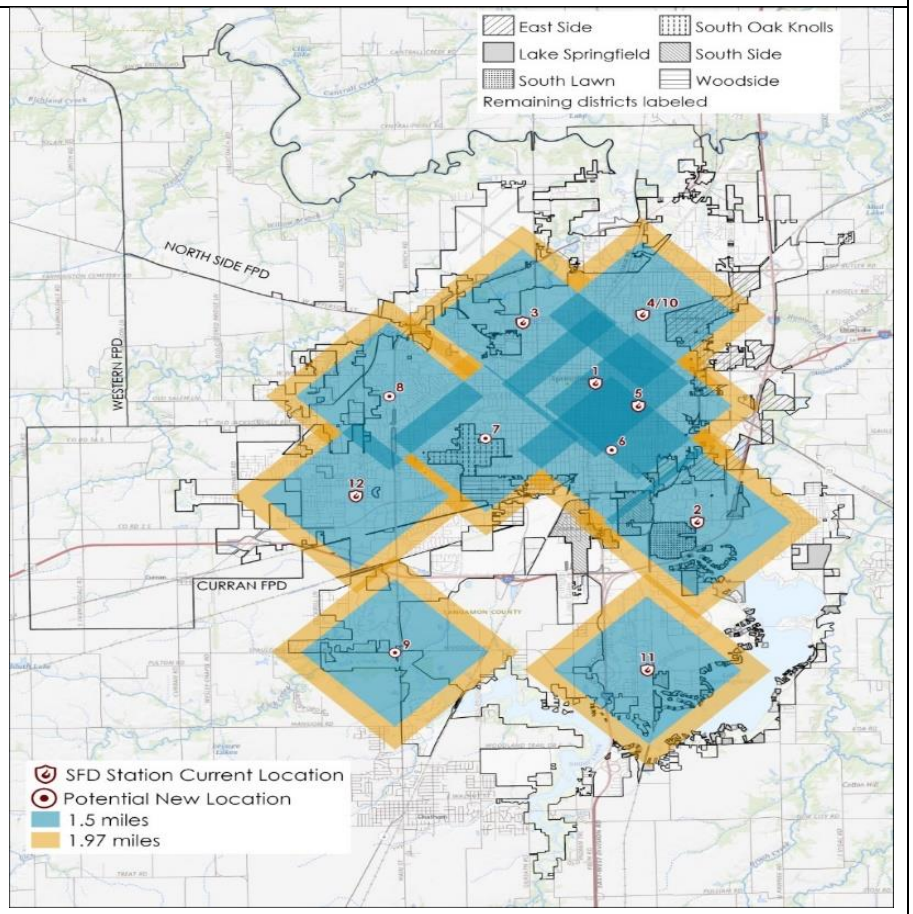
consolidates Stations 4 and 10 into a single station while adding a new Station 13 in the south end of the city. This configuration would maintain a 12-station deployment.

FIGURE 6-8: Travel Time Diamonds for Consolidated Station 4/10 and New Station 13

Current Station Configuration	Configuration with Stations 4/10 Consolidated and new Station 13
	

The map in Figure 6-9 illustrates the station configuration with Stations 6, 7, 8, and 9 all relocated, and Station 4 and Station 10 consolidated into a single station at or near the current location of Station 4. This would result in an 11-station deployment model.

FIGURE 6-9: Travel Time Diamonds for Relocated Stations 6, 7, 8, and 9, and Consolidated Station 4/10

Current Station Configuration	Configuration with Stations 4/10 Consolidated and Stations 6, 7, 8, 9 Relocated
	

While CPSM does not explicitly endorse or recommend this option, as there are many factors herein for the city to analyze, after our analysis, long term it does appear to be the most efficient regarding the optimal placement of stations not including a Station 5 relocation to the East. Should the city decide to explore this option as part of their long- term planning process, CPSM would strongly suggest that the following considerations also be included in the discussions.

- Merge the engines at Station 4 and 10 into a Quint with minimum staffing of four personnel.
    - This will provide better ladder coverage in the north end of the city, as well, as maintain three available truck companies for fire operations even when one of the quints is first due at a fire and therefore functioning as an engine.
    - Figure 6-10 illustrates the ISO 2.5-mile travel distance diamond for ladder company deployment. This deployment actually places a second ladder within a 2.5-mile travel distance from the downtown area where the greatest fire risk and most of the larger/taller buildings are located.
    - If not previously done, relocate one firefighter position to Tower 1 to also provide that unit with minimum staffing of four personnel.
    - This option would potentially result in savings that includes personnel services and operations/maintenance of one additional response apparatus (engines) (also assuming Quints are deployed from Stations 2 and 12) and would potentially allow minimum staffing to be adjusted from 49 to 44 per shift or 15 overall (five per shift).
    - CPSM views this alternative as a reasonable long range planning option for the city as it works to increase efficiency with the SFD in that it results in no loss of function, but with a staffing level of four per shift on each Quint/aerial apparatus, the SFD would now have four units strategically located throughout the city that are staffed with four personnel.
    - This alternative may require bargaining with the collective bargaining unit as this alternative may affect minimum staffing articles/clauses.

- In this scenario, CPSM would recommend that the SFD purchase and deploy Squad or Rescue Engine apparatus to Stations 3 and 11, in addition to the previously recommended Station 7. By placing these companies in close proximity to the Quints at Stations 2, 4, and 12 (and to a lesser extent Station 1) the squad companies can be used as a force multiplier for the quints and vice versa.

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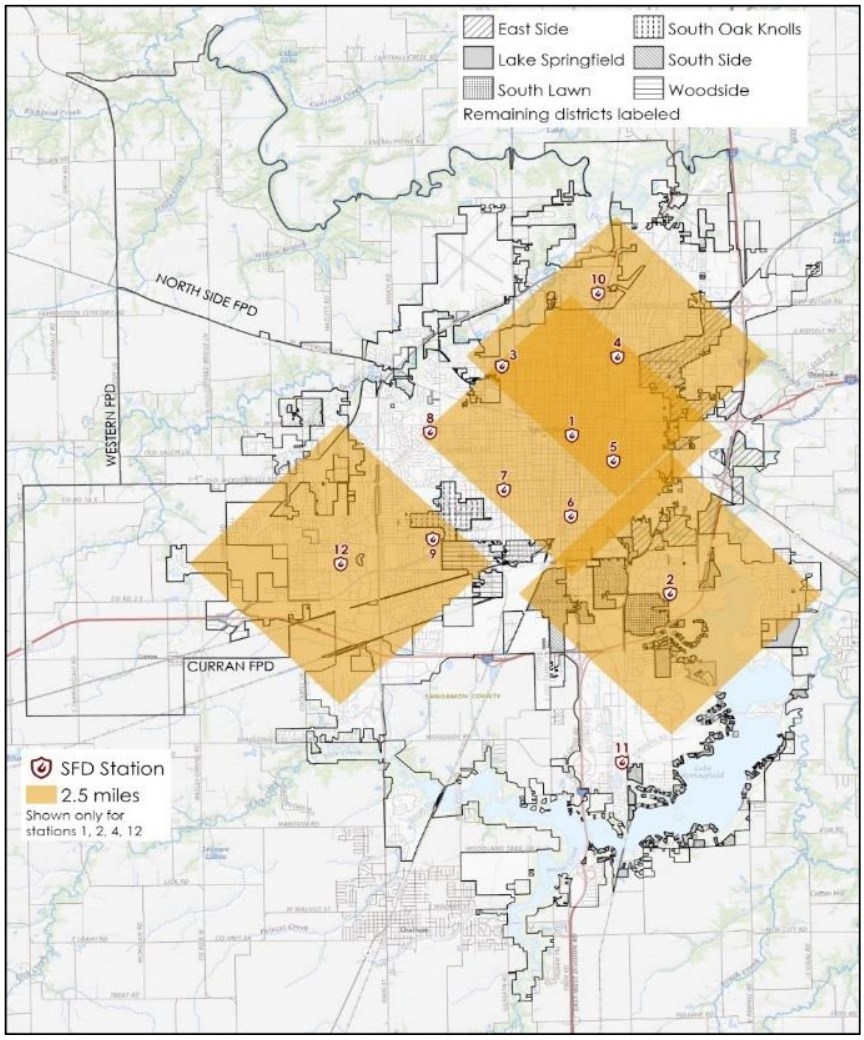
Figure 6-10: ISO 2.5 Mile Ladder Coverage Diamonds for Stations 1, 2, 4, 12 (Stations 2, 4, 12-Qunit Apparatus)



EMS DELIVERY SYSTEM

CPSM has been engaged with multiple cities and EMS entities, particularly since the start of the COVID-19 crises, that have transformed, or are in the process of transforming, their EMS service delivery models. Many have either sought bids for providing service, or moved patient transport in-house, so the entire system is operated by a single entity. In the past, fire departments occasionally made EMS calls for service; today many fire departments are primarily EMS service providers that also perform fire duty. This is in no way meant to understate the importance of a robust fire protection delivery system commensurate with risk in a community. However, the fact is that it is not uncommon for 70 percent to 80 percent of the calls for service received by most fire departments in the United States to be EMS-related.

Like many fire department's today, a greater percentage of SFD requests for service are EMS related rather than fire-type incidents. When analyzing the calls for Springfield, we found 58.3 percent of the calls for service are for EMS while 32.9 percent of the calls are fire-related. Factoring out false alarms, good intent, and public service calls for service would considerably increase the percentage of workload devoted to EMS.

Cities across the United States are looking at ways to deliver EMS services in an environment that continues to refine itself. One of the first challenges for EMS is that the service is normally not specified as a requirement in city charters; is not covered under most state enabling legislation for cities; and does not receive a cabinet-level focus at the federal level (usually can be found under the Department of Transportation). As a result, some communities have taken the position that it is not a mandated service and have allowed the free market to respond.

FIGURE 6-11: Types of EMS Delivery Systems

There are five basic ways to provide EMS services to community:

- Private for-profit.
- Private Non-profit.
- Public Third Service (separate from fire or other city services).
- Hospital-Based.
- Fire-Based.

In Springfield, EMS operations are referenced under Article XL in the city code. Although the fire department is ultimately responsible for the EMS delivery system, the current process allows any company to seek a permit to operate an EMS service within the city limits. However, the code contains no provisions for performance evaluations, metric reporting, cost sharing, or any other requirements. No request for proposal (RFP) is issued and none of the companies operate under a formally awarded contract with the city. Article XL provides for "six ambulances" that have been determined to be necessary, but does not further look at whether those numbers can be adjusted up or down on nonpeak, overnight hours in favor of additional units during the peak hours of the daytime.

In our discussions with both SFD staff and ambulance providers, we learned there is an increasing number of times when non-emergency transports and other activity occupies the available ambulance units and thus lowers the number of units immediately available to handle 9-1-1 transports in the city. The ambulance companies transport 100 percent of all city and county FPD calls, then bills for all procedures performed, regardless of which agency (ambulance company or SFD) performed them. The SFD usually (but not always) receives replacement for the medical supplies used on calls; however, beyond that the SFD receives no compensation from any ambulance company or the receiving hospitals for the treatments it performs prior to or during transport. This is not unique to Springfield.

Currently three different firms provide transport EMS services to the City of Springfield: America, Life Star, and AMT/Medics First provide patient transport after initial care is provided by the SFD.

With the transport component of the EMS delivery system facing timely service delivery challenges (a situation not unique to Springfield and which is faced by cities and counties across the county as EMS demand increases), CPSM recommends that the City of Springfield consider one of the following four options for modifications and enhancements to the comprehensive EMS delivery system.

- Create a new municipal based system, either fire department or third service, using civilian EMTs and Paramedics who are not sworn/fire or police certified.
- Create a franchise for EMS services in the city that would provide Springfield reimbursement for first-response services.
- Franchise EMS services in the city with a strict metric and provide reduced first responder (SFD) services to only those EMS calls of the highest priority, or when a EMS unit is not available.
- City EMS Service Ordinance where the city establishes performance metrics and licensing for EMS agencies to provide 9-1-1 ground transport services.

Alternative 1 – Create a Municipal Based System

The first option, in terms of high-quality service delivery, is the option that involves creation of a municipal-based system for EMS transport. Under this system a new division would be created within the fire department or a separate third service would be created for Springfield with ambulance units stationed across the city at existing fire stations. In a single-role system in the fire department, the department has an EMS division or section, but its personnel, and often management, are kept separate from fire suppression and perform EMS duties only. Employees in the new fire department division or third service would only be trained to the EMT and advanced-EMT (paramedic level) and would not be sworn SFD employees.

Advantages of this option include:

- Fire stations are already part of neighborhoods and positioned to meet response time and demand.
- Firefighters and civilian EMS personnel employed by fire departments are highly respected within the community and provide a high degree of comfort to citizens for sustainability of EMS.
- Fire/EMS department/division managers are directly responsible to local government senior management and elected officials, thus allowing oversight to ensure accomplishment of key performance goals.

- Facilitates day-to-day management oversight.
- Enhances versatility of workforce, providing flexibility for management.
- Greater employee job satisfaction; lower attrition rate.

Disadvantages include:

- Measured on level of effort (LOE) rather than performance results.
- Uses fixed-base (static) resource deployment model, which may limit efficiency in managing the system status during peak times when applicable.
- Use of 24-hour unit schedule results in excessive resources during nonpeak hours and inadequate resources during peak hours.
- Fire service heavily organized, resulting in competitive compensation and retirement programs; adds degree of complexity, often limiting organization's ability to manage system.
- As with most government models, only serves patients who request care through 9-1-1 systems. Nonemergency patient transport needs are usually delegated to local private providers.
- While the city will recover some of the cost of providing the service through ground transport fees, the return on investment to operate this service when you consider additional staffing costs, which at a minimum with six units deployed around the clock (current number) is forty-eight additional staff using a constant staffing model, the initial investment of eight ambulances (six front-line and two reserve), and operations and maintenance costs.

The following figures outline what the allowable rates are for various EMS calls for service. If the city adopts alternative 1, it should regularly review rates and charge the maximum allowable for the Diagnostic Related Groups (DRG).

FIGURE 6-12: Springfield Medicare Rate Structure

Medicare Allowable Rates – Springfield, IL						
ALS E A0427	ALS NE A0426	BLS E A0429	BLS NE A0428	ALS 2 A0433	SCT A0434	MILEAGE A0425
$410.85	$259.48	$345.98	$216.24	$594.65	$702.77	$7.37

Medicaid Allowable Rates – Sangamon County, IL						
ALS E A0427	ALS NE A0426	BLS E A0429	BLS NE A0428	ALS 2 A0433	SCT A0434	MILEAGE A0425
$218.26	$218.26	$138.44	$138.44	218.26	$285.72	$5.60

FIGURE 6-13: Midwest versus National Medicare Comparison

Service Level	Midwest	National
ALS E	$868.56	$1,200
ALS NE	$765.26	$1,079
BLS E	$701.07	$851
BLS NE	$571.60	$675.30
ALS 2	$1,234.03	$1,437
SCT	$1,744.33	$2,751
MILEAGE	$16.11	Not Reported

The collection amounts for calls in the Midwest are lower than in other parts of the country, which is also reflected in the average cost of paramedics and EMTs.

- Paramedic – The 90th percentile for paramedic wages in Illinois is $57,676 per year. The median for Illinois is $46,745. Assuming a fringe benefit percentage of 40 percent would result in cost per employee of approximately $65,447 to $80,746.
- EMT wages in Illinois range from $34,000 to $42,000 resulting in cost per employee – including 40 percent fringe benefits - of $47,600 to $58,800. Both assume the lower pension premiums and not the fire pensions.

If the city opted to use a four-platoon, 12-hour shift schedule (recommended in high-volume EMS systems), employees would work an average of 42 hours of regular time with every other weekend off. However, under this schedule, personnel work 36 hours one week and 48 hours the following week, creating an automatic eight hours of overtime per pay period (assuming a two week pay period). A three-platoon, 24-hour shift would require fewer employees, but the workload may exhaust employees working that type of shift configuration because it assumes an opportunity for rest that EMS personnel do not often get because of call volume. In addition, for non-firefighter EMS personnel the Fair Labor Standards Act (FLSA) mandates they be paid overtime for any hours worked in a week over 40 (the threshold for firefighters is 53 hours). Therefore a 24-hour schedule creates automatic overtime as well.

If the city were to utilize all-Paramedic crews with a total of 48 personnel (six ambulances with two personnel per unit requires 12 per shift x four shifts), the annual cost would be $3,791,456 to $4,525,808 per year for ambulance personnel. This includes an estimated $650,000 in automatic overtime based upon the shift schedule.

Many municipalities utilize a system where each ambulance is staffed with one Paramedic and one EMT-B or EMT-I. If the city were to use this system it would require a minimum of 24 paramedics and 24 EMTs. Under this scenario, the annual base personnel cost would be between $3,213,128 and $3,849,104 which includes an estimated $500,000 in automatic overtime for the shift schedule.

Additional fiscal considerations:

- The above estimates do not include overtime to cover shift vacancies that will need to be filled anytime personnel are on any type of leave (vacation, personal, sick, injury, comp time, training, military, etc.).

- The above minimum staffing requirements do not include any extra or pad personnel on any shift to fill vacancies created by leave. Budgeting one or two additional personnel per shift for this purpose may be more cost effective than paying overtime for every vacancy.

- The above calculations do not include the need for an agency chief (if a standalone department) and a 24/7 EMS supervisor in a command/chase/quick response vehicle. If the supervisors' salary was 10 percent to 15 percent more than a top paramedic the cost of each position would be between $88,820 and $92,858 for a total between $355,280 and $371,431 annually for four supervisors.

- The above calculations do not include any clerical/administrative support.

- The above calculations do not include any training costs for classes, overtime and/or shift coverage for personnel to attend, materials, etc.

- Maintenance contracts on stretchers, defibrillators, etc. are approximately $50,000 to $75,000 per year.

- Costs for medications and other consumable/disposable supplies are estimated at approximately $200,000 per year.

Medstar Ambulance, which serves Dallas-Ft. Worth area communities using a public utility model, recently purchased 65 Demers Type 1 ambulances using the Dodge 4500 chassis at a cost of $250,000 per ambulance or $350,000 complete cost with all equipment and supplies. If the city starts with deploying six ambulances 24/7 until good data can be developed that would support adjusting that model, the city will need a minimum of eight ambulances (nine or ten would be better) to keep six units on the street. This would result in an initial startup capital cost of between $2,000,000 and $2,800,000. Funding would also need to be allocated to replace each ambulance every five to seven years, or an average of one or two annually once the cycle begins. Annual maintenance costs, even for new ambulances that are being properly maintained are estimated at $50,000 per year.

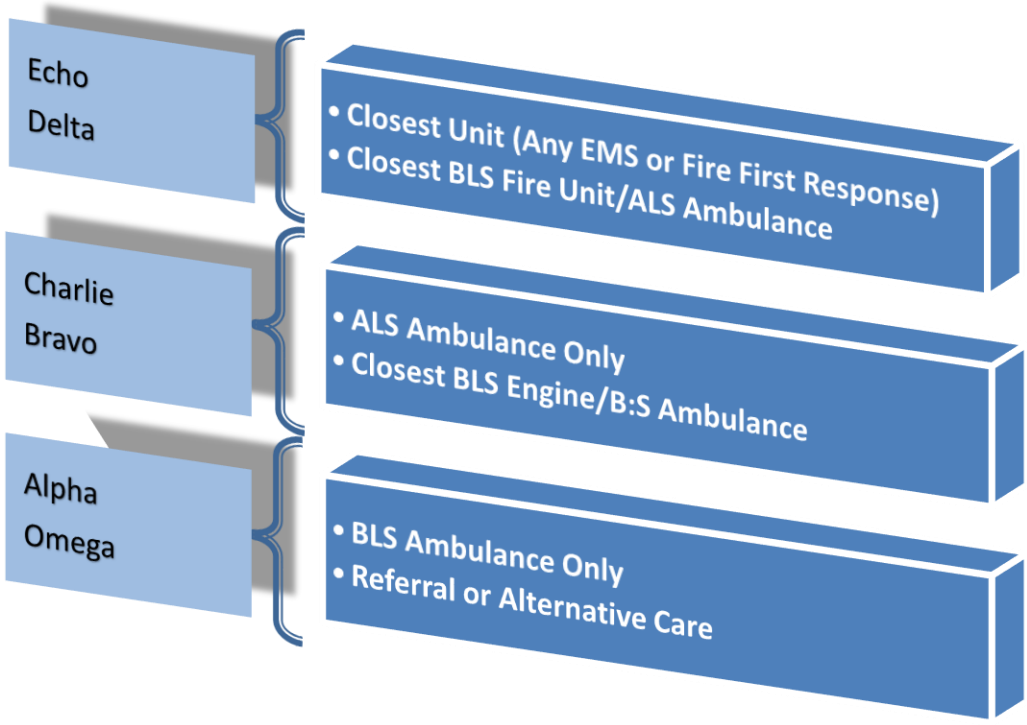
As mentioned earlier, it is recommended billing be provided by a third-party billing company; these companies normally charge a percentage of revenue collected as fee for service. A collection rate of 65 - 75 percent on billed amounts is a good standard to adopt.

Several additional benefits of this option, which would assist with modernizing how fire units are dispatched to EMS calls are:

- Should the city progress to service provided by cutting-edge agencies across the country using true EMD, ambulances could be dispatched alone to Alpha and Bravo calls (unless there are no ambulances available) and reduce the demands on fire first responders. Applying a general overview to the calls for service in Springfield showed about 54 percent of the EMS calls for service were for ALS-related causes; meaning the remaining 46 percent should have been handled by the ambulance alone and likely did not require lights and siren response or first responders. That is a significant reduction in calls for service to the fire department and reduces the risk of exposure to loss responding to and from those calls.

- CPSM recommends that dispatch be reconfigured to screen calls and first responders only be dispatched to the more serious calls for service, that is, Charlie, Delta, and Echo emergencies. The next figure illustrates an example of the priority levels of all EMS call determinants.

FIGURE 6-14: EMS Call Determinants



At this time, CPSM does not recommend that the City of Springfield consider the expansion of its EMS service provision into the ground transport of patients to the hospital, unless the additional alternatives listed below are not deemed to be viable after the completion of due diligence or the issuance of an RFP that results in either no, or inadequate responses.

Mobile Integrated Health Care and Community Paramedicine (MIH/CP) present a new way for agencies to manage their EMS call demand, particularly with regard to frequent users of the system. Mobile Integrated Healthcare is defined by the National Association of EMTs (NAEMT) as "the provision of healthcare using patient-centered, mobile resources in the out-of-hospital environment." It can be provided through community paramedicine programs, which are programs that use EMTs and paramedics to provide this out-of-hospital health care. MIH/CP programs help facilitate more appropriate uses of emergency care resources and enhance access to primary care, particularly for underserved populations, by focusing on chronic disease management, post-discharge follow-up, and transport to non-emergency care settings.

The benefits of MIH/CP are therefore two-fold. These programs potentially help provide more appropriate health care to community residents, and if reimbursement arrangements can be agreed upon, also offer a substitute funding stream, separate from emergency transport, for community-based EMS transport programs.

It should also be noted that changes in EMS reimbursements adopted during COVID-19 now provide reimbursement to EMS providers in certain circumstances for non-transport of patients as if they were transported (treatment via telemedicine). This may provide a new source of

revenue for the city that should be explored as part of a comprehensive overhaul of the city's EMS response system. At this time, first responders are dispatched to the scene and only the ambulance provider is reimbursed for these calls despite the fire department performing initial triage. As more and more providers adopt tele-medicine concepts that pay for non-transport, the City of Springfield costs may continue to increase while they receive no reimbursement.

Alternative 2 – Franchise Fee EMS Service

The current EMS "system" dispatches firefighters on every call for EMS service. The firefighters triage the patient, package the patient, and then turn transport over to one of three private providers that then perform transport to the medical care facility.

National studies conducted by the IAFC and NAEMT have shown that only about 20 percent of calls for service to EMS providers require Advanced Life Support (ALS) Intervention, meaning that about 80 percent of the calls should require no further support than what is provided by the ambulance crew (exceptions being obese patient loading and unloading or situations that require movement up and down buildings).

Applying a general overview to the calls for service in Springfield showed about 54 percent of the EMS calls for service were for ALS-related causes; this means the remaining 46 percent should have been handled solely by an ambulance crew and likely did not require lights and siren response or first responders. This would represent a significant reduction in calls for service to the fire department and would reduce the risk of exposure to loss responding to and from those calls.

In many communities that CPSM has studied, the community offers a (often) sole-source contract for emergency EMS services, although some communities do have multiple entities that provide service. As with the fire service, these contracts may be level of effort or performance-based, with a focus on results. Management and oversight of clinical care, day-to-day operations, assets, and capitalization are all accomplished in the private sector, and the level of involvement and financial support of local government is completely negotiable. Note that the franchise is for emergency services and so existing providers could continue inter-hospital transports and other scheduled work (but should be licensed to do so).

Advantages of this alternative include:

- Local government not directly tied to day-to-day operations of the service. Focus is on solid contracting, established performance results, and quality assurance.
- No investment in physical resources, e.g., buildings, ambulances, equipment, or staff; no maintenance or replacement costs.
- Clear scorecards with which to assess the performance of contractors, thus facilitating benchmarking efforts against similar communities.
- Local officials can hold contractors accountable and replace if warranted.
- Motivated by satisfying customers and making profit, private for-profit companies focus on practices that increase efficiency and keep costs down. Usually heavily engaged in nonemergency market as well to help offset costs of serving the emergency market.

Disadvantages include:

- Locating a private third-party contractor interested in providing service in the local government's location.

- Aggressive billing procedures.
- Lack of accountability and transparency.
- Performance data may not be accessible.
  - Follow-up on complaints and inquiries may be inconsistent.
  - Financial oversight often limited.
  - Unregulated competition—especially true within nonemergency transport market, where ability to pay mix is more lucrative than in emergency environment. Clear local regulation and contracting can curtail problems.
- Sudden withdrawal of the provider from the market is also a potential concern. This may occur if provider decides the market doesn't provide enough revenue to support its service, or it can be due to internal financial issues that force downsizing. The community needs to clearly address this in the contract and remain alert to the potential need for another contractor if one is available and willing to take on the contract to provide service on short notice.
- Less attractive for field providers. Lower wages, less opportunity for advancement, and higher expectations for productivity are all factors that may contribute to turnover. The exclusive franchise should provide payment to the city for first responder services with the amount in the range as if the city were providing the service (Option 1). Other considerations for the city include:
- Any franchise should include specific metrics for performance by any provider and not be limited simply to response time. Key performance Indicators are regularly cited by many agencies when structuring service levels and should be part of any franchise.
    - **City will probably require between six ambulances 24/7 and eight ambulances during high activity hours. These numbers can be adjusted as reliable data is developed on actual needs.**
    - **Key Metric: Require ambulance response time from call received to on location of eight minutes and 59 seconds (00:08:59) at the 90th percentile for high acuity (Charlie, Delta, and Echo) EMS incidents.**
    - **Require monthly reporting of statistical data to city with detailed explanation for all incidents where benchmark response time was exceeded even if overall performance achieved 90th percentile.**
- Excessive time for response should lead to monthly fines/penalties by the providers. Tulsa, San Diego, and other communities set a range of response times necessary for specific call types.
- Franchise operators should have the option to co-locate at fire stations and reimburse the City of Springfield for use of stations. As an example, in CSA-17 outside of San Diego, cities are provided up to $50,000 by ambulance providers for the ability to co-locate.

Alternative 3 – Franchise Fee EMS Service with City Billing

Alternative 3 is much like alternatives 1 and 2 but would involve the City of Springfield creating an EMS service, selecting an exclusive franchise holder that provides transport services at a set fee, while the city bills for service.

This option is like the arrangement in the link found under Option 2 by EMSA in California.

In this scenario, the city establishes rates and oversees billing (through its finance department or third party). The selected transport entity provides staffing, equipment, and operations oversight for transport with units co-located at city stations for a fee.

The benefits of this option are that the city avoids purchasing ambulance units, the employee hiring process, employment costs, and operation oversight for transport.

Alternative 4 – City EMS Service Ordinance

As an alternative to the franchise fee model that usually offers a sole-source contract for emergency EMS services, the City of Springfield could adopt a city ordinance regarding the licensing of EMS ground transport providers in the city that sets specific criterion for those who wish to be included in the 9-1-1 delivery system (ambulance services must already have city approval to operate). As with the other alternatives listed, these requirements may be level of effort or performance-based, with a focus on results. Management and oversight of clinical care, day-to-day operations, assets, and capitalization are all still accomplished in the private sector with accountability provided to the city through monthly reports. The level of involvement and financial support of local government would be negotiable. The requirements specified in the ordinance would be for emergency (9-1-1) services and so existing providers could continue inter-hospital transports and other scheduled work (remaining licensed to do so) that don't interfere with their 9-1-1 obligations, or, even decline to participate in the 9-1-1 EMS system.

As with Option 2 or 3, the ordinance should include the provisions and key metrics expected of any companies that are providing 9-1-1 EMS transport services including, but not necessarily limited to:

- The licensed provider(s) should provide payment to the city for first responder services with the amount in the range as if the city were providing the service.
- Any licensed provider should be required to meet specific metrics for performance and not be limited simply to response time. Key performance Indicators are regularly cited by many agencies when structuring service levels and should be part of any ordinance requirements.
    - **City will probably require between six ambulances 24/7 and eight ambulances during high activity hours. These numbers can be adjusted as reliable data is developed on actual needs.**
    - **Key Metric: Require ambulance response time from call received to on location of eight minutes and 59 seconds (00:08:59) at the 90th percentile for high acuity (Charlie, Delta, and Echo) EMS incidents.**
    - **Require monthly reporting of statistical data to city with detailed explanation for all incidents where benchmark response time was exceeded even if overall performance achieved 90th percentile.**
- Excessive time for response should lead to monthly fines/penalties by the providers.
- EMS providers should still have the option to co-locate at fire stations and reimburse the City of Springfield for use of stations.

Recommendations and Planning Objectives:

- CPSM recommends that the City of Springfield and SFD create a 5-, 10-, and 15-year strategic plan for the fire department that integrates with existing city land-use, master, capital improvement, and strategic plans. (Recommendation No. 27.)
  - The strategic plan should create a "standard of response" cover that outlines what service levels are expected when a call for service is received. Response areas should include urban, suburban, and unincorporated areas. Response time metrics should include emergency and non-emergency response profiles. (27A)
  - The capital improvement component of the strategic plan should include the plan and timeline for the relocation and replacement of stations, 6, 7, 8, and 9 and the consolidation of Stations 4 and 10. (27B)
  - The capital improvement component of the strategic plan should include the plan and timeline for replacement of fire apparatus commensurate with its use and in accordance with NFPA and industry recommendations. Part of this process should include the purchase and deployment of Quints and Squads as identified in this report. (27C)
  - The capital improvement component of the strategic plan should include a plan for equipment replacement to meet existing NFPA standards on equipment replacement. This should include but not be limited to firefighter PPE, SCBA, cardiac monitors, and other high-cost items. (27D)
  - Consideration should be given to a type of "lease-purchase" program that would stage acquisition of equipment in the department, pay the yearly "lease" fee to the manufacturer and in turn, have the option to purchase the equipment at the end of the lease term or return it for a newer model. Many agencies, such as Plymouth, Michigan, have used this process to stabilize the yearly costs of equipment replacement as well as provide the best equipment to responders and avoid large repair/maintenance costs. (27E)
- CPSM recommends that at this time the city primarily consider EMS Alternative 2 as presented in this report and each of its components as the best immediate option for the city to include: (Recommendation No. 28.)
  - As part of reconfiguring the EMS response system in the city, the SFD should implement a true EMD or Priority Dispatch system of only having an ambulance respond to Alpha and Bravo or BLS criterion calls unless there is no ambulance available, then an SFD fire apparatus should respond. The SFD should continue to respond the closest available resources in fire suppression units to Charlie, Delta, and Echo, or ALS criterion calls. (28A)
  - CPSM further recommends that the City of Springfield and SFD should explore the feasibility of implementing some type of community-based mobile integrated health care or paramedicine program in an attempt to provide better service to the community, and to the extent possible, attempt to minimize the recurring demand on the service from continual and repeated use of critical resources for non-emergency responses. The city should also explore the feasibility of introducing telemedicine as part of this program and if funding for non-transport of patients would be available. (28B)

- CPSM strongly recommends that with the majority of SFD responses being EMS related that the position of EMS Coordinator be filled ASAP independent of future decisions regarding the overall EMS delivery system. (Recommendation No. 29.)

The City of Springfield has numerous large buildings where even once emergency responders arrive on the scene they may have to travel an extended distance, which takes valuable minutes, to reach the patient. Several communities have implemented programs that incorporate trained volunteers into the emergency medical response system. Like Springfield, the driving factors behind these programs are often the dense population along with numerous high-rises where this type of response force can speed initial life-saving care to those in need, particularly where it may take emergency personnel some time to make their way to the patient even after arriving on location.

The American Heart Association continues to recognize the chain of survival by early recognition, early CPR, early defibrillation, and rapid transport. PulsePoint® is an app for iPhones that can be downloaded by anyone in the community who is willing to participate in this program, enabling them to be notified when someone is having a cardiac arrest in their vicinity. Fifty-seven percent of adults in the United States say they have had CPR training. Utilizing new technology, bystander performance, and active citizen involvement enhances the care provided to the community.

- CPSM recommends that as a planning objective the SFD should explore the possibility of enhancing their technological capabilities to provide increased service to the community for serious cardiac incidents such as through the iPhone PulsePoint® app or other similar programs or apps. (Recommendation No. 30.)
- **CPSM recommends that the City of Springfield explore all possible options to increase revenues that could be used to offset the cost of providing fire and EMS services to the city and FPDs, such as additional PILOT payments from the State of Illinois and other tax exempt and non-profit entities, public safety assessment for commuters, hotel tax, fire prevention fees, etc. before considering service reductions.** (Recommendation No. 31.)

One of the keys to being able to maintain current minimum staffing levels and reduce the amount of overtime being utilized is to monitor and attempt to minimize the amount of unscheduled leave—primarily sick and injury—that personnel utilize. CPSM is not suggesting that personnel are not entitled to legitimate use of both these types of leave; however, we are also very cognizant of the fact that there are personnel in every department who misuse, and in fact abuse this type of leave and the system. The larger the department, the more of these personnel there likely are. Monitoring these types of leave and personnel who are suspected of misusing it can assist with keeping the need for overtime down and reduce staffing costs.

- CPSM recommends as a planning objective that SFD leadership work with the firefighters bargaining unit to develop a policy for monitoring and verification of personnel who are on sick or injury leave. Examples of things that can be discussed include requiring a location where they will be for in-person verification by a chief officer, providing a doctor's note, being required to see a city-arranged doctor, and not being eligible for overtime until they have worked a regular shift after a sick call out. (Recommendation No. 32.)

Accreditation is a comprehensive self-assessment and evaluation model that enables organizations to examine past, current, and future service levels and internal performance and compare them to industry best practices. This process leads to improved service delivery. The Center for Public Safety Excellence's (CPSE) accreditation program, administered by the Commission on Fire Accreditation International (CFAI) allows fire and emergency service agencies to compare their performance to industry best practices in order to:

- Determine community risk and safety needs and develop community-specific Standards of Cover.
- Evaluate the performance of the Department.
- Establish a method for achieving continuous organizational improvement.

Particularly for emergency services, local officials need criteria to assess professional performance and efficiency. The CFAI accreditation process provides a well-defined, internationally recognized benchmark system to measure the quality of fire and emergency services.

As noted in several sections of this report, the SFD is operationally and administratively a very good fire department. Based upon that premise, once the department accomplishes some of the pressing strategic plan recommendations contained in this report, the SFD with support from the City of Springfield, should consider undertaking the accreditation process. Although time consuming and labor intensive it would allow the SFD to be recognized for its excellence.

- CPSM recommends as a planning objective that once the SFD accomplishes some of the pressing strategic plan recommendations contained in this report, it should, with support from the elected officials of the City of Springfield, consider undertaking the accreditation process. (Recommendation No. 33.)

SECTION 7. DATA ANALYSIS

This data analysis was prepared as a key component of the study of the Springfield Fire Department (SFD). This analysis examines all calls for service between January 1, 2019, and January 1, 2021, as recorded in the Sangamon County Central Dispatch System's (SCCDS) computer-aided dispatch (CAD) system and National Fire Incident Reporting System (NFIRS).

This analysis is made up of four parts. The first part focuses on call types and dispatches. The second part explores the time spent and the workload of individual units. The third part presents an analysis of the busiest hours in the year studied. The fourth and final part provides a response time analysis of SFD units.

During the year covered by this study, the Springfield Fire Department provided several types of life safety service to about 115,900 city residents within 61 square miles land area and 6.3 square miles water area, along with nine unincorporated areas in and around Springfield known as Fire Protection Districts. The SFD operates at least 49 personnel daily, including two battalion chiefs. The SFD operated out of 12 stations. The frontline apparatus includes 12 engines, three ladder trucks, a multiple-purpose squad, and two special event designated units (EMS units designated for large public events). The SFD also operated two spare rigs that were occasionally in service when other frontline engines were out of service and a spare truck as a backup when another ladder truck was out of service.

In 2019, the Springfield Fire Department responded to 19,668 calls, of which 58 percent were EMS calls. The total combined workload (deployed time) for SFD units was 8,219.2 hours. The average dispatch time was 1.8 minutes and the average total response time was 6.7 minutes. The 90th percentile dispatch time was 2.9 minutes and the 90th percentile total response time was 9.8 minutes.

In 2020, SFD responded to 19,224 calls, of which 57 percent were EMS calls. The total combined workload (deployed time) for SFD units was 7,888.5 hours. The average dispatch time was 1.7 minutes and the average total response time was 6.9 minutes. The 90th percentile dispatch time was 2.8 minutes and the 90th percentile total response time was 10.0 minutes.

METHODOLOGY

In this report, CPSM analyzes calls and runs. A call is an emergency service request or incident. A run is a dispatch of a unit (i.e., a unit responding to a call). Thus, a call may include multiple runs.

We received CAD data and NFIRS data for the Springfield Fire Department. We first matched the NFIRS and CAD data based on the incident numbers provided. Then, we classified the calls in a series of steps. We first used the NFIRS incident type to identify canceled calls and to assign EMS, motor vehicle accident (MVA), and fire category call types. EMS calls were then assigned detailed categories based on their detailed CAD incident call types shown in Attachment V.

We received records for 39,494 total calls in 2019 and 2020. We removed 602 calls for various reasons. Based on their call type descriptions, 32 test calls were removed. An additional 36 calls lacking a responding SFD unit were removed. Finally, we removed all runs that did not have at least an en route or an arrival time. This led us to exclude another 308 calls. In addition, 226 calls that only involved administrative or inspection units were not included in the analysis. However,

the work associated with these calls is included in the analysis of additional personnel in Attachment II.

In this report, canceled and mutual aid (given) calls are included in all analyses other than the response time analyses. To assign mutual aid calls, we used each call's recorded latitude and longitude to determine the fire protection district where a call was made. SFD serves the fire protection districts presented in the following table. All calls responded by SFD units but located in areas not primarily covered by SFD were classified as "mutual aid" calls.

TABLE 7-1: Fire Protection Districts Serviced by SFD

Fire Protection District
Curran
East Side
Lake Springfield
North Side
South Lawn
South Oak Knolls
South Side
Springfield (City)
Western
Woodside

The analysis results are primarily presented for 2019. The results for 2020 are presented along with the corresponding 2019 results in Attachment IV for comparison.

AGGREGATE CALL TOTALS AND RUNS

In 2019, SFD responded to 19,668 non-administrative calls. Of these, 264 were structure fire calls and 233 were outside fire calls.

Calls by Type

The following table and two figures show the number of calls by call type, average calls per day, and the percentage of calls that fall into each call type category for the 12 months studied.

TABLE 7-2: Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
Breathing difficulty	2,124	5.8	10.8
Cardiac and stroke	1,408	3.9	7.2
Fall and injury	937	2.6	4.8
Illness and other	5,140	14.1	26.1
MVA	670	1.8	3.4
Overdose and psychiatric	453	1.2	2.3
Seizure and unconsciousness	734	2.0	3.7
EMS Total	**11,466**	**31.4**	**58.3**
False alarm	2,363	6.5	12.0
Good intent	829	2.3	4.2
Hazard	476	1.3	2.4
Outside fire	233	0.6	1.2
Public service	2,311	6.3	11.8
Structure fire	264	0.7	1.3
Fire Total	**6,476**	**17.7**	**32.9**
Canceled	1,588	4.4	8.1
Mutual aid	138	0.4	0.7
Total	**19,668**	**53.9**	**100.0**

FIGURE 7-1: EMS Calls by Type

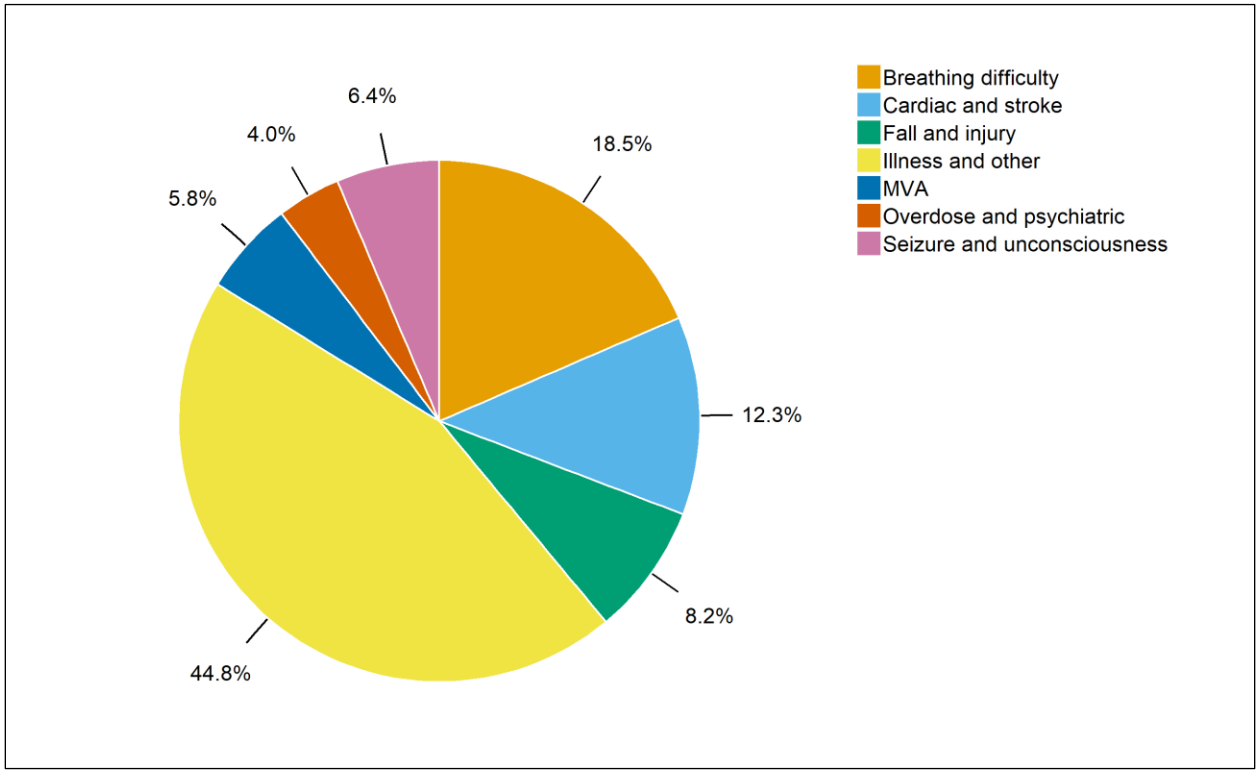
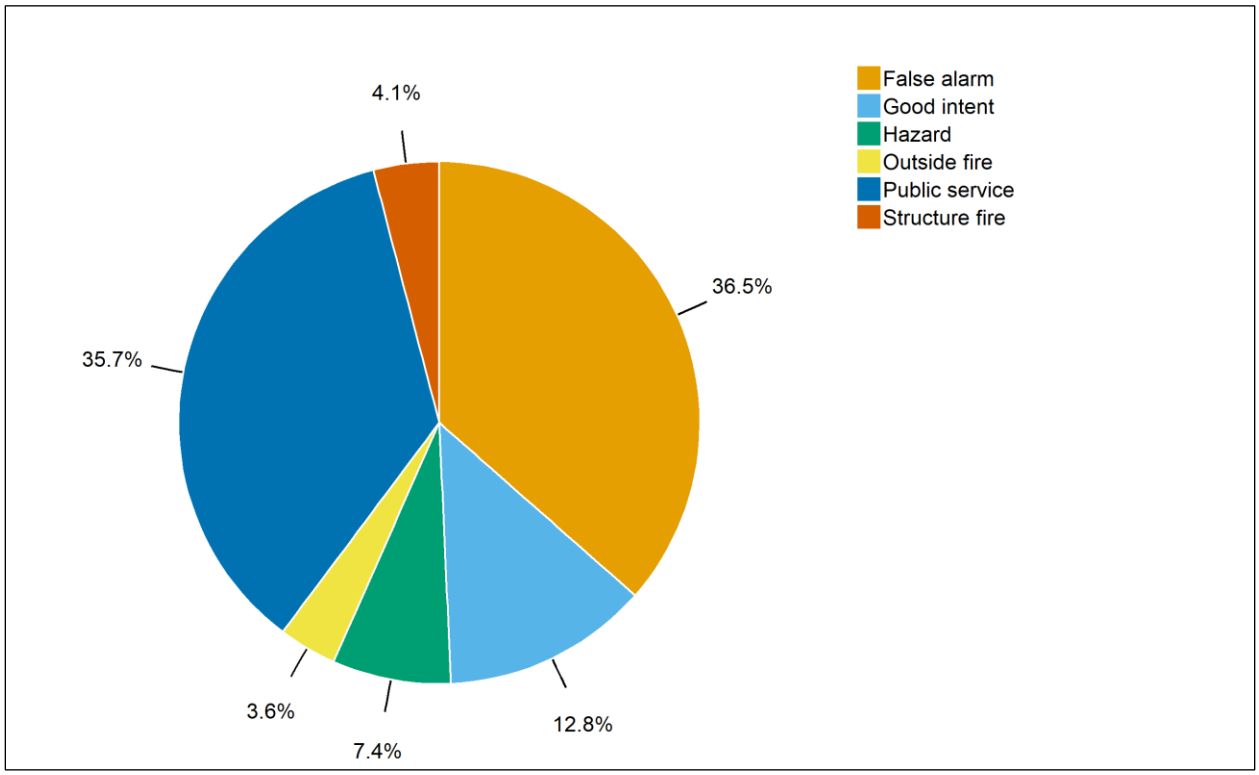


FIGURE 7-2: Fire Calls by Type



Observations:

Overall

- The department received an average of 53.9 calls per day, including 4.4 canceled calls (8 percent of all calls) and 0.2 mutual aid calls.

EMS

- EMS calls for the year totaled 11,466 (58 percent of all calls), an average of 31.4 calls per day.
- Illness and other calls were the largest category of EMS calls at 45 percent of EMS calls, an average of 14.1 calls per day.
- Cardiac and stroke calls made up 12 percent of EMS calls, an average of 3.9 calls per day.
- Motor vehicle accidents made up 6 percent of EMS calls, an average of 1.8 calls per day.

Fire

- Fire calls for the year totaled 6,476 (33 percent of all calls), an average of 17.7 calls per day.
- False alarm calls were the largest category of fire calls at 36 percent of fire calls, an average of 6.5 calls per day.
- Structure and outside fire calls combined made up 8 percent of fire calls, an average of 1.4 calls per day.

Calls by Type and Duration

The following table shows the duration of calls by type using four duration categories: less than 30 minutes, 30 minutes to one hour, one to two hours, and more than two hours.

TABLE 7-3: Calls by Type and Duration

Call Type	Less than 30 Minutes	30 Minutes to One Hour	One to Two Hours	More Than Two Hours	Total
Breathing difficulty	1,965	144	15	0	2,124
Cardiac and stroke	1,342	62	4	0	1,408
Fall and injury	822	100	14	1	937
Illness and other	4,584	505	48	3	5,140
MVA	504	133	30	3	670
Overdose and psychiatric	404	48	1	0	453
Seizure and unconsciousness	665	64	5	0	734
EMS Total	**10,286**	**1,056**	**117**	**7**	**11,466**
False alarm	2,185	160	18	0	2,363
Good intent	776	47	6	0	829
Hazard	314	111	40	11	476
Outside fire	175	40	17	1	233
Public service	2,209	90	10	2	2,311
Structure fire	92	73	76	23	264
Fire Total	**5,751**	**521**	**167**	**37**	**6,476**
Canceled	1,580	7	0	1	1,588
Mutual aid	101	21	13	3	138
Total	**17,718**	**1,605**	**297**	**48**	**19,668**

Observations:

EMS

- On average, there were 0.3 EMS calls per day that lasted more than one hour.
- A total of 11,342 EMS calls (99 percent) lasted less than one hour, 117 EMS calls (1 percent) lasted one to two hours, and 7 EMS calls (less than1 percent) lasted two or more hours.
- A total of 1,404 cardiac and stroke calls (100 percent) lasted less than one hour, and 4 cardiac and stroke calls (less than 1 percent) lasted one to two hours.
- A total of 637 motor vehicle accidents (95 percent) lasted less than one hour, 30 motor vehicle accidents (4 percent) lasted one to two hours, and 3 motor vehicle accidents (1 percent) lasted two or more hours.

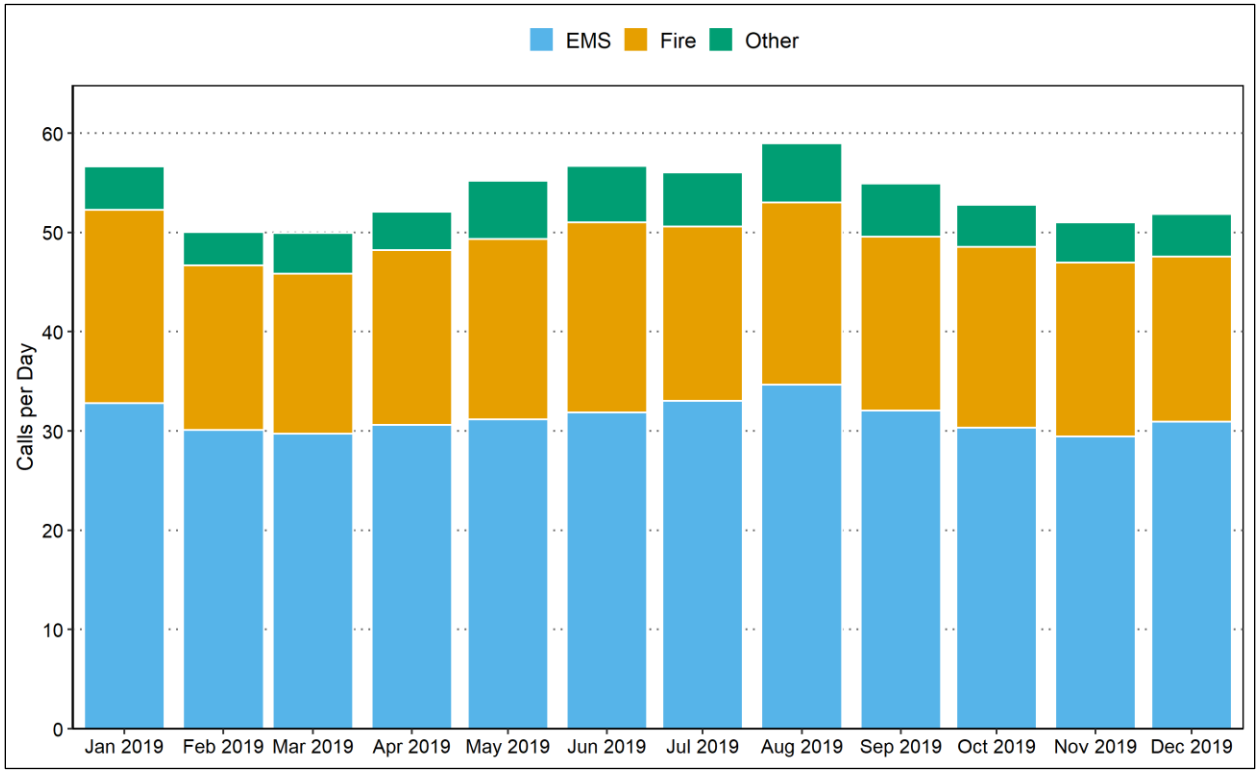
Fire

- On average, there were 0.6 fire calls per day that lasted more than one hour.
- A total of 6,272 fire calls (97 percent) lasted less than one hour, 167 fire calls (3 percent) lasted one to two hours, and 37 fire calls (1 percent) lasted two or more hours.
- A total of 2,345 false alarm calls (99 percent) lasted less than one hour, and 18 false alarm calls (1 percent) lasted one to two hours.
- A total of 215 outside fire calls (92 percent) lasted less than one hour, 17 outside fire calls (7 percent) lasted one to two hours, and 1 outside fire call (less than 1 percent) lasted two or more hours.
- A total of 165 structure fire calls (62 percent) lasted less than one hour, 76 structure fire calls (29 percent) lasted one to two hours, and 23 structure fire calls (9 percent) lasted two or more hours.

Average Calls by Month and Hour of Day

The following figure shows the monthly variation in the average daily number of calls handled by the SFD in 2019. Similarly, the subsequent figure illustrates the average number of calls received each hour of the day for the year.

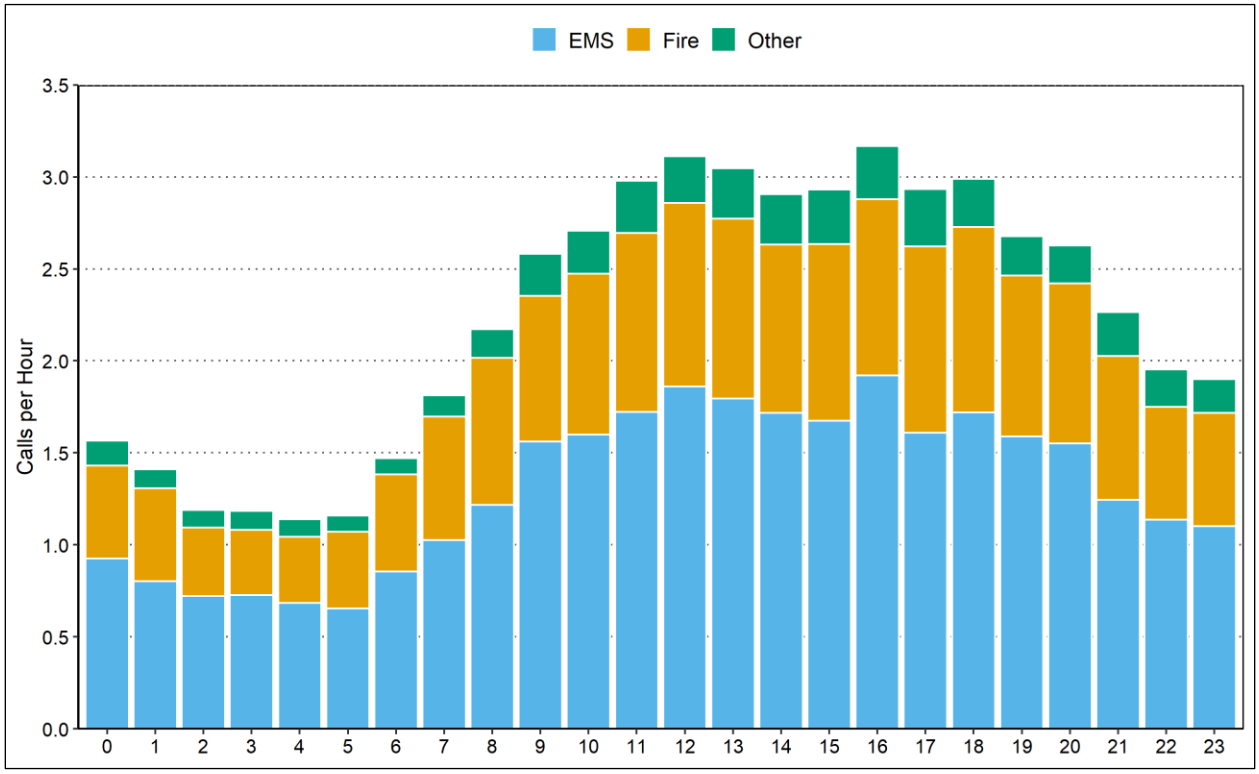
FIGURE 7-3: Average Calls by Month



Observations:

- Average EMS calls per day ranged from 29.5 in November 2019 to 34.7 in August 2019.
- Average fire calls per day ranged from 16.1 in March 2019 to 19.5 in January 2019.
- Average other calls per day ranged from 3.4 in February 2019 to 5.9 in August 2019.
- Average calls per day overall ranged from 49.9 in March 2019 to 59.0 in August 2019.

FIGURE 7-4: Calls by Hour of Day



Observations:

- Average EMS calls per hour ranged from 0.7 between 5:00 a.m. and 6:00 a.m. to 1.9 between 4:00 p.m. and 5:00 p.m.
- Average fire calls per hour ranged from 0.4 between 3:00 a.m. and 4:00 a.m. to 1.0 between 5:00 p.m. and 6:00 p.m.
- Average other calls per hour ranged from 0.1 between 5:00 a.m. and 6:00 a.m. to 0.3 between 5:00 p.m. and 6:00 p.m.
- Average calls per hour overall ranged from 1.1 between 4:00 a.m. and 5:00 a.m. to 3.2 between 4:00 p.m. and 5:00 p.m.

Units Arrived at Calls

The following table and two figures detail the number of calls with one, two, three, and four or more units arriving to a call, broken down by call type. In this section, we limit ourselves to calls where a unit arrives. There were 711 calls where an SFD unit recorded an en route time but no unit recorded an arrival time. Of these 711 calls, 710 were canceled calls and 1 was a public service call.

TABLE 7-4: Calls by Call Type and Number of Units Arriving

Call Type	Number of Units				Total Calls
	One	Two	Three	Four or More	
Breathing difficulty	2,062	60	2	0	2,124
Cardiac and stroke	1,388	20	0	0	1,408
Fall and injury	785	149	1	2	937
Illness and other	4,792	304	40	4	5,140
MVA	305	311	33	21	670
Overdose and psychiatric	384	68	0	1	453
Seizure and unconsciousness	722	11	1	0	734
EMS Total	**10,438**	**923**	**77**	**28**	**11,466**
False alarm	1,677	421	249	16	2,363
Good intent	735	34	13	47	829
Hazard	332	37	71	36	476
Outside fire	196	16	12	9	233
Public service	2,230	57	19	4	2,310
Structure fire	15	38	35	176	264
Fire Total	**5,185**	**603**	**399**	**288**	**6,475**
Canceled	831	35	3	9	878
Mutual aid	110	7	10	11	138
Total	**16,564**	1,568	**489**	**336**	**18,957**
Percentage	**87.4**	8.3	**2.6**	**1.8**	**100.0**

Note: Only calls with arriving units were considered. Therefore, the number of calls is less than that presented in Table 7-1.

FIGURE 7-5: Calls by Number of Units Arriving – EMS

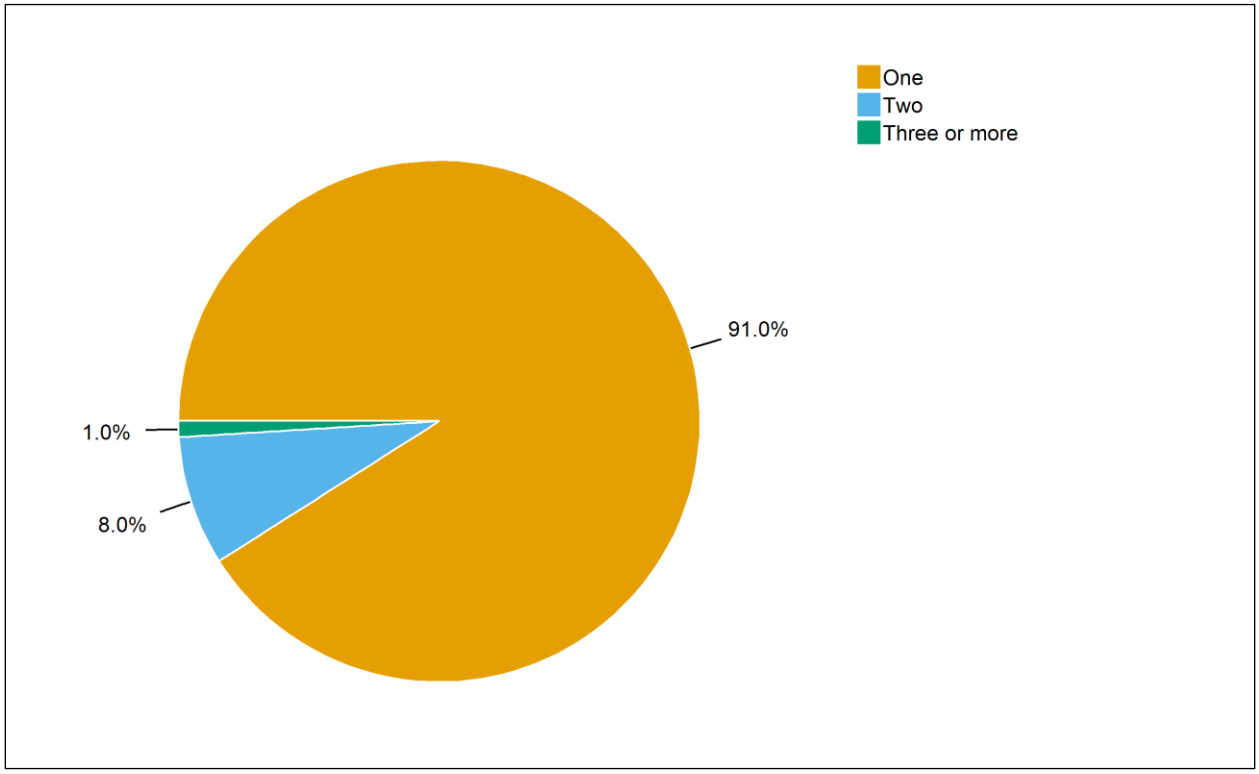
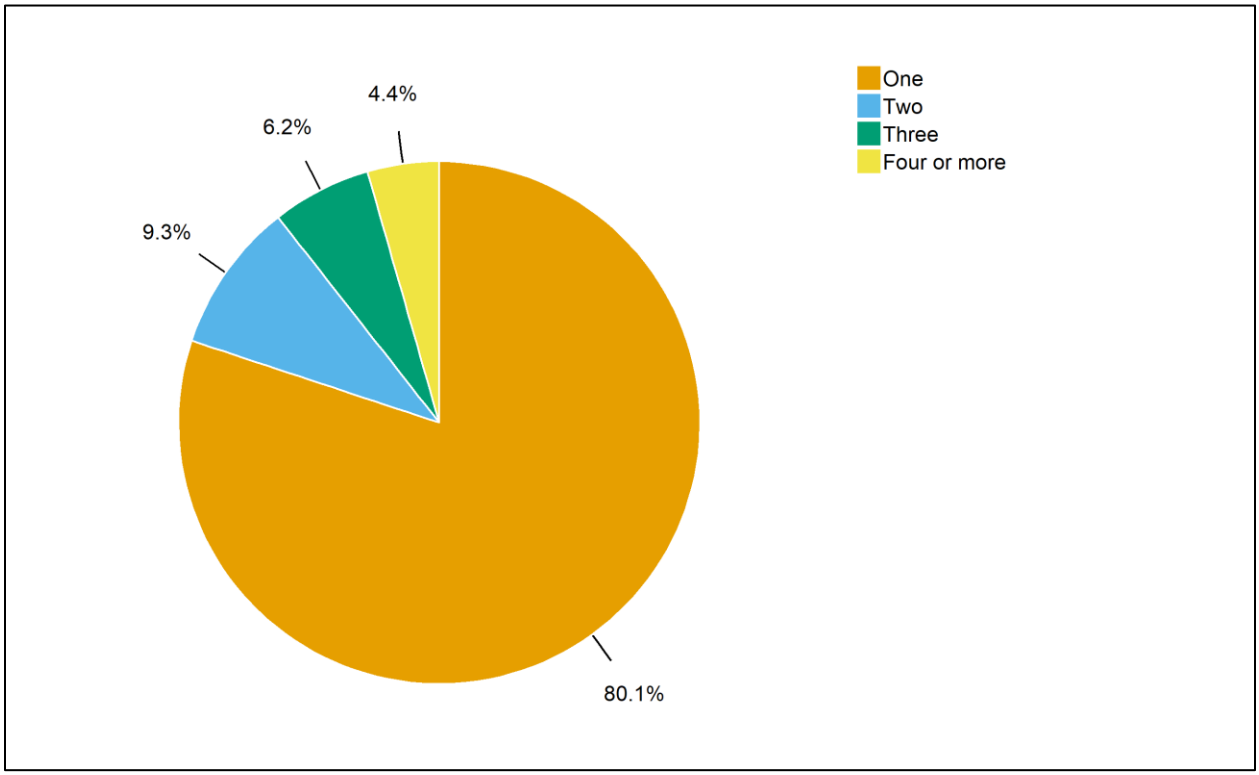


FIGURE 7-6: Calls by Number of Units Arriving – Fire



Observations:

Overall

- On average, 1.2 units arrived at all calls; for 87 percent of calls, only one unit arrived.
- Overall, four or more units arrived at 2 percent of calls.

EMS

- On average, 1.1 units arrived per EMS call.
- For EMS calls, one unit arrived 91 percent of the time, two units arrived 8 percent of the time, and three or more units arrived 1 percent of the time.

Fire

- On average, 1.4 units arrived per fire call.
- For fire calls, one unit arrived 80 percent of the time, two units arrived 9 percent of the time, three units arrived 6 percent of the time, and four or more units arrived 4 percent of the time.
- For outside fire calls, three or more units arrived 9 percent of the time.
- For structure fire calls, three or more units arrived 80 percent of the time. An average of 5.0 units arrived at structure fire calls.

WORKLOAD: RUNS AND TOTAL TIME SPENT

The workload of each unit is measured in two ways: runs and deployed time. The deployed time of a run is measured from the time a unit is dispatched through the time the unit is cleared. Because multiple units respond to some calls, there are more runs than calls, and the average deployed time per run varies from the total duration of calls.

Runs and Deployed Time – All Units

Deployed time, also referred to as deployed hours, is the total deployment time of all units deployed on all runs. The following table shows the total deployed time, both overall and broken down by type of run, for SFD units in 2019. Table 7-6 and Figure 7-7 present the average deployed minutes by hour of day.

TABLE 7-5: Annual Runs and Deployed Time by Run Type

Call Type	Deployed Minutes per Run	Annual Hours	Percent of Total Hours	Deployed Minutes per Day	Annual Runs	Runs per Day
Breathing difficulty	17.5	649.0	7.9	106.7	2,221	6.1
Cardiac and stroke	16.8	403.5	4.9	66.3	1,445	4.0
Fall and injury	17.9	341.4	4.2	56.1	1,146	3.1
Illness and other	18.8	1,798.6	21.9	295.7	5,754	15.8
MVA	20.9	455.8	5.5	74.9	1,311	3.6
Overdose and psychiatric	18.2	165.6	2.0	27.2	547	1.5
Seizure and unconsciousness	18.2	233.4	2.8	38.4	768	2.1
EMS Total	**18.4**	**4,047.5**	**49.2**	**665.3**	**13,192**	**36.1**
False alarm	12.9	1,096.6	13.3	180.3	5,120	14.0
Good intent	13.4	316.4	3.8	52.0	1,416	3.9
Hazard	27.0	445.7	5.4	73.3	990	2.7
Outside fire	20.8	143.2	1.7	23.5	413	1.1
Public service	14.6	617.2	7.5	101.5	2,533	6.9
Structure fire	39.8	1,197.6	14.6	196.9	1,806	4.9
Fire Total	**18.7**	**3,816.7**	**46.4**	**627.4**	**12,278**	**33.6**
Canceled	7.5	228.7	2.8	37.6	1,828	5.0
Mutual aid	31.8	126.3	1.5	20.8	238	0.7
Other Total	**10.3**	**355.0**	**4.3**	**58.4**	**2,066**	**5.7**
Total	**17.9**	**8,219.2**	**100.0**	**1,351.1**	**27,536**	**75.4**

Observations:

Overall

- The total deployed time for the year was 8,219.2 hours. The daily average was 22.5 hours for all units combined.
- There were 27,536 runs, including 1,828 runs dispatched for canceled calls and 238 runs dispatched for mutual aid given calls. The daily average was 75.4 runs.

EMS

- EMS runs accounted for 49 percent of the total workload.
- The average deployed time for EMS runs was 18.4 minutes. The deployed time for all EMS runs averaged 11.1 hours per day.

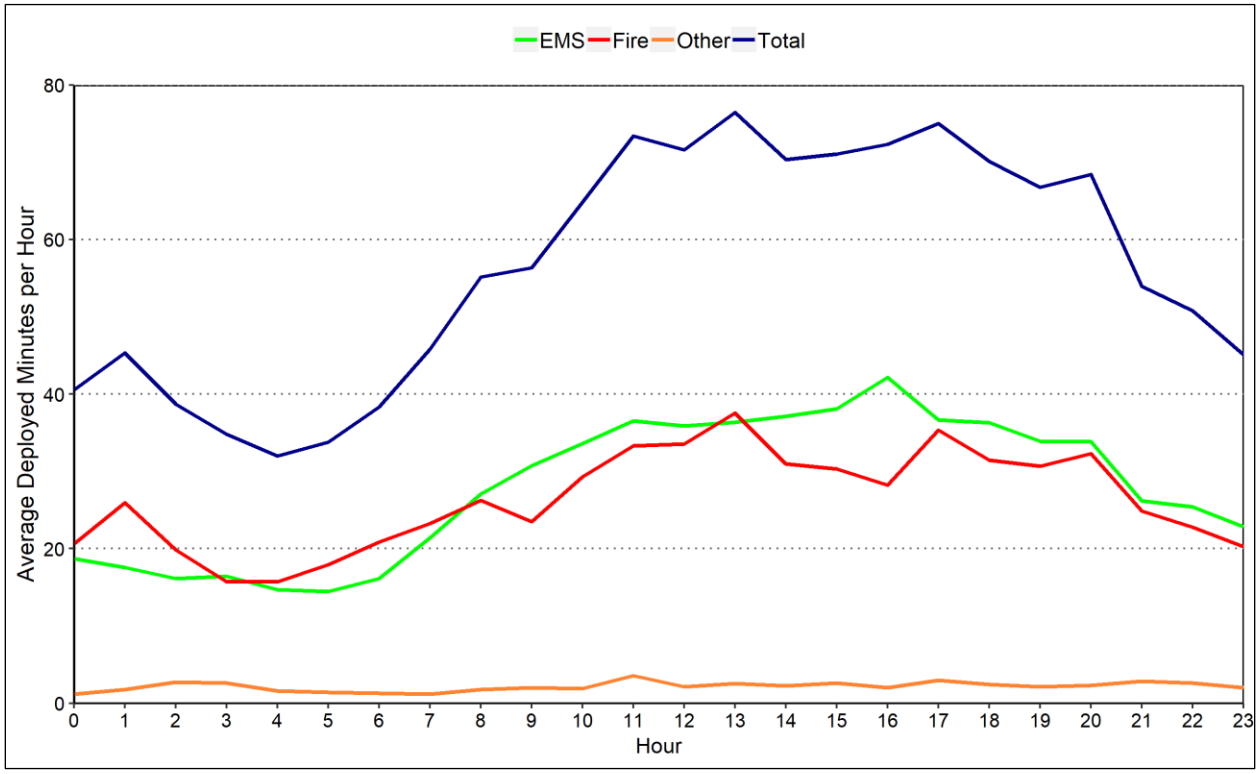
Fire

- Fire runs accounted for 46 percent of the total workload.
- The average deployed time for fire runs was 18.7 minutes. The deployed time for all fire runs averaged 10.5 hours per day.
- There were 2,219 runs for structure and outside fire calls combined, with a total workload of 1,340.9 hours. This accounted for 16 percent of the total workload.
- Accounting for 12 engines and 3 ladder trucks operating for a total of 131,400 hours annually, structure and outside fire calls amounted to 1.02 percent of available time.
- The average deployed time for outside fire runs was 20.8 minutes per run, and the average deployed time for structure fire runs was 39.8 minutes per run.

TABLE 7-6: Average Deployed Minutes by Hour of Day

Hour	EMS	Fire	Other	Total
0	18.5	20.6	1.4	40.6
1	17.6	26.2	1.5	45.3
2	16.1	20.9	1.7	38.7
3	16.1	16.8	1.9	34.8
4	14.6	16.1	1.2	32.0
5	14.5	17.6	1.7	33.8
6	16.2	20.8	1.3	38.3
7	21.4	23.2	1.2	45.8
8	27.3	26.0	1.8	55.1
9	30.5	23.4	2.4	56.3
10	33.0	29.2	2.7	64.8
11	36.6	33.2	3.6	73.4
12	35.9	32.5	3.2	71.6
13	36.3	36.0	4.2	76.5
14	37.0	30.2	3.2	70.3
15	38.1	30.0	3.0	71.1
16	41.5	28.2	2.7	72.3
17	36.5	35.2	3.2	75.0
18	36.2	31.0	3.0	70.1
19	33.7	29.7	3.3	66.7
20	33.5	32.5	2.5	68.4
21	26.1	25.1	2.8	54.0
22	25.4	22.8	2.6	50.8
23	22.5	20.1	2.4	45.1
Daily Avg.	**665.2**	**627.4**	**58.4**	**1,351.0**

FIGURE 7-7: Average Deployed Minutes by Hour of Day



Observations:

- Hourly deployed time was highest during the day from 11:00 a.m. to 7:00 p.m., averaging between 70 and 76 minutes.
- Average deployed time peaked between 1:00 p.m. and 2:00 p.m., averaging 76 minutes.
- Average deployed time was lowest between 4:00 a.m. and 5:00 a.m., averaging 32 minutes.

Workload by Fire Protection District

The following table breaks down the workload of SFD by fire protection district of the call. Table 7-8 provides further detail on the workload associated with structure and outside fires calls, also broken down by fire protection district in and around Springfield. All calls outside of SFD's service area are listed as "other."

TABLE 7-7: Annual Workload by Fire Protection District

Fire Protection District	Calls	Pct. Annual Calls	Runs	Runs Per Day	Minutes Per Run	Annual Hours	Pct. Annual Work	Minutes Per Day
Springfield (City)	16,983	86.3	23,925	65.5	17.5	6,968.9	84.8	1,145.6
East Side	620	3.2	841	2.3	18.7	261.9	3.2	43.1
North Side	513	2.6	686	1.9	20.7	236.1	2.9	38.8
Woodside	419	2.1	507	1.4	17.7	149.4	1.8	24.6
South Side	394	2.0	513	1.4	16.1	137.5	1.7	22.6
Western	225	1.1	318	0.9	22.9	121.5	1.5	20.0
South Lawn	154	0.8	183	0.5	19.3	58.9	0.7	9.7
Lake Springfield	74	0.4	112	0.3	41.4	77.3	0.9	12.7
Curran	60	0.3	91	0.2	33.6	50.9	0.6	8.4
South Oak Knolls	60	0.3	81	0.2	18.7	25.2	0.3	4.1
Other	166	0.8	279	0.8	28.3	131.6	1.6	21.6
Total	**19,668**	**100.0**	**27,536**	**75.4**	**17.9**	**8,219.2**	**100.0**	**1,351.1**

TABLE 7-8: Runs for Structure and Outside Fires by Fire Protection District

Fire Protection District	Structure Fire Runs	Structure Fires Deployed Minutes per Run	Outside Fire Runs	Outside Fires Deployed Minutes per Run	Total Annual Hours for Structure and Outside Fires	Pct. of Structure and Outside Fire Workload
Springfield (City)	1,594	39.5	336	19.0	1,155.8	85.2
East Side	68	41.3	27	26.9	58.9	4.3
North Side	28	64.5	15	35.8	39.0	2.9
Woodside	23	24.6	6	22.2	11.7	0.9
Western	22	58.8	6	47.7	26.3	1.9
South Lawn	22	26.0	7	35.8	13.7	1.0
South Side	21	10.5	13	15.1	6.9	0.5
South Oak Knolls	15	9.9	0	NA	2.5	0.2
Curran	7	152.1	3	23.7	18.9	1.4
Lake Springfield	6	71.1	0	NA	7.1	0.5
Other	12	60.5	6	28.9	15.0	1.1
Total	**1,818**	**39.9**	**419**	**20.9**	**1,355.9**	**100.0**

Observations:

Springfield (City)

- Total deployed time for the year was 6,968.9 hours or 85 percent of the total annual workload. The daily average was 19.1 hours for all units combined.
- There were 23,925 runs, including 1,601 runs dispatched for canceled calls. The daily average was 65.5 runs.

Other Fire Protection Districts Covered by SFD

- Total deployed time for the year was 1,118.7 hours or 14 percent of the total annual workload. The daily average was 3.1 hours for all units combined.
- There were 3,332 runs, including 186 runs dispatched for canceled calls. The daily average was 9.1 runs.

Other

- Total deployed time for the year was 131.6 hours or 2 percent of the total annual workload. The daily average was 21.9 minutes for all units combined.
- There were 279 runs, including 41 runs dispatched for canceled calls and 238 runs for mutual aid given calls.

Workload by Unit

The following table provides a summary of each unit's workload. Tables 7-10 and 7-11 provide a more detailed view of workload, showing each unit's runs broken out by run type (Table 7-10) and its daily average deployed time by run type (Table 7-11).

TABLE 7-9: Call Workload by Unit

Station	Unit	Unit Type	Deployed Minutes per Run	Total Hours	Total Pct.	Deployed Minutes per Day	Total Runs	Runs per Day
1	B01	Battalion chief	21.3	347.2	4.2	57.1	976	2.7
	E01	Engine	16.1	690.4	8.4	113.5	2,576	7.1
	Haz1	Special Response	67.2	3.4	0.0	0.6	3	0.0
	Haz2	Trailer	67.2	3.4	0.0	0.6	3	0.0
	Sq1	Squad	16.3	59.7	0.7	9.8	220	0.6
	T01	Platform/truck	17.3	423.4	5.2	69.6	1,468	4.0
	Total		**17.5**	**1,527.3**	**18.6**	**251.1**	**5,246**	**14.4**
2	E02	Engine	18.8	609.3	7.4	100.2	1,948	5.3
	T02	Ladder	16.5	311.3	3.8	51.2	1,131	3.1
	Total		**17.9**	**920.6**	**11.2**	**151.3**	**3,079**	**8.4**
3	E03	Engine	**17.3**	**478.6**	**5.8**	**78.7**	**1,663**	**4.6**
4	E04	Engine	**17.1**	**646.4**	**7.9**	**106.3**	**2,262**	**6.2**
5	E05	Engine	**16.4**	**561.5**	**6.8**	**92.3**	**2,056**	**5.6**
6	B02	Battalion chief	17.7	295.6	3.6	48.6	1,003	2.7
	E06	Engine	15.3	395.3	4.8	65.0	1,555	4.3
	Total		**16.2**	**690.9**	**8.4**	**113.6**	**2,558**	**7.0**
7	E07	Engine	**16.2**	**475.9**	**5.8**	**78.2**	**1,762**	**4.8**
8	E08	Engine	**18.7**	**646.4**	**7.9**	**106.3**	**2,070**	**5.7**
9	E09	Engine	20.8	658.0	8.0	108.2	1,894	5.2
	M01	Mobile Ventilation	238.7	4.0	0.0	0.7	1	0.0
	Total		**21.0**	**662.0**	**8.1**	**108.8**	**1,895**	**5.2**
10	E10	Engine	20.9	435.8	5.3	71.6	1,251	3.4
	Haz3	Hazmat Supply	71.1	5.9	0.1	1.0	5	0.0
	Total		**21.1**	**441.7**	**5.4**	**72.6**	**1,256**	**3.4**
11	E11	Engine	**19.9**	**329.2**	**4.0**	**54.1**	**992**	**2.7**
12	E12	Engine	20.0	530.0	6.4	87.1	1,592	4.4
	T03	Truck	16.5	267.7	3.3	44.0	976	2.7
	Total		**18.6**	**797.7**	**9.7**	**131.1**	**2,568**	**7.0**
SFD	E15	Reserve Engine	15.1	0.5	0.0	0.1	2	0.0
	E18	Reserve Engine	7.4	0.1	0.0	0.0	1	0.0
	EMS1	Special Designation	20.0	25.0	0.3	4.1	75	0.2
	EMS2	Special Designation	18.1	15.4	0.2	2.5	51	0.1
	Total		**19.1**	**41.0**	**0.5**	**6.7**	**129**	**0.4**
Total			**17.9**	**8,219.2**	**100.0**	**1,351.1**	**27,536**	**75.4**

TABLE 7-10: Total Annual Runs by Run Type and Unit

Station	Unit	EMS	Structure Fire	Outside Fire	Other Fire	Canceled	Mutual Aid	Total
1	B01	73	158	17	693	29	6	976
	E01	1,410	141	33	667	322	3	2,576
	Haz1	0	0	0	2	0	1	3
	Haz2	0	0	0	2	0	1	3
	Sq1	122	19	2	41	34	2	220
	T01	366	211	25	808	55	3	1,468
	Total	**1,971**	**529**	**77**	**2,213**	**440**	**16**	**5,246**
2	E02	1,115	47	27	614	129	16	1,948
	T02	285	179	24	583	40	20	1,131
	Total	**1,400**	**226**	**51**	**1,197**	**169**	**36**	**3,079**
3	E03	**938**	**95**	**26**	**486**	**115**	**3**	**1,663**
4	E04	**1,307**	**101**	**35**	**654**	**158**	**7**	**2,262**
5	E05	**1,220**	**123**	**34**	**463**	**215**	**1**	**2,056**
6	B02	40	110	13	810	13	17	1,003
	E06	872	123	43	362	150	5	1,555
	Total	**912**	**233**	**56**	**1,172**	**163**	**22**	**2,558**
7	E07	**930**	**110**	**31**	**549**	**133**	**9**	**1,762**
8	E08	**1,208**	**77**	**24**	**658**	**100**	**3**	**2,070**
9	E09	1,026	74	16	687	68	23	1,894
	M01	1	0	0	0	0	0	1
	Total	**1,027**	**74**	**16**	**687**	**68**	**23**	**1,895**
10	E10	736	62	30	324	94	5	1,251
	Haz3	0	0	0	3	0	2	5
	Total	**736**	**62**	**30**	**327**	**94**	**7**	**1,256**
11	E11	**449**	**34**	**7**	**379**	**47**	**76**	**992**
12	E12	797	44	18	621	91	21	1,592
	T03	188	97	8	640	29	14	976
	Total	**985**	**141**	**26**	**1,261**	**120**	**35**	**2,568**
SFD	E15	2	0	0	0	0	0	2
	E18	0	1	0	0	0	0	1
	EMS1	62	0	0	10	3	0	75
	EMS2	45	0	0	3	3	0	51
	Total	**109**	**1**	**0**	**13**	**6**	**0**	**129**
Total		**13,192**	**1,806**	**413**	**10,059**	**1,828**	**238**	**27,536**

Note: The type of each unit is given in Table 7-11. Other fire includes false alarm, good intent, hazard, and public service calls.

TABLE 7-11: Daily Average Deployed Minutes by Run Type and Unit

Station	Unit	EMS	Structure Fire	Outside Fire	Other Fire	Canceled	Mutual Aid	Total
1	B01	4.6	25.0	1.2	25.1	0.6	0.7	57.1
	E01	59.9	16.3	1.4	29.2	6.2	0.3	113.5
	Haz1	0.0	0.0	0.0	0.3	0.0	0.2	0.6
	Haz2	0.0	0.0	0.0	0.3	0.0	0.2	0.6
	Sq1	5.3	2.1	0.1	1.4	0.8	0.2	9.8
	T01	14.9	25.4	0.8	27.3	1.1	0.1	69.6
	Total	**84.7**	**68.8**	**3.4**	**83.6**	**8.8**	**1.8**	**251.1**
2	E02	62.5	4.3	1.8	27.4	2.9	1.3	100.2
	T02	15.6	12.4	1.0	20.2	0.7	1.3	51.2
	Total	**78.1**	**16.6**	**2.8**	**47.6**	**3.6**	**2.6**	**151.3**
3	E03	**43.6**	**9.4**	**1.6**	**20.9**	**2.8**	**0.3**	**78.7**
4	E04	**61.4**	**12.8**	**2.6**	**26.2**	**2.8**	**0.4**	**106.3**
5	E05	**52.7**	**13.2**	**1.9**	**20.0**	**4.5**	**0.0**	**92.3**
6	B02	3.7	13.1	0.5	28.4	0.3	2.5	48.6
	E06	35.9	10.6	2.2	13.1	2.8	0.4	65.0
	Total	**39.6**	**23.6**	**2.8**	**41.5**	**3.1**	**2.9**	**113.6**
7	E07	**41.9**	**9.8**	**1.1**	**21.9**	**2.5**	**1.0**	**78.2**
8	E08	**64.0**	**8.9**	**1.5**	**29.1**	**2.3**	**0.3**	**106.3**
9	E09	63.8	7.6	1.2	31.6	1.4	2.7	108.2
	M01	0.7	0.0	0.0	0.0	0.0	0.0	0.7
	Total	**64.4**	**7.6**	**1.2**	**31.6**	**1.4**	**2.7**	**108.8**
10	E10	40.5	8.3	2.6	17.5	2.0	0.7	71.6
	Haz3	0.0	0.0	0.0	0.6	0.0	0.4	1.0
	Total	**40.5**	**8.3**	**2.6**	**18.1**	**2.0**	**1.1**	**72.6**
11	E11	**29.6**	**2.1**	**0.5**	**15.8**	**1.1**	**4.9**	**54.1**
12	E12	48.8	5.0	0.9	29.1	1.9	1.5	87.1
	T03	9.9	10.8	0.6	21.0	0.6	1.2	44.0
	Total	**58.6**	**15.8**	**1.5**	**50.0**	**2.5**	**2.7**	**131.1**
SFD	E15	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	E18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EMS1	3.6	0.0	0.0	0.4	0.0	0.0	4.1
	EMS2	2.3	0.0	0.0	0.1	0.1	0.0	2.5
	Total	**6.1**	**0.0**	**0.0**	**0.6**	**0.1**	**0.0**	**6.7**
Total		**665.3**	**196.9**	**23.5**	**407.0**	**37.6**	**20.8**	**1,351.1**

Note: The type of each unit is given in Table 7-11. Other fire includes false alarm, good intent, hazard, and public service calls.

Observations:

- At the station level, station 1 made the most runs (5,246 or an average of 14.4 runs per day) and had the highest total annual deployed hours (1,527.3 or an average of 4.2 hours per day).
  - EMS calls accounted for 38 percent of runs and 34 percent of total deployed time.
  - Structure and outside fire calls accounted for 12 percent of runs and 29 percent of total deployed time.
- At the station level, station 2 made the second most runs (3,079 or an average of 8.4 runs per day) and had the second-highest total annual deployed hours (920.6 or an average of 2.5 hours per day).
  - EMS calls accounted for 45 percent of runs and 52 percent of total deployed time.
  - Structure and outside fire calls accounted for 9 percent of runs and 13 percent of total deployed time.
- At the unit level, Engine E01 made the most runs (2,576 or an average of 7.1 runs per day) and had the highest total annual deployed time (690.4 or an average of 1.9 hours per day).
  - EMS calls accounted for 55 percent of runs and 53 percent of total deployed time.
  - Structure and outside fire calls accounted for 7 percent of runs and 16 percent of total deployed time.
- At the unit level, Engine E09 made the sixth most runs (1,894 or an average of 5.2 runs per day) and had the second-highest total annual deployed time (658 or an average of 1.8 hours per day).
  - EMS calls accounted for 54 percent of runs and 59 percent of total deployed time.
  - Structure and outside fire calls accounted for 5 percent of runs and 8 percent of total deployed time.

ANALYSIS OF BUSIEST HOURS

There is significant variability in the number of calls from hour to hour. One special concern relates to the resources available for hours with the heaviest workload. We tabulated the data for each of the 8,760 hours in the year. The following table shows the number of hours in the year in which there were zero to four or more calls during the hour. Table 7-13 shows the 10 one-hour intervals which had the most calls during the year. Table 7-14 examines the number of times a call within a station's first due area overlapped with another call within the same area. Table 7-15 examines the availability of a unit at a station to respond to calls within its first due area.

TABLE 7-12: Frequency Distribution of the Number of Calls

Calls in an Hour	Frequency	Percentage
0	1,279	14.6
1	2,093	23.9
2	2,104	24.0
3	1,413	16.1
4	910	10.4
5	540	6.2
6	259	3.0
7+	162	1.8
Total	**8,760**	**100.0**

TABLE 7-13: Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Deployed Hours
6/28/2019, 1:00 p.m. to 2:00 p.m.	11	17	4.0
8/10/2019, 4:00 p.m. to 5:00 p.m.	11	13	2.8
1/16/2019, 4:00 p.m. to 5:00 p.m.	10	14	6.0
8/15/2019, 6:00 p.m. to 7:00 p.m.	10	11	3.1
6/18/2019, 11:00 p.m. to midnight	10	11	2.8
5/9/2019, 9:00 p.m. to 10:00 p.m.	10	11	2.5
1/12/2019, 8:00 a.m. to 9:00 a.m.	9	20	4.6
4/14/2019, 4:00 a.m. to 5:00 a.m.	9	19	8.9
1/28/2019, 5:00 p.m. to 6:00 p.m.	9	16	4.0
12/26/2019, 1:00 p.m. to 2:00 p.m.	9	15	3.6

Note: Total deployed hours is a measure of the total time spent responding to calls received in the hour, and which may extend into the next hour or hours. The number of runs and deployed hours only includes SFD units.

TABLE 7-14: Frequency of Overlapping Calls

Station	Scenario	Number of Calls	Percent of All Calls	Total Hours
1	No overlapped call	1,865	94.1	477.6
	Overlapped with one call	110	5.5	14.7
	Overlapped with two calls	7	0.4	0.9
2	No overlapped call	1,779	92.7	557.6
	Overlapped with one call	135	7.0	23.5
	Overlapped with two calls	6	0.3	0.3
3	No overlapped call	1,200	96.2	343.1
	Overlapped with one call	47	3.8	6.9
4	No overlapped call	2,283	92.3	637.1
	Overlapped with one call	178	7.2	27.6
	Overlapped with two calls	13	0.5	1.4
5	No overlapped call	2,033	93.2	549.3
	Overlapped with one call	145	6.6	18.7
	Overlapped with two calls	3	0.1	0.5
6	No overlapped call	1,271	96.2	341.4
	Overlapped with one call	49	3.7	6.4
	Overlapped with two calls	1	0.1	0.0
7	No overlapped call	1,155	95.9	320.7
	Overlapped with one call	48	4.0	6.8
	Overlapped with two calls	1	0.1	0.1
8	No overlapped call	1,728	93.2	551.0
	Overlapped with one call	122	6.6	23.3
	Overlapped with two calls	4	0.2	0.6
9	No overlapped call	1,827	91.7	616.4
	Overlapped with one call	156	7.8	25.9
	Overlapped with two calls	9	0.5	1.2
10	No overlapped call	959	93.6	336.1
	Overlapped with one call	63	6.1	11.7
	Overlapped with two calls	3	0.3	0.4
11	No overlapped call	858	96.6	297.9
	Overlapped with one call	30	3.4	6.0
12	No overlapped call	1,358	94.2	461.3
	Overlapped with one call	80	5.5	15.0
	Overlapped with two calls	4	0.3	0.3

The following table focuses on each station's availability to respond to calls within its first due area. At the same time, it focuses on calls where an SFD unit eventually arrived and ignores calls where no unit arrived. Out of 19,530 calls that are not mutual aid given, there were 711 calls where an SFD unit went en route but no unit arrived. For this reason, the individual rows and the total in Table 7-15's second column do not match the corresponding values for Table 7-14.

TABLE 7-15: Station Availability to Respond to Calls

Station	Calls in Area	First Due Responded	Percent Responded	First Due Arrived	Percent Arrived	First Due First	Percent First
1	1,875	1,583	84.4	1,566	83.5	1,522	81.2
2	987	784	79.4	780	79.0	747	75.7
3	866	801	92.5	798	92.1	782	90.3
4	1,384	1,306	94.4	1,301	94.0	1,285	92.8
5	1,873	1,788	95.5	1,781	95.1	1,749	93.4
6	1,199	1,045	87.2	1,043	87.0	1,018	84.9
7	2,362	1,799	76.2	1,785	75.6	1,717	72.7
8	2,073	1,407	67.9	1,386	66.9	1,324	63.9
9	1,268	988	77.9	958	75.6	916	72.2
10	1,158	1,001	86.4	997	86.1	978	84.5
11	1,817	1,519	83.6	1,510	83.1	1,478	81.3
12	1,957	1,564	79.9	1,555	79.5	1,499	76.6
Total	**18,819**	**15,585**	**82.8**	**15,460**	**82.2**	**15,015**	**79.8**

Note: For each station, we count the number of calls within its first due area where at least one SFD unit arrived. Next, we focus on units from the first due station to see if any unit responded, arrived, or arrived first.

Observations:

- During 162 hours (1.8 percent of all hours), seven or more calls occurred; in other words, the department responded to seven or more calls in an hour roughly once every 2 days.
- The highest number of calls to occur in an hour was 11, which happened twice.
- The hour with the most calls was 1:00 p.m. to 2:00 p.m. on June 28, 2019. There was a hailstorm at that time.
  - The hour's 11 calls involved 17 individual dispatches resulting in 4.0 hours of deployed time. These 11 calls included four public service calls, two false alarm calls, two illness and other calls, one breathing difficulty call, one cardiac and stroke call, and one canceled call.
- Another hour with the most calls was 4:00 p.m. to 5:00 p.m. on August 10, 2019.
  - The hour's 11 calls involved 13 individual dispatches resulting in 2.8 hours of deployed time. These 11 calls included six illness and other calls, two canceled calls, two public service calls, and one breathing difficulty call.
  - August 10, 2019, had 89 calls which was the most in a single day.

RESPONSE TIME

In this part of the analysis, we present response time statistics for different call types. We separate response time into its identifiable components. *Dispatch time* is the difference between the time a call is received and the time a unit is dispatched. Dispatch time includes call processing time, which is the time required to determine the nature of the emergency and the types of resources to dispatch. *Turnout time* is the difference between dispatch time and the time a unit is en route to a call's location. *Travel time* is the difference between the time en route and arrival on scene. *Response time* is the total time elapsed between receiving a call to arriving on scene.

In this analysis, we included all calls within the primary response area of the Springfield Fire Department to which at least one non-administrative unit from SFD was dispatched and at least one unit from SFD arrived, while excluding canceled calls. In addition, calls with a total response time of more than 30 minutes were excluded. Finally, we focused on units that had complete time stamps, that is, units with all components recorded, so that we could calculate each segment of response time.

Based on the methodology above, we excluded 138 mutual aid given calls, 1,588 canceled calls, 504 non-emergency calls, 10 calls where no units recorded a valid on-scene time, 44 calls where the first arriving unit response was greater than 30 minutes, and 478 calls where one or more segments of the first arriving unit's response time could not be calculated due to missing or faulty data. As a result, in this section, a total of 16,906 calls are included in the analysis.

Response Time by Type of Call

The following table breaks down the average dispatch, turnout, travel, and total response times by call type for all calls within the primary service area of SFD, and Table 7-17 does the same for 90th percentile response times. A 90th percentile means that 90 percent of calls had response times at or below that number. For example, Table 7-17 shows a 90th percentile response time of 9.9 minutes, which means that 90 percent of the time, a call had a response time of no more than 9.9 minutes. Figures 7-8 and 7-9 illustrate the same information.

TABLE 7-16: Average Response Time of First Arriving Unit, by Call Type

Call Type	Minutes				Number of Calls
	Dispatch	Turnout	Travel	Total	
Breathing difficulty	1.4	1.3	3.5	6.2	2,086
Cardiac and stroke	1.4	1.2	3.5	6.1	1,375
Fall and injury	1.9	1.2	3.2	6.4	819
Illness and other	2.1	1.2	3.6	6.9	4,742
MVA	3.0	1.2	3.1	7.3	565
Overdose and psychiatric	2.2	1.3	3.5	7.0	440
Seizure and unconsciousness	1.3	1.2	3.3	5.8	718
EMS Total	**1.8**	**1.2**	**3.5**	**6.6**	**10,745**
False alarm	1.5	1.5	3.7	6.7	2,288
Good intent	2.1	1.4	3.9	7.4	763
Hazard	1.7	1.4	4.5	7.7	438
Outside fire	1.5	1.3	4.1	7.0	219
Public service	1.7	1.4	4.4	7.4	2,206
Structure fire	1.1	1.3	2.9	5.4	247
Fire Total	**1.6**	**1.4**	**4.0**	**7.1**	**6,161**
Total	**1.8**	**1.3**	**3.7**	**6.7**	**16,906**

FIGURE 7-8: Average Response Time of First Arriving Unit, by Call Type – EMS

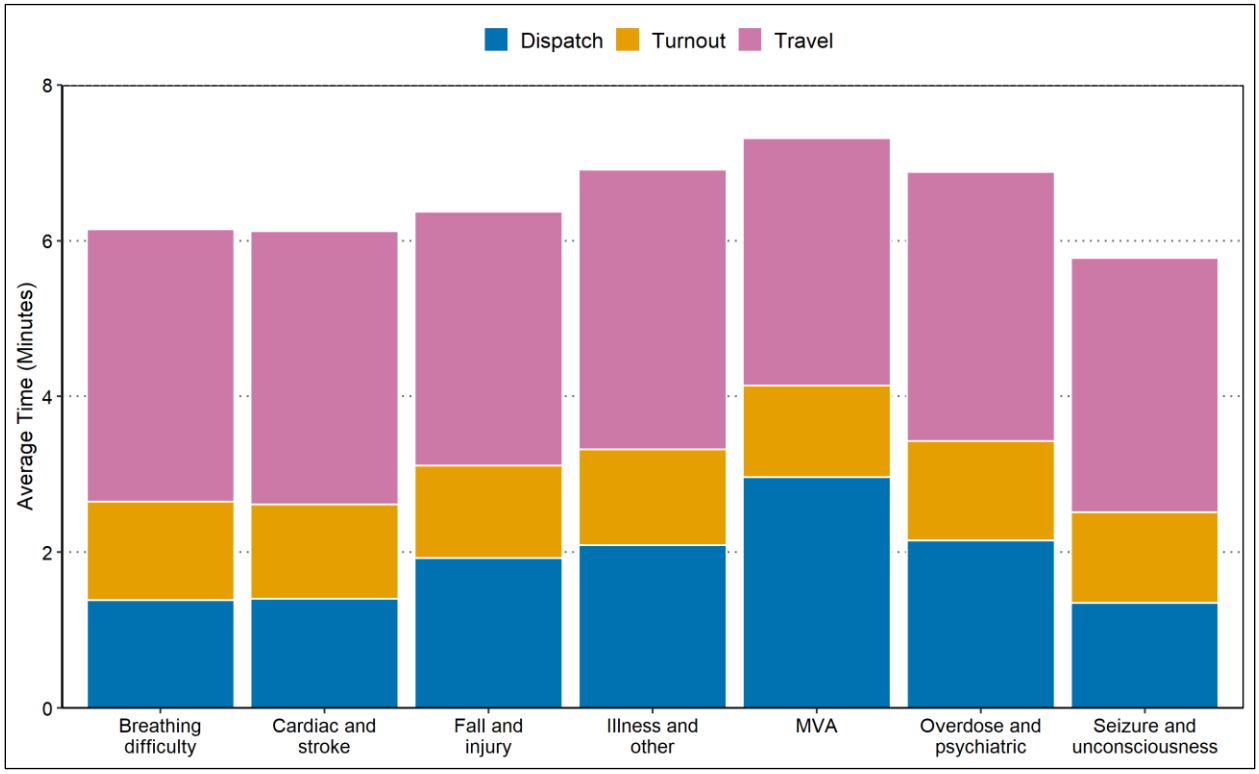


FIGURE 7-9: Average Response Time of First Arriving Unit, by Call Type – Fire

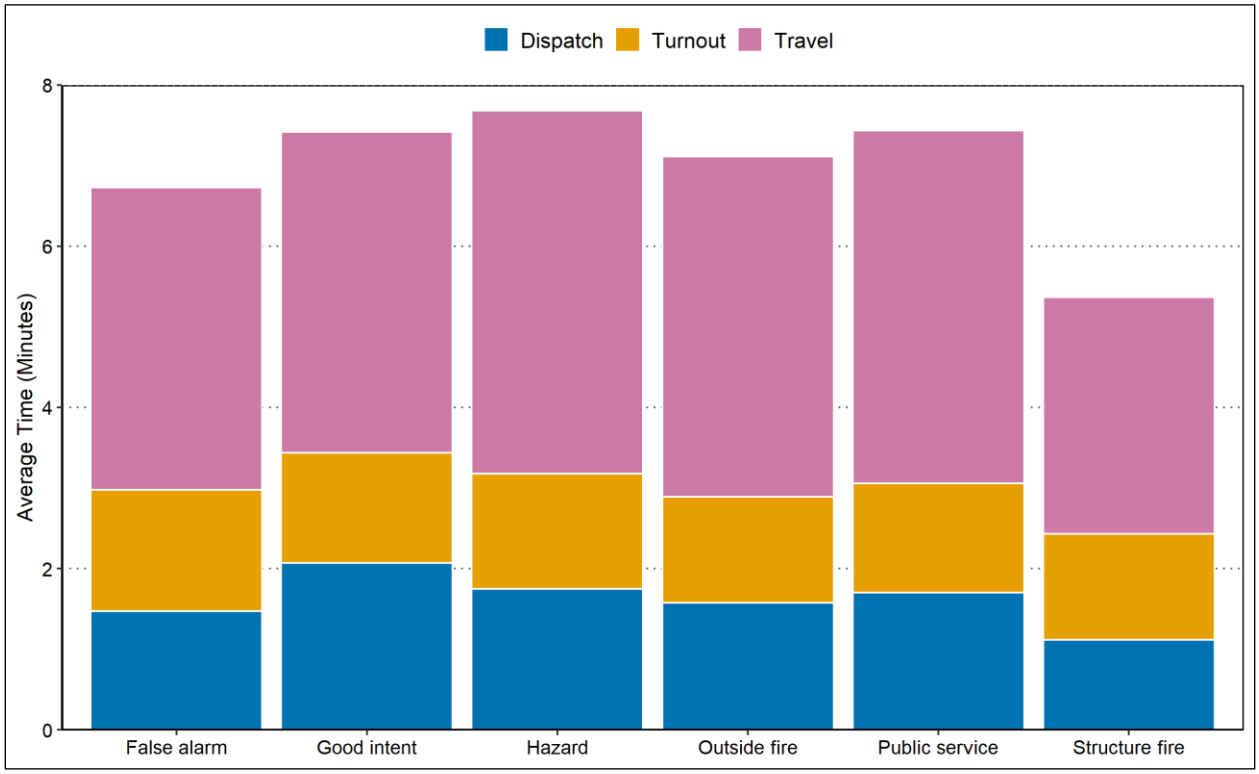


TABLE 7-17: 90th Percentile Response Time of Average Response Time of First Arriving Unit, by Call Type

Call Type	Minutes				Number of Calls
	Dispatch	Turnout	Travel	Total	
Breathing difficulty	2.2	2.1	5.6	8.6	2,086
Cardiac and stroke	2.3	2.0	5.4	8.4	1,375
Fall and injury	3.1	1.9	5.3	9.0	819
Illness and other	3.4	2.1	5.9	10.0	4,742
MVA	5.4	1.9	5.4	11.3	565
Overdose and psychiatric	3.9	2.1	5.4	10.2	440
Seizure and unconsciousness	2.2	2.0	5.1	8.0	718
EMS Total	**3.0**	**2.0**	**5.6**	**9.3**	**10,745**
False alarm	2.4	2.4	6.6	10.0	2,288
Good intent	3.4	2.2	6.7	11.2	763
Hazard	2.8	2.3	8.0	11.7	438
Outside fire	2.6	2.2	7.5	11.1	219
Public service	2.7	2.3	7.3	10.8	2,206
Structure fire	2.1	2.1	4.8	7.6	247
Fire Total	**2.7**	**2.3**	**6.9**	**10.5**	**6,161**
Total	**2.9**	**2.1**	**6.1**	**9.8**	**16,906**

Observations:

- The average dispatch time was 1.8 minutes.
- The average turnout time was 1.3 minutes.
- The average travel time was 3.7 minutes.
- The average total response time was 6.7 minutes.
- The average response time was 6.6 minutes for EMS calls and 7.1 minutes for fire calls.
- The average response time was 7.0 minutes for outside fires and 5.4 minutes for structure fires.
- The 90th percentile dispatch time was 2.9 minutes.
- The 90th percentile turnout time was 2.1 minutes.
- The 90th percentile travel time was 6.1 minutes.
- The 90th percentile total response time was 9.8 minutes.
- The 90th percentile response time was 9.3 minutes for EMS calls and 10.5 minutes for fire calls.
- The 90th percentile response time was 11.1 minutes for outside fires and 7.6 minutes for structure fires.

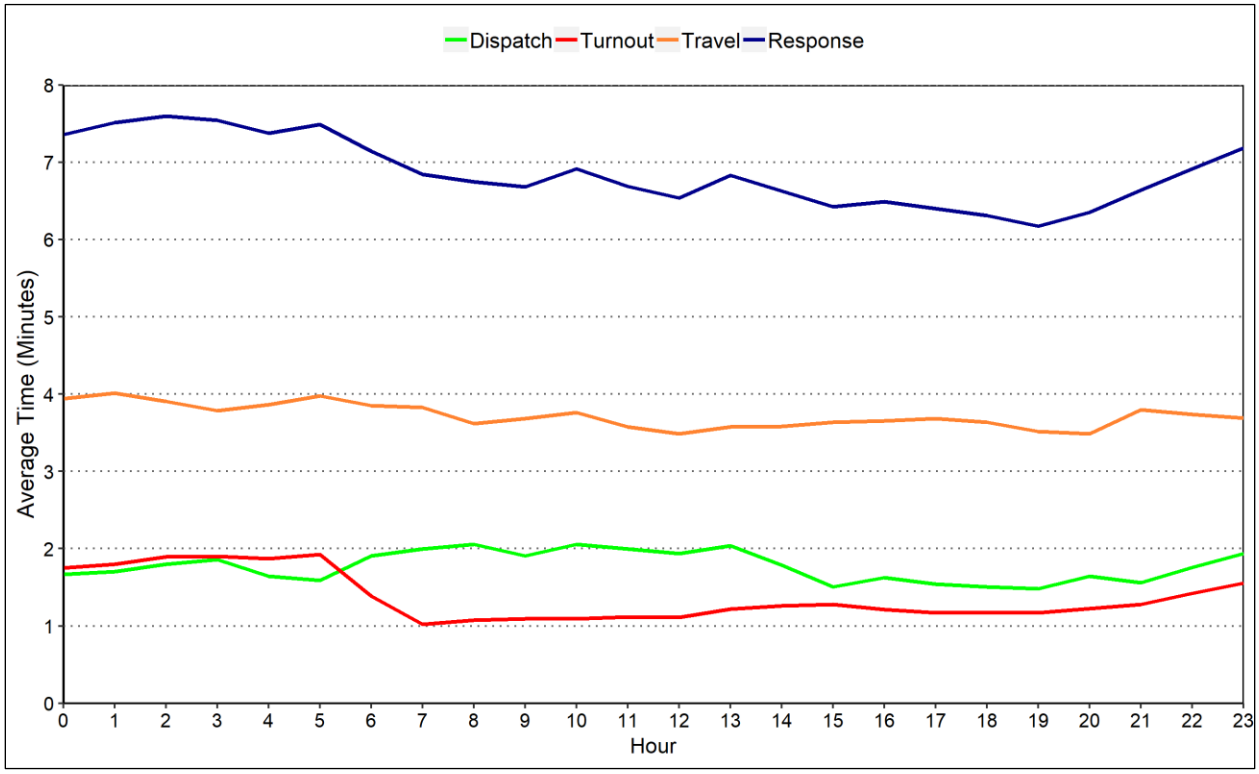
Response Time by Hour

Average dispatch, turnout, travel, and total response time by hour for calls in the jurisdiction of SFD are shown in the following table and figure. The table also shows 90th percentile response times.

TABLE 7-18: Average and 90th Percentile Response Time of First Arriving Unit, by Hour of Day

Hour	Minutes					Number of Calls
	Dispatch	Turnout	Travel	Response Time	90th Percentile Response Time	
0	1.7	1.8	3.9	7.4	10.6	491
1	1.7	1.8	4.0	7.5	10.5	446
2	1.8	1.9	3.9	7.6	10.8	376
3	1.9	1.9	3.8	7.5	10.6	372
4	1.6	1.9	3.9	7.4	10.5	365
5	1.6	1.9	4.0	7.5	10.1	376
6	1.9	1.4	3.9	7.1	10.1	476
7	2.0	1.0	3.8	6.8	10.3	593
8	2.1	1.1	3.6	6.7	10.1	698
9	1.9	1.1	3.7	6.7	9.8	807
10	2.1	1.1	3.8	6.9	10.4	838
11	2.0	1.1	3.6	6.7	9.7	915
12	1.9	1.1	3.5	6.5	9.3	990
13	2.0	1.2	3.6	6.8	9.7	963
14	1.8	1.3	3.6	6.6	9.6	912
15	1.5	1.3	3.6	6.4	9.5	911
16	1.6	1.2	3.7	6.5	9.7	972
17	1.5	1.2	3.7	6.4	9.5	905
18	1.5	1.2	3.6	6.3	9.3	937
19	1.5	1.2	3.5	6.2	8.9	847
20	1.6	1.2	3.5	6.4	9.2	840
21	1.6	1.3	3.8	6.6	9.5	694
22	1.8	1.4	3.7	6.9	10.1	597
23	1.9	1.6	3.7	7.2	10.4	585
Total	**1.8**	**1.3**	**3.7**	**6.7**	**9.8**	**16,906**

FIGURE 7-10: Average Response Time of First Arriving Unit, by Hour of Day



Observations:

- Average dispatch time was between 1.5 minutes (7:00 p.m. to 8:00 p.m.) and 2.1 minutes (10:00 a.m. to 11:00 a.m.).
- Average turnout time was between 1.0 minutes (7:00 a.m. to 8:00 a.m.) and 1.9 minutes (5:00 a.m. to 6:00 a.m.).
- Average travel time was between 3.5 minutes (8:00 p.m. to 9:00 p.m.) and 4.0 minutes (1:00 a.m. to 2:00 a.m.).
- Average response time was between 6.2 minutes (7:00 p.m. to 8:00 p.m.) and 7.6 minutes (2:00 a.m. to 3:00 a.m.).
- The 90th percentile response time was between 8.9 minutes (7:00 p.m. to 8:00 p.m.) and 10.8 minutes (2:00 a.m. to 3:00 a.m.).

Response Time Distribution

Here, we present a more detailed look at how response times to calls are distributed. The cumulative distribution of total response time for the first arriving unit to EMS calls is shown in Figure 7-11 and Table 7-19. Figure 7-11 shows response times for the first arriving unit to EMS calls as a frequency distribution in whole-minute increments, and Figure 7-12 shows the same for the first arriving unit to outside and structure fire calls.

The cumulative percentages here are read in the same way as a percentile. In Figure 7-11, the 90th percentile of 9.4 minutes means that 90 percent of EMS calls had a response time of 9.4 minutes or less. In Table 7-19, the cumulative percentage of 81, for example, means that 81 percent of EMS calls had a response time under 8 minutes.

FIGURE 7-11: Cumulative Distribution of Response Time – First Arriving Unit – EMS

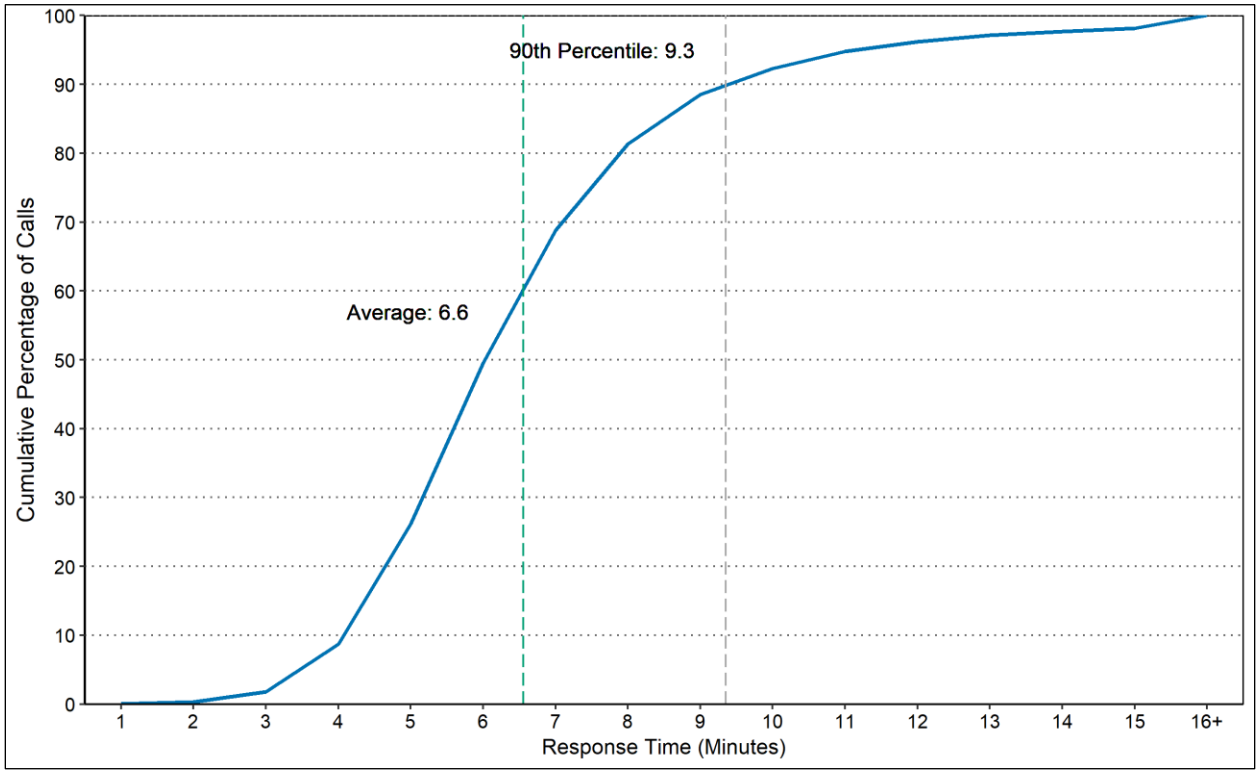


FIGURE 7-12: Cumulative Distribution of Response Time – First Arriving Unit – Outside and Structure Fires

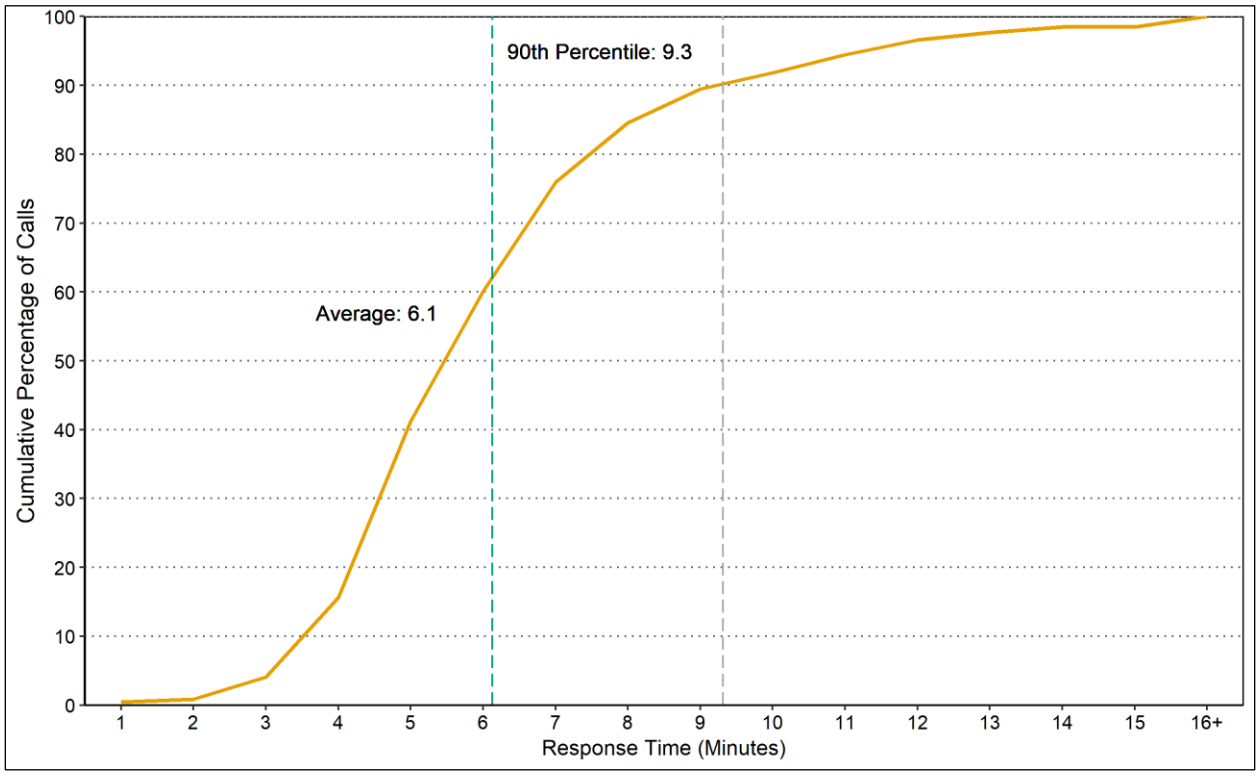


TABLE 7-19: Cumulative Distribution of Response Time – First Arriving Unit – EMS

Response Time (minute)	Frequency	Cumulative Percentage
1	3	0.0
2	33	0.3
3	157	1.8
4	744	8.7
5	1,868	26.1
6	2,515	49.5
7	2,079	68.9
8	1,342	81.3
9	773	88.5
10	404	92.3
11	267	94.8
12	153	96.2
13	97	97.1
14	61	97.7
15	50	98.1
16+	199	100.0

TABLE 7-20: Cumulative Distribution of Response Time – First Arriving Unit – Outside and Structure Fires

Response Time (minute)	Frequency	Cumulative Percentage
1	2	0.4
2	2	0.9
3	15	4.1
4	54	15.7
5	119	41.2
6	88	60.1
7	74	76.0
8	40	84.5
9	23	89.5
10	11	91.8
11	12	94.4
12	10	96.6
13	5	97.6
14	4	98.5
15	0	98.5
16+	7	100.0

Observations:

- For 81 percent of EMS calls, the response time of the first arriving unit was less than 8 minutes.
- For 85 percent of outside and structure fire calls, the response time of the first arriving unit was less than 8 minutes.

Response Time by Fire Protection District

The following table breaks down the average dispatch, turnout, travel, total response times, and 90th percentile response times by the fire protection districts serviced by SFD, for EMS and fire calls, respectively.

TABLE 7-21: Average Response Time of First Arriving Unit, by Fire Protection District

Call Type	Fire Protection District	Minutes					Number of Calls
		Dispatch	Turnout	Travel	Response Time	90th Percentile Response Time	
EMS	Curran	3.3	1.3	5.8	10.4	18.0	35
	East Side	1.6	1.2	3.9	6.8	9.2	379
	Lake Springfield	1.9	1.1	5.2	8.2	12.2	50
	North Side	1.6	1.1	4.3	7.0	11.7	283
	South Lawn	1.7	1.1	2.9	5.7	7.6	82
	South Oak Knolls	1.7	1.2	3.1	6.1	7.9	34
	South Side	1.7	1.1	3.8	6.7	9.2	219
	Springfield (City)	1.9	1.2	3.4	6.5	9.2	9,293
	Western	2.0	1.3	5.6	8.8	12.8	113
	Woodside	1.7	1.2	3.8	6.7	8.9	257
	Subtotal	**1.8**	**1.2**	**3.5**	**6.6**	**9.3**	**10,745**
Fire	Curran	1.6	2.0	7.3	10.9	14.3	16
	East Side	1.6	1.2	4.6	7.4	10.9	157
	Lake Springfield	1.9	1.1	5.7	8.7	13.1	20
	North Side	1.5	1.5	5.4	8.5	14.6	126
	South Lawn	1.4	1.1	3.7	6.2	9.0	65
	South Oak Knolls	1.5	1.2	4.2	6.8	8.7	23
	South Side	1.6	1.3	5.3	8.2	11.5	119
	Springfield (City)	1.6	1.4	3.9	6.9	10.2	5,437
	Western	1.9	1.4	7.2	10.6	14.0	91
	Woodside	1.8	1.4	4.7	7.9	10.9	107
	Subtotal	**1.6**	**1.4**	**4.0**	**7.1**	**10.5**	**6,161**
Total		**1.8**	**1.3**	**3.7**	**6.7**	**9.8**	**16,906**

Observations:

- Average response times varied significantly among fire protection districts.
- The average response time was fastest to South Lawn.
- The average response time was slowest to Curran.
- The average response time within Springfield City Protection District was slightly faster than the overall average.

ATTACHMENT I: ACTIONS TAKEN

TABLE 7-22: Actions Taken Analysis for Structure and Outside Fire Calls

Action Taken	Number of Calls	
	Outside Fire	Structure Fire
Action taken, other	9	7
Enforce codes	2	0
Establish safe area	0	1
Extinguishment by fire service personnel	159	161
Extricate, disentangle	1	0
Fire control or extinguishment, other	8	11
Forcible entry	0	1
Incident command	3	35
Information, Investigation & Enforcement	3	1
Investigate	69	80
Provide advanced life support (ALS)	0	1
Provide basic life support (BLS)	1	1
Remove hazard	2	6
Rescue, remove from harm	0	1
Restore fire alarm system	1	4
Restore sprinkler or fire protection system	0	2
Salvage & overhaul	2	62
Search	0	8
Secure property	0	1
Ventilate	1	97

Note: Totals are higher than the total number of structure and outside fire calls because some calls recorded multiple actions taken.

Observations:

- Out of 233 outside fires, 159 were extinguished by fire service personnel, which accounted for 68 percent of outside fires.
- Out of 264 structure fires, 161 were extinguished by fire service personnel, which accounted for 61 percent of structure fires.

TABLE 7-23: Workload of Administrative Units

Unit ID	Unit Type	Annual Hours	Annual Runs
FD1	Fire Chief	31.6	30
DIV1	Division Chief	11.1	9
DIV1A	Division Chief	8.5	4
DIV1B	Division Chief	29.6	14
DIV2	Fire Safety Officer	39.9	23
DIV3	Fire Training Officer	17.9	7
DS01	Health and Safety Officer	57.3	61
INS1	Inspector	86.3	34
INS2	Inspector	108.5	43
INS3	Inspector	63.4	34
INS4	Inspector	78.2	29
INS5	Inspector	80.9	33
INS6	Inspector	137.8	59
INS24	Inspector	54.6	23

ATTACHMENT III: FIRE LOSS

TABLE 7-24: Total Fire Loss Above and Below $25,000

Call Type	No Loss	Under $25,000	$25,000 plus
Outside fire	140	87	6
Structure fire	38	175	51
Total	**178**	**262**	**57**

TABLE 7-25: Content and Property Loss – Structure and Outside Fires

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Outside fire	$765,781	90	$337,625	33
Structure fire	$2,678,431	186	$860,148	174
Total	**$3,444,212**	**276**	**$1,197,773**	**207**

Note: The table includes only fire calls with a recorded loss greater than 0.

Observations:

- 140 outside fires and 38 structure fires had no recorded loss.
- Six outside fires and 51 structure fires had $25,000 or more in losses.
- Structure fires:
  - The highest total loss for a structure fire was $220,000.
  - The average total loss for all structure fires was $15,657.
  - 174 structure fires recorded content losses with a combined $860,148 in losses.
  - Out of 264 structure fires, 186 recorded property losses, with a combined $2,678,431 in losses.
- Outside fires:
  - The highest total loss for an outside fire was $600,000.
  - The average total loss for outside fires with loss was $11,865.
  - 33 outside fires recorded content losses with a combined $337,625 in losses.
  - Out of 233 outside fires, 90 recorded property losses, with a combined $765,781 in losses.

ATTACHMENT IV: TREND IN SERVICE

In this analysis, we examine the historical trends of EMS and fire responses based on two years of data from 2019 through 2020 for the Springfield Fire Department. We present trends in calls by type, unit workload, service availability, and response time over these two years. This analysis illustrates that the department's activity in 2020 closely resembles the corresponding results in 2019. For this reason, our detailed analysis focusing on 2019 is sufficient.

Trends in Call Volume

The following table shows the number of calls by grand call type for both 2019 and 2020. Tables 7-27 and 7-28 detail calls for each EMS and fire call type. Figure 7-13 shows the monthly variation in the average daily number of calls in two years. Similarly, Figure 7-14 illustrates the average number of calls received each hour of the day in the two years.

TABLE 7-26: Calls by Year and Grand Call Type

Grand Call Type	Number of Calls		Calls per Day	
	2019	2020	2019	2020
EMS	11,466	10,980	31.4	30.1
Fire	6,476	6,524	17.7	17.9
Other	1,726	1,720	4.7	4.7
Total	**19,668**	**19,224**	**53.9**	**52.7**

TABLE 7-27: EMS Calls by Year and Type

Call Type	Number of Calls		Calls per Day	
	2019	2020	2019	2020
Breathing Difficulty	2,124	2,124	5.8	5.8
Cardiac and Stroke	1,408	1,168	3.9	3.2
Fall and Injury	937	780	2.6	2.1
Illness and Other	5,140	5,191	14.1	14.2
MVA	670	599	1.8	1.6
Overdose and Psychiatric	453	463	1.2	1.3
Seizure and Unconsciousness	734	655	2.0	1.8
Total	**11,466**	**10,980**	**31.4**	**30.1**

TABLE 7-28: Fire Calls by Year and Type

Call Type	Number of Calls		Calls per Day	
	2019	2020	2019	2020
False Alarm	2,363	2,171	6.5	5.9
Good Intent	829	880	2.3	2.4
Hazard	476	481	1.3	1.3
Outside Fire	233	329	0.6	0.9
Public Service	2,311	2,412	6.3	6.6
Structure Fire	264	251	0.7	0.7
Total	**6,476**	**6,524**	**17.7**	**17.9**

Observations:

- The average number of EMS and fire calls per day in two years was 30.5.
- The number of EMS calls per day decreased four percent from 31.4 in 2019 to 30.1 in 2020.
- The total number of fire calls did not change significantly from 2019 to 2020.
  - False alarm calls per day decreased from 6.5 in 2019 to 5.9 in 2020.
  - Outside fire calls per day increased 43 percent from 0.6 in 2019 to 0.9 in 2020.

FIGURE 7-13: Calls per Day by Month of Year

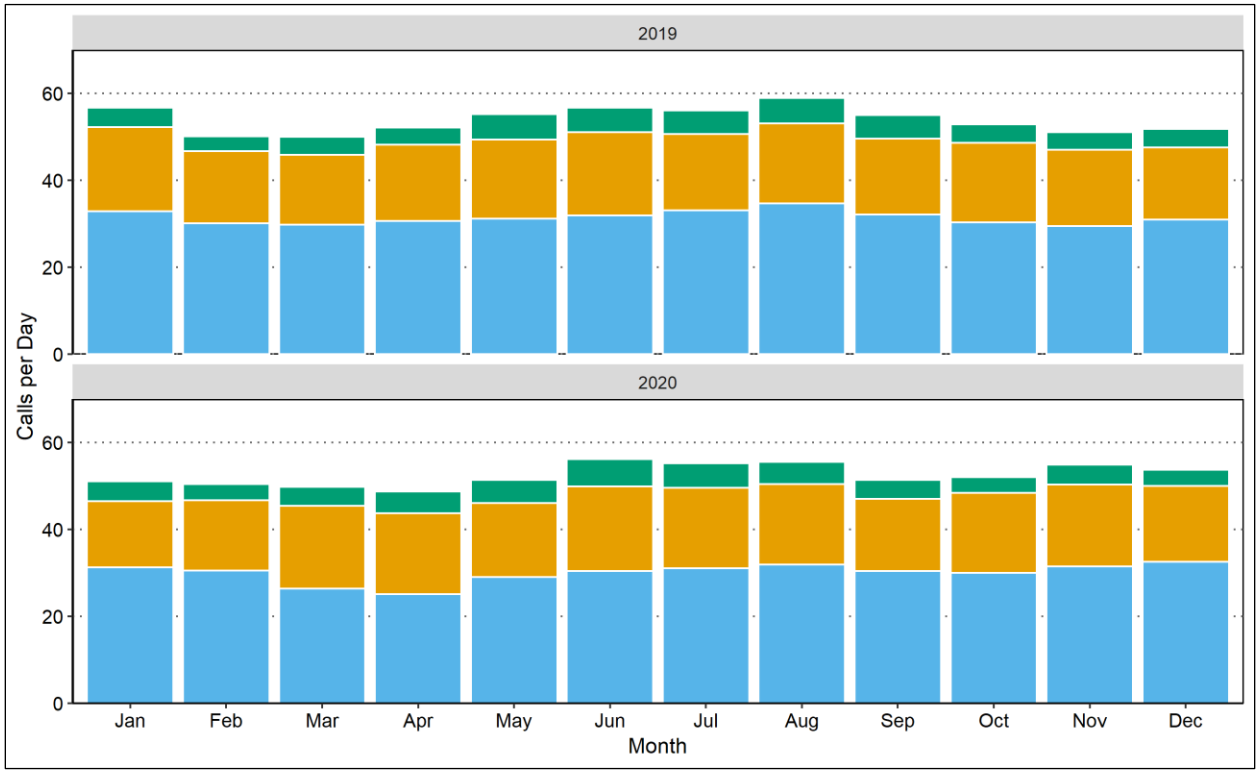
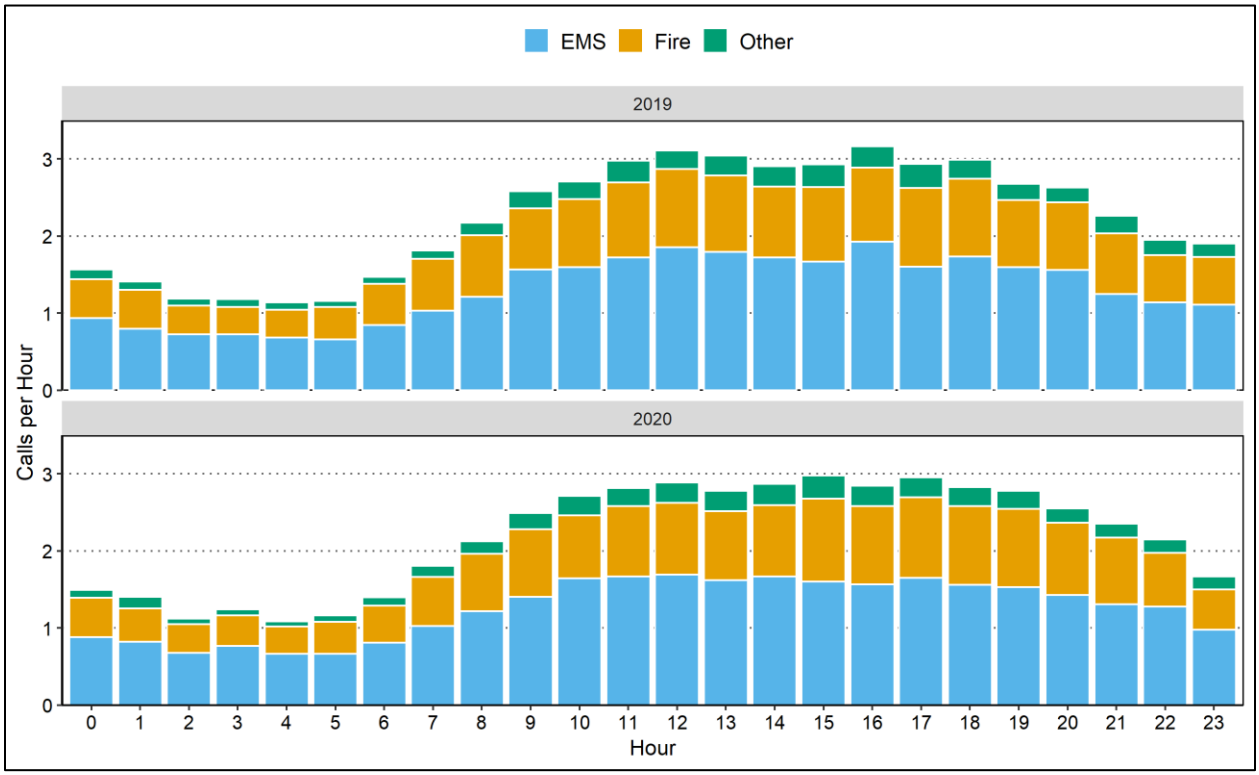


FIGURE 7-14: Calls per Hour by Year and Time of Day



Trends in Workload

The following table compares the runs and workload for responding SFD units in 2019 and 2020. The total workload decreased from 2019 to 2020.

TABLE 7-29: Unit Runs and Workload by Year

	Station	Unit	Unit Type	2019		2020	
				Runs	Hours	Runs	Hours
Frontline Units	1	B01	Battalion chief	976	347.2	921	309.6
		E01	Engine	2,576	690.4	2,449	653.1
		Sq1	Squad	220	59.7	150	36.9
		T01	Platform/truck	1,468	423.4	1,332	363.6
		Total		**5,240**	**1,520.6**	**4,852**	**1363.3**
	2	E02	Engine	1,948	609.3	1,903	569.8
		T02	Ladder	1,131	311.3	1,027	291.2
		Total		**3,079**	**920.6**	**2,930**	**861.0**
	3	E03	Engine	**1,663**	**478.6**	**1,741**	**485.0**
	4	E04	Engine	**2,262**	**646.4**	**2,362**	**707.5**
	5	E05	Engine	**2,056**	**561.5**	**2,071**	**596.1**
	6	B02	Battalion chief	1,003	295.6	940	274.6
		E06	Engine	1,555	395.3	1,632	448.9
		Total		**2,558**	**690.9**	**2,572**	**723.5**
	7	E07	Engine	**1,762**	**475.9**	**1,736**	**487.0**
	8	E08	Engine	**2,070**	**646.4**	**2,026**	**589.9**
	9	E09	Engine	**1,894**	**658.0**	**1,735**	**547.1**
	10	E10	Engine	**1,251**	**435.8**	**1,256**	**421.5**
	11	E11	Engine	**992**	**329.2**	**934**	**342.2**
	12	E12	Engine	1,592	530.0	1,502	514.2
		T03	Truck	976	267.7	873	245.6
		Total		**2,568**	**797.7**	**2,375**	**759.8**
	Total			**27,395**	**8161.6**	**26,590**	**7,883.9**
Special Response Unit Total				**141**	**57.6**	**7**	**4.7**
Total				**27,536**	**8,219.2**	**26,597**	**7,888.5**

Note: Special response units include Brush1, E15, E18, EMS1 and EMS2, HAZ1, HAZ2, and HAZ3, M01, and T04.

Trends in Station Availability

The following table examines the availability of each SFD station's units to respond to calls within its first due area by year. Availability to respond, arrive, and arrive first is shown.

TABLE 7-30: Station Availability to Respond to Calls by Year

Station	2019			2020		
	Pct. Response	Pct. Arrive	Pct. First	Pct. Response	Pct. Arrive	Pct. First
1	84.4	83.5	81.2	81.4	80.2	78.8
2	95.5	95.1	93.4	95.7	95.4	94.6
3	87.2	87.0	84.9	87.6	87.2	85.8
4	76.2	75.6	72.7	76.5	75.9	73.0
5	67.9	66.9	63.9	70.5	70.1	67.2
6	77.9	75.6	72.2	79.6	78.2	74.5
7	86.4	86.1	84.5	87.4	87.4	85.4
8	83.6	83.1	81.3	83.3	83.0	81.1
9	79.9	79.5	76.6	81.2	80.8	78.1
10	79.4	79.0	75.7	91.0	90.9	89.3
11	92.5	92.1	90.3	93.6	93.3	92.3
12	94.4	94.0	92.8	92.8	92.5	90.6
Total	**82.8**	**82.2**	**79.8**	**83.6**	**83.1**	**81.0**

Observations:

- For most of the stations, their availability increased from 2019 to 2020.
- Station 10 displayed the largest increase. For example, from 2019 to 2020, the availability of Station 10's units to arrive first at calls increased from 76 to 89 percent.

Trends in Response Time

Figure 7-15 compares 2019 and 2020 dispatch, turnout, travel, and total response time by hour for calls in SFD's jurisdiction. Tables 7-31 and 7-32 compare the average and 90th percentile response time components in two years.

FIGURE 7-15: Comparison of Average Response Time of First Arriving Unit, by Hour of Day

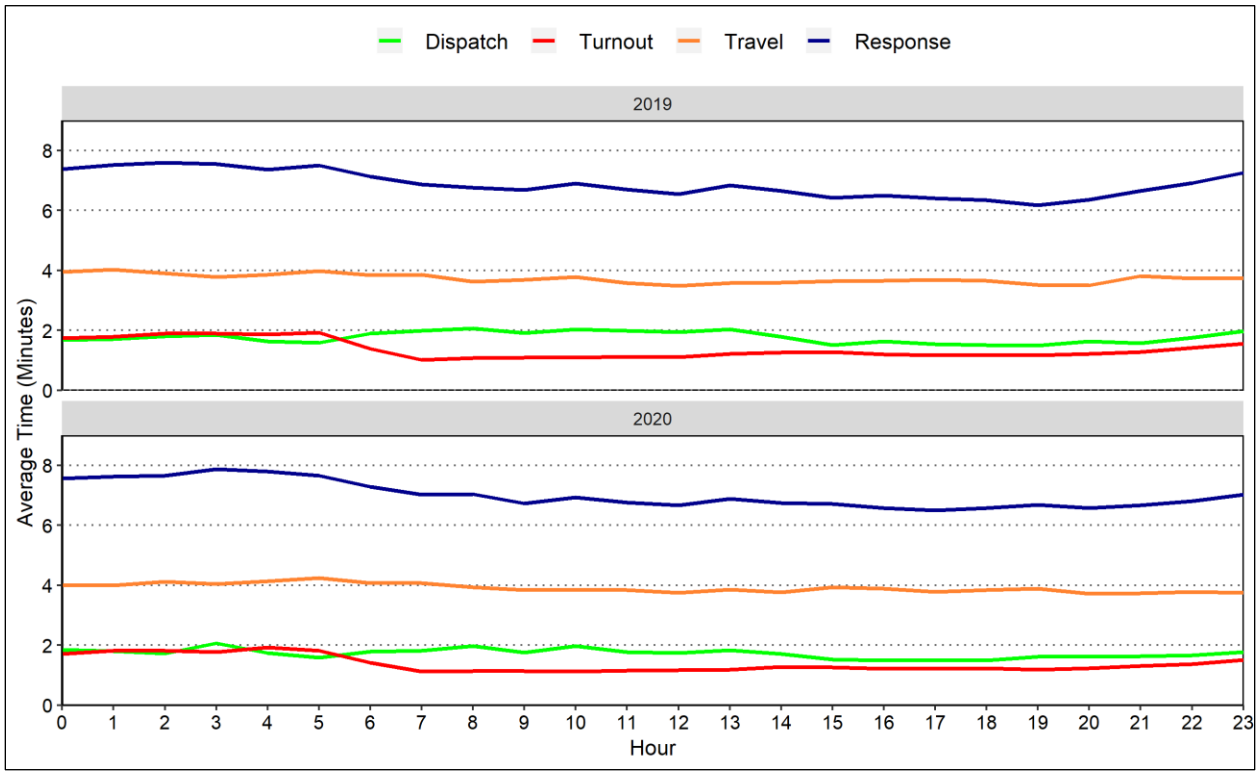


TABLE 7-31: Comparison of Average Response Time of First Arriving SFD Unit in 2019 and 2020

Station	2019, Minutes				2020, Minutes			
	Dispatch	Turnout	Travel	Total Response	Dispatch	Turnout	Travel	Total Response
EMS Total	**1.8**	**1.2**	**3.5**	**6.6**	**1.8**	**1.3**	**3.8**	**6.9**
Structure Fire	1.1	1.3	2.9	5.4	0.9	1.3	2.7	4.9
Outside Fire	1.5	1.3	4.1	7.0	1.4	1.4	4.0	6.9
Other Fire	1.7	1.4	4.1	7.2	1.5	1.4	4.1	7.0
Fire Total	**1.6**	**1.4**	**4.0**	**7.1**	**1.5**	**1.4**	**4.0**	**6.9**
Total	**1.8**	**1.3**	**3.7**	**6.7**	**1.7**	**1.3**	**3.9**	**6.9**

TABLE 7-32: Comparison of 90th Percentile Response Time of First Arriving SFD Unit in 2019 and 2020

Station	2019				2020			
	Dispatch	Turnout	Travel	Total Response	Dispatch	Turnout	Travel	Total Response
EMS Total	**3.0**	**2.0**	**5.6**	**9.3**	**3.0**	**2.1**	**6.2**	**9.9**
Structure Fire	2.1	2.1	4.8	7.6	1.7	2.0	4.4	6.6
Outside Fire	2.6	2.2	7.5	11.1	2.5	2.1	7.0	10.5
Other Fire	2.7	2.3	7.0	10.6	2.5	2.3	6.8	10.2
Fire Total	**2.7**	**2.3**	**6.9**	**10.5**	**2.5**	**2.2**	**6.8**	**10.1**
Total	**2.9**	**2.1**	**6.1**	**9.8**	**2.8**	**2.2**	**6.4**	**10.0**

Observations:

- The average response times of 2019 and 2020 did not change significantly.
- The 90th percentile response time for structure fires decreased by 1 minute from 2019 to 2020.
- The 90th percentile total response times of 2019 and 2020 did not change significantly.

ATTACHMENT V: ASSIGNMENT OF EMS CALL TYPE

When available, NFIRS data serves as our primary source for assigning call categories. For 17,715 of the 38,892 calls in the two years, NFIRS incident types were used to assign call types for MVA, fire, canceled, and mutual aid calls. However, EMS calls (including NIFIRS incident types 300, 311, 320, and 321) do not have corresponding EMS types; we instead used the incident type from the computer-aided dispatch (CAD) data to assign a call category. Table 7-33 describes the method of EMS type assignment based on available CAD incident types. The count column in the table reflects the number of calls that were assigned call types from a specific CAD incident type.

TABLE 7-33: Assignment of EMS Type Based on CAD Incident Type

CAD Incident Type	EMS Type	Count		
		2019	2020	Total
<new call>	illness and other	0	6	6
9 1 1 investigation	illness and other	5	8	13
accident prop damage	illness and other	8	10	18
accident unknown injury	illness and other	1	2	3
accident w/injuries	illness and other	0	69	69
accident w/injuries z	illness and other	154	49	203
aid call unclassified	illness and other	3,223	3,147	6,370
alarm investigation	illness and other	1	2	3
ambulance only	illness and other	21	38	59
animal problem	illness and other	1	1	2
armed robbery	fall and injury	9	3	12
assist motorist	illness and other	7	6	13
assist other agency	illness and other	0	106	106
assist person up	illness and other	131	201	332
attempted suicide	illness and other	39	34	73
automatic fire alarm	illness and other	1	0	1
battery	fall and injury	98	66	164
breathing difficulty	breathing difficulty	2,124	2,124	4,248
burglar alarm	illness and other	1	2	3
Burglary	illness and other	1	2	3
cardiac problem	cardiac and stroke	43	34	77
check on welfare	illness and other	83	72	155
chest pain	cardiac and stroke	1,062	848	1,910
code red	illness and other	1	0	1
coroner case	illness and other	5	8	13
criminal damage	illness and other	1	2	3
criminal damage in progress	illness and other	1	0	1
diabetic	illness and other	272	261	533

CAD Incident Type	EMS Type	Count		
		2019	2020	Total
disturbance	illness and other	165	109	274
domestic disturbance	illness and other	0	1	1
drug law violation	illness and other	1	2	3
electric arc/sparks	Illness and other	1	0	1
elevator entrapment	illness and other	40	29	69
er transport - private	illness and other	45	34	79
fight	fall and injury	23	3	26
follow up investigation	illness and other	0	2	2
hit & run	illness and other	18	11	29
home invasion	illness and other	5	5	10
intoxicated driver	overdose and psychiatric	1	0	1
kidnapping	fall and injury	1	0	1
lines down	illness and other	0	1	1
lock out	illness and other	11	15	26
loud music/party	illness and other	1	0	1
medical alert alarm	illness and other	448	455	903
mental subject	overdose and psychiatric	92	97	189
notification	illness and other	0	1	1
odor investigation	illness and other	1	2	3
other type fire	illness and other	2	3	5
overdose	overdose and psychiatric	355	365	720
panic duress alarm	overdose and psychiatric	3	1	4
patrol investigation	illness and other	14	19	33
person down	fall and injury	706	614	1,320
person exposing self	illness and other	1	0	1
person w/weapon	illness and other	13	9	22
possible deceased	illness and other	99	156	255
pregnancy	illness and other	109	85	194
premise check	illness and other	1	0	1
reckless driving	overdose and psychiatric	2	0	2
remove property	illness and other	1	1	2
remove subject	illness and other	6	5	11
robbery	fall and injury	7	5	12
seizure	seizure and unconsciousness	732	653	1,385
sexual assault	illness and other	2	2	4
shooting	fall and injury	38	33	71
shoplifting	illness and other	4	1	5
shots fired	fall and injury	2	3	5
sick person	illness and other	58	76	134

CAD Incident Type	EMS Type	Count		
		2019	2020	Total
slumped driver	illness and other	76	76	152
special detail	illness and other	1	1	2
special duty	illness and other	5	15	20
stabbing	fall and injury	49	48	97
stroke	cardiac and stroke	302	286	588
suicide	illness and other	3	6	9
suspicious person	illness and other	8	5	13
suspicious vehicle	illness and other	4	5	9
theft over	illness and other	0	2	2
theft under	illness and other	0	1	1
trespass	illness and other	2	0	2
ts	illness and other	5	2	7
unknown medical	illness and other	33	35	68
vicious animal	illness and other	4	0	4
warrant service	illness and other	2	0	2

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