Delivery of Services Analysis of the Saint Paul Fire Department

Submitted to:

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July 2017

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ACKNOWLEDGMENTS

We wish to thank the leadership and staff members of the Saint Paul Fire Department (SPFD) and city staff that provided valuable insight for this study. The study committee among others provided data and information, and they welcomed our visits to the fire stations.

We particularly want to acknowledge Matt Larson and John Swanson. Mr. Larson was our direct contact and the city's coordinator for the study. Mr. Swanson acted as our point of contact with the SPFD, and provided much of the background information needed. He also coordinated the transfer of data necessary for the response time and demand analysis portion of the project.

Specifically, we wish to thank the following for their help on this project:

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While TriData received excellent input and cooperation from the city, the evaluation and recommendations reflected in this report are those of our project team. The principal members of the team and their areas of responsibility are shown below; however, this was a team effort and views were sought from multiple team members on virtually every subject area.

TriData Staff

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EXECUTIVE SUMMARY

Saint Paul requested the assistance of TriData to conduct a review of its Fire Department (SPFD). TriData has conducted technical research on fire and EMS related issues for over 35 years. A comprehensive study of the SPFD was previously conducted by TriData in 2007.

Particular emphasis for this study was to compare the service levels and response times to various community neighborhoods. Staffing, deployment of resources, response times, unit workloads, apparatus and facilities were all reviewed. The study was also to examine service delivery from the perspective of equity – are there service-level gaps in some communities? Questions posed by the City for the study were:

1. How can Saint Paul Fire Department personnel best be utilized given current and projected demand?
2. How effectively are resources (apparatus and stations) being used, given current and future demand?

SPFD is a career fire department with 433 personnel. It responds to approximately 45,000 calls annually from 15 fire stations. Deployed to the stations are 16 engines, 7 ladders, and 3 squad companies. Thirteen of the stations have medic units, 10 of which are dual-staffed and three are Super-Medics. Dual-staffed medics have a four-person crew for the engine and medic unit. With dual-staffing the crew can be dispatched as a medic crew or fire crew, but not both. Super-Medics are independently staffed by two paramedics. Dual-staffing is efficient but becomes less so when demand is high, as it is in some Districts.

District Councils

TriData used the city's 17 District Council neighborhoods to analyze service levels and equity. Analyzing emergency service levels and outcomes by community is an excellent way to understand whether services are being delivered efficiently and effectively. Saint Paul is to be commended on its forward-thinking approach with regards to service levels and equity.

District Councils are autonomous 501(c) (3) non-profit community groups organized for the purpose of improving community involvement in planning. Demographic information and data for each District compiled by Minnesota Compass project was used for this study. In addition to the size, population and density, the analysis considered six factors that can influence the need for emergency services.

- Median Family Income
- Percent of Population Below the Poverty Level
- Percent of Vacant Housing
- Percent of Owner-Occupied Housing
- Percent of Population with Less than High School Education.

- Percent of Population with Bachelor's Degree or Higher

These factors often determine the demand for fire and medical services, and the severity of incidents responded to by fire departments. Most fire deployment studies use nationally recommended response time and staffing guidelines when analyzing service delivery. This study is unique because these six factors were examined. Some demographic highlights:

- Summit Hill (District 16) and Macalester-Groveland (District 14) are the most affluent communities with the highest median family and personal income. Residents here are some of most highly educated. North End (District 6) and Capitol River (District 17) have the lowest income.
- Districts of Greater East Side, Payne-Phalen, North End, Dayton's Bluff and Thomas-Dale/ Frogtown, are where the highest percentage of residents live with less than a high school education. Not surprisingly, these areas also have the lowest median family and personal income.

Key Findings

- The study found that there was a much higher use of fire and medical services in the communities with the highest poverty and lowest education levels. The number of structures fires was also higher in those communities, as was the annual fire loss.
- Medical service demand is increasing at about 3-4 percent per year, faster than population, and is likely to continue for the next 5-7 years. To meet the already increasing medical demand, SPFD added a dual-staffed medic unit to Station 5 and three Super Medics. The addition of Medic 5 has really improved service delivery, as it reduced the call volume of Medic 8 (Downtown) and Medic 14 (Union Park).
- While calls for service are high and some companies are approaching 3,000 calls per year, Unit-hour-utilization (UHU) for most companies is below 10 percent (less than two hours per day). The exceptions are the dual-staffed engines as many of these are at or over 20 percent. The major problem facing SPFD is the combined workload for crews in dual-staffed stations. Because they must run both fire and medical calls, crews on these units have very high workloads. Another issue affecting SPFD is the policy of running the engine at stations with Super-Medics on every medical call along with the Super-Medic.

Other findings were:

- Adding the medic to Station 5 resulted in a 32 percent decrease in responses by the engine (most of the calls were for the Medic).

- The data determined that in stations with a Super Medic, both the engine and medic unit responded to the same calls, thereby reducing the effectiveness of independent staffing for medic units.
- The busiest ladder company (Ladder 8) responds to roughly 2,500 incidents per year, the majority of which were medical calls. Responses for all seven ladders are mostly medical calls.
- Demand for Station 17, which is a single-unit dual-staffed station, outside of its area is reducing service delivery to the North End District.
- The majority of responses by the three squad units are to medical incidents and few are for structure fires.

Response travel times for a first-in fire unit were less than 4 minutes to 90 percent of structure fires throughout most of the city. The 90th percentile standard is the most difficult to meet and few cities can. Districts 1, 6, 10 and 12 had slightly higher response travel times but were still reasonable. District Council 6, where Station 17 is located, is the area in most need, and we recommend adding a Super-Medic here.

Key Recommendations

Most of the recommendations made in this study are changes to keep fire and medical services at the very good level they are now. More Super-Medic units are needed. SPFD also needs to change its policy regarding Super-Medics, which is to have the co-located engine respond on all medical calls, even when the call is minor and could be handled easily (and safely) by the two personnel on the medic. The current policy is placing unnecessary load on the system (and on personnel).

SPFD also needs to increase its efforts to recruit paramedics to meet demand and keep enough paramedics in the system.

Other recommendations to improve service delivery are:

- Provide hiring preference for firefighter candidates who possess Minnesota Paramedic licensure or National Registry of EMTs Paramedic certification.
- Replace the second engine at Station 6 with a Super-Medic unit.
- Consider eliminating one squad and using its resources to add two Super-Medics, or to expand the BLS program.
- Discontinue the policy of browning out the Super-Medics first; instead brown-out one of the three squads.
- Upgrade the dual-staffed medic units at Stations14 and 17 to Super-Medics.

- Revise the facilities plan and consolidate Stations 20 and 23, and consider constructing the proposed training facility at the same location.

SPFD has made many positive changes over the past few years, largely because of support from elected officials. Among the positive changes:

- Increased staffing from three to four-person minimum on all fire apparatus
- Expanded Station 19 and moved Ladder from Station 10 to 19
- Added new Station 10 and headquarters
- Implemented County-wide automatic aid
- Initiated Automatic Vehicle Locator (AVL) dispatching
- Added Assistant Chief and shift Captains for EMS

In summary, Saint Paul is getting very good fire and EMS service from its fire department, and it is equitably delivered. Our recommendations are largely to increase efficiency in light of the burgeoning EMS demand.

The fact that city management looked at the level of emergency services by district, and determined the results concerning service equity, should be understood by the citizens. It even may be worth touting nationally, as a model in these times of public distrust of government.

I. INTRODUCTION

TriData LLC of Arlington, Virginia was selected to review the Saint Paul Fire Department deployment practices; in particular whether the resources and deployment strategies are consistent with the needs of the city's various communities and neighborhoods. The study was to analyze the response time and service delivery to determine whether there are gaps in service, and whether the services provided are consistent with current and future needs of its many neighborhoods.

TriData has conducted technical research on fire and EMS related issues for over 35 years. We conducted a comprehensive study of the Saint Paul Fire Department in 2007. We have undertaken similar studies for over 200 other communities, many of which are major cities like Saint Paul.

Scope of Work

The scope of work included two key questions: How can Saint Paul Fire Department personnel best be utilized, given current and projected demand? How effectively are resources (apparatus and stations) being used, given current and future demand?

Particular emphasis was given to fire and EMS staffing, deployment of resources, response times, and unit workloads. Review of the city's 17 District Council communities and the equity of service delivery to them was a prime consideration.

Methodology

This study was conducted using the successful approaches developed by TriData over the past 35 years.

The study began in April 2017, with a kickoff conference call. During this call, representatives from the TriData study team and the City of Saint Paul Project Team reviewed the scope of work, the goals of the study and the specific information needed to ensure accurate analysis. The project team then collected data in the form of call statistics, CAD information, GIS mapping information, personnel, apparatus and facilities.

After the kickoff call we made a week-long "triage" visit during which the TriData team met with senior SPFD staff and other stakeholders. Throughout the project we conducted interviews with key management and union officials, visited stations, and had telephone conference calls and numerous e-mail exchanges. Conference calls and weekly reports updated the city's project manager on progress and tentative key findings.

Team members reviewed and analyzed data and information collected from interviews. The project team regularly discussed information and data, and solicited feedback on major findings. Individual project team members were assigned specific responsibilities, but the end product is a collaborative effort.

Overview of the Department

The SPFD is a career fire department that serves a city with over 300,000 residents. With a proud 125 year-history of public service, the men and women of SPFD are dedicated to providing the best fire, EMS, and rescue services available. The 433 member department covers 56 square miles of land and responds to approximately 40,000 calls annually. It has 15 fire stations. Within the 15 stations are 16 engines, 7 ladder companies, 3 squad companies, and 3 district chiefs. A deputy chief is in command of each shift.

Organization of the Report

The remainder of this report is organized as follows:

Chapter II, District Council Areas and Demographics – This chapter reviews the demographics of the 17 Community Council Districts. A major portion of this study was to compare the delivery of services to the city's various communities top determine if services are delivered equitably. Presented in this section are the population, ethnicity, median family and personal income, and other demographic factors, such as education of those living within the 17 Districts.

Chapter III, Demand, Workload and Response Time Analysis – In this chapter we discuss the pressures on the fire and EMS system, including an analysis of expected future population changes and a projection of demand, which is important in evaluating future viability of the system as well as the need for more or less resources to meet future demand. It presents population and demand projections through 2025.

Chapter IV, Fire, Rescue, and EMS Operations – This chapter discusses the current delivery of services by the SPFD from its 15 fire stations, including staffing and operational protocols. The section begins with a review of structure fires and other incident types. Of particular importance are recommendations for changes to current deployment practices and strategy for future service delivery.

Chapter V, Facilities and Apparatus – This discusses the facilities and apparatus deployed by SPFD, and the capital replacement strategy and plans for the future.

II. DISTRICT COUNCIL AREAS AND DEMOGRAPHICS

Saint Paul is very diverse. The demographics of neighborhoods have changed, some dramatically, over the past several decades. For this project, city officials desired to understand how emergency services are delivered to its various communities and neighborhoods. For example, are there gaps or longer response times to neighborhoods with higher population of disadvantaged citizens? Also, how might service requirements need to change in various neighborhoods based on the current and future demands, and what strategic changes should the fire department consider to meet them?

District Councils

To determine how services are delivered, we examined demand and response times by the 17 District Council neighborhoods. According to its website, "Saint Paul is comprised of 17 autonomous 501(c) (3) non-profit agencies that provide residents in each neighborhood an opportunity to become involved in city planning. The primary focus of most district councils is land use, community development and transportation. Other issues that district councils may focus on include parks and recreation centers, community gardens, environmental action, crime prevention and neighborhood beautification. District councils rely on community building activities and events as the basis for convening residents to become involved in their neighborhood."[1]

Demographic information about the District Council Areas was available through the Minnesota Compass project. "Minnesota Compass is a social indicators project that measures progress in our state, its seven regions, 87 counties and larger cities. Compass tracks trends in topic areas such as education, economy and workforce, health, housing, public safety, and a host of others. Compass gives everyone in our state – policymakers, business and community leaders, and concerned individuals who live and work here – a common foundation to identify, understand, and act on issues that affect our communities."[2]

The 17 District Council neighborhoods in Saint Paul are:

District 1 – Eastview-Conway-Battle Creek-Highwood Hills

District 2 – Greater East Side

District 3 – West Side

District 4 – Dayton's Bluff

District 5 – Payne-Phalen

District 6 – North End

District 7 – Thomas-Dale/Frogtown

District 8 – Summit-University

District 9 – Fort Road/ West Seventh

[1] https://www.stpaul.gov/residents/live-saint-paul/neighborhoods/district-councils

[2] http://www.mncompass.org/about/minnesota-compass

District 10 – Como

District 11 – Hamline-Midway

District 12 – Saint Anthony Park

District 13 – Union Park

District 14 – Macalester-Groveland

District 15 – Highland Park

District 16 – Summit Hill

District 17 – Capitol River (Downtown)

District Area Descriptions

The 17 districts vary in their attributes of size, population and demographics. Below are brief descriptions of each of the districts.

1. **Eastview-Conway-Battle Creek-Highwood Hills** is located in southeast Saint Paul. It is the largest district at just under 10 square miles. This district has mostly residential communities that vary extensively economically, geographically, and culturally. This district has single-family homes on large lots and high density apartment complexes.

   Its population density is the lowest of the 17 communities. This district has the highest median family income and lowest percentage of population below the poverty level of all the districts on the city's east side. Fire Station 24 is located here.

2. **Greater East Side** has a population of 28,000 with a density of 7,200 per square mile, and covers 3.9 square miles. Its boundaries are the city limits on the north and east; Minnehaha Avenue to the south; and Johnson Parkway to the west. It includes the neighborhoods of Frost Lake, Hillcrest, Prosperity Heights, Hayden Heights, Beaver Lake, Hazel Park, and Phalen Village. This district is one of the most diverse of all of the districts: 59 percent of the population is non-white and 25 percent have incomes below the poverty level. Fire Station 9 is located in this District.

3. **West Side** is 4.7 square miles with a population of 15,358 and density of 3,200 per square miles. This district is in the eastern half of Saint Paul, to the south and across the Mississippi River from downtown.

   Non-white residents make up 56 percent of the population. This district has one of the largest Hispanic communities centered along Cesar Chavez Boulevard. The median family income is $43,500 and 29 percent of those working have incomes below the poverty level; and 20 percent of the population has less than a high school education. Fire Station 6 in this district and is unique among the city's 15 fire stations for having two engines (Engine 6 and Engine15.)

4. **Dayton's Bluff** has a population of 18,000 in 2.8 square miles. Dayton's Bluff is located on the east side of the Mississippi River in southeastern Saint Paul. It is a residential district on a raised plateau bounded by the ridges of the Mississippi River Valley. The name honors Lyman Dayton (1810-1865), as well as a village and township in Hennepin County that were also named after him.

   Thirty-two percent of Dayton's Bluff's residents have incomes below the poverty level and the median family income is $40,000. Twenty-two percent of the adult population has less than a high school education. Station 7 is located in Dayton's Bluff.

5. **Payne-Phalen** has a population of 31,000 in 4.3 square miles. Located in this district are Railroad Island, Phalen Park, Rivoli Bluff, Vento, Wheelock Park, and Williams Hill neighborhoods. The neighborhoods range from a blue-collar area to the south, to a middle-class area north of Maryland Avenue, including high-end real estate around Lake Phalen.

   Non-white residents make up 65 percent of the population. Thirty (30) percent of those working have incomes below the poverty level and 27 percent of adults have less than a high school education. Ten (10) percent of the available single-family homes are vacant in Payne-Phalen, the second highest percentage in the city. The only district with a higher percentage of vacant houses is Thomas-Dale/Frogtown (10.4 percent). Fire Stations 4 and 17 are located in the Payne-Phalen District.

6. **North End** has the lowest median family income of the 17 districts. This district covers 3.5 square miles. It is located south of Maryland Avenue, with Victorian-era homes built on narrow lots. The district's North End is one of Saint Paul's largest residential areas.

   With a population of just under 23,000, 36 percent of residents have earnings below the poverty level. Seventy (70) percent of the residents in the North End are non-white and 26 percent of adults have less than a high school education. Fire Station 22 is located in this District.

7. **Thomas-Dale/Frogtown** informally known as Frogtown, is a historical community bordered by University Avenue on the south, Van Buren Avenue on the north, Dale Street on the west, and Western Avenue on the east. It has a population of 15,505 with 79 percent being non-white.

   Thirty-five (35) percent of the area is below the poverty level and 28 percent have less than a high school education. Over 10 percent of the available single-family homes in Thomas-Dale/Frogtown are vacant. From 1990-2000, the population increased by almost 19 percent, though it has fallen again to 1990 levels. Fire Station 18 is located in this district.

8. **Summit-University** covers 1.8 square and has a population of 18,296; this community has the highest population density of the 17 districts. This district is ethnically and economically diverse, and includes a large Hmong community as well as large numbers of Vietnamese, Laotians, and Cambodians.

   Twenty-seven (27) percent of the population is below the poverty level though 45 percent have a bachelor's degree or higher education. Summit-University is one of the most stable communities as its population is the same as it was in 1990. Fire Station 5 is located in Summit-University.

9. **Fort Road/ West Seventh** has a population of just over 11,000 in 2.8 square miles with a median income of $52,000. It is known as Fort Road due to its location on historic Native American and fur trader paths along the northern bank of the Mississippi River stretching from downtown Saint Paul to Fort Snelling. Originally, this area was the location of European immigrant neighborhoods along the western bluffs.

   The district has a very stable population with an increase of only 600 residents since 1990. Seventy-five (75) percent of residents are white, 8 percent are black, and 17 percent are other non-white. Thirty-six (36) percent of adults have a bachelor's degree or higher while 7.7 percent have less than a high school education. There are no fire stations in the Fort Road/ West Seventh District, though Fire Stations 1 and 19 are nearby.

10. **Como** is situated around Como Lake and has many recreational resources, including a golf course, bike path, various open fields, a pavilion, a municipal pool, and the Como Zoo. Como Zoo is one of two zoos in the Twin Cities.

    The population is 79 percent white, is 3.3 square miles, and has 16,000 residents. The single-family home vacancy rate in Como is low (3.3 percent) though 18 percent of residents are below the poverty level. Its median income is $67,600 and 55 percent of adults have a have a bachelor's degree or higher. Fifty-nine (59) percent of homes in Como are owner-occupied; only Macalester-Groveland is higher (67 percent). There are no fire stations in the Como.

11. **Hamline-Midway** got its name from being halfway between downtown Minneapolis and downtown Saint Paul. This district includes Hamline University. This district has a population of just over 12,000 of which 29 percent are non-white.

    Eighteen (18) percent of Hamline-Midway is below the poverty level which has a median family income of just under $51,000. It is the fifth smallest District with a population density of 6,500 residents per square mile. There are no fire stations in Hamline-Midway, which is served primarily by Fire Stations 20 and 23.

12. **Saint Anthony Park** is known by local residents as SAP. This district borders northeast Minneapolis on the west and the Minnesota State Fairgrounds on the east. It is 2.4 square miles with a population of 8,200 for a density of 3,400 per square mile.

    As with most other districts in west Saint Paul, Saint Anthony Park has a majority white population (74 percent). Sixty-seven (67) percent of adults have a bachelor's degree or higher and fewer than 4 percent have less than a high school diploma. Fire Stations 20 and 23 are in this district.

13. **Union Park** has a population of 17,800, down very little from its population of 18,400 in 1990. This district was formed after Merriam Park, Snelling Hamline, and Lexington-Hamline District Councils merged, and it is now a residential neighborhood with a large number of early 20th-century housing, boutique-dominated commercial strips on Selby, Cretin, and Cleveland Avenues.

    Covering 3.0 square miles, 78 percent of residents are white. Approximately 18 percent of residents are below the poverty level in this District where 6 percent of adults have less than a high school education. The median family income is just under $54,000. Fire Station 14 is located in Union Park.

14. **Macalester-Groveland** covers 2.5 square miles and has a population of 18,800. This district has a good mix of single-family homes and apartments with corner stores and vibrant commercial corridors. The "influence of academia and college life is felt throughout the neighborhood, offering residents an array of cultural, athletic, and musical opportunities."[3]

    Eighty-seven (87) percent of residents are white. Macalester-Groveland has the second highest median family income ($73,462), with only Summit Hill being higher ($76,760). Seventy-one (71) percent of adults have a bachelor's degree or higher and 2 percent have less than a high school diploma. 67 percent of homes are owner occupied (highest). There are no fire stations in Macalester-Groveland, which is served primarily by Fire Stations 5, 14, and 19.

15. **Highland Park** is the most populated district (24,700), and is home to Saint Catherine University as well as two private preparatory schools. For 85 years Ford's Twin Cities Assembly Plant was located in this district; the plant closed in 2011.

    Nine (9) percent of the population is below the poverty level and has the third highest median family income of $70,744; Summit Hill and Macalester-Groveland are one and two. Fifty-nine (59) percent of adults have a bachelor's

[3] http://www.macgrove.org/

degree or higher in this community where 9 percent are below the poverty level. Fire Station 19 is in the District of Highland Park.

16. **Summit Hill** is the most affluent of the 17 districts. The community is bounded by Summit Avenue and Ramsey Street on the north, Interstate 35E on the south, and east and Ayd Mill Road on the west. Summit Hill is one of the oldest neighborhoods and is known for its history, architecture, and shopping.

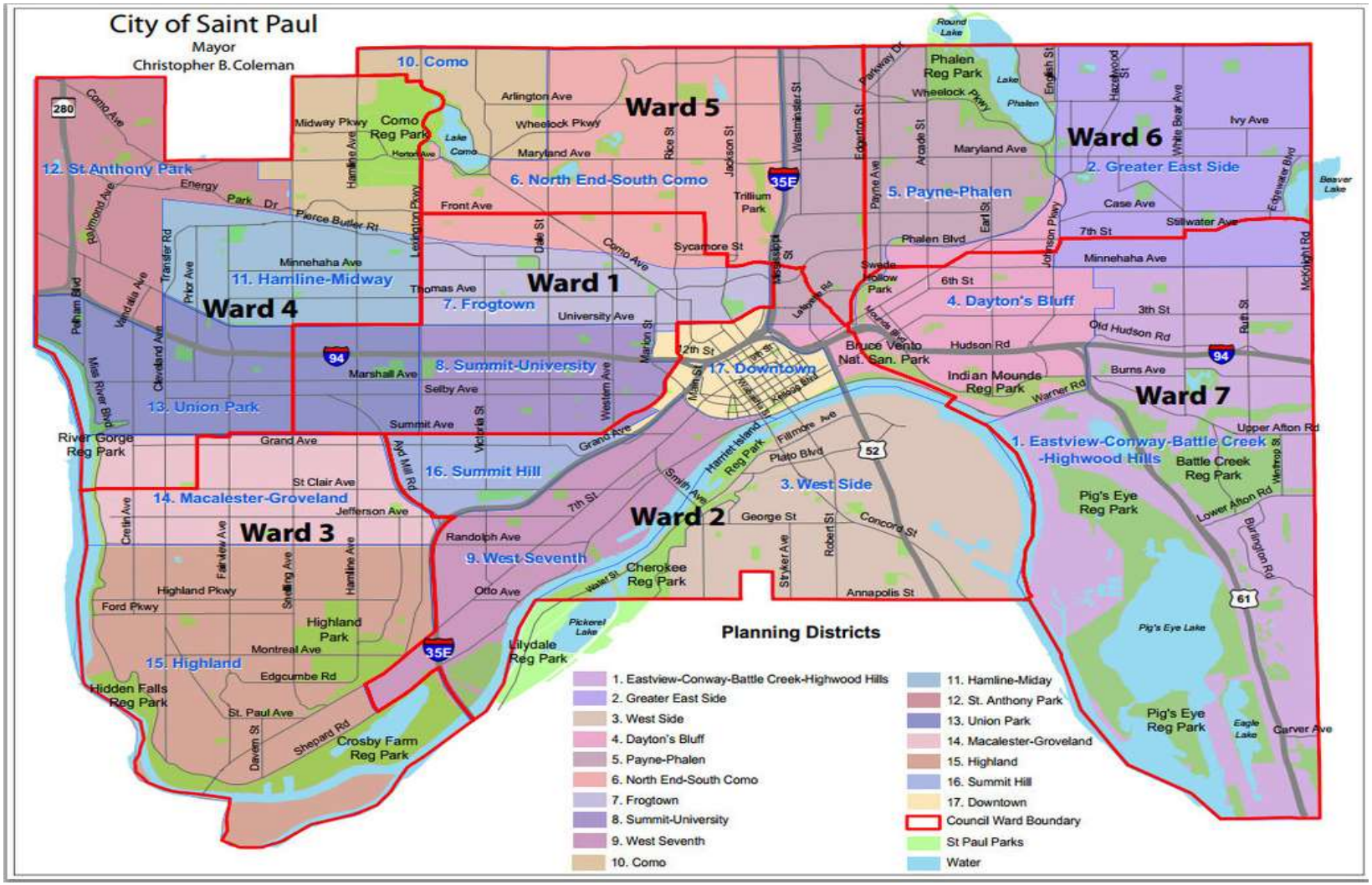
    Covering less than 1 square mile, Summit Hill has a population of 6,800 where almost 70 percent have a bachelor's degree or higher. The median family income of $76,760 is the highest in this district where 7.6 percent of residents are below the poverty level. Non-white residents make up 15 percent of the population in Summit Hill. The city's newest fire station, Station 1, is located in this district. SPFD's administrative offices are also located at Station 1.

17. **Capitol River (Downtown)** covers 1 square mile and has major venues such as Xcel Energy Center (home of the Minnesota Wild), Galtier Plaza, and the McNally Smith College of Music, the Minnesota Swarm, and Wells Fargo Place.

    This district has the lowest median family income ($34,000), presumably because most households are single adults. Since 1990, the population has increased by 76 percent from 4,400 to 7,800. Increase in weekday population of those working downtown results in this district having the highest demand of all communities. Of those living downtown, 21 percent have incomes below the poverty level.

Council district neighborhoods are not to be confused with city council wards, of which there are seven. Neighborhood districts do not follow the political boundaries of the council wards, as can be seen in the map below.

Figure 1: City Council Districts & Community Planning Areas



Study Evaluation Factors – To examine the relationship between service delivery, demand and response time, population figures and other demographic information such as race was reviewed. The analysis also considered six other factors often associated with the demand for emergency services:

- **Median Family Income** – Families with low income are often disadvantaged in their ability to seek preventive medical treatment. They are also often unable to provide or maintain basic fire safety equipment, or address unsafe issues in the home.
- **Percent of Population Below the Poverty Level** – Individuals with income below the poverty level are often unable to seek medical care outside of that provided by emergency responders. Likewise, fire safety equipment and prevention may not be readily available or adequately addressed.
- **Percent of Vacant Housing** – Studies have determined that areas with higher percentages of vacant housing often have higher crime rates. Vacant properties can also be targets for vandals and arson fires.
- **Percent of Owner-Occupied Housing** – Areas with lower income often have less home ownership, which tends to result in higher rates of turnover. Properties occupied by a homeowner are more likely to be better cared for over the long term, and more likely to have working smoke alarms.
- **Percent of Population With Less Than High School Education** - The level of one's education is often related to knowledge about safety, and the ability to understand the consequences of actions, illness and injury. Populations with less education often rely more heavily on public services such as fire and EMS. Communities where a higher percent of the population has less than a high school education also have less income.
- **Percent of Population with Bachelor's Degree or Higher** – Communities with higher level education have higher income levels and often can afford needed services, in particular medical, without relying on the city's EMS. Likewise, areas where the population has a higher level of education typically have lower fire incident rates.

Individually, none of the demographic criteria listed above are reliable predictors of the incidence of fire and medical calls. For this project, however, it was useful to understand the demographics of the 17 neighborhoods to compare whether the quality of services delivered in poorer, less advantaged neighborhoods, was as good as those in more affluent communities.

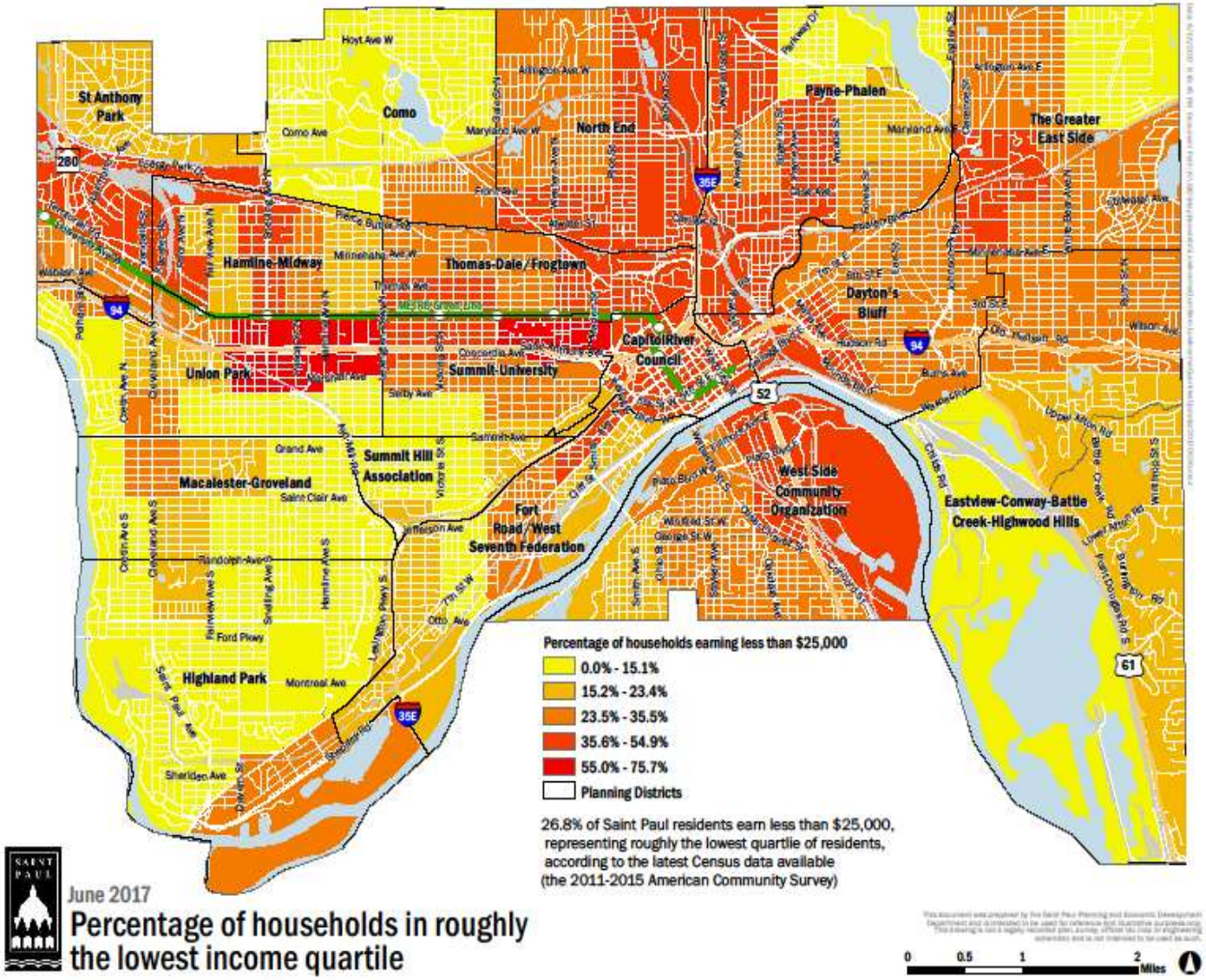
Table 1: District Council Demographics

DISTRICT	Square Miles	Population 1990	Population 2000	Population 2015	Population Square Mile	% White	% Black	% Other Non-White	Median Family Income	% Population Below Poverty	% Vacant Housing	% Housing Owner Occupied	% Population Less Than High School	% Population Bachelors Degree of Higher
1 - Eastview-Conway-Battlecreek-Highwood Hills	9.6	18,968	20,063	22,011	2,293	40	23	37	$49,964	13.1	4.7	50.6	13.3	25.4
2 - Greater East Side	3.9	24,475	26,566	28,000	7,179	41	15	44	$43,630	25.4	6.5	57.7	19.8	20.1
3 - West Side	4.7	15,207	16,133	15,358	3,268	44	15	41	$43,537	28.6	6.7	48.0	19.6	26.4
4 - Dayton's Bluff	2.8	15,442	17,758	18,013	6,433	36	14	50	$40,145	31.9	8.7	41.7	22.3	20.2
5 - Payne-Phalen	4.3	26,692	31,531	31,121	7,237	35	12	53	$43,229	29.6	9.7	44.5	26.7	20.2
6 - North End	3.5	NA	20,657	22,848	6,528	30	23	47	$32,339	35.7	6.3	39.0	25.8	17.0
7 - Thomas-Dale/ Frogtown	1.7	14,540	17,248	15,505	9,120	21	28	51	$35,126	35.3	10.4	35.1	28.3	19.3
8 - Summit-University	1.8	18,249	18,192	18,296	10,164	48	34	18	$47,306	27.2	4.6	33.6	11.9	45.3
9 - Fort Road/ West Seventh	2.8	10,724	10,412	11,324	4,044	75	8	17	$51,990	12.1	8.1	45.1	7.7	36.0
10 - Como	3.3	NA	16,406	16,022	4,855	79	8	13	$67,600	13.1	4.8	58.9	4.4	54.9
11 - Hamline-Midway	1.9	11,815	11,822	12,435	6,544	71	14	15	$50,750	17.8	3.3	52.0	7.0	43.8
12 - Saint Anthony Park	2.4	6,656	6,076	8,196	3,415	74	7	19	$55,900	20.7	5.4	38.0	3.8	67.0
13 - Union Park	3.0	18,401	18,803	17,773	5,924	78	10	12	$53,710	18.3	4.5	40.8	6.1	60.0
14 - Macalester-Groveland	2.5	20,416	19,772	18,838	7,535	87	3	10	$73,462	8.8	4.2	66.7	2.0	70.6
15 - Highland Park	6.1	23,037	23,202	24,724	4,053	76	13	11	$70,744	8.8	5.0	50.5	3.7	59.4
16 - Summit Hill	0.96	7,210	6,741	6,839	7,124	85	4	11	$76,760	7.6	4.5	42.5	2.4	69.7
17 - Capitol River	1.0	4,410	5,743	7,765	7,765	73	11	16	$34,059	21.3	6.3	27.4	5.4	54.1

As can be seen in Table 1, the most affluent communities, those with the highest median family are Summit Hill (16) and Macalester-Groveland (14). North End (6) and Capitol River (17) have the lowest median income. Eight communities on the west side (Communities 9-16) have the highest median family income and the highest percentage of residents with a Bachelor's degree or higher. Conversely, Communities 2-7 have the lowest family median income and the highest percentage of residents with less than high school education. The percentage of white residents is also much lower in these neighborhoods than on the west side; the percentage of blacks and non-whites in Communities 2-7 is between 56 and 79 percent.

The map below shows by census tract the percentage of households with earnings less than $25,000. Census tracts with the highest percentage include portions of Thomas-Dale/Frogtown, Payne-Phalen, and Dayton's Bluff. Combined, census tracts in Union Park, Summit-University, Summit Hill, Macalester-Groveland, and Highland Park have the lowest percentage of households earning less than $25,000. This area is roughly 14 square miles and encompasses about one-fourth of the city.

Figure 2: Household Income Under $25,000, 2017



Since TriData's 2007 study, Saint Paul has seen significant change spurred mostly by a new Light Rail system. Most of the population growth in Saint Paul is along the Light Rail line where gentrification and new construction is occurring. Other changes are a new minor league baseball stadium (downtown), and a soccer stadium currently under development at University and N. Snelling Avenues.

The most growth in Saint Paul is along the Green Line Light Rail with smaller, infill development, occurring throughout the city as properties are torn down or small land tracts become available. There are 26 miles of shoreline, though there is very little development along the water. The most significant redevelopment is the former Ford plant in Highland Park, which is being redeveloped into a residential mixed-use community.

Clearly, there are significant differences among the 17 neighborhoods. The questions for this project were: how effectively are services delivered to the 17 communities; and, are there inequities in service delivery that can be related to disparities in race, income, education, home ownership, or other factors? Effectiveness was measured by the time it takes for emergency responders to arrive at the scene once a call is received at a fire station.

The next chapter discusses the data analysis findings of this study: fire and EMS demand, response times, and workloads of the fire and medical units deployed by SPFD. A comparison of service delivery response times to the 17 District's in also included in the chapter.

III. DEMAND, WORKLOAD, AND RESPONSE TIME ANALYSIS

TriData performed a response time, demand, and workload analysis using 24-months of CAD, ImageTrend, and Sansio data. The city is interested in identifying service gaps that may exist across the 17 district council areas, validating recent operational changes that included adding a medic unit to Station 5, evaluating current and future service demand to guide resource deployment decisions, and providing information useful to the development of a strategic plan for the fire department.

The department provided TriData with three different data sets that span April 2015 through March 2017. Data included detailed information about all emergency responses encompassing more than 158,000 cases. While analysis of data usually focuses on calendar or fiscal year time periods, Ramsey County changed to a new computer-aided dispatch (CAD) system in March 2015. Validity and completeness of CAD data prior to the CAD conversion was questionable, so this analysis is focused on the 24 months of data available from the new CAD to increase reliability. The three databases include:

- Computer-Aided Dispatch (CAD) – Response data for all incidents
- ImageTrend – Fire incident data
- Sansio – Emergency medical incident data

Computer-Aided Dispatch (CAD) data is maintained at the Ramsey County dispatch center. Ramsey County dispatches all St. Paul Fire Department units to emergency and non-emergency events. CAD data includes incident numbers assigned to each dispatched event, call received time, call dispatched time, unit(s) enroute time, unit(s) on scene time, and unit(s) return to service time, type or nature of incident, and the street address of incidents. This is the most comprehensive data set for analyzing response times because it includes every unit response to which the SPFD is dispatched. It is updated in real time, as emergency incidents are received through the 911 system, processed by dispatchers, and then assigned to emergency response units.

CAD data is valid, but not error free. Unit enroute, arrival, and clear time stamps for incident responses are subject to errors. Time stamps are entered into the CAD for responding units in one of three ways: 1) the geo-fence system[4] in conjunction with the automatic vehicle locator (AVL) system using GPS time stamps enroute when it detects vehicle movement, or on scene when the unit reaches its destination 2) the officer on the responding unit presses the enroute or on scene or clear button on the mobile data; terminal (MDT) in the unit, or 3) the dispatcher enters a time stamp when notified by a unit via radio that it is enroute, on scene, or clear of the incident. Despite the redundancies, geo-fences can fail to accurately record a vehicle enroute or

[4] Geofencing is a technology that defines a virtual boundary around a real-world geographical area. In doing so, a radius of interest is established that can trigger an action in a geo-enabled phone or other portable electronic device.

on scene time, a dispatcher may be delayed time stamping a unit, or the officer may forget to notify dispatch, compromising the data reliability. The large volume of CAD data for this project fortunately does smooth errors, limiting their impact on the analysis.

The ImageTrend software is used to record fire unit response and incident specific data and also to report information to the National Fire Incident Reporting System (NFIRS). Anytime a fire unit (Engine, Ladder, Squad, or HazMat) responds, an ImageTrend incident report is completed. The ImageTrend report uses the incident number assigned through the CAD and includes the incident address, type of incident (See Appendix with NFIRS codes), dollar loss associated with the incident, and other incident specific information. ImageTrend reports are completed by a fire officer who responded to the incident, so this has more detail than is provided through the CAD system.

Sansio software is used to record information about EMS incidents. Anytime a medic unit or ambulance responds to a medical emergency or non-emergency event, a report is completed in Sansio. Sansio data is comprised of patient care reports (PCR) completed by the paramedic or EMT who cared for the patient on each medical incident. The Sansio data includes an incident number that matches CAD, address of incident, patient information, medical treatment rendered, chief medical complaint, patient care protocol, and the hospital to which the patient was transported.

While every unit dispatched to an event is logged into the CAD, Sansio and ImageTrend reports are not completed for every response. For example, if ten fire units respond to a fire event, only one ImageTrend report is completed, but response information about all ten units is recorded in the CAD. To perform the response and workload analysis, the datasets were merged using a relational database. In addition to merging the three datasets, the city's GIS department assisted in the analysis by linking each emergency incident location to one of the 17 District Council areas.

Service Delivery Analysis: Introduction

While many factors affect or reflect service delivery, this analysis focuses on service demand (call volume), response/travel times, unit workloads, and fire losses. Each of these variables is the basis for evaluating the level and location of emergency service resources provided by SPFD. Communities have differing population dynamics, socioeconomic traits, geography, weather, and other factors that influence the emergency service environment.

Demand for SPFD services continues to increase, especially for emergency medical calls. SPFD is a full-service department, providing fire suppression, hazardous materials, rescue, and medical response and transport services. A unique aspect of its deployment is staffing ten stations with dual-staffed engine/medic units. At dual-staffed stations, four personnel are assigned to staff the engine and medic unit simultaneously. When a medical call is dispatched the four personnel

respond in the medic unit (ambulance), and when a fire incident is dispatched they respond in the fire engine.

The challenge of dual staffed units is that when the crew is responding to a medical emergency in the ambulance, the fire suppression unit (typically an engine) is out-of-service until the crew returns to the station. This deployment model has efficiencies but also challenges, since increases in demand in one area can impact the other. For Saint Paul the demand increase is in medical calls.

The 10 dual-staffed stations are complemented by 3 "Super-Medic" stations (Station 8, 9, & 23), where medic units and engines are staffed independently. Super-Medics, though rarely called by this name, are the more traditional staffing model for fire-based medical response and transport units in large cities. At Super-Medic stations, two personnel staff the medic unit and four personnel staff the engine; therefore, when the medic unit responds to a medical event, the engine can continue to handle calls. The SPFD however, chooses to have the engine respond on every medical call with the Super Medic, thus there is really little difference in dual-staffing and Super-Medics as they are used by SPFD.

Due to high demand and concerns about response time, SPFD added a dual-staffed medic unit at Station 5 in June 2016. The addition of another medic unit in the system produced excellent results, as it took some of the demand off of neighboring medic units and engines. Adding the medic unit to Station 5 was certainly needed.

Demand Projections – The incident projection methodology used for this study have been developed over 35 years of conducting fire department studies with demand projections. We estimate low demand growth and high growth scenarios. This model considers demand increases due to both population increase and changes in per capita demand. This produces high and low bounds which future year incident totals can be expected to fall.

1. The first method for estimating the number of incidents in a future year is to assume the current per capita demand for service will remain constant. In this case, demand grows in proportion to population growth. However, in most cases, per capita demand has been shown to increase over time, thus the demand predicted with this method will often fall short of the true value.

2. The second projection method assumes that per capita demand will follow the historic trend, at least up to some level. In this projection method we calculate incident growth rates by multiplying per capita demand (by incident type) by the annual population forecasts. The number of incidents projected in this manner tends to be above the true value since per capita demand often levels off eventually. The per capita growth rate was assumed to slow by a factor of one-half after seven years. Demand is unlikely to continue to grow at the observed rate for the entire period. Using these two models, upper and lower boundaries are

produced. The number of incidents in any given year can be predicted to fall between the two projections.

Using population projections supplied by the city and the observed per capita demand growth rates discussed above, high and low projections through 2025 were created. Table 2 shows the projected incidents for each year by incident type.

Table 2: Incident Projections by Type

	Fire		EMS/Rescue		Haz-Mat		Other			Total Incidents	
Year	High	Low	High	Low	High	Low	High	Low	Population	High	Low
2017	1,664	1,647	38,318	37,383	1,020	1,010	5,447	5,447	**303,027**	46,448	45,487
2018	1,697	1,664	39,664	37,752	1,040	1,020	5,555	5,501	**306,020**	47,956	45,937
2019	1,730	1,680	41,053	38,122	1,061	1,030	5,665	5,554	**309,013**	49,509	46,386
2020	1,764	1,696	42,487	38,491	1,082	1,040	5,776	5,608	**312,006**	51,109	46,835
2021	1,790	1,704	43,747	38,666	1,097	1,045	5,860	5,634	**313,426**	52,495	47,048
2022	1,816	1,712	45,044	38,841	1,113	1,049	5,945	5,659	**314,846**	53,918	47,261
2023	1,842	1,719	46,378	39,016	1,129	1,054	6,031	5,685	**316,266**	55,381	47,475
2024	1,869	1,727	47,751	39,192	1,146	1,059	6,118	5,710	**317,686**	56,883	47,688
2025	1,886	1,735	49,164	39,367	1,157	1,064	6,206	5,736	**319,106**	58,413	47,901

The overall incident and response projections for the next 5-7 years show substantially greater demand increases for medical calls than any other category. More pressure on the EMS assets directly impacts availability of ladder, engine, and squad companies. Projecting future service demand for individual units is not 'exact science' and somewhat more difficult for SPFD due to the fluid deployment strategy which uses Automatic Vehicle Locator (AVL) technology.

Table 3 and Table 4 are the unit response projections out to the year 2025. The two projection models to calculate future incident demand were also used to calculate a low and high projection for each unit.

Table 3: Low Unit Responses

Unit	Base	2017	2020	2023	2025	Unit	Base	2017	2020	2023	2025
Engine 4	917	926	954	967	975	Medic 4	3605	3641	3749	3800	3834
Engine 5	1494	1509	1554	1575	1589	Medic 5	1316	1329	1369	1387	1400
Engine 6	315	318	328	332	335	Medic 6	2184	2206	2271	2302	2323
Engine 7	1984	2004	2063	2091	2110	Medic 10	2154	2175	2240	2271	2291
Engine 8	3373	3407	3508	3555	3587	Medic 14	3223	3255	3352	3397	3428
Engine 9	2184	2206	2271	2302	2323	Medic 17	3002	3032	3122	3164	3193
Engine 10	626	632	651	660	666	Medic 18	3299	3332	3431	3477	3509
Engine 14	811	819	843	855	863	Medic 19	1766	1784	1836	1862	1878
Engine 15	1292	1305	1344	1362	1374	Medic 22	3171	3203	3298	3343	3373
Engine 17	598	604	622	630	636	Medic 24	2808	2836	2920	2960	2986
Engine 18	1020	1030	1061	1075	1085	S/Medic 8	4076	4117	4239	4297	4335
Engine 19	420	424	437	443	447	S/Medic 9	2686	2713	2793	2831	2857
Engine 22	606	612	630	639	645	S/Medic 23	2309	2332	2401	2434	2456
Engine 23	1796	1814	1868	1893	1910	Ambulance 51	1164	1176	1210	1227	1238
Engine 24	420	424	437	443	447	Ambulance 52	649	655	675	684	690
Ladder 7	1894	1913	1970	1996	2014	Engine/Medic 4	4522	4567	4702	4767	4809
Ladder 8	2648	2674	2754	2791	2816	Engine/Medic 5	2810	2838	2922	2962	2989
Ladder 10	1347	1360	1401	1420	1433	Engine/Medic 6	2499	2524	2599	2634	2658
Ladder 18	1861	1880	1935	1962	1979	Engine/Medic 10	2780	2808	2891	2930	2957
Ladder 20	1810	1828	1882	1908	1925	Engine/Medic 14	4034	4074	4195	4252	4290
Ladder 22	1626	1642	1691	1714	1729	Engine/Medic 17	3600	3636	3744	3795	3829
Ladder 24	1459	1474	1517	1538	1552	Engine/Medic 18	4319	4362	4491	4553	4594
Squad 1	2880	2909	2995	3036	3063	Engine/Medic 19	2186	2208	2273	2304	2325
Squad 2	2553	2578	2655	2691	2715	Engine/Medic 22	3777	3815	3928	3981	4017
Squad 3	1441	1455	1498	1519	1533	Engine/Medic 24	3228	3260	3357	3403	3433
Haz-Mat 1	45	45	47	47	48						
Haz-Mat 2	25	25	26	26	27						

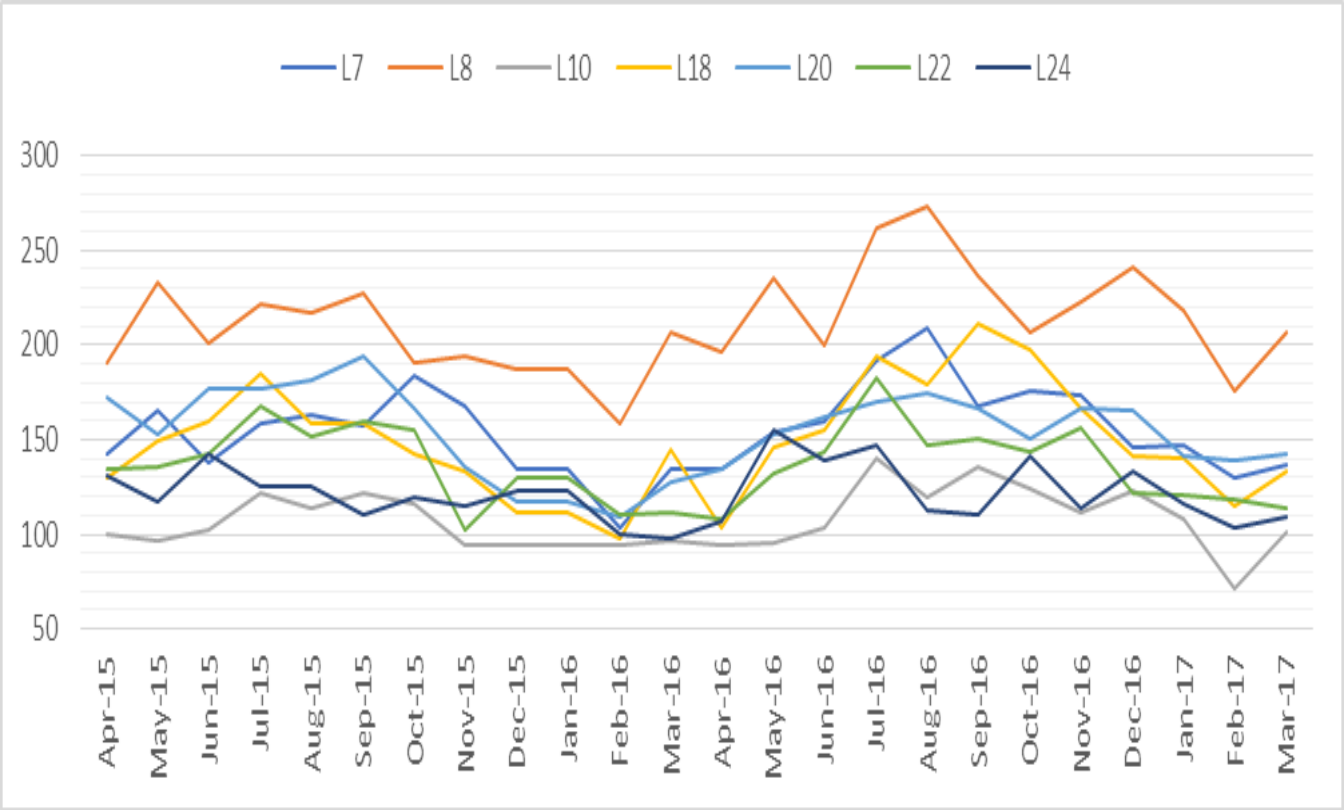
Table 4: High Unit Responses

Unit	Base	2017	2020	2023	2025	Unit	Base	2017	2020	2023	2025
Engine 4	917	940	982	1011	1027	Medic 4	3605	3696	3862	3974	4039
Engine 5	1494	1532	1601	1647	1674	Medic 5	1316	1349	1410	1451	1475
Engine 6	315	323	337	347	353	Medic 6	2184	2239	2340	2407	2447
Engine 7	1984	2034	2126	2187	2223	Medic 10	2154	2208	2308	2374	2414
Engine 8	3373	3458	3614	3718	3779	Medic 14	3223	3304	3453	3553	3611
Engine 9	2184	2239	2340	2407	2447	Medic 17	3002	3077	3216	3309	3364
Engine 10	626	642	671	690	701	Medic 18	3299	3382	3534	3636	3696
Engine 14	811	831	869	894	909	Medic 19	1766	1810	1892	1947	1979
Engine 15	1292	1324	1384	1424	1448	Medic 22	3171	3251	3397	3495	3553
Engine 17	598	613	641	659	670	Medic 24	2808	2879	3008	3095	3146
Engine 18	1020	1046	1093	1124	1143	S/Medic 8	4076	4178	4367	4493	4567
Engine 19	420	431	450	463	471	S/Medic 9	2686	2753	2878	2961	3010
Engine 22	606	621	649	668	679	S/Medic 23	2309	2367	2474	2545	2587
Engine 23	1796	1841	1924	1980	2012	Ambulance 51	1164	1193	1247	1283	1304
Engine 24	420	431	450	463	471	Ambulance 52	649	665	695	715	727
Ladder 7	1894	1942	2029	2088	2122	Engine/Medic 4	4522	4636	4845	4984	5067
Ladder 8	2648	2715	2837	2919	2967	Engine/Medic 5	2810	2881	3010	3097	3149
Ladder 10	1347	1381	1443	1485	1509	Engine/Medic 6	2499	2562	2677	2755	2800
Ladder 18	1861	1908	1994	2051	2085	Engine/Medic 10	2780	2850	2978	3064	3115
Ladder 20	1810	1855	1939	1995	2028	Engine/Medic 14	4034	4135	4322	4446	4520
Ladder 22	1626	1667	1742	1792	1822	Engine/Medic 17	3600	3690	3857	3968	4034
Ladder 24	1459	1496	1563	1608	1635	Engine/Medic 18	4319	4428	4627	4761	4839
Squad 1	2880	2952	3085	3174	3227	Engine/Medic 19	2186	2241	2342	2410	2449
Squad 2	2553	2617	2735	2814	2861	Engine/Medic 22	3777	3872	4046	4163	4232
Squad 3	1441	1477	1544	1588	1615	Engine/Medic 24	3228	3309	3458	3558	3617
Haz-Mat 1	45	46	48	50	50						
Haz-Mat 2	25	26	27	28	28						

Unit response projections for Engine/ Medic 5, though useful, may not be the best because the medic unit was added mid-year 2016, so full impact of this addition is not reflected in the available data.

Graphs 1, 2, and 3 depict the total number of engine, ladder and medic unit responses by month.

Figure 3: Ladder Responses by Month



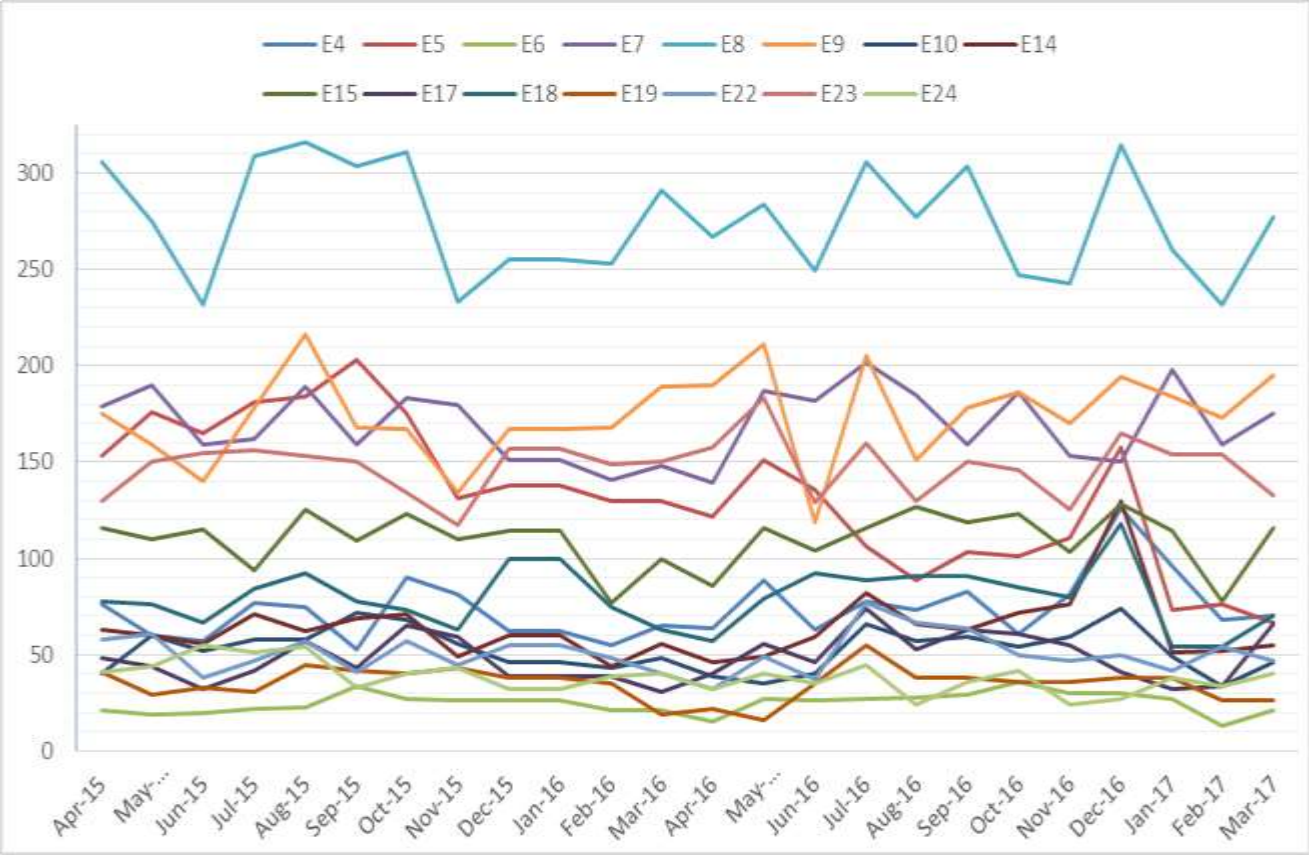
The busiest ladder company (Ladder 8) responds to roughly 2,500 incidents per year, with the least busy ladder responding to about 1,300 calls per year. Table 5 provides the responses by incident type based on National Fire Incident Reporting System (NFIRS) codes for each ladder unit, which were generated from the ImageTrend data set.

Table 5: Ladder Responses by Incident Type, April 2016-March 2017

Unit	Fire (111)	% Fire	Fire-Other	% Fire-Other	Haz-Mat	% HM	Medical	% EMS	Rescue	% Rescue	Other	% Other	Total
L7	61	3.3%	170	9.1%	127	6.8%	718	38.5%	141	7.6%	647	34.7%	1864
L8	63	2.4%	188	7.2%	132	5.1%	966	37.2%	280	10.8%	967	37.2%	2596
L10	22	1.7%	82	6.3%	105	8.1%	331	25.5%	70	5.4%	687	53.0%	1297
L18	41	2.3%	150	8.3%	120	6.6%	598	33.1%	162	9.0%	738	40.8%	1809
L20	19	1.0%	118	6.5%	103	5.7%	756	41.5%	134	7.4%	690	37.9%	1820
L22	41	2.6%	130	8.3%	102	6.5%	565	36.2%	101	6.5%	620	39.8%	1559
L24	34	2.4%	137	9.7%	91	6.4%	541	38.2%	103	7.3%	512	36.1%	1418
Total	**281**	2.3%	**975**	7.9%	**780**	6.3%	**4475**	36.2%	**991**	8.0%	**4861**	39.3%	**12,363**

In addition to the number of responses by incident type, Table 5 details the percentage of total calls by incident type. Ladder companies responded to a total of 12,805 incidents or 442 more calls than are depicted in Table 5 based on CAD data. To generate this report, ImageTrend data and CAD data were merged using a relational database. Responses that did not generate an ImageTrend report or did not match CAD data were not counted. However, the incidents not counted are random, and therefore do not skew the percentage calculations for incident types.

Figure 4: Engine Responses by Month



Engine company responses are significantly impacted by whether the unit is dual staffed with a medic unit or staffed independently. Engine 8 is the busiest engine company responding to roughly 3,300 incidents per year. Engine 7, Engine 9 and Engine 23 are the next busiest engine companies. There is no medic unit at Station 7 and Engines 9 and 23 are co-located with a Super Medic. It was determined that engine companies with dual-staffed medic units respond to fewer incidents because personnel respond to EMS events in the medic units rather than in engines. As an example, when the medic unit was added to Station 5, there was a 32% decrease in responses by Engine 5.

Table 6 provides engine company responses by NFIRS incident type spanning April 2016 to March 2017. Again, some data points were not counted because of missing data caused by the absence of an ImageTrend report or a match did not occur when linking ImageTrend data to CAD data.

Table 6: Engine Responses by Incident Type, April 2016-March 2017

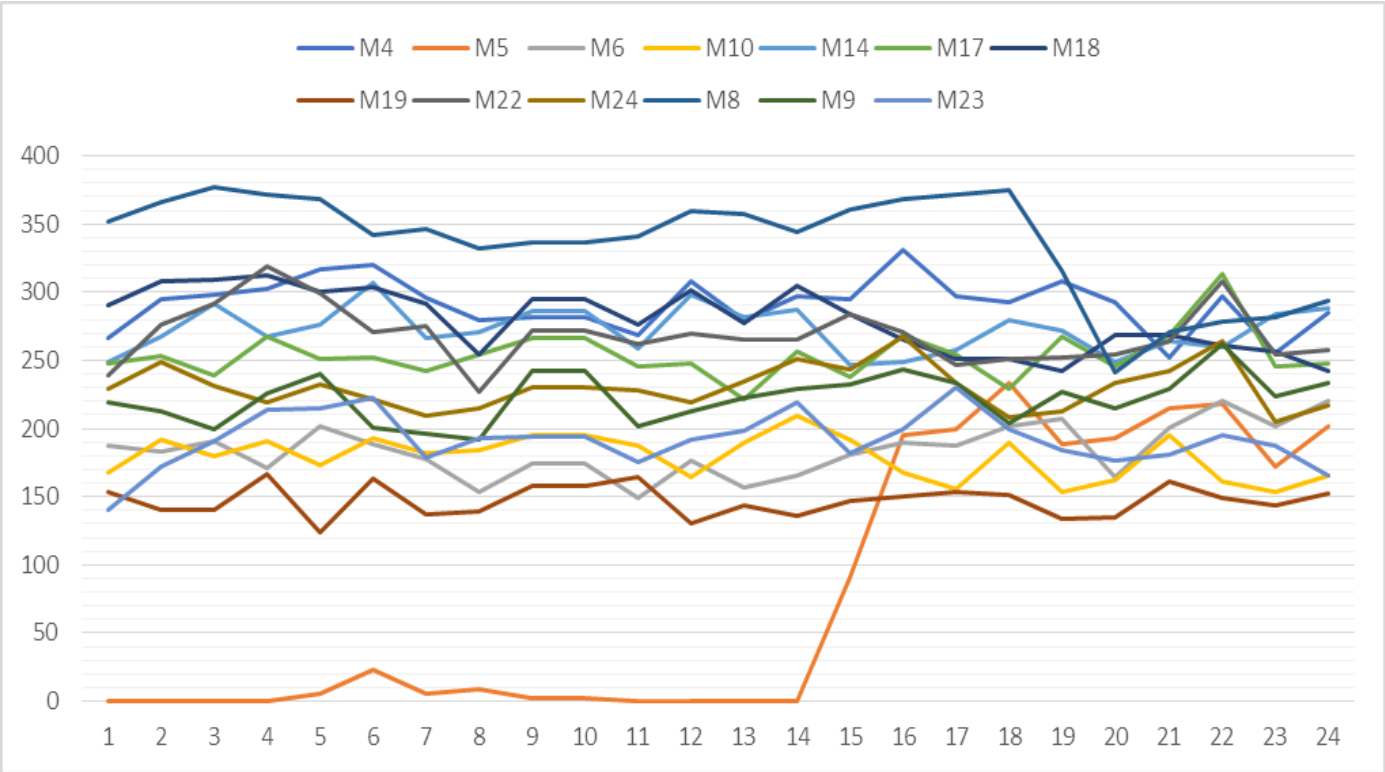
Unit	Fire (111)	% Fire	Fire-Other	% Fire-Other	Haz-Mat	% HM	Medical	% EMS	Rescue	% Rescue	Other	% Other	Total
E4	75	7.9%	183	19.3%	98	10.4%	74	7.8%	4	0.4%	512	54.1%	946
E5	49	4.0%	167	13.5%	140	11.3%	230	18.6%	6	0.5%	642	52.0%	1234
E6	17	5.5%	40	13.0%	30	9.7%	3	1.0%	0	0.0%	218	70.8%	308
E7	87	4.4%	237	11.9%	108	5.4%	866	43.6%	12	0.6%	675	34.0%	1985
E8	92	3.2%	281	9.7%	169	5.8%	1393	48.1%	19	0.7%	944	32.6%	2898
E9	43	2.1%	169	8.4%	75	3.7%	1347	66.7%	24	1.2%	361	17.9%	2019
E10	31	5.1%	95	15.7%	75	12.4%	21	3.5%	2	0.3%	380	62.9%	604
E14	35	4.5%	152	19.4%	98	12.5%	47	6.0%	5	0.6%	446	57.0%	783
E15	37	2.9%	125	9.7%	101	7.8%	363	28.2%	47	3.7%	614	47.7%	1287
E17	62	10.1%	142	23.2%	68	11.1%	9	1.5%	0	0.0%	331	54.1%	612
E18	64	6.8%	199	21.1%	100	10.6%	42	4.5%	4	0.4%	533	56.6%	942
E19	12	3.1%	75	19.4%	65	16.8%	21	5.4%	10	2.6%	204	52.7%	387
E22	54	8.9%	123	20.3%	51	8.4%	22	3.6%	2	0.3%	355	58.5%	607
E23	24	1.5%	106	6.4%	77	4.7%	1007	61.0%	21	1.3%	415	25.2%	1650
E24	33	8.0%	116	28.2%	40	9.7%	5	1.2%	1	0.2%	217	52.7%	412
Total	**715**	**4.3%**	**2210**	**13.3%**	**1295**	**7.8%**	**5450**	**32.7%**	**157**	**0.9%**	**6847**	**41.1%**	**16,674**

The response characteristics comparing the dual staffed engines (Engines 4, 5, 6, 10, 14, 17, 18, 19, 22, & 24) to the engines (Engines 8, 9, & 23) housed with Super-Medic units is dichotomous. Dual staffed engines respond to few if any medical or rescue type incidents and have significantly lower call volume, while majority of incident responses by engines with super-medics are to medical events. The data determined that in stations with a Super Medic, both the engine and medic unit responded to the same calls. Having an engine and medic unit respond on serious medicals calls is advantageous and necessary for patient care, though most calls can be handled by just the medic unit.

Graph 3 depicts responses by month for each of the medic units. The impact of Medic 5 on many of the other medic unit response characteristics is evident. Medic 8 experienced a noticeable decrease in responses when Medic 5 was placed into service. In addition to Medic 8, Medic units 4, 17, and 24 also experienced decreases. Station 5 is a high call volume area that sits adjacent to Station 8, which is the highest call volume area. Medic 5 freed up Medic 8 to answer more EMS calls in Station 8's area, which also helped limit the number of responses by Medics 4, 17, and 24 into Station 8's area. It should also be noted that six of the thirteen medic units respond to more than 3,000 incidents per year.

The call volume at three of the ten dual staffed engine/medic stations exceeds 4,000 responses per year. Even though the responses at dual-staffed stations include both the engine and medic units, it is the same personnel responding to this heavy call volume. Limiting the number of personnel responding to most medical calls would pay dividends by reducing the stress on responders.

Figure 5: Medic Responses by Month



The addition of Super-Medics and the dual-staffed Medic 5 (June of 2016) have improved medical response, but service demand associated with medical emergencies continues to grow 3% to 4% per year. Chart 1 provides a visual depiction of medical response service demand by station area from April 2016 to March 2017.

Table 7: Medic Unit Responses by Station Area, April 2016-March 2017

Station Area	*St. 0	St. 1	St. 4	St. 5	St. 6	St. 7	St. 8	St. 9	St. 14	St. 17	St. 18	St. 19	St. 20	St. 22	St. 23	St. 24	*Other	Total Responses	% outside area
M4 (Dual)	1	12	**1231**	12	125	855	721	91	7	219	53	5	8	83	3	175	14	***3,615***	65.9%
M5 (Dual)	16	140	8	**788**	13	2	129	1	207	0	433	35	58	31	45	2	0	***1,908***	58.7%
M6 (Dual)	1	52	44	8	**1491**	34	501	14	5	11	42	20	2	19	3	46	5	***2,298***	35.1%
M10 (Dual)	6	**1085**	5	120	107	4	254	1	124	5	43	285	31	7	12	4	1	***2,094***	48.2%
M14 (Dual)	67	83	7	167	8	6	41	4	**1565**	3	236	171	559	10	287	3	3	***3,220***	51.4%
M17 (Dual)	4	3	451	5	13	522	41	231	4	**1196**	22	2	0	515	4	30	16	***3,059***	60.9%
M18 (Dual)	13	18	14	565	6	5	78	3	152	2	**1945**	10	59	239	60	3	0	***3,172***	38.7%
M19 (Dual)	4	125	3	8	2	1	7	0	194	0	5	**1382**	13	1	4	1	7	***1,757***	21.3%
M22 (Dual)	34	7	58	37	19	20	109	28	19	100	543	3	6	**2080**	88	6	16	***3,173***	34.4%
M24 (Dual)	2	3	38	1	7	676	16	358	4	11	5	1	0	3	0	**1664**	22	***2,811***	40.8%
M8 (Super)	2	44	208	81	155	55	**2570**	12	12	34	391	11	4	224	9	30	17	***3,859***	33.4%
M9 (Super)	1	2	59	0	2	491	13	**1704**	1	153	4	3	1	19	2	291	9	***2,755***	38.1%
M23 (Super)	428	4	3	6	0	1	5	1	259	2	250	17	429	78	**826**	2	5	***2,316***	64.3%
Total by St. Area	***579***	***1578***	***2129***	***1798***	***1948***	***2672***	***4485***	***2448***	***2553***	***1736***	***3972***	***1945***	***1170***	***3309***	***1343***	***2257***	***115***	***36,037***	
% Assigned	0.0%	68.8%	57.8%	43.8%	76.5%	0.0%	57.3%	69.6%	61.3%	68.9%	49.0%	71.1%	0.0%	62.9%	61.5%	73.7%	0.0%		

**Station 0 are predominately responses into Falcon Heights/Other are predominately responses into Maplewood*

The yellow highlighted boxes are the responses by the assigned unit into its station area. The non-highlighted boxes are responses by medic units into other station areas. The "% Assigned" row at the bottom of the chart is the percentage of medical incidents in that station area responded to by the assigned medic unit. The "% outside of area" column provides the percentage of total responses by medic units into other station areas. Station 7 and Station 20 do not have medic units assigned, so all medical incidents within these areas are handled by units assigned to other stations.

The absence of a medic unit at Station 7 is placing additional call volumes on Station 17, which is a single engine, dual-staffed station. Station 17 is in the North End district, which has a high fire call volume so the absence of the engine when the medic unit is on a call is a concern. Placing a Super-Medic sat Station 7 would also relieve stress on Stations 4, 9, and 24.

Eleven of the thirteen medic units respond to more than 2,000 incidents per year, with the other two units approaching 2,000 responses. While 2,000 responses is not a particularly heavy call load, it must be remembered that this is only the medical calls- the same crews must also handle fire calls, and other units where the engine must respond.

In addition to engine, ladder, and medic units, SPFD also staffs three squad/heavy rescue units. These units do not carry water or have a fire pump. These units primarily are used for extrication and other rescue situations such as vehicle extrications, high angle rescues, water rescues, and structure fire responses. Personnel assigned to these units are trained in each of these technical rescue disciplines, and function as firefighters and emergency medical technicians. The number of working rescue incidents, like working structure fires, is low. However, the squad units respond to a significant number of incidents. Table 8 provides the squad responses by incident type.

Table 8: Squad/Heavy Rescue Responses by Incident Type

Unit	Fire (111)	% Fire	Fire-Other	% Fire-Other	Haz-Mat	% HM	Medical	% EMS	Rescue	% Rescue	Other	% Other	Total
S1	147	5.2%	428	15.1%	231	8.2%	509	18.0%	232	8.2%	1280	45.3%	2827
S2	61	2.4%	207	8.3%	187	7.5%	772	30.9%	186	7.5%	1082	43.4%	2495
S3	71	5.0%	123	8.7%	108	7.6%	357	25.2%	102	7.2%	658	46.4%	1419
Total	**279**	4.1%	**758**	11.2%	**526**	7.8%	**1638**	24.3%	**520**	7.7%	**3020**	44.8%	**6,741**

The majority of responses by the three squad units are to medical incidents and few are for structure fires. Other incident types account for false calls, service calls, and good intent calls. The high percentage of other incident responses is not uncommon for specialty units, as they are often cancelled by first arriving units. Each of the squads is assigned to a station with a busy dual staffed engine/medic unit, which likely explains the number of medical responses.

Unit Responses – Unit responses are a measure of workload. The number of calls handled can provide an indication of the unit's 'busyness'. Fire/EMS system must consider the workloads and sometimes build in redundancies based on whether adjacent stations or units are likely to be available for emergency response. Saint Paul does have redundancy in the system which helps keep response times low. The problem is the same personnel are staffing the medic and fire units, which makes the system vulnerable during periods of high demand. SPFD personnel themselves are also affected because they must handle the workload of both the fire and medical calls. This is not the same as in other cities where there are different crews on fire and medic units. Below are general guidelines developed by TriData that outline response levels and our experience with workloads as they may impact availability.

Very Low (<500 responses/year) – Simultaneous calls are infrequent and unit availability usually is assured. Stations/units can be spaced at the maximum distance possible to achieve stated travel time objectives established by the community.

Low (500-999 responses/year) – Few calls will overlap and unit availability usually is assured. Stations/units can be spaced at the maximum distance possible to achieve stated travel time objectives established by the community.

Moderate (1,000-1,999 responses/year) – Some overlap of calls will occur, usually at peak demand periods; however, stations/units are usually available. Stations/units must be located with marginal overlap to achieve stated travel time objectives established by the community.

High (2,000-2,999 responses/year) – Additional overlap of calls will likely occur; however, stations/units will probably be available for emergency response. Stations/units must be located with significant overlap to achieve stated travel time objectives established by the community. This footprint usually achieves the best results in terms of cost efficiency and effectiveness of service delivery. (Overlap can be achieved with additional stations or additional units in existing stations.)

Very High (3,000-3,999 responses/year) – Overlapping calls occur daily, usually during peak demand periods, and working incidents are frequent. The closest station/unit may not be available, thus requiring the response of adjacent stations/units. Stations/units must be located with the significant overlap to achieve stated travel time objectives established by the community. (Overlap can be achieved with additional stations or additional units in existing stations.)

Extremely High (>4,000 responses/year) – Overlapping calls may occur hourly, regardless of the time of day. The closest station/unit is likely to be unavailable thus requiring the response of adjacent stations/units. Frequent transfers or move-ups are required for the delivery system to meet demand. Stations/units must be located with redundancy (back-up units) to achieve stated travel time objectives established by the community. This footprint is usually found in very densely populated urban areas and is especially evident in EMS services located in urban areas

with very high demand for service. (Overlap can be achieved with additional stations or additional units in existing stations.)

The 3,000–3,200 response level (very high category above) is the point at which units are often considered "busy" and their availability needs to be evaluated. This is a rough rule of thumb, not a fixed standard. At this point, response times often will begin to lengthen from frequent call overlap (calls to the same first-due area arriving back-to-back).

As units become busier, the chances for overlap or simultaneous alarms increase, and second-due units begin to answer more calls. This causes a domino effect where unit B is dispatched to a call in unit A's area because unit A is already engaged, causing unit B to be unavailable for the next call in its own area. Unit C must then respond to unit B or unit A's area, and so forth. The scenario described occurs frequently in Saint Paul, again because the same crews are handling both fire and medical incidents.

Call demand and the number of times units respond into other station areas as the first-in unit to incidents was assessed for each of three time periods: 1) April 2015 to March 2016; 2) April 2016 to March 2017; and, 3) Calendar year 2016.

- Station areas 5, 7, and 20 were the highest recipients of first-in responses from stations outside their first due area.. Stations in those three areas do not have a medic unit or, in the case of 5 and 20, are single company stations (Medic 5 was added to station five in June 2016, so was accounted for in the Year 2 data) making these areas more likely to require assistance.
- Engine 5 was the first-in unit to incidents in Station 5's primary response area fewer than 40% of the time across the three time periods analyzed. It improved with the addition of Medic 5 in June 2016 to 50.5% during time-period two (Year 2).
- Ladder 20 is the only company assigned to Station 20. Over the three time periods analyzed, Ladder 20 was the first-in unit to about 65% of the incidents in Station 20's primary response area.
- Units assigned to Station 7 were the first-in units to about 40% of incidents in this station's area. Station 7 does not have a medic unit, which is a driver of this low percentage. In fact, medic units were the first-in unit for almost half of the incidents occurring in Station 7's area. In addition, Station 7's area is surrounded by four other stations that are in close proximity, so with AVL technology apparatus from the adjacent stations are often closer to incidents in this area.

Fortunately, the city is geographically compact, so longer responses for other than first-in units are not critically affecting response times, as the travel distances to incidents are typically short. However, most units are responding to well over 3,000 incidents per year, fire and EMS combined, and the continued increase of medical calls will impact service delivery. It also affects

firefighters, especially paramedics, who must handle the increased workload under the dual-staffing model.

Unit Hour Utilization (UHU) Analysis

A better measure of unit availability is unit hour utilization (UHU). UHU is a calculation of the amount of time (in hours) a unit is occupied on emergency calls, as a percentage of the total number of hours a unit is staffed and available for response. A unit staffed full-time is available 8,760 hours per year. In other words, UHU measures the percentage of on-duty time consumed by emergency service field activities. A high UHU means lower availability to respond to calls. Poor availability negatively impacts response times. The formula to calculate UHU is:

$$\text{UHU} = \frac{(\text{number of calls}) \times (\text{average call duration in hours})}{8{,}760 \text{ hours per year}}$$

There is other work that is not accounted for in the UHU calculation, such as time for training, maintenance, and other preparedness-related functions. Public education efforts also are not included in the UHU calculation. In other words, when units are not engaged in emergency response, it does not mean they are not working. UHU is used more in relation to EMS units than fire suppression units; although, evaluation of UHUs is useful to different extents in both cases.

While there is consensus within the industry on the importance of utilization rates and how to measure them, the interpretation of how indicative utilization rates are of overall system efficiency is debatable. Most ambulance companies believe that a UHU between 35 and 45 percent for EMS is good for economic efficiency. If a UHU is greater than 45 percent, units often are not available and response times suffer. Units may not be well utilized when the UHU is below 35%, although response times can still be high at this UHU. Many communities choose to aim for a UHU of fire department medic units in the 15 to 25 percent range, to maintain good response times. If a unit has a UHU of 40 percent, it will not be available for the next call 40 percent of the time. This is, of course, an average over the course of the day.

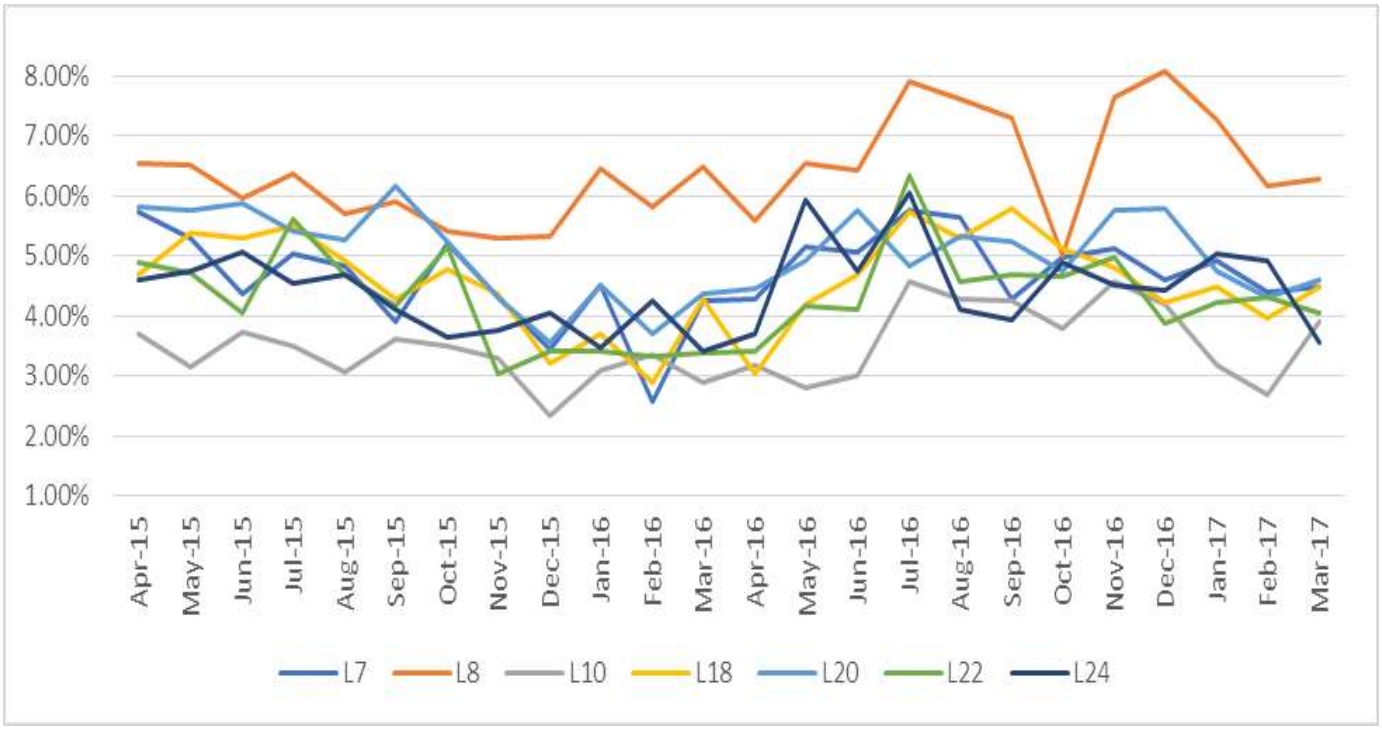
There are no guidelines on UHU levels for fire units; however, many larger departments evaluated by TriData experience engine and truck UHUs between 5 and 15 percent. If a unit is out of its station on a call more than 10 percent of the time, then it is unlikely to meet response time goals of 90 percent of calls in 4 minute travel times, since a second further away station will have to respond. Thus, UHU of 5 to 15 percent is consistent with a goal of being there about 90 percent of the time.

SPFD UHU – To calculate UHU rates, CAD data was analyzed on a month-by-month basis for the 24 months that spanned April 2015 to March 2017. UHU tends to be more accurate when evaluated over smaller durations of time. The total number of hours each unit was assigned to an incident according to CAD was divided by the total number of hours in each month, since each

unit is available 24 hours per day, to generate a UHU or percentage of time the unit was unavailable to respond to another incident of its total staffed hours.

The following three graphs show the UHU for Engine, Ladder, and Medic units for each of the 24 months. It is important to note that dual staffed engine UHU statistics include the hours the medic unit was assigned to a call, because whether the engine was assigned to an incident or its crew was on the medic unit the engine was not available to respond. Time spent returning to the station by the dual staffed units was not available to include in the calculation, so all dual staffed engine and medic UHU measures were slightly lower than the actual UHU.

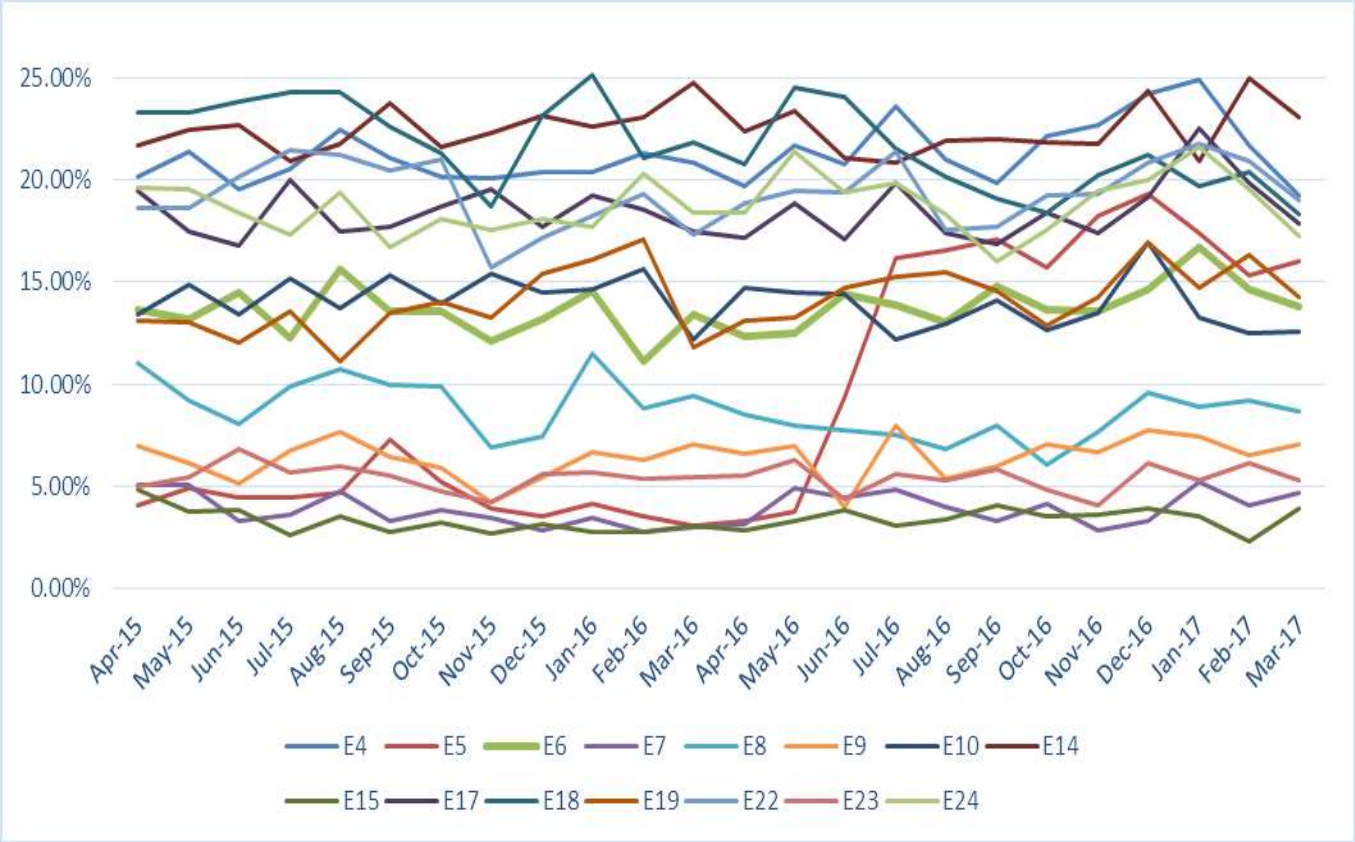
Figure 6: Ladder UHU, 24 Month Period



Graph 4 illustrates the UHU for all ladder units over the 24-month period. The number of unit responses correlates strongly to the UHU. Ladder 8 is the busiest ladder company responding primarily to incidents in the downtown area. While number of responses and UHU are correlated, SPFD ladders all have UHU rates under 10 percent. This is indicative of short duration incident responses. In fact, roughly 75% of all ladder unit responses are to EMS or miscellaneous (Other) incidents. The moderate call volume and relatively low UHU number indicate excess capacity within the ladder units.

The engine UHU statistics are provided in Graph 5. Ten stations have dual staffed engine/medic units. When calculating UHU, the dual staffed units essentially count as one unit because whether the crew is responding in the engine or medic unit, the other unit is unavailable. Therefore, the workload between engine and medic units is more intertwined than with other units, such as the ladder companies.

Figure 7: Engine UHU, 24 Month Period



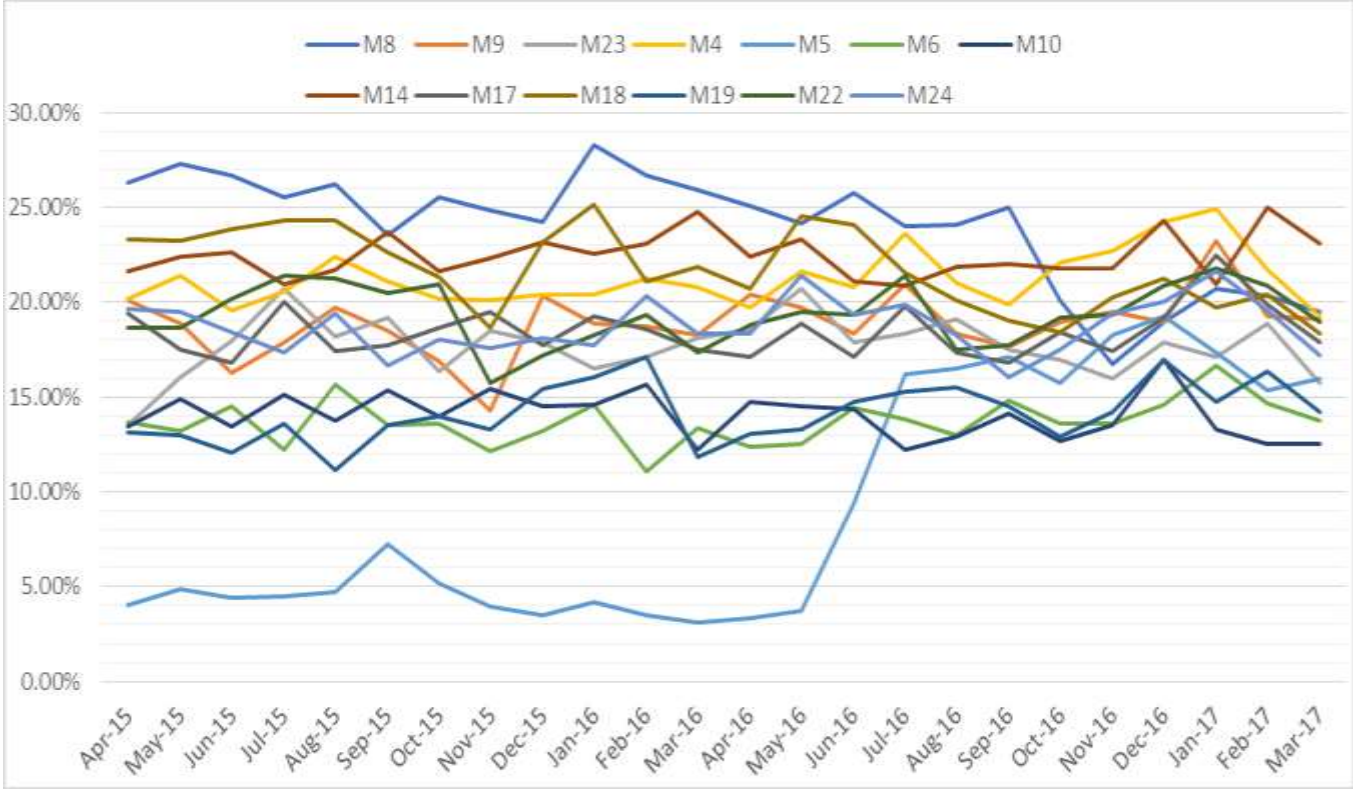
Engines 7, 8, 9, 15, and 23 have UHU values under 10%, while the dual staffed engine companies have UHU above 10 percent with several approaching 25 percent. It was determined that personnel at the dual-staffed engines spend less than 4 percent of the UHU responding to fire incidents.

UHU also shows the impact of adding Medic 5. Engine 5 was a relatively busy company prior to adding the medic, responding to about 2,000 incidents per year with a UHU less than 5 percent. As a dual staffed station, Engine/Medic 5 is now almost 20 percent. Adding Medic 5 positively impacted Engine 8, as it slightly decreased its monthly UHU. This impact is somewhat counter to what one would expect, because as a dual staffed station the engine is available fewer hours per day.

Another takeaway from this graph is the UHU of dual-staffed engine companies compared to stations with Super-Medics or stations with no medic. Because of the dual-staffed stations, medic unit UHU is impacted not only by EMS responses but also fire responses. Again, when the engine responds to a fire incident from a dual-staffed station, the medic unit is not available.

Graph 6 shows the UHU for all medic units for each of the 24 months of data. The positive system impact of adding Medic 5 in June 2016 is evident.

Figure 8: Medic UHU, 24 Month Period



Prior to Medic 5, Medic 8's UHU approached 30% each month. The addition of Medic 5 lowered the UHU of Medic 8 from the upper 20% range to below 20%. It is also important to note that Medic 8 is a Super Medic, so all of its UHU value is generated from EMS responses and is not impacted by Engine 8's responses.

Station 8's area in the downtown area has the highest EMS demand. Medic 5 is located in a station adjacent to Station 8, so it relieved pressure on Medic 8 by reducing the number of incidents in Station 5's area to which Medic 8 must respond. Comparing medic unit UHU six months before and six months after Medic 5 went into service, Medic units 8, 10, 18 and 23 experienced a reduction in UHU.

It is also necessary to analyze UHU values in conjunction with a city's overall situation such as the location of hospitals since medic units must transport patients to a receiving medical facility. Saint Paul has three hospitals located in center city, thus transport distances are relatively short. This allows medic units to clear from incidents within minutes of delivering a patient to the hospital. Even the busiest medic units have relatively low UHU for the total number of responses each year.

It must be remembered again however, that most medic units are dual-staffed and the same firefighters are responding to both fire and medical incidents. The same is true for stations with Super-Medics, as current policy has the engine crew responding with the Super-Medics on almost every call.

The combination of total runs and UHUs signal a need for operational changes and additional resources to maintain current service delivery levels, especially as it pertains to dual-staffing. The model used by Saint Paul is unique so it is not possible to determine the actual point where unit availability will impact response times. It is known that several units are at peak demand and some areas, such as Station 17, are already being impacted by the dual-staffing model.

Automatic Aid – SPFD has an automatic aid agreement with Falcon Heights and Maplewood. Stations 9 and 24 respond most frequently into Maplewood. In 2016, units from Station 9 or Station 24 responded into Maplewood about 116 times, which was roughly 1% of these station's total responses. Almost half of these responses were to the 3M Corporate campus for alarm activations or other miscellaneous issues.

For Falcon Heights, Engine and Medic 23 responded 650 times during calendar year 2016. A large percentage of these responses were to the university campus located just north of Station 23. Responses to the university campus were roughly 15% of total responses by units assigned to Station 23. Units from Station 23 were first-in to over 65% of incidents in 23's primary response area during this same time-period. Station 23 covers District 12, Saint Anthony Park, which has one of the longest response times of the 17 District Councils. Automatic aid, though good, is affecting response times in Station 23's area.

Response Times

Response time is a common performance measure used by the fire service to evaluate effectiveness. Citizens understand the response time metric, it is easy to compute, and it is useful for evaluating resource deployment. It provides a way to evaluate the level of service provided; however, the response time itself does not measure service quality, though it does reflect the timeliness of service, which is one attribute desired by citizens.

While demand for services and individual unit workloads dictate how many stations and apparatus are needed in a community, response times are useful for determining where resources should be placed. The most widely recognized standard used in response time analysis for career or substantially career fire departments is outlined in NFPA 1710, Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments. NFPA 1710 was updated in 2016. This standard addresses response time benchmarks for career fire service organizations, including specific recommendations regarding unit staffing. Specifically, NFPA 1710 establishes response time benchmarks to be achieved in 90 percent of a jurisdiction's responses. These NFPA guidelines are reflected in Table 9.

Table 9: NFPA Response Time Standards

Nature of Incident	Turnout Time	First-Arriving Unit	Greater Response
Fire Suppression	One minute, 30 seconds	Engine Company Four minutes (240 seconds)	Full Alarm 8 minutes (480 seconds)
EMS	One minute (60 seconds)	First Responder 4 minutes (240 seconds)	ALS Providers 8 minutes (480 seconds)
Special Operations	One minute (60 seconds)	The Authority Having Jurisdiction should develop response standards that conform to 29 CFR 1910.120 (Hazmat incidents), 29 CFR 1910.146 (Confined Space incidents) and the jurisdiction's expectations of the department during other Special Operations incidents including, but not limited to: WMD, terrorist incidents, and natural disasters.	

Like all NFPA standards, NFPA 1710 may be adopted by a local jurisdiction, but is not mandatory. Unlike many NFPA standards, NFPA 1710 is based on limited research. It was approved by majority vote reflecting the experience and opinion of a committee, within which there was much disagreement. There is no published information on the expected reductions in losses or injuries as a function of increased staffing and only a little on the effect of increased response times. Nevertheless, despite having been formed largely on the basis of expert opinions and task sequencing (what must be done and how many it takes to do it) rather than research, NFPA 1710 has become the de facto benchmark for the emergency response community.

NFPA 1710 has not been embraced by all groups, including the ICMA. The Center for Public Safety Excellence (CPSE) and the National Fire Protection Association both recommend fractal response time goals in their guidelines. In the Accreditation Standards of Cover Manual, the CPSE states averages are "not a true reflection of performance" since a few isolated, abnormal response times will skew the average. Most contemporary fire departments have discontinued the use of average response times and are formally adopting performance goals of 75 and 80 percent as fractal measurements, because 90 percent is difficult to achieve in many urban settings.

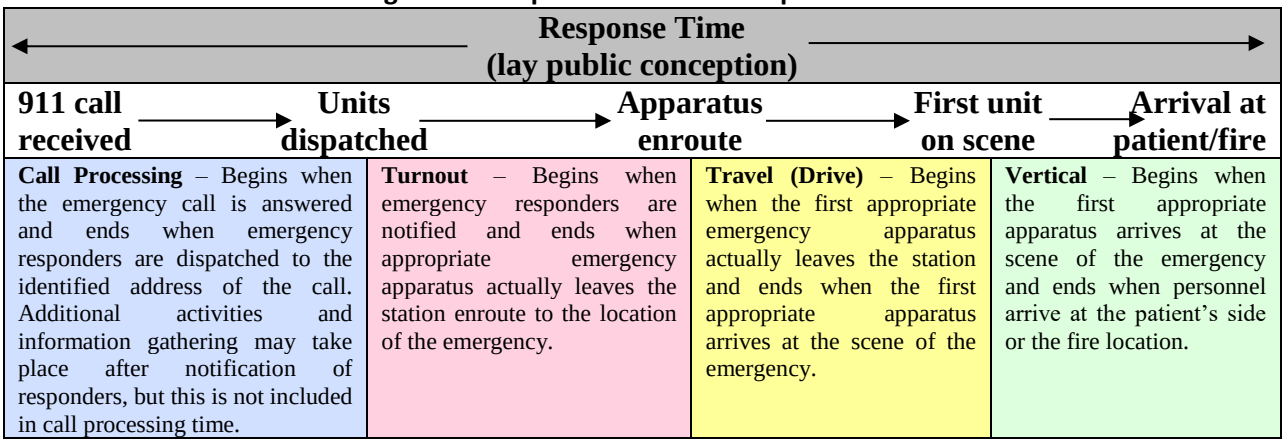
Response Time Measurement Methodology – To determine overall response time, the clock starts when an individual calls 911 (or alternate emergency number) and stops when the first emergency provider arrives at the patient's side or the scene of the incident. SPFD does not have operational control over the 911 dispatch center, as it is a Ramsey County function/department. In addition, NFPA 1710 defines the response time as the time the apparatus is enroute to the time the apparatus arrives on scene, which is more traditionally defined as "travel" time. Therefore, this analysis focuses on "travel" times to compare with the NFPA 1710 standard.

Several caveats should be kept in mind. First, response times are subject to a variety of measurement errors and only measure one aspect of overall system performance. For example, response times are distorted when units report their arrival on scene either early or late. Second, response times are frequently not comparable across fire-rescue systems because of the differing manners in which they are calculated. Not all departments track vertical response times (that is, the time from arrival on scene to patient contact), so their total response times likely would be lower than the total response times of a department that does track them.

Fractal response times of x at the 90th percentile means that unit's respond in x minutes, or less, 90 percent of the time. The times beyond the compliance fractal (90th percentile in this case) is the operational tolerance for the system, meaning the system is designed with the understanding that 10 percent of calls will have response times that exceed the target. Although it is possible to design a system that may ensure rapid response close to 100 percent of the time, it is generally not cost-effective.

Typically, response times are defined to include four components, which are described and then further illustrated in Figure 9.

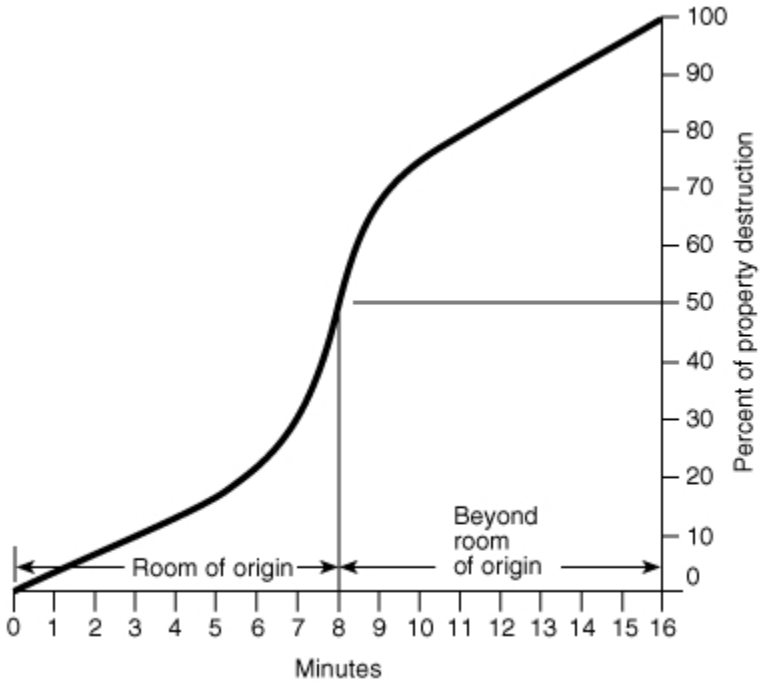
Figure 9: Components of Total Response Time



Importance of Rapid Response Times– While response time benchmarks are the established criteria for evaluating service delivery, one must consider that a very small percentage of incidents are truly time sensitive. Of the roughly 45,038 incidents that St. Paul Fire Department responded to during calendar year 2016, fewer than 250 were structure fires. That was one-half of a percent of all incidents. Typically, 5-10 percent of emergency incidents (Fire, EMS, Haz-Mat, and Rescue) within a community are truly time sensitive, meaning that the response time is directly related to the outcome of the incident.

Nevertheless, one must be prepared to respond rapidly. Fire spreads quickly after ignition, and the speed with which it is found and extinguished correlates to survivability and property damage. This is also true for certain life threatening medical emergencies; the probability of survival increases the quicker the patient is treated.

Figure 10: Fire Propagation Curve



Source: Fire Protection Handbook, 18th Ed., National Fire Protection Association

Figure 10 depicts the fire propagation curve, which shows the effect of time and temperature rise of a free-burning fire on the destruction of property. According to multiple studies, extension of the fire beyond the room of origin begins approximately 6 to 8 minutes after ignition, and flashover of the room of origin occurs within 10 minutes of ignition. (Flashover is the simultaneous ignition of all flammable material in an enclosed area.) In some modern rooms with low ceiling and plastics, flashover can occur in two to four minutes, according to studies by the National Institute of Standards and Technology.

SPFD also provides advanced life support (ALS) medical response and transport services. Active fire events are certainly time sensitive low frequency events, but time sensitive medical emergencies, while still a relatively low percentage of incidents, occur more frequently. Many EMS systems measure response time effectiveness based on the number of patients treated who suffer cardiac arrest (require CPR) and survive to the point of being released from a hospital. Although survival is not solely a function of the timeliness of care, time is crucial to a critically injured or seriously ill patient. Guidelines published by Basic Trauma Life Support International (a widely known training institute) suggest that a trauma patient's odds of survival are directly linked to the amount of time that elapses between the injury and definitive surgical treatment.

Nationally, the closest thing to a response time standard for paramedic (ALS) transport units in an urban/suburban EMS system with automatic defibrillation-capable first responders is 8 minutes in 90 percent of the critical (i.e., life-threatening) calls. This de facto standard is an amalgamation of generally accepted criteria or rules-of-thumb. No standards-making consensus

group has ever formally defined a standard for ambulance response times. Generally, various EMS systems interpret the idea of a standard in two ways. Some jurisdictions view the 8-minute standard to mean 8 minutes and all of the 59 seconds that follow; other jurisdictions view it as 8 minutes exactly. The latter, more stringent definition is suggested and is more consistent with the medical principles on which it is based.

For Saint Paul, ALS first responder services are provided primarily by the medic units at the dual staffed stations, while personnel at stations without a medic unit or those with a super-medic respond in the fire apparatus. Regardless, the response time for the first arriving unit is the same as the NFPA 1710 6-minute response time (1 minute call processing/dispatch, 1 minute turnout, and 4 minutes travel).

Despite generalized goals, statistical models are limited when it comes to predicting the quality of fire services in terms of lives saved and property losses averted based on response time metrics with a high level of certainty. The emergency environments, while predictable to some degree, are highly dynamic and unpredictable when it comes to the low frequency, high impact events. To this end, priority dispatch algorithms have become reliable in predicting the severity of incidents based on caller information, which permits the triage of events to help more efficiently allocate limited emergency service resources. It is not efficient to respond to all incidents, regardless of severity, in the same manner. Low life hazard and property loss events can be managed with fewer resources and with less urgency.

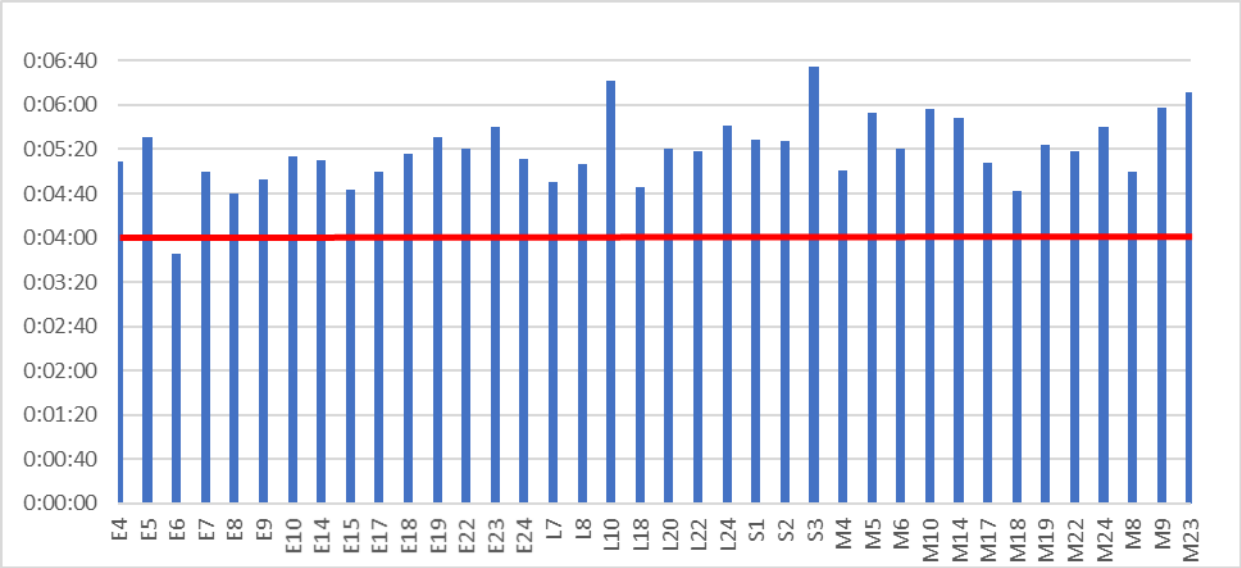
SPFD units have automatic vehicle location (AVL) devices, which permits the CAD to choose the closest unit(s) to an incident for dispatch. This can significantly improve response times, as dispatchers no longer have to select response units based on a static location model. AVL makes the response environment in Saint Paul dynamic, as the closest unit to an incident is assigned, regardless of the station to which a unit may be assigned. For example, during weekday periods when EMS demand downtown is high, any number of medic units may be picked up by AVL and the units will probably remain in this area until such time as demand decreases and they can return to their home area. This is the same strategy used by private ambulance companies when they 'dynamically deploy' their units based on predictable demand.

Response Time Analysis - Travel and response times were calculated using the CAD data. Travel time is defined as the time from when the unit is enroute to when it arrives on scene, while the response time is the time from dispatch to arrival on scene. All times are calculated based on the 90th percentile, meaning that the time provided for each unit is the maximum time it took that unit during the 12-month period to arrive at 90% of incidents from dispatch.

Figure 11 shows the 90th percentile travel time for each unit for year 2 of data that spans April 2016 to March 2017. To calculate these measures, responses out of the city and non-emergency responses were filtered so that only emergency responses within the city were included. NFPA 1710 recommends travel times of 4 minutes at the 90th percentile. Only Engine 6 meets the NFPA recommendation. While the 90th percentile is a high standard to meet, it provides a reliable metric to benchmark and evaluate resource deployment decisions. Also, ladder and

squad units cover larger areas so their travel times would naturally be longer. The red horizontal line in Figure 11 depicts the 4-minute travel time mark, which is the ideal goal.

Figure 11: 90th Percentile Travel Times, April 2016-March 2017



Three units exceed travel times of 6 minutes for 90% of responses: Ladder 10, Squad 3, and Medic 23. Ladder 10 is housed at Station 19, which is in the southwest part of the city or the Highland Park area. The closest three stations to Station 19's north do not have ladders, so Ladder 10 has more extended travel times as it covers a larger geographical area than other ladder companies.

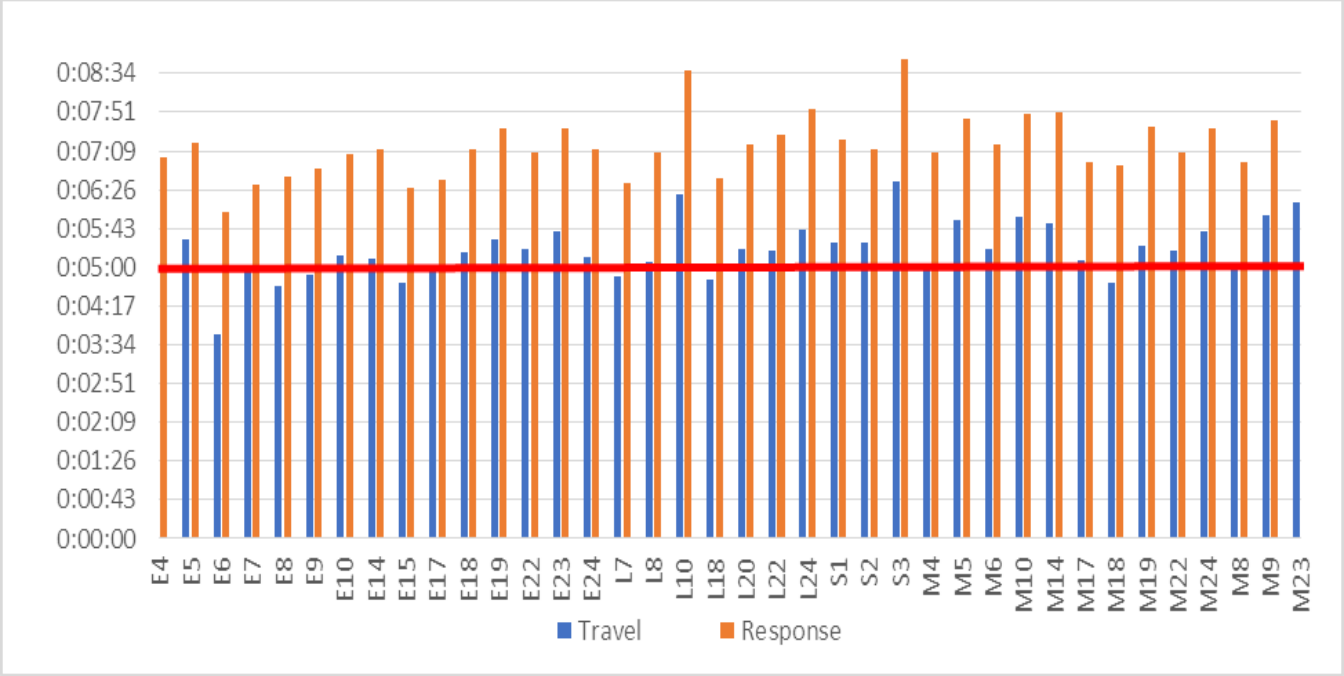
Squad 3 and the two other squads, serve as the heavy rescue resources responding citywide, rather than being focused on a particular area. Medic 23 is one of the three Super-Medics, meaning it is staffed independently of Engine 23. Medic 23 is located in the St. Anthony Park District Council, which is in the far northwestern part of the city, so it regularly responds into Station 20's area to the south, which does not have a medic unit, and into the Falcon Heights community to the north on mutual aid calls.

In general, most front-line units have travel times of 4-6 minutes to 90% of incidents within the city. While this does not meet NFPA 1710's travel time benchmark, travel times for all units are strong and demonstrate effective resource deployment. It is likely that making some small changes within the current deployment structure could lower the travel times of the units exceeding 6 minutes, especially Medic 23.

Figure 12 depicts the turnout and travel times for each unit to all incidents. Turnout time is calculated from the time of dispatch to arrival on scene. The difference between the response time and travel time is the "turnout" time, which is the time-period from incident dispatch to the unit marking enroute. NFPA 1710 recommends that turnout time not exceed 1 minute for medical calls and 1 minute 30 seconds for fire calls.

Turnout time can be affected by many factors that include proximity to the apparatus; however, it is an aspect of the response time that emergency crews have some control. Based on the data spanning April 2016 to March 2017, turnout time was 2 minutes and 46 seconds at the 90th percentile. Turnout times are too long and SPFD should take steps to improve them. Reducing turn-out times by 30 seconds to one minute is the equivalent to moving the fire station a half mile closer to the incident. This improvement in service delivery has no cost!

Figure 12: 90th Percentile Response and Travel Times, April 2016-March 2017



It is instructive to calculate response time criteria for individual units to gain a snapshot of potential service delivery gaps in the system using a universal response time benchmark. However, evaluating response times to specific incident types across clearly defined geographic boundaries can prove more useful for making future resource allocation decisions.

Service Demand, Workload, and Response Times by District Council

City officials collect demographic, economic, housing, and other data about each of the 17 neighborhoods/district council areas to help guide policy decisions. To perform this analysis, TriData requested city GIS connect each emergency response in the CAD data with the appropriate District Council area. City GIS linked each incident to the district council area where it occurred using longitude and latitude coordinates from the CAD. Only 60 cases out of the over 158,000 total cases did not have longitude and latitude coordinates preventing these records from being assigned a district council area. With this information, TriData calculated travel/response times, workload, fire loss, and other metrics for each of the district council areas. The information about the district councils uses the second year of data that spans April 2016 to

March 2017. This time duration provides information from the most recent operational and unit deployment changes.

Table 10 lists the 17 District Council areas and the fire station(s) which are *typically* dispatched to calls in those areas.

Table 10: Closest Fire Stations to District Council Areas

District Council Areas		Station Response Area
1: Eastview-Conway-Battlecreek-Highwood Hills		Station 9 & 24
2: Greater East Side		Station 9
3. West Side		Station 6
4. Dayton's Bluff		Station 7
5. Payne-Phalen		Station 9 & 17
6. North End		Station 22
7. Thomas-Dale/Frogtown		Station 18
8. Summit-University		Station 5
9. Fort Road/West Seventh		Station 1
10. Como		Station 23
11. Hamline-Midway		Station 20
12. Saint Anthony Park		Station 23
13. Union Park		Station 14 & 20
14. Macalester-Groveland		Station 14
15. Highland Park		Station 19
16. Summit Hill		Station 1 & 5
17. Capital River		Station 8

Information for each district council is divided into five sections based on incident type: 1) Structure Fires, 2) Other Fires, 3) Hazardous Materials, 4) Rescue/EMS, and 5) Other incident types. These category designations are based on the National Fire Incident Reporting System (NFIRS) incident type definitions. NFIRS assigns three digit codes to identify the many different types of incidents fire departments manage. All 100 codes are fires, 200 and 400 codes identify hazardous materials/conditions, 300 codes are for medical and rescue incidents, and 500, 600 and 700 codes are assigned to false calls, miscellaneous, and other response types.

Structure Fires by District Council - This section includes all incidents assigned a NFIRS code 111, which identifies a structure fire response. Structure fires are fire events involving a building, home, or other fixed structure. These events are isolated for analysis because they involve significant life hazard, potential property loss, and are time sensitive events. It is also the mission of the fire department to protect life and save property, so evaluating structure fire responses is a valid measure of service delivery. As mentioned above, fire grows exponentially (doubles in size every minute) when left unchecked, with flashover occurring in the room of origin within about 10 minutes. Flashover is an important benchmark because during this phase of fire growth temperatures reach a point that everything in the room/area combust. Flashover is not a survivable event, so it is critical that fire suppression resources arrive prior to flashover to

improve survivability of victims and limit fire spread to other parts of the structure. NFPA 1710 recommends the first unit arrive within 5 minutes with a full response complement of at least 15 fire personnel arrive within 8 minutes.

Table 11 provides the number of structure fire responses into each district council area. Total number of responses counts each time a fire apparatus responded to a structure fire. Structure fire incidents with estimated property and content dollar loss are also included. The final column is "Fires >$1,000 Loss" which counts the number of structure fires that caused at least $1,000 in property damage. Property loss is damage caused to the structure itself, while content loss is damage to items that can be removed from the structure. Counting the number of fires with at least $1,000 in property loss is a means to identify truly working fire events that either did or could have escalated if not for the fire department responding.

Roughly 139 of the 225 structure fires, or 62 percent, involved property loss greater than $1,000 across the 17 district council areas.

Table 11: Structure Fire Responses and Loss by District Council, April 2016-March 2017

April 2016 to March 2017						
District	**Fire Responses**	**Fire Incidents**	**Property Loss**	**Content Loss**	**Total Fire Loss**	**Fires >$1000 Loss**
1	190	21	$1,021,800	$465,400	$1,487,200	14
2	152	17	$307,025	$198,200	$505,225	11
3	135	14	$360,750	$140,000	$500,750	11
4	148	17	$203,130	$85,347	$288,477	10
5	383	36	$943,005	$282,390	$1,225,395	26
6	240	24	$439,543	$345,245	$784,788	19
7	123	14	$359,200	$136,350	$495,550	8
8	115	14	$429,000	$191,350	$620,350	7
9	94	11	$117,100	$64,175	$181,275	4
10	89	10	$565,108	$339,847	$904,955	9
11	65	10	$84,200	$49,900	$134,100	5
12	57	6	$164,000	$87,000	$251,000	4
13	42	6	$25,000	$4,300	$29,300	5
14	41	6	$5,500	$1,000	$6,500	1
15	62	8	$17,500	$7,000	$24,500	4
16	6	1	$0	$0	$0	0
17	46	6	$3,010	$3,550	$6,560	1
Total	**2046**	**225**	**$5,044,871**	**$2,401,054**	**$7,445,925**	**139**

Structure fire events accounted for just one-half of one percent of the total incidents responded to by SPFD during this one-year period. Working structure fires are low probability events but generate high risk to life and property. Therefore, responding to these less predictable events in an expeditious fashion with sufficient resources is critical to effectively mitigating these incidents.

Total loss from fire approached or exceeded $1.0M in District Council areas 1, 5, & 10. District Council 10 experienced 36 structure fire incidents, while District Council 6 had 24 incidents. The fewest structure fires causing greater than $1,000 property damage were in District Council 16 with zero and then District Council areas 14 and 17 – one each. District Council 17 is the

downtown area where most of the structures are concrete office type buildings with fire protection systems that are less likely to experience a significant fire event. District Council areas 14 and 16 are affluent areas with high owner occupancy rates and median incomes that often correlate with low fire demand.

Structure fire events are time sensitive, so response times are an important aspect of effective incident mitigation to ensure life safety and limit property loss. Table 12 provides 90th percentile travel times to structure fire events for the first six units arriving on scene, which accounts for a first alarm that should arrive within 8 minutes 90 percent of the time. The max response time for first-in apparatus and the average response times for first arriving units is included, which accounts for not only travel time but the turn-out time following dispatch.

Travel times for the first-in unit were less than 4 minutes to 90 percent of structure fire events in all district council areas except areas 1, 6, 10 and 12. The average response times and 90th percentile travel times for District Councils 1, 6, and 12 were two standard deviations above the average time for the first arriving unit across the 17 districts. Each of these areas is served by stations that are somewhat more spread out, as these areas have lower population density.

District Council 6 is covered by Station 17, which has a dual-staffed medic unit. This unit is often covering medical calls in adjacent areas such as Station 7, which has no medic. Keeping the engine in Station 17 available more of the time would improve structure fire response times in District Council 6.

Table 12: 90th Percentile Travel times (Structure Fires)

District	90th Percentile Travel							
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Max- First Unit	1st Avg RespTIme
1	0:05:44	0:09:27	0:08:48	0:07:55	0:08:46	0:11:39	0:08:53	0:05:16
2	0:03:19	0:05:19	0:05:15	0:05:07	0:07:24	0:11:02	0:08:34	0:04:11
3	0:02:42	0:03:43	0:05:19	0:05:24	0:06:02	0:07:22	0:05:20	0:03:42
4	0:02:57	0:04:40	0:03:52	0:04:38	0:05:15	0:07:13	0:05:11	0:03:17
5	0:02:51	0:04:37	0:04:37	0:05:40	0:05:13	0:06:55	0:05:45	0:03:12
6	0:05:31	0:05:00	0:05:37	0:05:42	0:08:45	0:07:21	0:10:37	0:04:47
7	0:03:37	0:04:40	0:04:18	0:06:16	0:05:31	0:07:39	0:04:56	0:03:39
8	0:02:49	0:03:03	0:03:11	0:03:32	0:04:28	0:04:58	0:05:37	0:03:14
9	0:03:47	0:03:44	0:05:32	0:05:36	0:06:29	0:07:00	0:05:42	0:03:57
10	0:04:48	0:05:30	0:06:30	0:05:56	0:08:35	0:06:54	0:07:42	0:04:11
11	0:03:42	0:03:56	0:03:28	0:04:57	0:07:18	0:08:33	0:07:49	0:04:17
12	0:05:58	0:06:14	0:08:05	0:07:59	0:08:41	0:09:49	0:07:31	0:05:00
13	0:03:15	0:03:04	0:06:16	0:05:48	0:03:59	0:07:17	0:13:23	0:05:02
14	0:03:07	0:03:52	0:03:09	0:04:42	0:06:15	0:10:49	0:04:59	0:03:55
15	0:03:40	0:04:56	0:04:49	0:07:10	0:06:16	0:06:36	0:05:52	0:04:29
16	0:01:29	0:03:21	0:02:41	0:04:08	0:04:03	0:00:00	0:02:53	0:02:53
17	0:01:54	0:02:48	0:02:33	0:03:33	0:04:10	0:03:59	0:04:51	0:03:17

Primary response boundaries around each station do not perfectly match District Council boundaries; however, it is possible to approximate the station areas with district council areas. When assessing travel and response times, it is valuable to also understand whether the primary fire unit responded as the first apparatus or if a unit from outside the area arrived first because the primary unit was on another call or unavailable.

For structure fires, the first-in unit is the primary response unit for that area about 70 percent of the time. For example, the first-in unit to all but one of the structure fires in District Council 12's area was Engine 23, which is the primary unit for that area. When the primary response unit is the first-in unit with an extended travel time, other factors such as traffic, weather conditions, or even station location may be the cause. It is also important to keep in mind that the low number of structure fire responses provides an opportunity for response times to be skewed by outliers.

As more reliable data becomes available using the district councils as study areas, any service gaps that may exist will become more evident.

Other Fires by District Council - "Other fires" are incidents coded 100 to 199, but does not include the "111" structure fires. Other fires include cooking fires without extension to the structure, chimney fires without extension, trash or rubbish fires, grass fires, vehicle fires, dumpster fires, etc. These are lower risk fire events but require rapid response and extinguishment to prevent extension or spread into a building or other area that may threaten life or property. Table 13 provides response, incident, and fire loss data for each of the district council areas caused by fires not considered structure fires.

Table 13: Other Fires by District Council

District	Fire Responses	Fire Incidents	Property Loss	Content Loss	Total Loss	Fires >$1000 loss
1	484	94	$9,762	$200	$9,962	2
2	503	107	$28,549	$800	$29,349	6
3	148	45	$5,600	$0	$5,600	3
4	258	63	$75,700	$2,000	$77,700	10
5	484	140	$75,374	$15,600	$90,974	14
6	389	83	$56,300	$9,500	$65,800	10
7	306	69	$14,410	$1,500	$15,910	4
8	360	84	$25,618	$0	$25,618	4
9	102	26	$8,500	$400	$8,900	2
10	204	44	$22,300	$1,000	$23,300	2
11	169	43	$17,280	$325	$17,605	3
12	123	26	$10,400	$1,000	$11,400	1
13	287	69	$38,898	$1,400	$40,298	6
14	132	29	$0	$0	$0	0
15	285	64	$3,800	$0	$3,800	1
16	56	15	$600	$500	$1,100	0
17	435	96	$11,200	$0	$11,200	3
Total	**4,819**	**1,119**	**$404,291**	**$34,225**	**$438,516**	**73**

Other Fires tend to cause less property loss than structure fire events, which is why they are analyzed separately. District Councils 4, 5, & 6 suffered the largest losses due to other fires. These areas are the most disadvantaged, poverty-wise, of the 17 District Council areas.

The 90th percentile travel times for the first arriving unit are consistently between 4-5 minutes to all areas. Again, District Council 1 and 10 appear to have extended travel times for the first-in unit compared to many of the other district councils. In these districts, the times are just beyond one standard deviation above the average response times of the other districts. While not structure fires, a full first alarm assignment is arriving on scene 90 percent of the time within 8 minutes travel time to each of the 17 district council areas.

Table 14: 90th Percentile Travel Times for Other Fire Events

	90th Percentile Travel							
District	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	**Max-First Unit**	**1st Avg RespTIme**
1	0:05:13	0:06:51	0:07:05	0:07:24	0:07:58	0:07:47	0:14:14	0:05:12
2	0:04:09	0:05:00	0:05:59	0:05:31	0:05:31	0:04:56	0:08:38	0:04:05
3	0:04:32	0:05:30	0:05:14	0:05:45	0:06:35	0:05:05	0:07:53	0:04:09
4	0:03:44	0:03:56	0:07:31	0:04:21	0:04:25	0:06:47	0:07:22	0:03:56
5	0:04:27	0:04:56	0:05:28	0:05:11	0:04:54	0:05:32	0:13:22	0:04:07
6	0:04:25	0:05:48	0:07:02	0:06:03	0:06:27	0:07:00	0:16:27	0:04:39
7	0:03:04	0:04:00	0:05:44	0:04:34	0:05:10	0:06:13	0:17:19	0:03:57
8	0:03:12	0:03:35	0:04:28	0:04:34	0:04:37	0:04:51	0:13:54	0:03:36
9	0:03:22	0:03:39	0:03:53	0:04:18	0:04:28	0:04:23	0:06:56	0:04:26
10	0:05:07	0:06:07	0:06:16	0:05:47	0:06:20	0:08:04	0:08:39	0:04:44
11	0:04:38	0:04:13	0:04:46	0:04:19	0:04:48	0:05:18	0:10:55	0:04:48
12	0:04:50	0:05:46	0:07:05	0:05:20	0:06:34	0:06:12	0:14:41	0:04:10
13	0:04:08	0:04:00	0:05:25	0:04:41	0:05:39	0:05:18	0:13:14	0:04:09
14	0:04:29	0:05:35	0:06:20	0:05:07	0:04:38	0:04:09	0:08:43	0:04:37
15	0:05:49	0:06:05	0:06:11	0:06:47	0:06:28	0:05:41	0:12:16	0:05:23
16	0:05:17	0:04:36	0:03:36	0:04:05	0:04:02	0:03:57	0:15:07	0:05:08
17	0:03:12	0:03:15	0:03:26	0:03:02	0:03:28	0:04:24	0:07:00	0:03:26

Hazardous Materials by District Council - Incidents assigned NFIRS codes in the 200s or 400s were considered hazardous materials. The 200 codes signify overpressure rupture, explosion, and overheat (no fire) but exclude steam mistaken as smoke type incidents. The 400 codes are for incidents involving a hazardous condition, such as radiation, electrical wiring or equipment problem, biological hazard, bomb removal, or other conditions deemed hazardous but not involving fire. Hazardous material events are similar to structure fires in that they are low probability, high risk events.

Hazardous material incidents are more common in industrial areas and along major transportation corridors, such as rail or interstate highways. Travel and response times, especially for specialty units, are often extended because of their proximity to the incidents. SPFD has two hazardous material units to respond citywide. Because of the infrequent nature of these events, it is not cost effective to operate more than two units in this size city. The number of hazardous material incidents is somewhat evenly dispersed across all 17 district councils with District 5

experiencing the most and District 16 the fewest. Response and travel times are consistent and sufficient for these events across the 17 district council areas.

Table 15: Hazardous Material events by District Council

Districts	HM Responses	HM Incidents	1st Avg RespTIme	90th Percentile Travel						
				Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Max First in
1	139	61	0:05:36	0:06:01	0:04:56	0:06:37	0:06:34	0:08:10	0:07:50	0:19:25
2	198	60	0:04:45	0:05:20	0:04:40	0:07:07	0:06:56	0:08:09	0:07:05	0:10:04
3	135	49	0:05:08	0:06:10	0:04:31	0:05:34	0:06:27	0:07:00	0:09:40	0:14:39
4	205	66	0:03:42	0:03:28	0:03:29	0:02:57	0:03:46	0:04:42	0:07:10	0:07:23
5	324	104	0:04:30	0:04:57	0:04:13	0:05:07	0:04:48	0:06:33	0:07:05	0:10:30
6	120	66	0:06:03	0:06:53	0:05:42	0:06:01	0:05:38	0:06:48	0:05:48	0:16:18
7	166	55	0:04:18	0:04:48	0:03:29	0:04:57	0:04:46	0:06:10	0:07:00	0:10:15
8	248	69	0:03:56	0:04:03	0:03:27	0:04:13	0:04:30	0:05:16	0:06:28	0:09:04
9	246	61	0:04:28	0:03:51	0:04:22	0:04:58	0:04:55	0:06:00	0:06:37	0:10:14
10	187	57	0:05:50	0:07:15	0:05:47	0:07:10	0:07:23	0:07:33	0:09:56	0:13:45
11	100	42	0:04:58	0:05:22	0:03:37	0:04:02	0:04:28	0:05:48	0:04:23	0:10:49
12	66	22	0:04:45	0:04:35	0:06:41	0:06:54	0:05:51	0:06:44	0:07:37	0:09:29
13	209	72	0:04:29	0:05:08	0:03:52	0:04:52	0:05:14	0:05:52	0:07:13	0:12:56
14	187	57	0:04:45	0:05:42	0:05:01	0:05:43	0:06:23	0:06:33	0:07:09	0:11:26
15	207	68	0:06:09	0:07:19	0:07:29	0:07:06	0:08:00	0:08:29	0:08:18	0:12:57
16	48	21	0:04:57	0:04:38	0:05:26	0:03:29	0:04:35	0:04:33	0:06:52	0:09:34
17	221	41	0:03:34	0:03:13	0:03:08	0:03:29	0:03:28	0:04:16	0:04:51	0:07:00
Total	3,116	991								

Rescue and EMS by District Council - Incidents assigned NFIRS codes in the 300s are rescue and EMS related events. The number of rescue and EMS responses and incidents is artificially low because only the ImageTrend data contains the NFIRS codes to filter the specific incident types by district council area. The detailed EMS data or patient care reports (PCRs) are part of the Sansio data, which provides a detailed accounting of each medical response but is not coded using NFIRS terminology. Therefore, ImageTrend data was used for this analysis paired with the CAD data, so that each incident could be located by district council area and separated by incident type.

ImageTrend reports are generated for rescue and EMS incidents where an engine, squad, ladder, or other fire unit responds to assist the medic transport unit. Therefore, an ImageTrend report is not always completed for incidents involving only a medic unit or BLS ambulance response. EMS medical responses account for about 80% of the total incidents the SPFD responds to in any given year. In 2016, the department responded to roughly 36,000 medical emergencies. A more detailed account of the EMS system and responses is provided in a separate chapter.

Table 16 provides the 90 percent travel times for the first arriving six units to rescue events; however, most rescue incidents require fewer response assets than do working fire incidents. Therefore, most incidents deemed rescue or EMS are mitigated with one to four units and do not require a full fire alarm assignment.

Table 16: Rescue/EMS Responses by District Council

District	Resc. Resp.	Resc. Inc.	1st Avg RespTIme	90th Percentile Travel						
				Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Max First in
1	1216	486	0:05:25	0:06:37	0:08:36	0:07:11	0:13:07	0:13:33	0:00:31	0:14:27
2	2654	1198	0:04:44	0:04:48	0:05:35	0:05:06	0:05:09	0:05:11	0:11:33	0:18:34
3	879	358	0:04:54	0:05:29	0:06:35	0:06:06	0:05:04	0:07:50	0:09:40	0:17:46
4	2395	921	0:04:05	0:04:28	0:05:55	0:04:54	0:04:23	0:05:36	0:05:45	0:19:11
5	1659	714	0:04:20	0:04:35	0:05:26	0:04:23	0:04:06	0:07:21	0:07:56	0:18:37
6	1004	449	0:04:50	0:05:06	0:06:28	0:06:34	0:04:18	0:10:40	0:00:06	0:17:41
7	889	421	0:04:25	0:04:13	0:05:08	0:05:19	0:03:27	0:09:02	0:09:57	0:19:16
8	1291	601	0:04:24	0:04:08	0:05:25	0:04:45	0:05:13	0:03:58	0:04:41	0:18:24
9	953	402	0:04:36	0:04:32	0:05:41	0:05:45	0:07:36	0:05:41	0:03:55	0:10:39
10	953	446	0:05:36	0:05:39	0:08:00	0:06:00	0:05:35	0:05:33	0:03:27	0:13:40
11	759	344	0:04:55	0:05:00	0:06:18	0:05:41	0:03:29	0:00:00		0:11:53
12	1228	517	0:04:53	0:05:10	0:07:26	0:06:31	0:07:07	0:03:51	0:07:41	0:18:45
13	1872	787	0:04:36	0:05:06	0:06:59	0:06:15	0:05:35	0:07:03	0:09:36	0:17:40
14	302	139	0:05:07	0:05:53	0:06:19	0:06:30	0:03:59	0:06:08	0:04:38	0:11:44
15	629	281	0:06:23	0:07:04	0:09:14	0:07:46	0:07:57	0:02:50	0:00:00	0:14:14
16	232	106	0:04:04	0:03:57	0:05:04	0:03:46	0:05:16			0:08:02
17	2902	1317	0:03:59	0:03:30	0:04:00	0:04:33	0:04:32	0:05:38	0:06:24	0:19:59
Total	22,254	9,672								

Other Incident Types by District Council "Other" type incidents is in many ways a catch all for non-emergency calls. These incident types are assigned NFIRS codes in the 500s, 600s and 700s. The 500 series are for service calls that include water problems, smoke odor, animal problem or unauthorized burning. The 600 series is for good intent calls such as dispatched and cancelled enroute, wrong location, controlled burning, or vicinity alarm. Finally, the 700 series is for false alarms and false calls.

Table 17: Other responses by District Council

District	Other Resp.	Other Inc.	1st Avg RespTIme	90th Percentile Travel						
				Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Max First in
1	967	336	0:05:45	0:06:48	0:06:41	0:06:55	0:07:14	0:07:38	0:08:00	0:17:20
2	989	307	0:05:21	0:05:59	0:04:32	0:04:58	0:05:34	0:05:25	0:05:11	0:17:42
3	833	263	0:04:26	0:05:10	0:04:04	0:04:46	0:05:07	0:05:04	0:05:49	0:11:41
4	833	297	0:04:16	0:03:52	0:03:20	0:03:33	0:04:03	0:04:11	0:04:27	0:15:13
5	1523	480	0:04:34	0:04:36	0:04:12	0:04:11	0:04:32	0:04:45	0:04:38	0:19:44
6	1014	337	0:04:40	0:04:47	0:04:57	0:05:57	0:05:56	0:06:29	0:05:58	0:14:47
7	792	223	0:04:21	0:04:25	0:04:04	0:04:27	0:04:36	0:05:25	0:06:10	0:10:51
8	1005	306	0:04:34	0:04:15	0:03:36	0:03:58	0:04:28	0:04:44	0:04:58	0:17:46
9	997	319	0:04:54	0:04:37	0:04:07	0:04:45	0:04:26	0:05:06	0:04:55	0:16:31
10	639	234	0:06:15	0:06:43	0:05:40	0:05:48	0:06:29	0:07:08	0:06:56	0:13:36
11	593	203	0:05:14	0:05:02	0:04:13	0:05:09	0:04:55	0:05:04	0:06:10	0:11:48
12	699	164	0:04:42	0:05:27	0:05:59	0:06:11	0:06:34	0:07:30	0:07:25	0:15:26
13	1126	349	0:04:38	0:04:18	0:04:36	0:04:43	0:04:59	0:05:14	0:04:58	0:17:28
14	419	147	0:05:45	0:06:25	0:03:33	0:04:59	0:05:39	0:05:09	0:05:04	0:12:08
15	1024	372	0:06:44	0:06:55	0:05:13	0:05:48	0:06:21	0:05:59	0:05:19	0:14:37
16	275	72	0:04:56	0:04:55	0:04:06	0:04:10	0:04:05	0:04:27	0:03:56	0:10:58
17	1780	458	0:03:54	0:03:23	0:03:04	0:03:33	0:03:31	0:04:11	0:05:23	0:15:48
Total	16,097	4,990								

The majority of these incidents are not time sensitive and do not pose significant life hazard or potential for property loss. Therefore, travel and response times are less reliable to these types of incidents as units often respond routine traffic or quickly reduce their response to non-emergent after incident severity has been verified by the first arriving fire unit.

Comparison of District Councils - The 17 District Council neighborhood areas provide a unique opportunity for Saint Paul decision-makers to drive emergency service resource allocation decisions based on geographic, structural, and socioeconomic community variables that are associated with emergency service demand. Population density and service demand are clearly correlated, but density alone is just one factor that affects demand. Using population counts alone provides only limited information to guide decision-makers in allocating emergency resources efficiently and effectively. For example, an inner-city revitalization effort may spawn new high-density residential living opportunities. The new or refurbished residential structures are likely to replace older, dilapidated structures. Based on population measures, the emergency resources protecting this area would likely increase, while a decrease in emergency service demand related to fire risk is more likely because of the new construction and changing population characteristics.

A challenge for policy-makers is to allocate scarce emergency resources to their highest net present value. The goal of any emergency resource deployment strategy is to reduce the loss of life and property associated with fire, hazardous materials, rescue and medical events that afflict citizens. This requires emergency resources to be available and positioned to arrive in time to limit loss of life and/or property. Response time is a prevalent measure used in the emergency services industry to evaluate service delivery. Because of this, many communities make resource allocation decisions based solely on minimizing response times to all areas of a jurisdiction. This often leads to resources being equally located throughout a community, yet service demand for these resources is not dispersed evenly, creating resource allocation service demand mismatches. Because different areas within a community have varying degrees of risk for fire or other emergency events based on geographical, social, and structural characteristics, more effective and efficient locational decisions can be made by considering factors beyond response time and population density.

The scope of this analysis does not include true probability and correlation analysis of demographic, structural, and geographic variables for each district council area. The city is a dynamic community that continues to evolve with a myriad of development projects moving forward over the next decade that will not only influence the socio-economic make-up of the city but also significantly impact emergency service deployment strategies. For example, the light rail will continue to create new residential and retail growth along an extended corridor in center city that will displace older structures and change population dynamics. New high density residential growth in the Highland Park area such as redevelopment of the former Ford truck plant is likely to change service demand needs in that area.

Table 18 provides descriptive data about each of the 17 district council areas.

Table 18: District Council Demographic Data and Standard Scores

District Councils	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Mean	StdDev
Population Information																			
Total Population	22,011	28,000	15,358	18,013	31,121	22,848	15,504	18,296	11,324	16,022	12,435	8,196	17,773	18,838	24,724	6,839	7,756	17,356	6726
difference from mean	4,655	10,644	-1,998	657	13,765	5,492	-1,852	940	-6,032	-1,334	-4,921	-9,160	417	1,482	7,368	-10,517	-9,600		
Standard score	0.69	1.58	-0.30	0.10	2.05	0.82	-0.28	0.14	-0.90	-0.20	-0.73	-1.36	0.06	0.22	1.10	-1.56	-1.43		
Square Miles	9.60	3.90	4.70	2.80	4.30	3.50	1.70	1.80	2.80	3.30	1.90	2.40	3.00	2.50	6.10	0.96	1.00	3	2
Pop/SqMile	2,293	7,179	3,268	6,433	7,237	6,528	9,120	10,164	4,044	4,855	6,545	3,415	5,924	7,535	4,053	7,124	7,756	6087	2089
difference from mean	-3,794	1,093	-2,819	346	1,151	441	3,033	4,078	-2,042	-1,232	458	-2,672	-162	1,448	-2,034	1,037	1,669		
Standard score	-1.82	0.52	-1.35	0.17	0.55	0.21	1.45	1.95	-0.98	-0.59	0.22	-1.28	-0.08	0.69	-0.97	0.50	0.80		
Race/Ethnicity																			
White, not Hispanic	8,804	11,636	6,687	6,543	10,992	9,792	3,244	8,867	8,542	12,680	8,855	6,042	13,888	16,338	18,773	5,799	5,671	9597	3964
difference from mean	-793	2,039	-2,910	-3,054	1,395	195	-6,353	-730	-1,055	3,083	-742	-3,555	4,291	6,741	9,176	-3,798	-3,926		
Standard score	-0.20	0.51	-0.73	-0.77	0.35	0.05	-1.60	-0.18	-0.27	0.78	-0.19	-0.90	1.08	1.70	2.31	-0.96	-0.99		
Of Color	13,207	16,683	8,671	11,471	20,129	16,056	12,260	9,429	2,782	3,342	3,580	2,154	3,885	2,500	5,952	1,041	2,094	7955	5864
difference from mean	5,252	8,728	716	3,516	12,174	8,101	4,305	1,474	-5,173	-4,613	-4,375	-5,801	-4,070	-5,455	-2,003	-6,914	-5,861		
Standard score	0.90	1.49	0.12	0.60	2.08	1.38	0.73	0.25	-0.88	-0.79	-0.75	-0.99	-0.69	-0.93	-0.34	-1.18	-1.00		
African American	5,038	4,078	2,230	2,515	3,884	5,148	4,403	6,253	935	1,206	1,740	588	1,773	517	3,119	298	852	2622	1817
American Indian/Alaska			215				238											227	12
Asian/Pacific Islander	4,311	7,419	1,046	5,777	10,424	7,612	5,585	1,322	381	474	597	963	591	622	669	155	705	2862	3179
Other Race																			
Two or more Races	1,181	1,159	542	838	2,040	473	819	682	469	528	443	223	408	530	802	147	244	678	444
Hisp/Latino Total	2,481	3,859	4,535	2,210	3,422	2,590	1,205	997	943	1,002	742	299	1,065	785	1,291	427	265	1654	1262
Household Income																			
Total Households	7,896	9,562	5,415	5,707	9,574	7,718	4,750	7,632	5,219	6,911	4,767	3,486	7,019	7,888	10,987	3,358	5,116	6647	2115
Less than $35,000	2,672	3,940	2,182	2,593	4,143	4,039	2,483	3,311	1,734	1,721	1,795	1,315	2,440	1,833	2,783	806	2,593	2493	922
$35,000 to $49,999	1,385	1,515	814	689	1,359	1,170	617	972	839	791	522	474	883	841	1,271	394	655	894	328
$50,000 to $74,999	1,685	1,754	1,009	1,065	1,745	1,174	686	1,194	932	1,387	907	430	1,207	1,380	1,810	594	670	1155	417
$75,000 to $99,999	1,084	1,325	573	698	1,140	675	429	802	707	965	656	385	739	873	1,616	365	445	793	335
$100,000 or more	1,071	1,028	837	663	1,186	660	535	1,353	1,007	2,046	887	881	1,750	2,961	3,508	1,199	753	1313	800
Median House Income	$49,964	$43,630	$43,537	$40,145	$43,229	$32,339	$35,126	$47,306	$51,990	$67,600	$50,750	$55,900	$53,710	$73,462	$70,744	$76,760	$34,059	$51,191	$13,406
difference from mean	-$1,227	-$7,561	-$7,654	-$11,046	-$7,962	-$18,852	-$16,065	-$3,885	$799	$16,409	-$441	$4,709	$2,519	$22,271	$19,553	$25,569	-$17,132		
Standard score	-0.09	-0.56	-0.57	-0.82	-0.59	-1.41	-1.20	-0.29	0.06	1.22	-0.03	0.35	0.19	1.66	1.46	1.91	-1.28		
Income below poverty	3608	7106	4328	5655	9087	8091	5459	4842	1339	2049	2036	1593	3057	1480	2148	521	1636	3767	2498
Population w/o Health Ins.	2270	3943	1944	2720	4233	3341	2428	1600	1048	874	1166	642	1451	703	1549	429	643	1823	1142
Housing Information																			
Vacant Housing Units	394	659	387	543	1029	520	547	371	459	350	163	199	333	348	576	156	335	433	204
Occupied Housing Units	7893	9562	5415	5709	9576	7716	4721	7630	5236	6911	4770	3472	7039	7879	10988	3337	5024	6640	2123
Owner-Occupied	3992	5414	3038	2912	4823	3010	1771	2591	2467	4258	2799	1311	3249	5277	6045	1710	1046	3277	1441
difference from mean	715	2137	-239	-365	1546	-267	-1506	-686	-810	981	-478	-1966	-28	2000	2768	-1567	-2231		
Standard score	0.50	1.48	-0.17	-0.25	1.07	-0.19	-1.05	-0.48	-0.56	0.68	-0.33	-1.36	-0.02	1.39	1.92	-1.09	-1.55		
Renter Occupied	3901	4147	2377	2797	4753	4706	2950	5039	2769	2653	1972	2161	3789	2602	4943	1627	3978	3363	1079
difference from mean	538	784	-986	-566	1390	1343	-413	1676	-594	-710	-1391	-1202	426	-761	1580	-1736	615		
Standard score	0.50	0.73	-0.91	-0.52	1.29	1.24	-0.38	1.55	-0.55	-0.66	-1.29	-1.11	0.40	-0.70	1.46	-1.61	0.57		
Year Built																			
2000 or later	342	547	181	441	438	560	248	671	1034	212	63	604	642	228	1070	46	447	457	287
1970-1999	3573	2442	845	766	1889	2277	961	1477	1270	1876	699	762	696	767	2500	257	2163	1484	866
1940-1969	3691	5792	1763	1561	2909	2800	1032	1356	806	2643	778	654	1413	1849	4589	459	721	2048	1465
1939 or earlier	538	1218	499	323	752	539	256	363	186	923	241	235	405	742	1177	124	138	509	335
Housing by Type																			
Total Housing Units	8251	10345	5957	6597	10901	8259	5354	8102	5689	7403	5040	3634	7522	8361	11670	3548	5360	7176	2298
Owned Single-Family	3962	5817	2718	2607	4755	2953	1638	1642	2113	4226	2603	1035	2912	5279	5419	1067	12	2986	1643
Rental Single-Family	453	919	516	782	1288	857	655	374	375	380	366	112	403	420	373	79	3	491	316
Duplx/Triplex	383	507	969	1340	2046	778	1190	1181	617	361	819	318	1028	583	332	386	2	755	484
Owned Multi-Fam(Condos)	241	160	144	144	99	262	242	1081	457	130	18	344	160	303	484	440	1456	363	360
Rent Multi-Fam(Townhome)	54	58	87	69	82	64	47	507	345	24	11	98	33	48	130	119	576	138	164
Rent unit Apartment Build	3154	2880	1493	1632	2597	3278	1565	3268	1715	2277	1212	1652	2951	1713	4802	1452	3303	2408	945
Mobile Home	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown	4	4	30	23	34	67	17	49	67	5	11	75	35	15	130	5	8	34	33

Housing Assessed Value																			
Total Single Family Units	4415	6736	3234	3389	6043	3810	2293	2016	2488	4606	2969	1147	3315	5699	5792	1146	15	3477	1839
Less than $200,000	3722	6701	2842	3338	5866	3668	2272	1207	2264	2755	2702	221	1006	1005	1175	65	4	2401	1846
$200,000 to $249,000	466	30	267	33	105	109	12	166	161	1236	235	220	668	1473	1344	142	2	392	474
$250,000 to $299,999	127	3	66	10	38	26	8	143	32	406	22	201	542	1173	948	116	3	227	339
$300,000 or more	100	2	59	8	34	7	1	500	31	209	10	505	1099	2048	2325	823	6	457	707
Median Rent Payment	$850	$787	$736	$864	$821	$761	$743	$736	$936	$911	$772	$918	$788	$897	$886	$907	$931	$838	$71
Education																			
Population 25 or older	13373	16104	9222	10504	17505	12457	5423	11563	8221	11067	7604	5230	10961	11678	17665	4894	6610	10593	3926.70
Less than HS	1772	3181	1811	2342	4671	3210	2387	1378	634	492	529	201	665	232	653	119	356	1449	1285
difference from mean	323	1732	362	893	3222	1761	938	-71	-815	-957	-920	-1248	-784	-1217	-796	-1330	-1093		
Standard score	0.25	1.35	0.28	0.69	2.51	1.37	0.73	-0.06	-0.63	-0.74	-0.72	-0.97	-0.61	-0.95	-0.62	-1.03	-0.85		
HS or GED	4103	4563	2577	2822	4357	3753	1981	2146	2125	1859	1662	507	1496	957	2424	477	1065	2287	1245
Some college/Associates	4104	5115	2396	3223	4947	3380	2462	2798	2502	2643	2083	997	2228	2240	4100	886	1612	2807	1182
Bachelors	2238	2350	1591	1506	2446	1570	1139	3075	1669	3353	1926	1550	3489	4458	5823	1685	2267	2479	1192
Grad or Prof Degree	1154	895	847	611	1084	544	485	2167	1292	2719	1403	1975	3083	3790	4665	1727	1310	1750	1159
HS Grad or higher	11600	12923	7411	8162	12834	9247	6036	10185	7587	10574	7075	5029	10296	11445	17012	4775	6254	9320	3160
difference from mean	2280	3603	-1909	-1158	3514	-73	-3284	865	-1733	1254	-2245	-4291	976	2125	7692	-4545	-3066		
Standard score	0.72	1.14	-0.60	-0.37	1.11	-0.02	-1.04	0.27	-0.55	0.40	-0.71	-1.36	0.31	0.67	2.43	-1.44	-0.97		
Bachelors or higher	3393	3245	5821	2117	3529	2114	1624	5241	2961	6072	3329	3525	6572	8248	10488	3411	3577	4427	2288
Worker Earnings																			
$15,000 or less	2059	2520	1311	1680	2819	1972	1480	1739	1047	1305	1085	553	1406	1182	1980	582	619	1491	628
$15,001 to $39,999	3576	4828	2175	2918	4971	3842	2551	2488	1847	2210	1778	902	2139	1715	3275	914	965	2535	1202
$40,000 or more	3726	4161	2335	2074	3897	2488	1362	3090	2537	4524	2472	1734	4078	5030	6858	2063	1928	3197	1391
difference from mean	529	964	-862	-1123	700	-709	-1835	-107	-660	1327	-725	-1463	881	1833	3661	-1134	-1269		
Standard score	0.38	0.69	-0.62	-0.81	0.50	-0.51	-1.32	-0.08	-0.47	0.95	-0.52	-1.05	0.63	1.32	2.63	-0.82	-0.91		
Source: http://www.mncompass.org/profiles/neighborhoods/minneapolis-saint-paul#!community-areas																			

Table 18 provides the detailed demographic data from the Saint Paul Neighborhood Profile website by District Council area. For many of the descriptive variables the difference from mean and a standard score are calculated to better compare across district councils. The difference from mean provides the distance each district council measure is from the overall average across all district councils. For example, the average population across the 17 district councils is 17,356 based on 2015 information. District Council 1 has a population of 22,011, so its difference from mean is 4,655 more people than the average across the 17 districts.

The second calculation, standard score, uses the standard deviation of each metric across the 17 district councils to show how far from average based on a standardized metric. Again, District Council 1 has a population standard score of 0.69. This means that District Council 1's population is 0.69 standard deviations from the average population across all district council areas. The standard score provides a way to reliably compare measures between districts. District Council 16 has a population standard score of -1.56, which can be interpreted to indicate that District 16's population count is almost three times less than that of District 1.

Standard scores were also calculated for emergency service demand and response variables for each District Council, as a way to compare "apples-to-apples." The average total number of emergency service incidents across the district council areas was 2,635 for the 12-month period spanning April 2016 through March 2017. District 17 had the highest service demand with 5,858 incidents, which is 3,223 incidents more than average or 2.55 standard deviations above the average of the other districts.

The second highest total demand was in District Council 5 with 4,558 incidents or 1,923 above average (1.52 standard deviations above average). Both District's 5 and 17 are somewhat distressed based on median household income and education metrics, which measured below average compared to the other district council areas. However, response times to fire and EMS incidents in these areas measured at the 90th percentile are at least one standard deviation faster compared to the other districts with the exception of structure fire responses that are roughly half a standard deviation better. This translates to about a minute better response time than average to both fire and EMS incidents in these two districts compared to the others (Table 20 and Table 21).

District Council areas 16, 14, and 12 had the lowest total service demand with District 16 having 620 (-1.6 standard deviations below average) incidents and District 14 having 976 incidents (-1.31 standard deviations below average). District's 14 and 16, but 12 as well, measure well above average in median household income and education variables. Response measures for District 16 are some of the shortest for fire and EMS incidents, as this is a relatively small district with low demand and Fire Station 10 located within its boundaries. Response times to structure fire events in District 14 measure below the average compared to the other districts measured at the 90th percentile; however, response times to EMS incidents for both District's 12 and 14 are above average with District 12 experiencing some of the slowest response times in the city. District 12 is the far northwest part of the city. Station 23 is the closest station to this area.

Response times to 90% of incidents in this part of the city are about two minutes longer than average.

Table 19: Total Incidents across the District Councils with Standard Scores

District Council	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Average	Stddev
Total Incidents	2609	3048	2334	3190	4558	3019	2386	3595	2384	1746	1531	1139	3079	976	2726	620	5858	2635	1263
difference from mean	-26	413	-301	555	1923	384	-249	960	-251	-889	-1104	-1496	444	-1659	91	-2015	3223		
Standard score	-0.02	0.33	-0.24	0.44	1.52	0.30	-0.20	0.76	-0.20	-0.70	-0.87	-1.18	0.35	-1.31	0.07	-1.60	2.55		

Fire and EMS related service demand are dispersed somewhat differently across the city and impact how resources can be most efficiently allocated. As mentioned above, fire incidents account for about 20% of all incidents with structure fires being less than 1% of incidents. However, structure fires present high life hazard and property loss potential so are important to isolate for analysis.

Structure Fires – Between April 2016 and March 2017, the SPFD responded to 221 structure fire incidents located within the city limits. The average structure fire incidents per district was 13. District Council areas 5, 6, and 1 experienced the most structure fires with Districts 16, 12, 13, 14, and 17 experiencing the fewest. The number of structure fires by district ranged from 1 to 36 over this 12-month time-period.

Dollar loss from structure fire events ranged from $1,487,200 in District 1 to $0 in District 16 with $437,996 the average loss across all districts. The dollar loss variation across the districts is significant, as one large fire incident can skew the overall fire loss statistics with so few incidents. District Council 1 experienced 21 structure fire events with fire loss $1,049,200 over the average loss, which was 2.41 standard deviations above average. District 5 had 36 structure fire with $1,225,395 in total loss or 1.81 standard deviations above average. District 10 also had fire loss greater than one standard deviation from average that totaled $904,955 from 10 structure fire incidents. District 16, 17 and 14 had the lowest fire loss and the fewest fire incidents.

The average 90th percentile response time to structure fire events for the first arriving unit was 5 minutes 37 seconds. 90th percentile responses ranged from 2 minutes 53 seconds in District 16 to 9 minutes 7 seconds in District 13. Both of these areas had relatively few fires. District Council 1 had 21 structure fires sustaining the highest fire dollar loss with a 90th percentile response time of the first-in unit at 8 minutes 15 seconds. While this 90th percentile response time is the second longest among the 17 district council areas, it is only 2 minute 38 seconds above average in the largest district by square mileage that has the fifth highest population count. District 6 had 24 structure fire incidents with a 90th percentile response for the first-in unit of 7 minutes 20 seconds or 1 minute 43 seconds above the average. Districts 16 and 17 experienced the shortest response times, which makes sense with the higher density of these areas and low number of structure fire incidents.

Table 20: Structure Fire Incident Response Times and Standard Scores

District Council	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Average	Stddev
Structure Fire Incidents	21	17	14	17	36	24	14	14	11	10	10	6	6	6	8	1	6	13	8.17
difference from mean	8	4	1	4	23	11	1	1	-2	-3	-3	-7	-7	-7	-5	-12	-7		
standard score	0.98	0.49	0.12	0.49	2.81	1.35	0.12	0.12	-0.24	-0.37	-0.37	-0.86	-0.86	-0.86	-0.61	-1.47	-0.86		
Total Fire Loss	$1,487,200	$505,225	$500,750	$288,477	$1,225,395	$784,788	$495,550	$620,350	$181,275	$904,955	$134,100	$251,000	$29,300	$6,500	$24,500	$0	$6,560	$437,996	$435,345
difference from mean	$1,049,204	$67,229	$62,754	-$149,519	$787,399	$346,792	$57,554	$182,354	-$256,721	$466,959	-$303,896	-$186,996	-$408,696	-$431,496	-$413,496	-$437,996	-$431,436		
Standard score	2.41	0.15	0.14	-0.34	1.81	0.80	0.13	0.42	-0.59	1.07	-0.70	-0.43	-0.94	-0.99	-0.95	-1.01	-0.99		
Fire (111) 1st 90th Resp	0:08:15	0:04:47	0:04:50	0:04:54	0:04:46	0:07:20	0:04:52	0:04:23	0:05:32	0:06:19	0:05:22	0:07:30	0:09:07	0:04:49	0:05:28	0:02:53	0:04:15	0:05:37	0:01:33
difference from mean	0:02:38	-0:00:50	-0:00:47	-0:00:43	-0:00:51	0:01:43	-0:00:45	-0:01:13	-0:00:05	0:00:43	-0:00:14	0:01:54	0:03:30	-0:00:48	-0:00:08	-0:02:44	-0:01:22		
Standard score	1.70	-0.54	-0.50	-0.46	-0.54	1.11	-0.48	-0.79	-0.05	0.46	-0.15	1.22	2.26	-0.52	-0.09	-1.76	-0.88		
Avg. Fire (111) Response (1st in)	0:05:16	0:04:11	0:03:42	0:03:17	0:03:12	0:04:47	0:03:39	0:03:14	0:03:57	0:04:11	0:04:17	0:05:00	0:05:02	0:03:55	0:04:29	0:02:53	0:03:17	0:04:01	0:00:42
difference from mean	0:01:14	0:00:10	-0:00:19	-0:00:45	-0:00:49	0:00:46	-0:00:22	-0:00:47	-0:00:04	0:00:10	0:00:16	0:00:59	0:01:01	-0:00:06	0:00:28	-0:01:08	-0:00:44		
Standard score	1.77	0.23	-0.45	-1.06	-1.17	1.09	-0.51	-1.12	-0.09	0.25	0.38	1.40	1.44	-0.15	0.66	-1.62	-1.05		
Avg. Other Fire Response (1st in)	0:05:12	0:04:05	0:04:09	0:03:56	0:04:07	0:04:39	0:03:57	0:03:36	0:04:26	0:04:44	0:04:48	0:04:10	0:04:09	0:04:37	0:05:23	0:05:08	0:03:26	0:04:23	0:00:32
difference from mean	0:00:49	-0:00:18	-0:00:14	-0:00:27	-0:00:16	0:00:16	-0:00:26	-0:00:47	0:00:03	0:00:21	0:00:25	-0:00:13	-0:00:14	0:00:14	0:01:00	0:00:45	-0:00:57		
Standard score	1.53	-0.57	-0.43	-0.83	-0.51	0.48	-0.82	-1.47	0.10	0.66	0.78	-0.39	-0.45	0.43	1.86	1.40	-1.77		

Included in Table 20 is the average response time for the first-in unit to structure fires. While all fire events can pose a threat to life and cause property damage, other type fires are often not the primary focus when analyzing fire events. The average response time to these events across the districts is 4 minutes 23 seconds with the average range spanning from 3 minutes 26 seconds in District 17 to 5 minutes 17 seconds in District 1.

EMS Response – The total number of EMS incidents were also analyzed across the District Council areas. The average number of EMS incidents from April 2016 to March 2017 is 2,024. District Councils 5 and 17 experienced the highest EMS demand with Districts 12, 14, and 16 having the lowest. District 5 had 3,686 EMS incidents which was 1,662 more than the average, while District 17 had 3,612 or 1,588 more than the average. District Councils 17, 7, 16, 5, and 8 had the shortest response times for the first-in medic unit measured at the 90th percentile. The District 17 90th percentile response time was 6 minutes 26 seconds or 1 minute 15 seconds faster than the average across the 17 districts. District Councils 10 and 12 experienced the longest response times at the 90th percentile with the District 12 response time of 9 minutes 50 seconds or 2 minutes 9 seconds above the average 90th percentile response times across all districts.

Average response times for the first-in medic unit by District Council area were included in Table 21. Averages are useful to compare where larger number of incidents are included to help limit the impact of outlier response times. The average response times tend to validate the 90th percentile calculations across the 17 district council areas.

Table 21: EMS Response Time Measures and Standard Scores

District Council	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Average	Stddev
Total EMS Incidents	2062	2519	1898	2680	3686	2487	1925	2888	1807	1346	1135	860	2354	628	2114	404	3612	2024	917
difference from mean	38	495	-126	656	1662	463	-99	864	-217	-678	-889	-1164	330	-1396	90	-1620	1588		
Standard score	0.04	0.54	-0.14	0.72	1.81	0.51	-0.11	0.94	-0.24	-0.74	-0.97	-1.27	0.36	-1.52	0.10	-1.77	1.73		
EMS Medic Response (90th)	0:08:57	0:07:48	0:07:34	0:07:22	0:06:39	0:07:24	0:06:37	0:06:45	0:07:07	0:08:29	0:07:45	0:09:50	0:08:30	0:08:20	0:08:21	0:06:38	0:06:26	0:07:41	0:00:56
difference from mean	0:01:16	0:00:07	-0:00:07	-0:00:19	-0:01:02	-0:00:17	-0:01:04	-0:00:56	-0:00:34	0:00:48	0:00:04	0:02:09	0:00:49	0:00:39	0:00:40	-0:01:03	-0:01:15		
Standard score	1.37	0.13	-0.12	-0.34	-1.11	-0.30	-1.14	-1.00	-0.60	0.87	0.08	2.32	0.88	0.70	0.72	-1.12	-1.34		
EMS Avg. Medic Response	0:05:43	0:05:27	0:05:07	0:05:24	0:04:41	0:05:14	0:04:51	0:04:54	0:04:50	0:06:07	0:05:47	0:06:22	0:05:45	0:05:46	0:05:51	0:04:57	0:04:35	0:05:22	0:00:31
difference from mean	0:00:21	0:00:04	-0:00:16	0:00:02	-0:00:41	-0:00:09	-0:00:31	-0:00:28	-0:00:32	0:00:44	0:00:24	0:01:00	0:00:23	0:00:24	0:00:29	-0:00:25	-0:00:48		
Standard score	0.67	0.14	-0.51	0.05	-1.33	-0.28	-1.02	-0.91	-1.04	1.43	0.78	1.94	0.74	0.76	0.93	-0.82	-1.55		
Cardiac Arrest - Total Incidents	18	18	11	18	21	13	10	14	12	7	9	1	14	4	12	3	20	12	6
90th Response to CPR	0:10:00	0:06:57	0:08:18	0:07:12	0:06:23	0:05:36	0:04:30	0:05:34	0:05:56	0:05:41	0:07:23	0:06:56	0:08:39	0:07:55	0:07:20	0:07:55	0:04:54	0:06:53	0:01:24
difference from mean	0:03:07	0:00:03	0:01:25	0:00:19	-0:00:30	-0:01:18	-0:02:24	-0:01:20	-0:00:57	-0:01:12	0:00:29	0:00:03	0:01:46	0:01:01	0:00:27	0:01:02	-0:01:59		
Standard score	2.23	0.04	1.01	0.22	-0.36	-0.93	-1.72	-0.95	-0.68	-0.86	0.35	0.03	1.26	0.73	0.32	0.74	-1.42		

In addition to analyzing total incidents and responses, cardiac arrest incidents were evaluated independently. Cardiac arrest incidents, like structure fire events, are relatively low frequency in number but present significant life hazard. A person in cardiac arrest is not breathing and does not have a pulse. These patients need definitive care in the form of CPR and defibrillation within 10 minutes of the onset to have a statistical chance of survival. While many factors that contribute to cardiac arrest survivability are beyond the control of EMS personnel, these events are time sensitive to provide the patient the best chance for survival.

SPFD responded to 205 cardiac arrest medical incidents between April 2016 and March 2017 with an average 90th percentile response time across the 17 district council areas of 6 minutes and 53 seconds. The fastest response times at the 90th percentile to cardiac arrest events were in Districts 7 and 17. District 7 had a 90th percentile response of 4 minutes 30 seconds to 10 incidents and District 17 was 4 minutes and 54 seconds to 20 cardiac arrest incidents. District 1's 90th percentile response time was 10 minutes to 18 cardiac arrest events, which was 3 minutes 7 seconds slower than the average. District 3 and 13 also experienced response times more than one standard deviation slower than the average 90th percentile response times to cardiac arrest incidents.

Data Analysis Conclusions

Service delivery across the 17 district council areas based on fire and EMS demand is fairly consistent and significant gaps in service to areas of the city do not exist. This is not to say that there are not places to monitor and potentially shore up with additional resources or deployment of current resources differently.

Fire and medical response are inevitably connected due to the dual-staffed engine/medic unit model and the way Super-Medics are deployed and used. Dual-staffed units provide efficiencies

and it is effective strategy for some areas, as the low frequency of structure fires and quick turn-around times for EMS units delivering patients to a medical facility keep response times generally good. The downside is that high medical demand coupled with fire calls and other fire unit responses is a drain on responders, especially paramedics. Personnel and decision-makers recognize that as EMS call volume increases the dual-staffing concept is becoming more problematic. Increased medical calls will mean that fire units (mostly engines) will be out-of-service for longer periods of time, thus response times will get longer.

The city does have a sufficient number of suppression resources and fires will continue to be low, as compared to medical calls. Medical calls will continue to increase SPFD needs to prepare for it. Some engine/ medic units are already responding to a large number of calls in other districts which, because of AVL is understandable.

As to District Council areas, Payne-Phalen (5) and North End (6) are areas to monitor, as these districts have large populations, generate significant service demand, and based on economic, education, and structural measures are somewhat distressed compared to other parts of the city. District 6, which is served by Station 17, is likely to experience even longer response times if changes are not made. The good news is the addition of Medic 5, which improved response and reduced some of the workload of Medic 8 in District 17.

District 5 experienced 36 structure fire incidents, which was the most of all districts. Only Engine/Medic 17, which is a dual staffed unit, are housed at Station 17. Station 17 is an outlying station, so as the volume of EMS responses continues to increase the area will become more exposed. During the most current 12-month period Medic 17 responded to 3,060 incidents while Engine 17 responded to 622. Well over half of Medic 17's responses were into adjacent areas. Station 7's area has high EMS demand and currently does not house a medic unit. A medic unit at Station 7, or staffing adjacent units as Super-Medics is an option moving forward.

Other problem areas to watch are Districts 10, 12, and 13. District 13 (Union Park) is the more imminent, as response times to medical calls and fire incidents are longer compared to the other districts and its service demand is above average. District 13 presents some response challenges, because its primary fire station, Station 20, does not have a medic unit. Medic 14, which is dual-staffed and Super-Medic 23 respond regularly into District 13 on medical calls. Districts10 and 12, which are covered by Super-Medics23 are also at risk for longer response times, due in part to the automatic- aid agreement with Falcon Heights and the absence of a medic unit at Station 20.

Analysis of District Council areas and the response times determined that services are delivered equitably. In fact, areas with the highest population of disadvantaged citizens often get a slightly faster response. In all Districts, response times for medical calls are slightly higher than for fires. This is because there are fewer medical response units, and there are multiple fire units in most stations. There are also many more medical incidents and calls often overlap, thus medic calls often have longer travel distances.

IV. FIRE AND EMS OPERATIONS

This section discusses the daily operations of the SPFD, in particular its fire suppression, rescue, and emergency medical services. Important topics discussed in this section are staffing, suppression and medical response unit types, and the model used to deliver services to the public.

Background

Revitalization efforts and changes to the city over the past 10 years were quite apparent to the study team, which participated in the last SPFD study in 2007. Re-development in many parts of the city, in particular along the Green Light-Rail line, has increased population, especially downtown. There are also new entertainment, sports, and cultural venues that were not available in 2007.

An earlier section of this report showed the significant demographic disparities among the 17 Districts. Areas such as Thomas-Dale/ Frogtown, Summit-University, North End, and Payne-Phalen, and Dayton's Bluff have large populations of disadvantaged residents, many with family incomes below the poverty level. And large percentages have less than a high-school education. The 17 Districts also vary considerably in their racial makeup, with the east side of Saint Paul being overwhelmingly non-white.

The good news is that, as shown in the previous chapter, the same level of service is being delivered to all areas of the city, whether poor, rich, black or white. This is a key finding that the city should be proud of – it delivers high-level fire and medical service to everyone. We are not aware of any similar study having been conducted regarding fire and medical services, but other communities should consider doing similar studies - and be as proactive as Saint Paul seeking the answer. [5]

City-wide, fire demand is very low, accounting for less than five percent of incidents, with structure fires accounting for about one-half of one percent of total incidents. Unit-hour Utilization (UHU), the percentage of actual working time for fire units, is also low, even for the busiest units. The busiest engine is below 8 percent, meaning it is on calls less than two hours each day. Many of the dual-staffed engines are even less. Medical service is the area where future demand is likely to increase the most. EMS demand has been increasing 3-4 percent annually, much faster than population, and it is likely to continue to increase.

Now and going forward, the big issue for the city and SPFD is how to increase resources to handle more medical calls and make adjustments to SPFD's fire suppression resources.

[5] We would go so far as to suggest that city leadership might consider giving a talk to the National League of Cities on both your question and the answer regarding service equality, or writing an article on the subject. It is highly newsworthy in this day and age especially.

Discussion with SPFD stakeholders revealed that most understand the need to increase medical response resources, but there are many opinions of how to do it. Analysis shows that shifting medic resources such as moving Super-Medics9 to Station 7 does not benefit the system without creating gaps elsewhere. The change since the last study, which was to add Super-Medics to Stations 9 and 23 and a dual-staffed medic at Station 5, have greatly improved service delivery. *To meet the increasing EMS demand the city must add more resources – either through funding, or by shifting budget resources from suppression to EMS.* Increased medical demand is the number one threat to maintaining services at the high quality they are now.

Making changes for fire departments is difficult, as tradition and culture sometimes get in the way. For SPFD, the culture is to resist most changes through politics, thereby keeping the status quo. Firefighters tend to get involved politically on most operational issues, which results in not moving forward. It is our opinion that firefighters have every right to take issues they care about to elected officials. However, not every issue is one that elected officials should get involved in, as often seems to occur.

Though improvements such as the three medic units are good, there remain cultural issues that do not allow the SPFD to recognize that its business portfolio is primarily an EMS department that occasionally must fight a fire. As the data analysis for demand and workloads showed earlier, fire companies spend the overwhelming time handling medical calls. Going forward, it is unlikely that the city will be able to dedicate more dollars to medical care, at the same time keeping the same number of fire trucks. Strategically, a paradigm shift still needs to occur within the SPFD

The article in Appendix 1 about the culture and fire-centric nature of SPFD is from 10 years ago – shortly after the TriData study in 2007. It still applies all too much.

Critical Features

The SPFD is a very good organization. It has quality personnel, very good equipment, and fire stations are in good shape. There is excellent coverage and response times across the city are very good. Fire personnel sincerely care about the quality of service they deliver.

Deployment – As noted earlier, services are provided from 15 fire stations, shown in the map below. Every fire station has at least one engine and seven have a ladder company. Stations 5, 9, 17, 20, and 23 are the only stations with only one fire unit; all others have at least two. Deployed to the 15 stations are 16 engines, 7 ladders, and 3 squads. 13 Medic units are also deployed. Stations 7 and 20 are the only stations without a medic unit. SPFD also has two Basic Support Units (BLS), which are staffed only during certain weekday hours, primarily for non-emergency intra-facility patient transports. BLS units sometimes are requested to handle less severe medical cases to free up medic units.

Insert Map of Fire Stations

Fire personnel work a three-platoon, 56-hour schedule. When staffing is at full strength, each shift has approximately 144 personnel. Minimum staffing is considered to be 114 per shift. Overtime is used to fill shifts when staffing is below 114, or when a position must be filled with a particular classification such as paramedic or officer. Overtime is needed almost daily, albeit its use has subsided over the past two years as firefighter vacancies have been filled.

The ranks of personnel at fire stations include Captains, Fire Equipment Operators, and Firefighters. Some firefighters are trained as paramedics as each medic unit and engine must have at least one paramedic. Above the station level are three District Chiefs and one Deputy Chief. District Chiefs manage several fire stations each, while the Deputy Chief is responsible for an entire shift.

Dual-Staffing Model: SPFD remains unique among fire departments in that medic units are staffed by the same individuals that staff the engines, ladders, and squads. The concept is referred to as "dual staffing". Other departments may refer to dual-staffing as cross-staffing, but the concept is the same. 10 of the 13 medic units deployed by SPFD are dual-staffed, and 3 are 'Super-Medics' independently staffed by two paramedics. However, even though Super-Medics are independently staffed, operational protocols have an engine responding on every call along with the Super Medic, even when the medical call is minor.

Under the dual-staffing model, the entire crew of the engine or other fire unit housed with a medic unit responds to the medical call, which leaves the engine out-of-service at the fire station. Dual staffing is an efficient strategy to provide both fire suppression and medical response, although it becomes less effective during periods when medical call volumes are high. Gaps in fire suppression capabilities and longer response times for fire units can occur in this situation. Many cities provide both suppression and medical service with firefighters cross-trained as medical providers (ALS or BLS), but Saint Paul is one of few if not unique among major cities using the dual-staff model.

In addition to the TriData study in 2007, other studies of the SPFD and its operation have been conducted including one by Buracker (1989). Both earlier studies addressed the issue of medical service delivery and both made recommendations to begin the process of increasing the number of resources for medical response, such as by transitioning from the dual-staffed model to independently staffed medic units. The situation has not changed, and the city would be wise to make small increases for medical service each year rather than wait until there is an issue later. Enhancements to medical service can be achieved by increasing the SPFD budget or by shifting some resources from suppression to EMS. The latter can be done without diminishing the already excellent level of fire services available to residents.

Dual-Staffed Units: The most important issue to decide is whether the dual-staffing model is the right approach for Saint Paul to proceed with going into the future.

Dual-staffing has been in use since the 1970's. Dual-staffed medic units respond with the entire engine crew of four personnel. When Super-Medics are dispatched to a call, the engine also

responds to the call, even when it is a minor medical situation. The majority of medical calls can easily be handled by two responders. It appears that the current policy is to send the entire engine and medic, even when the medic is independently staffed. This situation is creating unnecessary demand on the system.

Response times are good but will worsen as the system overloads on EMS calls. There is also a question of whether the city can be so profligate in staffing so many units with so many paramedics. There are problems getting firefighters to become paramedics, and this scenario is likely to continue, especially if the city wishes to have a diverse fire department. Further, obtaining and keeping firefighters trained to the level of paramedic is expensive and time consuming. SPFD's BLS training program is excellent and could be expanded to incorporate more BLS units into the system, to relieve pressure on the paramedic units. The overwhelming majority of medical calls responded to by SPFD medic units are minor and could be handled by a BLS unit.

Fire-centric Culture: The SPFD culture and deployment is still fire-centric. The majority of its resources (personnel and equipment) are dedicated to fire suppression, even though it is medical calls that are the majority of its business. In some Districts, 85 percent of calls for service are medical. Less than five percent of the total calls are fires or rescues. Few of the five percent are structure fires. Most are automatic alarms or other calls easily handled by one or two units. Yet, 26 major units (engines, ladder trucks, and squads) are deployed for fire suppression while only 13 are for medical. Clearly, the Super-Medic program is not yet institutionalized in the SPFD, and most personnel view themselves as fire suppression and rescue responders first with medical response a secondary role. That should be turned around, and the department visualized as providing emergency medical services, with cross-trained personnel able to handle fires, too.

Squads: Three squads each with a five-person crew is very much an excess as compared to the number of calls that really need their services. There appears to be little justification for three squads. They require 15 personnel each day, to include three captains, three operators, and nine firefighters. Prior to 2008, fire units were often staffed with three personnel, and squads provided the extra personnel needed at a fire. Fire units are now always staffed with four personnel, and thus the extra personnel from squads is of less importance. Combined, the number of structure fires, technical rescues and hazmat calls do not justify three squads.

Prior to 2008, fire units were staffed with three personnel and squads provided the extra manpower needed at a fire. Four is the minimum staffing now, thus squads are not needed as much for the extra staffing. Three squads for a city the size of Saint Paul with a low volume of structure fires is ***VERY*** high.

Table 22: Squad Call Types and Percentages

	Structure Fire	Fire(other)	HazMat	Rescue/EMS	Other	Total
Squad 1	132	427	233	620	1268	2680
Squad 2	63	202	209	745	916	2135
Squad 3	66	137	101	406	625	1335
Percent						
Squad 1	4.93%	15.93%	8.69%	23.13%	47.31%	100.00%
Squad 2	2.95%	9.46%	9.79%	34.89%	42.90%	100.00%
Squad 3	4.94%	10.26%	7.57%	30.41%	46.82%	100.00%

Table 22 shows that SPFD squads made 6,150 responses in the 12-month period ending March 2017. Of these calls only 261 (4 percent) were structure fires while 4,580 (74 percent) were medical and 'Other' incident types. 'Other' incident types are usually automatic alarms and other non-emergency situations. 21 percent of responses were fires, other than structures and hazmat calls.

It is feasible to eliminate at least one squad with budget resources reallocated to additional medical response units, ALS or BLS. Each squad requires about 20 FTE positions annually and these could be used to add paramedics or BLS providers such as those at Station 1 (BLS 51 and 52).

Recommendation 1: Consider eliminating one squad and using the budget resources to add two Super-Medics. Another possibility is to expand the BLS program, which is very efficient and which could take a significant load off of the medics, especially Downtown where demand is highest.

The city can easily operate with fewer than three squads (New York City boroughs with three times the population of Saint Paul function with one.)

Brown-out Policy: Current policy when staffing is below 114 is to brown-out the Super-Medics.[6] There is no standard practice for which Super-Medics should be browned-out. Each shift makes a unilateral decision based on what it believes is best. In light of EMS demand, this policy makes no sense. Browning-out a squad has little impact on service delivery for most calls. Instead of browning-out Super-Medics first, one of the squads should be browned-out. Browning out a squad frees five positions whereas browning-out a Super-Medic results in only two positions.

Overtime Policy: Analysis of the factors driving overtime was not part of this study. However, it was determined that overtime is being paid even when the number of personnel is over 114. Overtime policy was an important issue for Councilmembers, in particular the callback of a Deputy Chiefs even when staffing was above 114 and a District Chief was available to act in the higher classification.

[6] On one day of our site visit, staffing was at 110 and two Super medics were browned-out.

Weight-of-Response: The number of units and personnel dispatched to various incident types is known as 'weight-of-response'. Ramsey County 911 call-takers and dispatchers determine the call type and the CAD applies the code which determines the weight-of response. As mentioned in a previous chapter, there are suggested guidelines for the number of units and fire personnel needed at various incident types.

For structure fires the number of personnel responding on the initial alarm varies from 13 for small single-family structures to 25 for high-hazard occupies such as high-rise buildings, hospitals, and manufacturing plants. The problem is SPFD dispatches a structure fire complement of apparatus and personnel even when the call is an automatic alarm. The 911dispatch policy for automatic alarms is to send three engines, one ladder, one squad, and one chief. This level of response results in 19 percent (5/26) of the available SPFD resources and 22 personnel being sent. If, as is likely, one or more of the units are from dual-staffed stations, medic units in those stations are no longer available for a call.

An analysis is needed of the number of units dispatched to various call types and whether all of the units were used. Dispatching too many units to calls has a cascading effect on the system that increases response times during busy periods. It also raises risks to firefighters and public to the possibility of accidents with emergency response vehicles rushing here and there. A community risk reduction approach is needed to balance risks vs needs.

Few automatic alarms turn out to be actual fires and most fire departments stopped sending full complements to these calls many years ago. Most departments now dispatch only one or two units to automatic alarms, not a full assignment. Policy-wise, departments also send the first unit with lights and siren, while others respond non-emergency.

Recommendation 2: Discontinue the practice of dispatching full assignments to automatic alarms, and review 911 event codes and weight-of-response guidelines to eliminate unnecessary responses. Doing so will further reduce the run volumes of fire units which will, in turn, increase availability and reduce response times to subsequent calls. Based om knowledge of the situation, company officers can always request additional resources.

Underappreciation of Accomplishments – Overall, the SPFD is in good shape and services are being delivered effectively. However, quite a few uniformed personnel with whom we spoke felt that that the Department was not progressing and, is at a standstill. We disagree, and these perceptions need to be disabused, perhaps by communication internally.

There have been many positive changes over the past 10 years; to include the addition of three Super-Medics, new stations 10 and 8, and the BLS Academy. Other significant improvements made by the SPFD, with support from the city's administration are:

- Increase from three to four-person minimum staffing on all fire apparatus
- Paramedic units added to Stations 5 & 8 (8 is now a Super Medic)
- Expanded Station 19 and moved Ladder from Station 10 to 19

- Countywide automatic aid implemented
- Automatic Vehicle Locator (AVL) dispatching system initiated
- New headquarters (at Station 10)
- Pen-based EMS reporting system initiated
- Assistant Chief and shift Captains added for EMS
- Chief of community relations added.

SPFD does have an active labor/management committee which represents both Unions and meets with the Fire Chief. Even with the positive changes, the Unions and Fire Chief have not been able to get together on further changes to make with regards to deployment. For example, Firefighters presented a plan to Council for a four-year investment strategy to increase staffing and resources at a cost of $2.1M. Another plan with a completely different strategy (and cost) was presented to Council by the Fire Chief.

In part, the plans presented by each group had to do with improving medical response and deploying the Super-Medics. The end result of not having a consensus was nothing was achieved. Relations seem to have improved with recent changes in representatives, and there appears to be agreement that 'getting things done' will necessitate open and honest dialogue between the Chief and committee. If this does not happen, policymakers are likely to disregard any requests from the SPFD as they get different, often conflicting information, from different sources. Internal rifts are common in most organizations, and it is not a major 'deployment issue'. However, continued rifts may well hurt the SPFD as it tries to get consideration for resources in the future. If, as we suspect, Councilmembers get different information from labor and management on the same topic, they are just as likely to disregard both groups and do nothing.

Fire and EMS Operations

There are presently 433 FTE line personnel authorized in the SPFD budget for shift work. Twenty-three (16 engines and 7 ladders) of the 26 fire units operate with four personnel, and three (rescues) operate with five. Table 23 shows the FTE personnel allocated by rank.

Table 23: Operational Staffing Allocations, 2017

Rank	Total Budgeted Positions
Deputy Chief	3
District Chief	9
Captain	94
Fire Equipment Operators	94
Firefighter/ EMT and FF/ Paramedic	221
Vacancies	12
Totals Authorized	433

The SPFD has an evolving management structure that reflects progress, but should also be viewed with caution. In 2016, the Fire Chief took the unprecedented action of realigning the senior staff, with one Assistant Chief overseeing fire operations and one overseeing EMS operations. This was unprecedented because never in Saint Paul, or most municipal fire departments histories, were fire operations and EMS operations placed on equal footing. To aid in continued success, deliberate actions must be taken to prevent backsliding into the traditional "fire-side" v. "EMS-side" mentality. The SPFD is attempting to ensure this, but even more deliberate action must be taken.

Assistant Chiefs – The Assistant Chief of Fire should be designated the assistant chief of Emergency Operations, and should oversee of all day-to-day operational functions. In practice, there is no fire or EMS side, but one emergency operation, including most primary services. In Saint Paul, every member of the fire department performs EMS, fire suppression, and community risk reduction functions. EMS licensure and certifications are required of all personnel, and advanced EMS training is encouraged. To allow regression towards a silo mentality is unacceptable and must be avoided.

The Assistant Chief of EMS Operations should oversee the provision of EMS care except for individual incidents. He should control EMS practices, hardware and software, Community Paramedicine, fire/EMS provider health and safety, dispatch liaison and recruitment and retention. The current Assistant Chief of Fire Operations has too much on his plate to effectively provide day-to-day oversight for these functions.

Moving fire/EMS provider health and safety recruitment and retention to be under the Assistant Chief of EMS Operations presents several advantages.

- Balance the workload between the Assistant Chiefs
- Both Assistant Chiefs are responsible for the overall success of SPFD programs
- Eliminates the probability of reinforcing an outdated silo mentality
- Provides pathways for future leaders to develop broader organizational expertise their careers

Recommendation 3: Change the titles of both assistant chiefs to better reflect what they oversee. The Assistant Chief of Fire Operations should be designated the Assistant Chief of Emergency Operations, and the Assistant Chief of EMS Operations should be designated as the Assistant Chief of EMS.

Recommendation 4: Shift responsibility for fire/EMS health and safety and recruitment and retention to the Assistant Chief of EMS, Health and Safety and Human Services.

The most critical point for the future of EMS is the ability for of the Assistant Chiefs to work in a cohesive manner to prevent the past "fire-side" v. "EMS-side" challenges common to fire-based EMS. It is critical that these officers not be trapped by a minority of rank and file members who

perpetuate us v. them behaviors. To achieve cohesiveness, personnel must realize that orders from one assistant chief must be treated as an order from both assistant chiefs.

EMS Captains – Another recent advance was the appointment of an EMS Captain (EMS Coordinator) for each shift. They are the on-duty EMS officers for the department. The EMS Captains provide clinical oversight, EMS supply management, and EMS vehicle management. They also oversee the EMS Medical Group during MCI's, provide hospital liaison, and related duties. EMS Captains are also assigned special projects, such as overseeing the Ambulance 51/52 program; managing special events; and technical oversight of EMS electronic reporting and similar information management programs.

There are many benefits to having an EMS shift captain on each shift. In addition to the above, they can be the on-duty safety liaison, provide timely liaison with medical facility staffs, quickly access vendor services, and be a resource for the chief officers involved in EMS situations. Arguably, the biggest benefit is having a shift officer responsible for EMS quality management, including liaison with the EMS Medical Director staff. They have responsibility for quantitative measure compliance, such as reporting to the National EMS Incident System (NEMSIS), the Minnesota State Ambulance Reporting Program (MNSTAR), Regents Hospital EMS (EMS Medical Directors) and similar agencies. They can also play an important role in the expanding Ambulance 51/52 program.

The EMS shift captains (EMS Coordinators) are off to a good start, but there are some obvious issues that need to be addressed. First, only two of the three EMS captain positions are funded. It is difficult to understand the situation, but both supporters and detractors of the position made specific mention of this issue. The funding of these positions should no longer be in question. This role is vital to the future of SPFD EMS and funding should be fully secured.

Recommendation 5: All three EMS shift captain (coordinator) positions should be fully funded. Another concern is the occasional non-staffing of the EMS shift captain position. Currently, when the designate EMS captain is off duty, another captain will be detailed to fill in. If this detail causes overtime, the position is left vacant. Again, essential positions should never be vacant. A qualified officer should always be assigned to this position.

Recommendation 6: The EMS captain position should always be staffed. Although titles are often considered a minor issue, the current term EMS Coordinator is not the most appropriate for the key functions of the position, and makes it sound dispensable. This term is a holdover from days where fire departments were uncertain about the future of EMS, or the term was considered less threatening to the rank and file. It's time for the SPFD to recognize the importance of EMS supervision and recognize these officers.

Recommendation 7: Retitle the EMS Coordinator position to EMS Shift Commander. This would remain a captain position, so no financial liability is created.

Firefighter/Paramedic – The term firefighter/paramedic is a misnomer because there is no official rank. Firefighters who achieve paramedic licensure and are privileged by the EMS Medical Director earn on average nine to 10 percent more, and with longevity can achieve up to

a 13 percent pay increase. Pay for paramedic licensure is counted toward retirement. Firefighters who promote to Captain keep their premium pay, but upon promotion to district chief that pay is rescinded.

There are 144 firefighter/paramedics in Saint Paul. They are considered dual role/cross-trained, meaning they can function as paramedics and firefighters. Many are also certified as emergency vehicle drivers who can drive any vehicle. Many are also hazardous materials technicians and are recognized as "Tox-Medics," having special training in EMS cared related to hazardous materials emergencies.

Throughout our visit to Saint Paul, management and labor representatives expressed concern about maintaining paramedic staff strength. Since EMS responses outnumber fire responses, paramedics provide much of the emergency response. Increased education requirements are cited as a reason to relinquish paramedic licensure. Traditionally, firefighters were sent to paramedic school on department time and expense. Since ten years ago, those interested in paramedic training are required to attend classroom and clinical training while off duty. If training conflicts with a firefighter's work schedule, the department will allow for leave if overtime is not created.

Recently, the department conducted paramedic training that mixed firefighters with cadets from the Ambo 51/52 program. This program was expensive to run and is not planned to be held on a continuous basis. At times, the department sponsors firefighters for paramedic school. They are guaranteed time off if training conflicted with their work schedule. Sponsoring was recently discontinued but could be restarted.

The time involved and cost of paramedic training continues to increase. To sit for the National Registry of EMTs or Minnesota Paramedic Examination, candidates must complete a paramedic program accredited by the Commission on Accreditation of Allied Health Education Programs upon the recommendation of the Committee on Accreditation of Educational Programs for the Emergency Medical Services Professions (CoAEMSP). Training is offered by several local colleges or EMS programs and is equivalent up to 75 college credits. Many programs require up to 24 hours per week of classroom training. During clinical rotations, candidates may be required to complete up to 40 hours per week for several months. The cost for paramedic training can be up to $13,000 for tuition and supplies. There is no educational supplement for those sponsored or taking paramedic on their own.

While there is no single solution for the paramedic recruitment and retention challenge, there are partial solutions to consider:

- Determine the number of paramedics needed based on the need for service.[7]
- Provide paramedic training at the EMS Academy (doable but expensive)

[7] This is discussed in the Operations Section.

- Provide tuition assistance based on milestones, including passing the education and training program (50%), passing the National Registry of EMTs paramedic examination (20%), achieving Minnesota licensure (10%), and receiving privileges from the EMS Medical Director (20%). Those unable to receive EMS Medical Director privileges would be required to repay all reimbursement money.
- Pay firefighters who are in paramedic training 50% of the extra pay that would receive as a `paramedic. This would help offset expenses for training. The paramedic trainee would only be eligible for 18 months of paramedic trainee pay.

Recommendation 8: Provide one or a combination of the above incentives for firefighters to become paramedics.

A controversial, but effective way to increase and preserve paramedic staffing is to offer preference for those applying for firefighter who have MN paramedic licensure or National Registry certification. The SPFD may select the best qualified candidates to fulfill citizen needs. A Nationally Registered paramedic allows a new firefighter to provide paramedic services up to two years before a firefighter who starts at the baseline.

Some community and public safety leaders are concerned that offering preference for paramedics may interfere with diversity practices. First, the number of women completing paramedic training continues to increase, thus adding more women to the pool of candidates. Second, paramedic training is offered by several local colleges and hospital training programs. These facilities share in the communitywide obligation of building a diverse workforce. The SPFD is not the only organization obliged to actively pursue a diverse pool of talent. Third, the SPFD Ambulance 51/52 (cadet) program provides an additional way to embrace diversity.

Recommendation 9: The SPFD should grant hiring preference for firefighter candidates who possess Minnesota Paramedic licensure or National Registry of EMTs Paramedic certification. The exact weight of this preference should be determined by the Fire Chief.

Firefighter- Prior to being hired, each firefighter candidate must be certified as a Minnesota EMT. There are many colleges and schools in the Twin Cities area that provide access to training for area residents. Having firefighter candidates certified as EMTs saves the City up to six weeks of time and training costs.

EMT is an essential skill for firefighters working for agencies that provide EMS transportation. This includes proficiency as a first responder and as part of a basic or advanced life support ambulance crew. Even the burgeoning field of Community Paramedicine has a place for EMTs because the skills provided are mostly basic.

Recommendation 10: The SPFD should retain the requirement of EMT certification as a minimum firefighter qualification. All firefighters should be required to keep their EMT certification throughout their careers.

Use of Overtime

As noted earlier, 114 personnel are needed for full staffing of the 16 engines, 7 ladders, 3 squads, and 4 chief positions on each shift. SPFD has established 108 as the absolute minimum that it will run. When staffing goes below 114, Super-Medics are browned-out until all three are eliminated (108 positions). There is no logic to browning-out Super-Medics first when medical calls are the majority of incidents responded to by SPFD. Daily staffing and the number of times that Super-Medics were browned-out was a major concern for fire personnel.

Data provided by the SPFD shows the following:

- Over two years, there were 132 days when staffing was less than 114 (18 percent) and at least one Super-Medics was 'browned out'
- In 2015, 2179 overtime shifts were used to meet minimum operational staffing of 114. In 2016, there were 1205 overtime shifts, a reduction of 974 shifts (45 percent).
- In 2015, only 36 days did not require some overtime
- In 2016, the days where no overtime was required increased to 85.
- Based on the current work schedule (2912 hours/yr.), 18 FTE personnel were needed to cover all of the overtime shifts in 2015. In 2016, 10 FTEs would have been needed.
- From 2015 to 2016, overtime was granted 133 times (18 percent) when staffing was already at the minimum of 114 or higher.
- Based on the average cost of overtime to cover one shift for 24 hours ($1,000), the overtime needed to cover 2,179 shifts in 2015 was $2.18M. In 2016, the cost was reduced to $1.2M, a savings of $.97M.

SPFD does maintain staffing at 114 the majority of time (82 percent) but the fact remains that at least one Super-Medic was not staffed 18 percent of the time. When Super-Medics are not staffed the engine does operate the medic as a dual-staffed unit so service levels are not completely disrupted.

In reviewing the data it was determined that overtime is being used when staffing is already at the minimum level of 114. By contract, Deputy Chiefs are entitled to eight overtime days per year. Current policy, however, is to call back a Deputy Chiefs on overtime whenever one of them are off and one of the other two Deputy Chiefs work the overtime. Calling back Deputy Chiefs on overtime is occurring even when shift staffing is above 114. The reason given is that Deputy Chiefs are more experienced. Districts Chiefs are also experienced and most of them are qualified to act in the position of Deputy Chief. The policy to call back on overtime is not contractual.

Prior to 2007, SPFD often staffed its engines and ladders with fewer than four personnel. The Fire Chief has committed to a minimum of four-person staffing on all fire units with five-person staffing on squads. With three-person staffing a full alarm assignment delivers 13 personnel when three engines, one ladder, and district chief were dispatched. Thirteen personnel responding on a structure fire is at the lower range of effective staffing, based on recommended standards. So having a squad with five personnel made sense, even for minor fires.

With four-person staffing now on all engines and ladders the same complement of apparatus provides 16 personnel. A five-person squad complement is not needed on every structure fire call as is the current policy. A majority of structure fires are minor and often handled by the first arriving engine and ladder. A squad with the extra personnel is needed only occasionally for the more serious structure fires. Squad personnel are also trained to handle calls involving hazardous materials and technical rescues. Thus, at least one squad should be maintained. As recommended earlier, when staffing goes below 114 and it is desired to avoid overtime, the first unit that should be browned out is a squad, not a Super Medic.

Fire Losses

Over the past year, firefighters were dispatched to 225 structure fires.[8] Of these incidents, 139 had a loss of $1,000 or more. The combined property and content losses of all structures fires over the past year was $7.4M. The average property loss was $22,422. While losses may be low due to good suppression, they are likely to be low here because of small fires easily extinguished. (What are really needed are estimates of the property saved at each fire, which is feasible to do, but not adopted yet by the fire service.

District 17, Downtown, is the busiest of the 17 in total calls, but there are few fires in this District and only one incident occurred in the past year where the loss was over $1,000. Payne-Phalen (District 5) has the most structure fires of the 17 districts. It also had the most structure fires with losses greater than $1,000. In looking at all fires, including vehicles, brush, etc., Districts 1-8 have three times the number of fires (1,486) as Districts 9-16 (502). Districts 1-8 are all in east Saint Paul where poverty rates are higher.

Differences in fire losses can be compared to the socio-economic differences among the city's 17 Community Council Districts. Districts 1-8 have the lowest median family and personnel income and the highest percentage of those without a high school education. On average, these areas have higher dollar losses per fire than do the more affluent Districts 9-16. The average loss in Districts 1-8 is $25,655 compared to $12,298 in Districts 9-16. Again, District 17 only had one fire with minimal loss so it was not included in the comparison.

Analysis revealed that the highest structure fire activity occurs in District 1, (Eastview-Conway-Battle Creek-Highwood Hills), District 5 (Payne-Phalen), and District 6 (North End). Districts 1,

[8] For the period of April 2016 through March 2017.

5, and 6 are both covered by stations with dual-staffed medic units. North End and Payne-Phalen is covered mostly by Station 17, a single-engine station with a dual-staffed medic unit and Station 22, which has a ladder and engine that also dual-staffs a medic unit. District 1 is covered by Station 24, which has a ladder, engine and dual-staffed medic. Combined, Districts 1, 5, and 6 had 40 percent of all fires responded to by the SPFD.

In comparing the losses, it was important to understand whether there are differences in response travel times, especially for structure fires where residents are most at risk. That does not seem to be the case. There are slight differences, but travel times are good overall. City-wide, the average travel time for the first unit to arrive at a structure fire is 3:36. The average response travel time for Districts 1-8 was 3:41 and 3:31 for Districts 9-17 it was 3:31, so not much difference. District 1 and District 6 have average response travel times of 5:13 and 4:55, so these areas are well above the overall average but still reasonable. District 6 is susceptible to longer response times because of dual-staffing and these are areas where an independently staffed Super-Medic would be beneficial. Other areas with longer travel times are Districts 12 (Saint Anthony Park) and District 13 (Union Park). These areas are covered by Stations 20 (one ladder) and 23 (engine and Super-Medic). Station 23 responds to a large number of automatic aid calls to Falcon Heights and there is no medic units at Station 20.

The higher fire losses in low income areas must have other causes than suppression response. One factor may be slower discovery of fires from having fewer smoke alarms, so the fires are larger when the fire service arrives. Another possibility is more multifamily housing, so when there is a fire it may do more damage. The reasons need to be explored further.

Fire Suppression Operations

Operationally the SPFD is a very good department. Personnel are aggressive and well-trained and the structure of the organization is sound, if not overly suppression oriented considering the types of calls and workload.

Response Policy – Super-Medics at Stations 8, 9, and 23 are good, however the way they are being operated is not producing the best results as the stations still operate the Super-Medics the same way they do with dual-staffed medics – the entire crew goes on the call. So instead of four responders on the medic as they do in stations with a dual-staffed medic, now six people are responding; two on the medic and four on the engine.

Being able to operate a medic unit independently of the engine, ladder or squad is a concern of firefighters that believe it is the responsibility of the officer to do the paperwork for calls. Paramedics, they say, are not considered supervisors and therefore not required to fill out incident and patient reports when they are assigned to a medic unit. On dual-staffed medic units Captains typically ride the front seat of the medic as the supervisor. Paramedics in other systems routinely fill out run and patient reports and doing so should be a requirement of any uniformed position, whether supervisor, paramedic, or firefighter.

Engines in stations with Super-Medics should be having fewer calls but they are having more! Data shows that 80 percent of calls handled by SPFD are medical. The largest percentage is minor medical situations, easily handled by a two-person medical crew. Continuing the same policy of having entire crews respond to every medical call is inefficient. It can also impact response times as other units farther away must cover calls. Response times are good but would be even better with a change in policy.

Recommendation 11: Discontinue the practice of responding a fire unit on every medical call, and use Medical Priority Dispatch criteria to determine which calls require a first responder unit.

West Side Community District 3 – Station 6 with its two engines and dual-staffed medic cover District 3. Combined the unit-hour-utilization for Engine 6 and Engine 15 is less than five percent, with Engine 15 being near four percent. Over the past three years, Engine 6 has responded to less than one call per day while Engine 15 averages less than four. There is little justification for two engines, except that one engine must be maintained due to the airport. In lieu of the second engine an independently staffed Super-Medics would be more efficient than having two engines. The majority of medical calls are of the BLS variety and these can be handled by the medic without an engine response.

Recommendation 12: Replace the second engine at Station 6 with a Super-Medic unit.

Automatic Mutual Aid – Recent changes to response in St. Paul include automatic aid with the bordering communities of Maplewood, Roseville, and Falcon Heights. Automatic mutual aid is a good practice as it improves efficiency when one station can serve two or more communities. Problems are encountered when one community provides a higher level of service than its partner community, or when significantly more aid is provided than is received. Automatic aid with Saint Paul is provided to and available from:

Maplewood borders Saint Paul on the north and east. It has three stations to protect the community of 38,018 (2010 census). [9] Its fire stations are located at:

Station 1 - 600 McKnight Road N

Station 2 - 1955 Clarence Street N

Station 3 - 1530 County Road C E

Maplewood is a combination department with part and full-time personnel. The department handles approximately 5,000calls per year.

Roseville is also located on Saint Paul's northern border between Hamline Avenue N and Rice Street. Located at 2701 Lexington Ave N, the department protects a city of 34,000. A combination department, Roseville has 4,700 fire and EMS calls annually. [10]

[9] https://search.yahoo.com/yhs/search?p=Maplewood%2C+MN+&ei=UTF-8&hspart=mozilla&hsimp=yhs-001

Falcon Heights is situated along Como Avenue between Cleveland and Snelling Avenues N. The department is staffed by part-time personnel, who respond from their residence or place of employment to the fire station. It has one station and responds to approximately 110 incidents per year.[11] SPFD Station 23 is also located on Como Avenue. Its location results in frequent automatic aid to Falcon heights though Falcon Heights rarely reciprocates.

Automatic aid is working as intended but the aid provided to Falcon Heights by Saint Paul is more than is being received from Falcon Heights, which is an all-volunteer department with no medical services, means that Engine/ Medic 23 respond almost daily into Falcon Heights. The Districts covered by Station 23, which includes Como, Hamline –Midway, Union Park, and Saint Anthony Park are areas covered by the engine from 23 and ladder from 24, thus they are susceptible to long response times when Engine/Super-Medics23 are on a call in Falcon Heights. Moving Super-Medics23 to Station 20 would alleviate some of the problem, though a better solution is to add a Super-Medic to Station 20. Later in this report we discuss the feasibility of consolidating Stations 20 and 23, which will also help. In the interim it is important to review the number of calls and longer response times created by the automatic aid agreement with Falcon Heights.

Recommendation 13: Review the Falcon Heights automatic aid agreement and consider moving Super-Medics23 to Station 20. Station 20 only has a ladder anyway and its medical calls are very high. Another option is to place a new Super-Medic sat Station 14.

Firefighter Turnout Times – Turnout time is the response time segment from the time a call is received by a unit until it actually begins its response – wheels rolling. A best practice is to monitor turnout times to make sure they remain good. NFPA 1710 suggests 1 minute as the 90th percentile goal for turnout times to medical calls and 1 minute 30 seconds for fire calls. The longer time allowance for fire calls is to allow firefighters to don full protective clothing before the response.

Turnout times analyzed for 2016 and three months of 2017 determined that 90th percentile turnout times are well above the standard, even for fire calls. Analyzed at the 80th percentile and the average, turnout times are still too long.

- Turn-out times 2016:
  - Average turnout: 1 minute 50 seconds
  - 80th Percentile: 2 minutes 25 seconds
  - 90th Percentile: 2 minutes 46 seconds

[10] https://www.cityofroseville.com/347/Fire

[11] http://www.falconheights.org/index.asp?SEC=C53C8F2F-7C4F-4EBE-863E-031E4EB23EC7&Type=B_BASIC

- Turnout times (April 2016 to March 2017):
  - Average turnout: 1 minute 49 seconds
  - 80th Percentile: 2 minutes 23 seconds
  - 90th Percentile: 2 minutes 44 seconds

Analysis shows that turnout times were 1 minute 46 seconds longer than the 1 minute standard for medical calls in 2016 and 1 minute 44 seconds in the first three months of 2017. Even when calls were for fires, turnout times were 1 minute 16 seconds and1 minute 14 seconds too long.

Our experience is that firefighters do turnout faster when the call is for a fire. They also become slower as the number of medical calls increase, especially when the majority of medical calls are minor and repeat system users (frequent flyers). The unique situation in Saint Paul where an entire fire crew of four personnel must respond in a medic unit is also a likely contributor as fire personnel must gather their full assortment of fire gear before getting on the unit. Data is available to determine where slow turn out times exists, by station, shift, and type of call, and appropriate remedial action taken. Another way to handle this problem is to publish the date for each shift and station, which may lead to self-correction by competition.

Recommendation 14: Initiate a process to review turnout times on a regular basis and follow up with particular stations/ shifts when turnout times are high.

Pre-Incident Planning – In addition to emergency activities and training, line units in most fire departments spend some time conducting fire inspections. A best practice is to evaluate high-risk properties and conduct pre-incident planning to collect important information.

There are some old pre-incident plans on paper but most are outdated. Firefighters should be conducting inspections and collecting information on target hazards, which can then be stored on computers and accessed by a commander when an event occurs. Pre-incident planning is akin to collecting intelligence before the battle. A St. Paul fire officer recently attempted to establish a standard for conducting pre-incident plans but the plan was nixed by others who thought the plan was not right for the SPFD.

Recommendation 15: Conduct a pre-incident plan for every major risk in the city. Set annual goals for the number of plans to be completed by each company annually, and establish timelines for periodic reviews and updates. Chiefs should be responsible for overseeing the pre-planning of major risks in their areas. District Chiefs will have more time to oversee pre-fire planning if their more mundane staffing assignment time is reduced by appropriate software, as discussed below.

Technology as a Management Tool – Shift Deputy Chiefs spend most of their time on staffing to make overtime callbacks and make details to fill vacancies at fire stations. The process is by paper and pencil and Deputy Chiefs are too far into the weeds making their job more secretarial than executive leader. SPFD leadership has improved significantly since the last study but the department has not embraced staffing technology to the extent it can.

SPFD could benefit from staffing software technology to keep better time and attendance records, help insure equity and fairness, accurately spread details and out of title and to objectively determine staffing patterns and issues. Time and attendance software would also serve as a *disruptive technology* that results in cultural changes in how staffing is managed. Technology such as Tele-Staff (or similar technologies) can automatically assign staff, automatically move personnel, determine overtime, and even notify personnel of assignments or overtime opportunities. District chiefs and deputy chiefs need only to become involved when captains are unable to rectify a staffing issue.

Management and representatives from both labor groups agreed that new technology was essential to the future success of SPFD. Garnering support for a staffing software package is not assured, but the possibility of implementing such improvements is worth the effort. The project could be assigned to a workgroup with representatives from senior staff and each Union.

Recommendation 16: Appoint a task force consisting of management and Union representatives to examine the implementation of online time and attendance software.

Emergency Medical Services management

Emergency Medical Services (EMS) continues to be a major component of the SPFD with demand increasing especially into areas with populations that are traditionally underserved. Emergency responses continue to increase, by as much as five percent annually.

Fortunately, data does not show any major issues with service-level response gaps or problem areas. The operational changes implemented since our last study in 2007 have the SPFD moving the right direction for dealing with more medical calls. EMS service demand is the number one threat to maintaining the department's current service delivery outcomes. While not in bad shape, the department is somewhat fire resource rich and EMS resource poor. Going forward some budget resources currently allocated for fire suppression can be redirected to EMS. If not redirected, budget allocations for medical services will have to be increased.

Since our last visit, Saint Paul has introduced a Community Paramedicine program that provides various services to direct residents to the proper level of care, and to assist with reducing post-discharge hospital readmissions. This service brings excitement and caution to the City since it will challenge the SPFD to balance its traditional mission of firefighting with its mission of medical care.

As to the unique operational model of the SPFD with its dual-staffing and Super-Medic model, data analysis and interpretation can be somewhat of a challenge. Overall, EMS response is very good and getting better. It was determined, however, that demand in some areas of the city are getting very high and the dual-staffing model is becoming problematic.

Current EMS Response – Between 2007 and 2016, Saint Paul's population has increased from 277,782 to 304,422 (8.76%). In contrast, the number of EMS calls increased much more rapidly, from 26,831 to 34,618 (22.5%). Figure 13 shows the EMS call trend between these years.

Figure 13: EMS Run Trend, 2007-2016

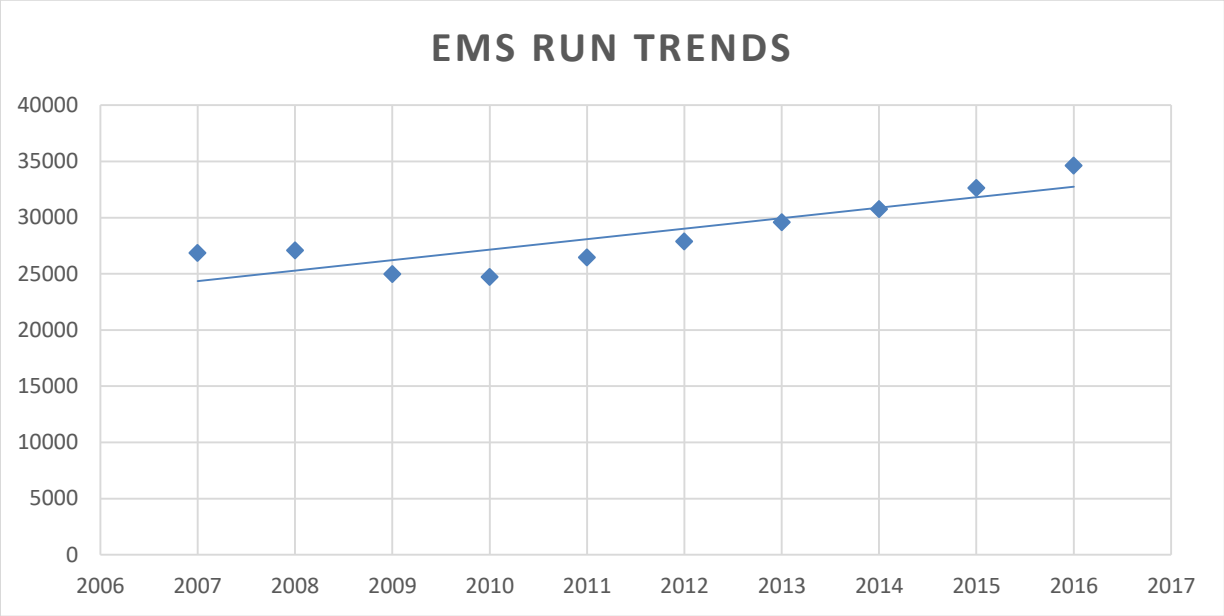


Table 24 shows a comparison of the 2007-2016 population change, EMS calls and the EMS calls per 10,000 population.

Table 24: Population, EMS Calls, and EMS Calls per 10,000 2007-2016

Year	Calls	Population	Calls per 10,000 Population
2007	26,831	277,782	2.68
2008	27,064	279,447	2.71
2009	24,977	281,253	2.50
2010	24,707	285,068	2.47
2011	26,430	288,673	2.64
2012	27,878	290,770	2.79
2013	29,578	294,873	2.96
2014	30,731	297,640	3.07
2015	32,634	300,851	3.26
2016	34,618	304,442	3.46

Table 25 shows a direct comparison between the Saint Paul population change and EMS calls per 10,000 population.

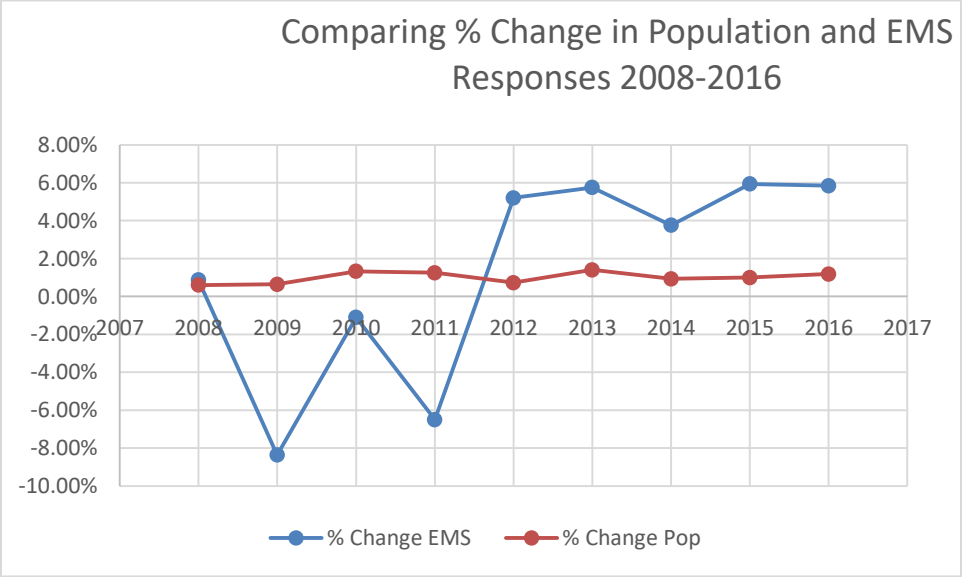
Table 25: Comparing Changes in Population and EMS Responses

Year	% Change EMS	% Change Population
2008	0.87%	0.60%
2009	-8.36%	0.64%
2010	-1.10%	1.33%
2011	-6.50%	1.25%
2012	5.20%	0.73%
2013	5.75%	1.40%
2014	3.76%	0.93%
2015	5.94%	1.00%
2016	5.84%	1.18%

Between 2009 and 2011 EMS responses declined. Since then, there has been a steady, significant increase, while the population increased at a moderate rate. These changes supported our 2005 recommendation of the need for two additional medic units.

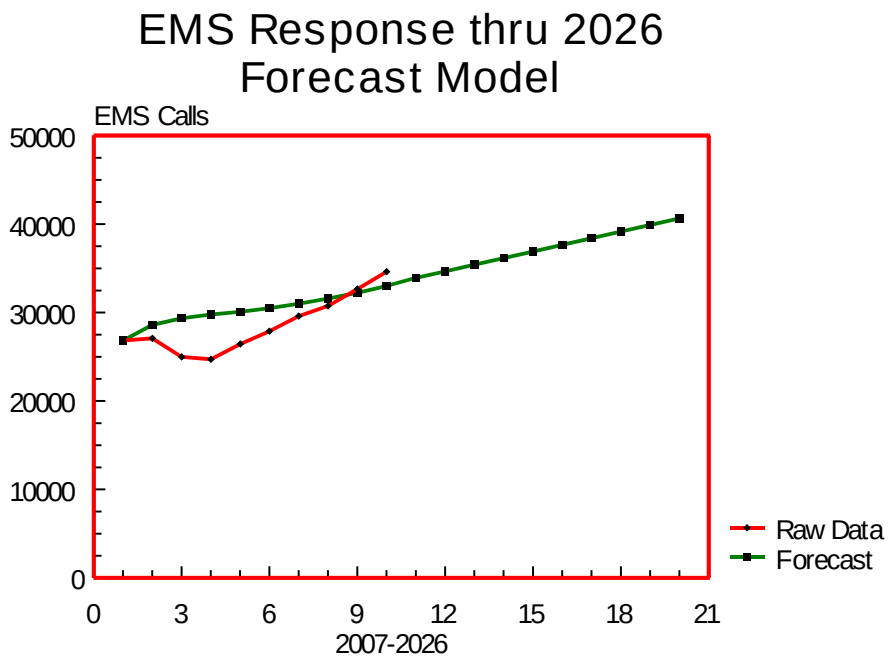
Figure 14 reinforces the above information.

Figure 14: Comparing Population Change with EMS Run % Change



Forecast- Based on demand for services and projected population changes, EMS demand should continue to grow thru 2026. Figure 15 shows that by 2026, EMS demand could surpass 40,000 responses.

Figure 15: EMS Response Forecast thru 2026



Super Medic – As explained earlier, traditional EMS responses were handled by ambulances assigned to stations that had at least one suppression piece. When an ambulance call came in, personnel responded on an ambulance. If a fire suppression call came in, the crew responded on a piece of equipment. The other piece of equipment was left unstaffed, and the next due unit covered the district. This was an innovative plan that in the early days was efficient. In some parts of the City, this plan may now be less prudent. The analysis in this study has detailed the specifics of the situation.

To remedy the situation, the SPFD introduced a "Super Medic" concept. A Super-Medic unit is always staffed by either two paramedics or one paramedic and one EMT. Super-Medics staffing is not dependent on other pieces of equipment. Stations 8, 9, and 23 have Super-Medic staffing. When staffing is low, the departments will "brownout" these units, returning the station to the traditional staffing model. We cannot support any reason to continue this practice. *Brownouts* reflect poorly on management and beg the question from the community of whether these pieces are really needed, if they can be browned out.

Recommendation 17: Discontinue the policy of browning out the Super-Medics. If brownouts are necessary, a squad unit should be chosen first, because it is less likely to be needed than a paramedic unit.

Additional Super-Medic Units – Outlying stations with single piece fire suppression units should not be dual staffed. Interior stations have stations nearby on all sides, so the absence of a fire or ems resource does not expose the area to undue fire or ems risk when the primary units are out of service. This is not the case with an outlying station, where adjacent stations are located just to

one or two sides of the area. This exposes many parts of the area to extended response times, not to mention that the outlying stations have primary response areas that are much larger than interior stations.

Recommendation 18: Upgrade the medic unit at Station 17 to a Super Medic. For the same reasons listed above, the SPFD should upgrade Medic 14 to a Super Medic. Engine/Medic 14 has one of the higher UHU rates at 22.49%. There is no need to urgently upgrade, but the department should put a plan in place.

Recommendation 19: Upgrade Station 14 to a Super Medic.

EMS Academy (Ambulance 51/52) – SPFD has begun an innovative program with the primary mission of preparing Saint Paul residents, especially those from under-represented communities, to train as emergency care providers. One intention was to increase diversity of the workforce, and another was to provide city residents with transferable skills to increase employability.

Ambulance 51/52 operates from an older SPFD firehouse that houses two EMT units, one operating from Monday thru Saturday from 8:00 AM to 12:00 Midnight and the other from 10:00 AM to 10:00 PM. Their initial role was to provide non-emergency ambulance transportation, such as to and from medical facilities, diagnostic facilities, long-term care facilities and hospital to home. Recently, its duties have been expanded to augment 911 services, after an initial paramedic assessment and determination that the patient does not require emergency services.

The Academy program is divided into three phases. Candidates must be 18 years of age and make application to the department to enter the first phase. Table 26 outlines each phase.

Table 26: Ambulance 51/52 Three-Phase Program

Phase	Training	Operations
I Orientation and EMT (10-20 candidates)	EMT training for 10 to 14 weeks.	-Prepared to work on the BLS Ambulance. -Starts supervised practical training on the BLS ambulance
II BLS Unit Service and continuing professional development.	-EMT skills maintenance -Begin Firefighter I and II or paramedic training	-Staffs the BLS Ambulance -Prepares to qualify as a firefighter or paramedic -Begins working toward and Associate of Arts Degree in fire, EMS or related field.

Phase	Training	Operations
III Numbers vary - eight cadets have completed the program and are employed by the SPFD.	Cadet Program	-Hired by the SPFD to continue training as a full-fledged SPFD member. -Trained to work at the Ambulance 51/52 Dispatch center.[12]

We were concerned that a public, non-emergency program would interfere with commercial services and restrain trade. However, the concern is unfounded because the Minnesota Emergency Medical Services Regulatory Board (MEMSRB) determined that the SPFD is the exclusive primary service provider of ambulance service for the City of Saint Paul.[13] We are not aware of any threat to alter this situation.

Our analysis found that the 2016 UHU rates for Ambulance 51 is 12.54% and for Ambulance 52 is 2.84%. This means that both units can provide additional services without interference with its primary purpose. There is also an opportunity to use the Ambulance 51/52 program to expand Community Paramedicine (see below). The expansion of the Ambulance 51/52 program can be done in phases insuring it meets system needs, provides good patient care, and properly trains and supervises EMS providers. Table 27 outlines a phase-in plan.

Table 27: Expansion of Ambulance 51/52 Program

Phase	Plan
Expansion of current practice- up to one year	As per current protocol, paramedics would continue to assess patients. If a case is determined to be non-emergency, the incident commander may request an ETA for Ambulance 51/52. If the ETA is less than 10 minutes, Ambulance 51/52 will be dispatched non-emergency to provide transportation. If the patient is under the care of an RN or EMT, Ambulance 51/52 could have an ETA up to 30 minutes. Also, with agreement of the paramedic, the incident commander may place all units in-service.
Dynamic Deployment of BLS Units to Stations and Expansion of Medical Priority Dispatch (one-year to 18 months)	Simultaneously, BLS units can be dynamically deployed to areas showing evidence-based need. For example, our analysis showed a need for additional services in Station 8's area. Ambulances will still be part of the Ambulance 51/52 program. 911 Center Dispatchers will use MPDS to code all incoming calls. Quality management personnel will determine compliance levels, targeting a 95%

[12] The Ambulance 51/52 dispatch center is separate from the 911 center. Non-emergency calls for scheduled and unscheduled service are called directly to this center.

[13] EMSRB. (2009). *MN Statutes and Rules for Ambulance Inspection 144E18.*

Phase	Plan
	compliance rate. BLS ambulances could begin being dispatched on 911 emergencies, MPDS Code A or B, under emergency or non-emergency status. Paramedic assessment would not be required.
Assignment of BLS Ambulances to Emergency Operations	BLS units staffed by EMTs (Phase III) and firefighter/EMTs would staff vehicles. These could be 24-hour or peak-staffed units. Two ambulances would still be assigned to traditional Ambulance 51/52 duties under current program management.

Advantages to expanding the Ambulance 51/52 program include.

- Expansion of EMS to handle growing demand with the right resources, at the right time, at a reasonable cost;
- Increasing the margin of safety by running more calls on a non-emergency basis (no red-lights or sirens);
- Creating an enhanced career pathway for city residence wishing to dedicate their careers to their home communities;
- Adjusting resources to reflect the proper level of training needed by employees. Every EMT does not need to become a paramedic;
- The provision of non-emergency medical transportation by highly skilled EMS professionals.
- The Ambulance 51/52 program can be expanded to include Community Paramedicine duties.[14]

Likewise, there are challenges that should be anticipated:

- Salaries and benefits for non-sworn EMS employees are usually lower than for sworn
- While cost effective, support from labor may be diminished. Those working on ambulances that are assigned to emergency operations should be sworn employees
- SPFD management should closely monitor the program to prevent sacrificing the primary mission to enhance the Ambulance 51/52 program.

[14] See Community Paramedic section below. Most Community Paramedicine skills are basic care skills.

Recommendation 20: Integrate the EMS Academy and Ambulance 51/52 program more fully into the SPFD operation and expand emergency and non-emergency ambulance service.

EMS Medical Direction

Regents Hospital continues to provide EMS Medical Direction for the SPFD and the rest of Ramsey County. The long-time medical director remains active, but additional physicians serve as co-directors. These physicians are Board-Certified Emergency Physicians who have completed or are eligible for the National Board of Medical Specialties sub-certification in Emergency Medical Services. The extensive role outlined in the previous study continues today. The EMS Medical Directors have added duties that include:

- Providing medical direction for the emerging Community Paramedicine program
- Implementing the First Watch software system
- Conducting and publishing research based on out-of-hospital care measurement

EMS Medical Directors believe that the SPFD is providing sound patient care that continues to evolve due to evidence-based care and close oversight. The addition of EMS field supervision has increased their confidence to allow SPFD to provide additional advanced skills including: (a) rapid sequence induction (RSI) used to enhance airway management, (b) video laryngoscopy to enhance placement and verification of endotracheal tubes, (c) development of Community Paramedicine, and (d) SPFD participation in out-of-hospital care research.

Fire/EMS Dispatch: Although fire/EMS dispatch was not directly included in our scope of work, it cannot be ignored because it is a vital part of the service. Dispatch efficiency is directly related total service efficiency. One concern raised was the inability of the 911 Center to fully implement the Medical Priority Dispatch System (MPDS) or to modify it to meet the needs of the SPFD. One concern is the 911 Center's reluctance to accept modification of dispatch protocols that are not endorsed by the software vendor, as it is thought that modifications could result in vendor warranties being voided.

The above concern is a remnant of the genesis of MPDS when there was little medical direction, operators with little training or experience, lack of universal 911 and lack of evidence-based protocols. Fast forward to 40 years later finds Ramsey County dispatch having progressed to its current state, the medical directors believe that the fear of "off label" customization needs reconsideration. We agree and support the ability for EMS medical directors to enact evidence-based customization of the MPDS program.

Recommendation 21: The EMS Medical Directors should be allowed to customize MPDS protocols to increase dispatch and patient care efficiencies.

Red Light and Siren Response: Closely related to fire/EMS dispatch is the continued reliance on emergency (red light and siren response) to all incidents. In 2016, 19 firefighters nationally

were killed secondary to traffic crashes, nearly 20 percent of 2016 line of duty deaths.[15] Also, many crashes have led to non-fatal injuries, property damage, and legal situations that distract from the provision of good care. The medical directors believe that more attention should be paid to reducing high risk red light and siren response and transportation, which can be accomplished by better assessment by fire/EMS dispatch professionals.

Future of Community Paramedicine: The EMS Medical Directors believe that the Community Paramedicine program is off to a good start, but should not be expanded without an ongoing needs assessment and continued measurement. Challenges include:

- The ability to reduce high-use rates of a small number of users
- Partnering with community healthcare systems to reduce post-discharge readmission;
- Keeping patients out of the hospital or from unnecessary medical procedures; and
- Determining what the goals of Community Paramedicine should be and which healthcare providers should be involved.

EMS Provider Health and Safety: The health and wellness of EMS providers is of primary concern to the medical directors. Physical and mental health challenges will detract from a healthy workforce. Services and oversight of provider care is an additional role for EMS medical directors (not necessarily providing all the care).

EMS Medical Director's Staff - Regents Hospital provides additional assistance to the SPFD by assigning one FTE equivalent for clinical quality management. Regent paramedics assigned to this position assist the medical directors by providing case reviews, qualitative protocol compliance, EMS continuing education and some EMS clinical supervision. This program continues to provide a good supplement to the SPFD EMS quality management program.

First Watch Software: Computer software is considered a support for EMS programs, but in this case compels primary recognition. Regents EMS has purchased the First Watch software program and wants to offer its benefits throughout Ramsey County. First Watch software can tie together emergency dispatch records, EMS and fire response records, hospital records and public health records to help determine the real-time status of public safety and public health. This includes using predictive analytics, early identification of impending disasters, planning for planned and unplanned multi-casualty incidents, and recognition of trends as they begin.

[15] Fahey, R.F., LeBlanc, P.R., and Molis, J.L. (2017). *Firefighter Fatalities in the United States-2016*. Quincy, MA: National Fire Protection Association.

Regents EMS Medical Directors are planning to use these technologies to assess needs and efficiencies for Community Paramedicine, systematizing data between agencies like dispatch, fire/EMS services, and hospitals, allowing system participants to access analytical data for quality management and decision-making processes, and planning for multi-casualty events. This includes the ability to provide sophisticated clinical analysis, and quality management metrics for the system. We support this process and see it as not only a best practice, but a *next practice* for the fire/EMS community.

The willingness of Regents to make this investment should be welcomed by the public safety and public health communities. There are times that resistance to change, fear of discovering poor performance, silo mentality (especially concerning the use of data), and lack of system thinking results in these investments yielding disappointing results.

Another advantage is that there needs to be only one purchase of the First Watch system, with the ability for agencies to purchase licenses to use it. Often, we find fire/EMS systems making redundant purchases, or not embracing analytic technologies because of high start-up costs. The stage has been set for agencies to participate in a cost-use sharing model that provides maximum efficiency for minimal costs.

Recommendation 22: The SPFD should provide leadership and advocacy of Regent's desire to employ First Watch as a primary tool for fire/EMS system management.

EMS Quality Management

Responsibility for EMS Quality Management is shared between the SPFD and Regents Hospital EMS Medical Directors. Two major methods of measuring quality are qualitative and quantitative measures.

Qualitative Assessment – The SPFD has a long history of partnering with Regents to provide excellent qualitative programs, including EMS report review, case review, and critical skills review. The next qualitative step would include joint case review with EMS dispatchers, all first responders, and medical system personnel. Case reviews with medical personnel should extend beyond the emergency department to include surgical centers, industry, freestanding emergency centers, athletic facilities, and mass gathering programs.

Quantitative Assessment – The SPFD needs to take the next step and include more quantitative measurement into their QM program. Expansion of EMS quality management will allow for expansion of areas measured, strengthen predictive analytics, quantification of decisions, evidence-based planning, and evidence-based training programs. Quantitative measures allow the SPFD to measure data including response times, protocol compliance, operator proficiency, outcomes, and financial data. Management can select single variables considered critical to quality, and the create data dashboards that monitor measures in real-time.

Advanced Airway Management: An example of operator proficiency is advanced airway management skills. Within the last decade, a major change in airway management techniques has

occurred. Traditionally, the endotracheal tube has been considered the gold standard for advanced prehospital airway management. The supraglottic airway (SGA) has been introduced to provide a back-up (rescue) airway. The SGA is done blindly and does not require visualization of the vocal cords. Some have replaced ET intubation with SGA intubation. Detractors claim that the airway is not for long-term use, and pressures from inflatable cuffs can be harmful.

The SPFD and the EMS Medical Directors have chosen to keep the ET as the primary advanced airway, with the SGA as a rescue device. In 2016, SPFD paramedics attempted advanced airway management on 197 patients, and ET intubation on 117 patients, with a 100 percent success rate for both. First attempt intubation was achieved on 97 percent of patients.

Table 28 shows the SPFD success rate compared to others in our database.

Table 28: ET Intubation Success Comparison

Source	Attempts	Success	% Success
Nova Scotia[16]	112	103	94.3%
Cady, C & Pirrallo, R.[17]	2,144	1,969	91.6%
Colwell, C.B., Et.al.[18]	124	120	96.7%
Garza, Et. al.[19]	1,066	909	85.3%
Wang, Et al.[20]	783	680	86.8%
Deakin, Et. al.[21]	52	35	71.2%
Gerich, Et. al.[22]	383	373	97.4%
Guire, Et. al.[23]	263	223	84.8%
El Dorado County EMS[24]	63	57	90.0%
SAINT PAUL (2007)[25]	103	89	86.4%

[16] Nova Scotia Emergency Health Services. (2005). Medical Quality Performance Measure Report. Unavailable: [On-line].

[17] Cady, C.E. & Pirrallo, R.G. (2005). The effect of Combitube use on paramedic experience in orotracheal intubation. American Journal of Emergency Medicine, 23(7), 868-71.

[18] Colwell, C.B., McVaney, K.E., Haukoos, J.S., Wiebe, D.P., Gravitz, C.S., Dunn, W.W. & Bryan, T (2005). An evaluation of out-of-hospital advanced airway management in an urban setting. Academic Emergency Medicine 12(5), 417-22.

[19] Garza, A.G., Gratton, M.C., Coontz, D., Noble, E. & Ma, O.J. (2003). Effect of paramedic experience on orotracheal intubation success rates. Journal of Emergency Medicine 25(2), 251-6.

[20] Wang, H.E., Kupas, D.F., Paris, P.M., Bates, R.R., & Yealy, D.M. (2003). Resuscitation 58(1), 49-58.

[21] Deakin, C.D., Peters, R., Tomlinson, P., & Cassidy, M. (2005). Securing the prehospital airway: A comparison of laryngeal mask insertion and endotracheal intubation by UK paramedics. Emergency Medicine Journal 22, 64-67.

[22] Gerich, T.G., Schmidt, U., Hubrich, V., Lobenhoffer, H.P., & Tscherne, H. (1998). Prehospital airway management in the acutely injured patient: The role of surgical cricothyrotomy revisited. Journal of Trauma 45(2), 312-314.

[23] McGuire, T. (2001, February). EMS News: Alameda County Emergency Medical Services Agency Newsletter 16(1). Available: [On-line.], p. 1.

[24] El Dorado County EMS (2004). EMS quality management data. Unpublished Data.

[25] SPC/TriData (2007). Comprehensive Management Study of the Saint Paul Fire & Safety Services Department. Arlington, VA: SPC/TriData Corporation.

Source	Attempts	Success	% Success
Ohio EMS[26]	3,686	2,531	68.67%
Portland, OR Fire[27]	370	336	90.8%
Alameda, CA[28]	99	57	57.58%
Palo Alto, CA[29]	24	11	45.83%
Medic EMS[30]	156	120	**76.9%**
Seminole County, FL[31]	97	51	**52.56%**
Overall	**9,422**	**7,239**	**76.83%**
SAINT PAUL (2017)[32]	**117**	**117**	**100% (P=.0001)**

Analysis of the ET intubation data revealed that the SPFD success rate is significantly higher than the EMS systems compared in the database.[33] Table 29 compared the current ET success rate with the FY 2006 success rate.

Table 29: Saint Paul ET Intubation Success 2006 v. 2016

Year	Attempt	Success	% Success
FY 2006	103	89	86.41%
2016	117	117	100% (p=.0001)

The comparison shows significant improvement in ET intubation skills between 2006 and 2016. It is unknown whether this was affected by the addition of RSI or video laryngoscopy. In 2016, Saint Paul paramedics chose to attempt SGA intubation on 93 patients with 87 successful intubations (94%). Anecdotally, this is a high success rate. As with ET intubation, we could not determine if successful intubation correlated with successful outcomes.

Recommendation 23: The EMS Medical Directors and the SPFD EMS staff should determine which operator skills are most important to measure.

EMS Quality Management data should be analyzed using traditional statistical methods and Statistical Process Controls (SPC). The former allows for precise quantitative measures, while

[26] OEMS. (2003). The Run Report: Bringing you information from EMSIRS. Ohio Division of Public Safety. www.ohiopublicsafety.com

[27] SPC/TriData. (2006). Comprehensive Assessment of the Portland, OR Fire and Rescue. Arlington, VA: SPC/TriData Corporation.

[28] SPC/TriData. (2010). *Assessment of EMS for the City of Alameda*, CA. Arlington, VA: SPC/TriData

[29] SPC/TriData. (2011). *Assessment of EMS in Palo Alto, CA*. Arlington, VA: SPC/TriData.

[30] SPC/TriData. (2014). *Comprehensive Assessment of EMS in Scott County, IA.* Arlington, VA: SPC/TriData

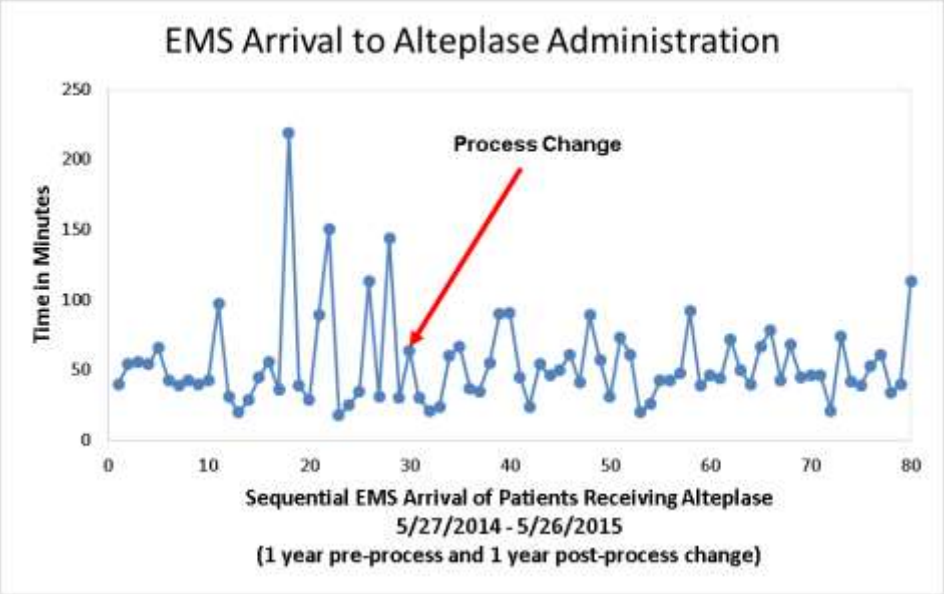
[31] SPC/TriData. (2015). Management/Organizational Assessment Study - Operational Efficiency Analysis of Seminole County Public Safety Department. Arlington, VA

[32] Information received from Saint Paul Fire Assistant Chief for EMS.

[33] Our databases did not have information concerning attempts, medication assist, video laryngoscope assist or other devices.

the later analyzes data from a quality focus. The EMS Medical Directors adoption of the First Watch system (with some modification) should provide the ability to perform these tasks. Figure 16 is an example of SPC data measuring EMS on scene to hospital administration of stroke medication.

Figure 16: EMS Arrival to Stroke Medication Time



Note: Shows how the addition of a process resulted in decreased EMS arrival to Alteplase Time[34]

Community Paramedicine

SPFD has taken a slow, calculated approach to the Community Paramedic program. Instead of rushing in full force to a program that is just beginning to find its place in EMS, the approach has been to start slow, be deliberate, and measure along the way. Currently, the program is funded by a grant received from Regents Hospital.

Community Paramedicine (also known as Mobile Healthcare, expanded scope of service/practice, etc.) involves using EMS and other healthcare professionals to fill the gaps that many communities experience concerning out-of-hospital care. These gaps are different in each community and may include the need to reduce readmission, medication compliance, overuse of emergency services, and creating a nexus between community medicine, social services, and healthcare facilities. In many communities, programs like community nursing and social services have handled these situations, while in others, gaps still exist. The SPFD is taking the reasonable

[34] Bourdin, R., Hussein, H., Burnett, A., et al. (2015). *Decreasing Time from Patient Arrival via Emergency Medical Services to CT Imaging and Alteplase Administration for Suspected Acute Ischemic Stroke Patients*. Poster Presentation. Presented at the 2015 American Society of Medical Quality.

and prudent approach of conducting a needs assessment, while introducing different approaches to determine effectiveness.

The SPFD started with one community paramedic who concentrated on reducing service recidivism and reduction in readmission to hospitals after treatment for conditions such as congestive heart failure. A focused program, interaction with healthcare partners, and active medical oversight has allowed for close measurement of results.

The formal Community Paramedicine program included patient metrics 90 days prior to enrollment, program participation, and 90 days post participation. As of May 2017, the program enrolled 57 patients. Of these, 25 patients completed all three steps, 10 patients completed program participation but it has been less than 90 days since the last visit. Three patients are currently receiving visits, while 19 patients did not complete the program due to death, subsequent refusal, or lost to follow-up.

The figure below compares the 25 patients who completed the Community Paramedicine program to 18 similar patients who were not enrolled.

Figure 17: Healthcare Utilization-Community Paramedicine Participant Group, 25 Participants

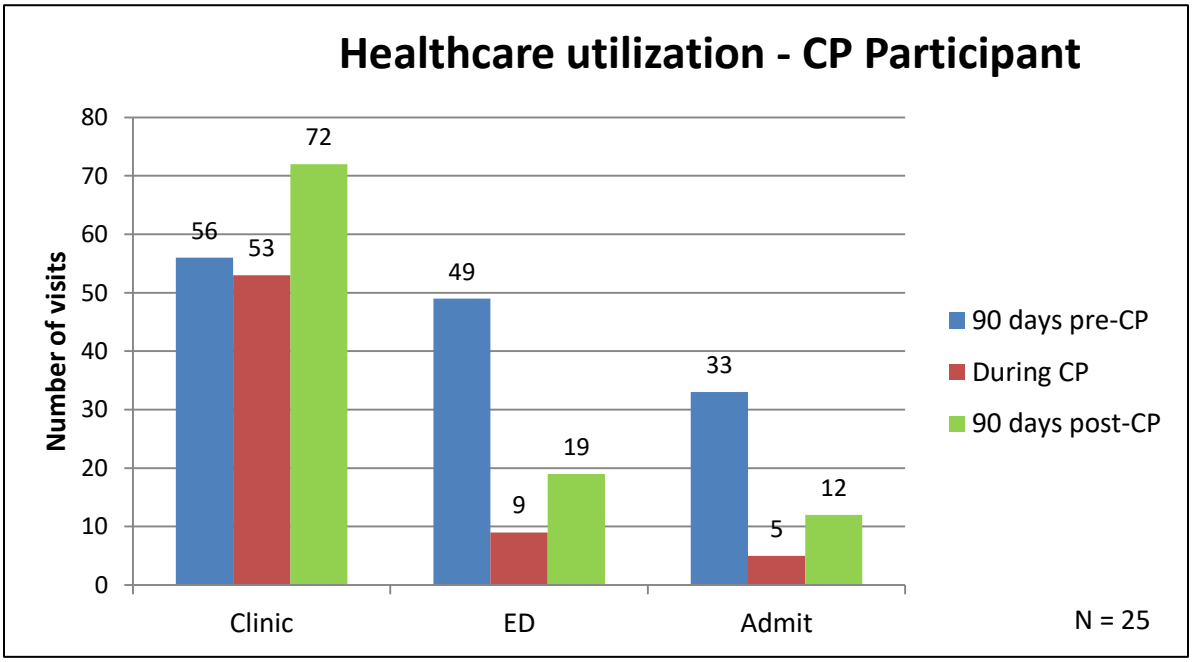
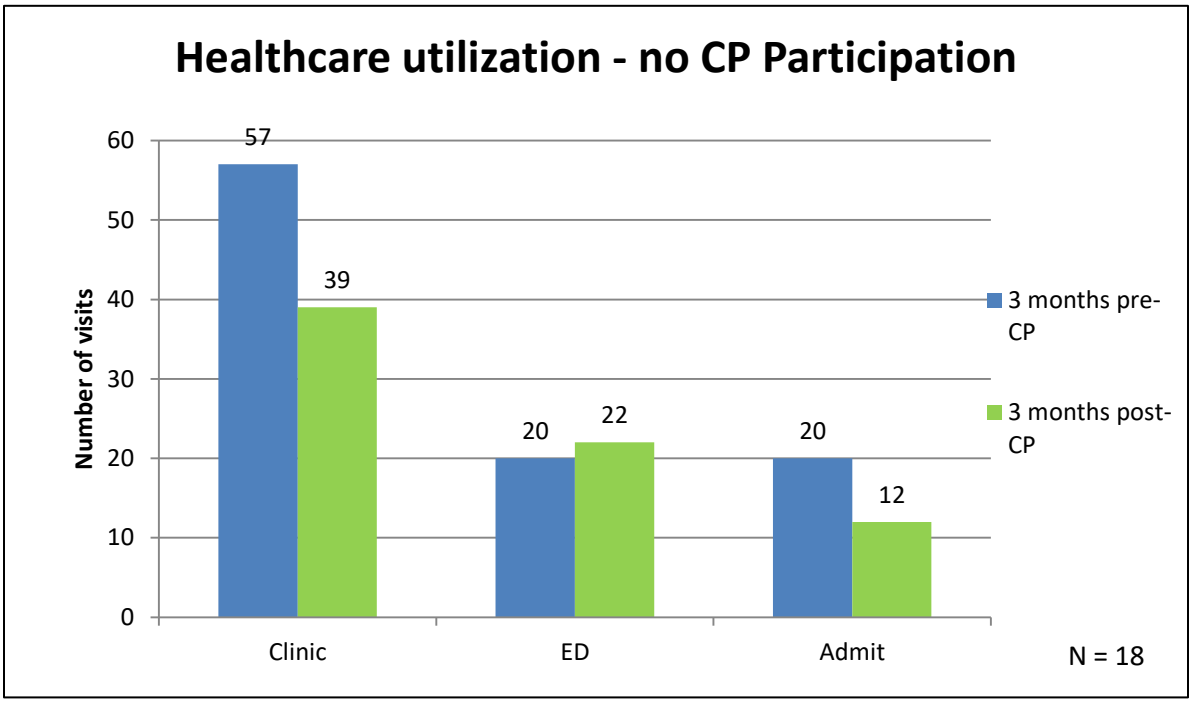


Figure 18: Healthcare Utilization- No Community Paramedicine Participation (18 Non-Participants)



The data is still insufficient to make strong conclusions, but preliminary results indicate major benefits. Those participating decreased calling 911 by 61 percent and ED visits by 64 percent. At the same time, the non-participating group had a 10 percent increase in ED visits and a 40% decrease in admissions.

Some noted that within 90 days after the program conclusion, the CP participants had a 29 percent increase in clinic visits, while the non-participants had a 32 percent decrease in clinic visits. This should be viewed positively, because a clinic visit costs much less than an ED visit.

Next Steps for Community Paramedicine: Recently, the first SPFD Community Paramedic retired and was replaced by another experienced paramedic. The medical directors are analyzing outcome data to confirm their initial findings. Currently, the CP program is continuing.

There are other variables for CP consideration. There are many responses to local mental health facilities that may not warrant paramedic response and transportation. A community paramedic can perform an initial assessment and determine if treat and release, non-emergency referral to ED or freestanding centers, or E911 referral is necessary. These alternative services may be useful in reducing emergency response to acute and extending rehabilitation facilities, psychiatric centers, corrections facilities and similar facilities. If Community Paramedicine is found advantageous, the SPFD can augment the system as follows.

- The Community Paramedic reports directly to the Assistant Chief of EMS Operations. As the program expands, this will become less practical. Direct responsibility should begin shifting to an EMS Coordinator (EMS Captain). Once the program reaches five personnel, the lead person should be an EMS Captain.

- Administratively, the Community Paramedicine program could be merged with the Ambulance 51/Ambulance 52 program. This could enhance the CP program because many of the CP duties can be performed by EMTs or a combination paramedic/EMT team.

Recommendation 24: Allow some Community Paramedicine skills to be performed by EMTs.

A CP program could benefit the department by having another career path for experienced or new personnel. As people live longer, guaranteed pension plans are at risk. Several agencies have increased the age for retirement. In public safety, an increase in age of retirement could require people to work longer at a physically demanding job. This could lead to an increase in accidental disability retirements. Having a CP program could provide an alternative for those needing to complete more service instead of being paid non-taxable disability payments.

The CP program could also hire those who have paramedic or EMT licensure, but cannot meet the physical requirements for firefighter. These alternatives could increase the City's commitment to diversity by offering opportunities to residents with disabilities.

The need to expand the Community Paramedicine program will depend on the several variables, including: outcomes for current services, reimbursement for care, state provider scope of practice regulations and city finances. The initial step would be for the SPFD to conduct a comprehensive needs assessment to determine the health care gaps within the City and which ones the SPFD could impact. The comprehensive assessment should be accomplished within one year and if indicated, expansion could begin.

Recommendation 25: The SPFD should conduct a comprehensive needs assessment to determine what healthcare gaps could be affected by an expanded Community Paramedicine program.

Health and Safety

SPFD does not have a fulltime safety officer. There is a safety committee comprised of Union members and the committee meets on a regular basis. However, there are issues with coordination and continuity once safety and health issues become known. Our 2007 recommended a full-time health and safety officer and the same issues then remain true now. The SPFD has grown past 400 members and handles many more calls, thus there are more exposure opportunities. Also, cancer has continued as a major concern among fire and EMS providers.

Recommendation 26: Hire a full-time health and safety officer. The individual should knowledgeable about the issues of fire and medical service delivery, but does not have to be a uniformed member of SPFD.

Automatic External Defibrillators (AEDs): AEDs are a low cost means to provide medical care for those experiencing a cardiac arrest. None of the light-duty vehicles have AEDs, so the

staff personnel and command officers are unable to provide medical assistance, if they arrive first at a cardiac incident. AEDs are low-cost and low-maintenance items proven top same lives. There are service organizations that would probably relish the idea of contributing to the safety and well-being of the community by donating AEDs for all fire department (and other city) vehicles.

V. FACILITIES AND APPARATUS

This chapter discusses the fire stations and training facilities and the capital replacement plan to update the facilities. Also included here is a discussion of the SPFD apparatus and replacement schedule.

SPFD Facilities

SPFD provides its services from 15 strategically located fire stations. Quite a few of the stations are past the useful service expectancy for fire stations, which is generally considered to be about 50 years. The good news is that fire stations have been well cared for and there are no critical issues. A full-time facilities manager is on staff, and problems are usually corrected quickly. The Department has also made upgrades to several stations over the past few years to allow changes in where apparatus are located. For example, Station 19 (2530 Edgecombe Drive) has just been upgraded with an additional apparatus bay. The addition was needed to allow a ladder truck from Station 1 to be relocated to Station 19.

Station Maintenance and Replacement – The fire stations, even when well maintained, present space challenges for the SPFD. Fire apparatus is much larger now than 40-50 years ago, and space is at a premium in all but the most recently constructed stations. Stations also lack amenities for female firefighters that are required in newer ones, such as separate showers, locker rooms, restrooms, and sleeping quarters. SPFD staff has modified fire stations as best as they can but the facilities in many stations are still inadequate. Figure 19 shows the small kitchen area at Station 17.

Figure 19: Kitchen at Station 17

Five stations are over 80 years old and five more are over 50 years. Fire Stations 1 and 8 are the only stations constructed in the past 35 years. The newest are Station 8 constructed in 2006, and Station 1, constructed in 2010. Station 1 is the location of fire administration. In addition to the

fire stations, SPFD also has a training/ maintenance facility and an EMS Academy. The EMS Academy is located at what used to Station 1, before it was merged with Station 10 at 754 Randolph Avenue.

Table 30: SPFD Facilities

Constructed/ Addition	Age (Years)	Square Feet	Property Name	Address
1890	127	7490	Fire Station #11 (Maintenance Facility)	676 Bedford Street
1908	109	10294	Fire Station #18	681 W. University Avenue
1921	96	9016	Fire Station #20	2179 W. University Avenue
1930	87	7229	Fire Station #5	860 Ashland Avenue
1930	87	7920	Fire Station #7	1038 Ross Street
1930	87	5215	Fire Station #17	1226 Payne Avenue
1958	59	9234	Fire Station #9	1924 E. Maryland Avenue
1958/2017	59/0	9234/4832	Fire Station #19	2530 Edgecombe Drive
1958/2007	59/10	9234/1579	Fire Station #22	225 Front Street
195?	60+	1881	Classroom Building	1683 Energy Park Drive
195?	60+	1872	Metro Training Site	1691 Energy Park Drive
1964	53	10458	Fire Station #6	33 Concord Street
1964	53	10458	Fire Station #51 (EMS Academy)	296 W. 7th Street
1968	49	12401	Fire Station #4	505 Payne Avenue
1968	49	12200	Fire Station #24	273 White Bear Avenue
1975	42	21766	FD-PD Repair &Service	1675 Energy Park Drive
1975	42	7068	Fire Reserve Building	1679 Energy Park Drive
1978	39	12693	Fire Station #23	1926 Como Avenue
1981	36	4500	Fire Training Tower	1690 Energy Park Drive
1982	35	14212	Fire Station #14	111 N. Snelling Avenue
2006	11	16244	Fire Station #8	65 E. 10th Street
2010	7	9800	Fire Station #1	754 Randolph Avenue
2010	7	56000	Administration	1000 West 7th Street
Average Age	57			

The oldest active station (18), constructed in 1908, has provided 109 years of service to the city. Though Station 18 is not the oldest, it is the first of six SPFD facilities slated for replacement. Of the 23 SPFD facilities, 13 (56 percent) are 50 years or older and six (26 percent) are 80 years or older. A 20-year capital development planned to begin in 2017 is expected to replace five of the oldest stations and the training facility. It was anticipated that Station 20 would be replaced beginning sometime in 2017, however it may be 2018 before the project begins. Of the five stations, three are to have four apparatus bays and two are to have three bays. Facilities slated for replacement, year and estimated cost are:

Table 31: 20-Year Facilities Replacement Plan, 201635

Year	Facility	Proposed	Estimated Cost
2017	Fire Station 20	Four-Bay Station	$7.76M
2020	Fire Station 7	Four-Bay Station	$9.64M
2024	Fire Station 17	Three-Bay Station	$10.89M
2028	Training Center	Burn Building, Classrooms, Offices	$38.58M
2032	Fire Station 18	Four-Bay Station	$22.96M
2036	Fire Station 5	Three-Bay Station	$25.93M

All of the fire stations are slated to be three or four bays with a cost range of just under $8M in 2017 to almost $26M in 2036. The estimates may be based on already known particulars having to do with site acquisition, engineering and other anticipated costs. And cost increases for future years are likely in the higher amounts. Still, the increases from 2024 to 2032 and 2036 seem uncharacteristically high. We also do not understand why three of the five stations need to be four-bay stations. Because SPFD does have many older fire stations space is problematic at many of them. However, four bays are generally only needed for situations where the storage of specialized apparatus will be made alongside the typical engine, truck, and medic. Building stations that are too large creates other issues such as higher maintenance costs. It also adds to longer turnout times for firefighters that must go from other areas in the station to the apparatus floor.

Recommendation 27: Conduct a facility space assessment before deciding on the size of new fire stations, and include firefighters in planning of new facilities.

Between 2007 and 2016, major work was completed at most of the fire stations. The City is to be commended on the way stations are maintained. Most cities do not provide this level of care and upgrading for fire stations. It is a key reason why the older stations in Saint Paul are still in relatively good shape after 60, 70, 80 years, and more. Over the past few years fire stations have all been outfitted with:

- Vehicle exhausts removal systems
- GPS receivers

[35] Information provided by the SPFD.

- Upgrades to emergency notification (speakers, lighting, display boards)
- Washers and dryers for cleaning fire gear (important to reduce carcinogens)

A valid maintenance concern of the firefighters is that many fire stations have carpeted floors in areas outside of the apparatus bay, and they need to be cleaned every year - which they are not. Using carpet in fire stations is not a particularly good practice. They require more maintenance and they have to be replaced every few years, whereas tile and concrete floors do not. And carpet is susceptible to harboring germs and dirt brought in by firefighters from calls.

Recommendation 28: Discontinue the practice of using carpet in fire stations. Whenever possible, tile or other non-porous surfaces should be used.

Station Locations – Fire stations in Saint Paul are generally in good locations. Most are on primary roads with good access. While this study was not tasked to conduct a station location analysis, it was important to consider their locations, because they impact strategic decisions about service delivery. A list of fire stations and recommended improvements and repairs is provided in the Appendix.

Concerning the location and replacement schedule of facilities, Stations 20 and 23 are where location changes should be considered. Station 20, located at 2179 W. University Avenue was constructed in 1921. It has one ladder truck and no medic unit. The location of Station 23 is no longer viable because the site is too small and the Light-Rail line along University Avenue makes it difficult to exit the station, and is even worse backing in. It is the first scheduled for replacement under the current plan. A potential site of 4.5 acres near Butler Road and Snelling Avenue is being considered for what would be a four-bay station, at an estimated cost of $7.8M. Constructing a 15,500 square foot station for one ladder truck does not make sense – fiscally or operationally. A better solution is to select a location to allow a consolidation of Stations 20 and 23.

Figure 20: Station 18, W. University Avenue

Figure 21: Station 18 Egress on University Avenue with Light Rail

Station 23, located at 1926 Como Avenue, has an engine and one of the three Super-Medics. It was constructed in 1971. Though it is not one of the facilities slated for replacement, its location on Como Avenue on the city's boundary is not particularly good, as much of its effective coverage area is outside of Saint Paul. The distance between Stations 20 and 23 is only 1.9 miles, with a midpoint of less than 1 mile.[36]

Depending on the final location selected, it may be possible to combine Stations 20 and 23 with the SPFD training facility, which is also slated for replacement and is nearby on Energy Park Drive. The burn building at the training facility is in poor condition with other structures like the classrooms and offices built in the 1950's. The cost of the training facility is estimated at $38.6M. If combined with the fire station, the cost would likely be far less since the site and structures of the fire station would be shared.

Figure 22: Burn Building

[36] https://www.google.com/maps/dir/2179+University+Ave+W,+St+Paul,+MN+55114/1926+Como+Ave,+St+Paul

Figure 23: Classroom Building, Constructed in the 1950's

Recommendation 29: Revise the facilities plan and consolidate Stations 20 and 23. At the same time consider the feasibility of constructing a new training facility on the same site.

Fire Stations and District Council Associations

Fire stations are located throughout the 17 Community Council neighborhoods. Fire and EMS units serve areas across the city, not just the neighborhoods where they are located. They are dispatched to calls using the latest technology, Automatic Vehicle Locator (AVL), which means the closest available unit, is usually sent to the call. AVL dispatching is an improvement over the dispatching system used in the past, which dispatched a unit from the station closest to the incident even though another unit may have been closer.

Descriptions of the stations, units assigned and neighborhood council where each station is located follows:

Station 1 is located in the Summit Hill Community (Council 16). Constructed in 2010 and consolidated with Station 10. It is the newest station. Located at Station 1 is one engine, a dual staffed medic and Rescue Squad 3. Ladder 10, which was previously at this station, was relocated to Station 19 to improve services to the Highland Park community. The squad crew is a manpower unit and also the technical rescue resource for Saint Paul. Nine personnel are on duty at Station 1.

Figure 24: Station 1/ 10 – 754 Randolph Avenue

Station 4 is located in the Payne-Phalen Community (Council 5). It has one engine, a dual-staffed medic and a squad; the squad being one the three in the city. This squad crew is also trained to respond to hazardous material incidents. Nine personnel are assigned to Station 4, four personnel for the engine and five for the squad.

Figure 25: Station 4 – 505 Payne Avenue

Station 5 is located in the Summit- University Community (Council 8). It has one engine and a recently added dual-staffed medic unit. Four personnel are on duty at Station 4, 24/7. Station 5 is one of three fire stations serving the community for 87 years, as it was constructed in 1930. (Stations 7 and 17 are the others.) Station 5 is not slated for replacement for another 19 years (2036). By then the station will have been in use for 106 years. The addition of a dual-staffed medic unit was a much needed improvement, though a better solution would have been to add a Super Medic, which is independently staffed.

Figure 26: Station 5 – 860 Ashland Avenue

Station 6 is located in the West-Side Community (Council 3). Station 6 is the only fire station in Saint Paul with two engines (6 and 15). Engine 6's crew besides firefighting staffs the fire rescue boat when needed. A dual-staffed medic unit is functionally attached to Engine 6. Engine 15's crew is trained in aircraft rescue firefighting and rescue (ARFF) to handle incidents at the nearby Holman Airport. Eight personnel are on duty at Station 6.

Figure 27: Station 6 – 33 Concord Street

Station 7 is located in the Dayton's Bluff Community (Council 4). Station 7 has one engine, one ladder, and one District Chief. It is only one of the two fire stations that do not have a medic unit, in part due the lack of space (Station 20 is the other). Station 7 is slated for replacement around 2020. The fire administration desired to move the Super-Medics currently at Station 9 to Station 7 and the ladder from Station 7 to Station 9 because it was felt the medic unit would be more valuable near where the highest call volumes were occurring. However, the plan to move the ladder and medic unit were nixed because of pressure from firefighters. Nine personnel are on duty at Station 7. The analysis determined that moving the Super-Medic from 9 to 7 is not a good move, though Station 7 does need a medic unit.

Figure 28: Station 7 – 1038 Ross Street

Station 8 is located downtown in the Capitol/ River Community (Council 17). Station 8 is located within a state-office facility and was constructed in 2006. One engine, one ladder, and a Super-Medic is located there, as is a District Chief. Daily staffing is 12; four for the engine, five for the ladder, two for the medic and a District Chief. When staffing is less than 12, the Super-Medic is not in service, and the engine and medic are dual-staffed.

Figure 29: Station 8 – 65 East 10th Street

Station 9 is located in the Greater East Side Community (Council 2). Station 9 has one engine and a Super-Medic unit. Six personnel are assigned daily to Station 9, four on the engine and two for the medic unit. As with the other two stations with Super-Medic units (Stations 8 and 23), when there is insufficient staffing on a particular day, the Super-Medic sat Station 9 may not be in service and the engine/ medic are dual-staffed.

Figure 30: Station 9 – 1924 East Maryland Avenue

Station 14 is located in the Union Park Community (Council 13). It has one engine, a rescue squad and a District Chief. A dual-staffed medic unit is also located at this station. Ten personnel are on duty each day.

Figure 31: Station 14 – 111 N. Snelling Avenue

Station 17 is located in the Payne-Phalen Community (Council 5). Station 17 has one engine, the crew of which also responds on medical calls as the engine and medic is dual staffed. Station 17 is one of three fire stations constructed in 1930 and is slated to be replaced under a proposed 20-year facility replacement plan. Four personnel are on duty at Station 17 each day.

Figure 32: Station 17 – 1226 Payne Avenue

Station 18 is located in the Thomas-Dale/ Frogtown Community (District 7). Station 18 has one engine, the crew of which also dual staffs a medic unit and one ladder. Constructed in 1908, Station 18 is the oldest fire station. It is not slated for replacement until 2032, which will make it 124 years old. Four other stations and the training complex are slated for replacement before Station 18. The facility appears to be in good condition so it is not unreasonable that it should be down the list of facilities to be replaced. The station is also in centrally located, with good east to west access along University Avenue. Eight personnel are on duty at Station 18.

Figure 33: Station 18 – 681 West University Avenue

Station 19 is located in the Highland Park Community (District 15). Station 19 has one engine, one medic (dual staffed) and one ladder. A recent renovation allowed the ladder truck from Station 1 to be relocated to Station 19. The reason for moving it was to improve service to areas in and around Highland Park. When the engine/medic at Station 19 is on a call, the nearest stations (10 and 14) have response times to Highland Park that are longer than in other areas of the city, where stations are closer together. Eight personnel are on duty at Station 19.

Figure 34: Station 19 – 2530 Edgecombe Drive

Station 20 is located in the Saint Anthony Park Community (District 12). Constructed in 1930, it is the second oldest fire station. It is planned that Station 20 will be replaced sometime in the next year or two. Station 20 has one ladder and no medic unit. A previous recommendation of this study is to combine Stations 20 and 23. In the interim, the Super-Medic sat Station 23 should be moved to Station 20. Four personnel are on duty at Station 20 each day.

Figure 35: Station 20 – 2179 W. University Avenue

Station 22 is located in the North End Community (District 6). Station 22 has one engine that also dual-staffs a medic unit, and one ladder. Eight personnel are on-duty at Station 22 each day.

Figure 36: Station 22 – 225 Front Street

Station 23 is also located in the Saint Anthony Park Community (District 12), the same District as Station 20. One engine and a Super-Medic are located at Station 23. Notable is its location on the border of Falcon Heights, a community with volunteer fire services and which contracts EMS from the city of Minneapolis. Automatic aid is provided to Falcon Heights based on closest unit response, thus Station 23 often responds into Falcon Heights. To better serve Saint Paul and improve efficiency, Station 23 can be consolidated with Station 20. Automatic aid for Falcon Heights can still be provided when SPFD units are the closest to the incident. Six personnel are on duty at Station 23.

Figure 37: Station 23 – 1926 Como Avenue

Station 24 is located in the Eastview-Conway-Battle Creek-Highwood Hills Community (District 1). Station 24 has one engine/ dual staffed medic unit and one ladder. In land area, District 1 is the largest, though much of the area is undeveloped, such as the area of Pigs Eye Lake. Nine personnel are on duty at Station 24 each day.

Figure 38: Station 24 – 273 White Bear Avenue

Overall, fire stations throughout the City are in good shape. Improved efficiency can result if Stations 20 and 23 are consolidated and there is need to rebuild a few older stations over the next 20 years – which is already planned.

Apparatus

SFFP has a fleet of 60 response vehicles, not including cars and other light-duty vehicles. The vehicles observed during our station visits were well maintained. It was also clear that personnel take care of the vehicles. There were no major issues reported about the fleet in the meetings we had with SPFD staff. The fleet includes first-line units which are used every day and reserves that are needed when a first-line unit breaks down or is in the shop for maintenance. The first-line suppression fleet includes 15 engines, 7 ladder trucks, and 3 squads. For medical calls there are 13 medic units – one for every station except Stations 7 and 20.

Figure 39: Typical First-Line Engine and Ladder Truck (Station 8)

It is necessary that the SPFD has a variety of vehicles, some of which are specially designed for a single purpose and used only a few times each year. The value of a particular vehicle or resource is not measured in how many times it may be used each year but also the risk if an event were to occur and the resource is not available. For example, water rescues and fires on the River occur infrequently; however, the risk is present and the City is wise to provide for such events (fire rescue boat and crew) when they do occur.

Figure 40: Boat, Utility Vehicle, and Gator at Station 6

Figure 41: Hazardous Material Response Vehicle

First-Line Units - The condition of first-line units is very good. SPFD has a plan with the goal of replacing engines and ladder trucks around when they are 12 to 13 years old. The average age of engines is 10.9 years and ladders 6.3 years. The two oldest engines (10 and 14) are to be replaced in 2017, so the average age of the engine fleet will be somewhat less than now.

Figure 42: First-Line Units

Unit	Year	Age	Unit	Year	Age
Engine 4	2008	9	Engine 15	2008	9
Engine 5	2006	11	Engine 17	2007	10
Engine 6	2002	15	Engine 18	2006	11
Engine 7	2008	9	Engine 19	2012	5
Engine 8	2012	5	Engine 22	2007	10
Engine 9	2008	9	Engine 23	2002	15
Engine 10	2000	17	Engine 24	2007	10
Engine 14	1998	19	**Average**		**10.9**
Ladder 7	2014	3	Ladder 20	2016	1
Ladder 8	2006	11	Ladder 22	2004	13
Ladder 10	2015	2	Ladder 24	2010	7
Ladder 18	2010	7	**Average**		**6.3**
Squad 1	2016	1			
Squad 2	2006	11			
Squad 3	2016	1			
Average		**4.3**			
Medic 4	2016	1	Medic 17	2013	4
Medic 5	2008	9	Medic 18	2013	4
Medic 6	2015	2	Medic 19	2013	4
Medic 8	2016	1	Medic 22	2010	7
Medic 9	2013	4	Medic 23	2015	2
Medic 10	2015	2	Medic 24	2015	2
Medic 14	2010	7	**Average**		**3.8**

There are no concrete standards for replacing fire apparatus, though 15 years for engines and 20 for ladder trucks are considered the norm. That SPFD is replacing its vehicles a few years earlier should be of some concern; a primary reason they are being replaced sooner is because of the use they get responding on medical calls.

SPFD dispatches a full assignment of three engines, one ladder truck and a rescue squad on automatic alarms. Most fire departments no longer send this much equipment on automatic alarms as most are turn out to be malfunctioning or false alarms. The fleet is in good shape and will continue to be so but the city will need to maintain its aggressive policy of fire vehicle replacement if fire units continue to get the high use they get now. The cost to replace an engine is about $550-$600K and even higher for a ladder truck $1.2M.

Vehicle Replacement Schedule – SPFD has a five-year plan for replacing its vehicles. In 2017-18, a new ladder truck, rescue squad and medic unit are to be purchased at a combined cost of $1.93M. The anticipated cost of replacing SPFD units over the five years, if all purchases are approved, will be $10.4M, an average of $2.1M per year. This cost does not include other vehicle purchases such as for staff and light-duty vehicles.

Year	Vehicles	Projected Cost[37]	Total
2017-18	1 Ladder Truck	$1,200,000	
	1 Squad	$528,000	
	1 Medic Unit	$231,000	$1,959,000
2018-19	2 Engines	$1,109,000	
	3 Medic Units	$727,000	$1,836,000
2019-20	1 Ladder Truck	$1,287,000	
	1 Engine	$582,000	
	2 Medic Units	$509,000	$2,378,000
2020-21	3 Engines	$1,834,000	
	2 Medic Units	$535,000	$2,369,000
2021-22	2 Engines	$1,284,000	
	2 Medic Units	$561,000	$1,845,000
		Total Cost	**$10,387,000**

Saint Paul is spending a lot of money on fire vehicles to respond on what are minor medical calls. There is little dispute that first response by fire units on serious medical calls such as heart attacks is good policy and saves lives. In our opinion however, the current policy where fire vehicles respond to every medical call results in replacing expensive engines and ladders when they may have a few more years of service if they did not respond to every medical call.

Fire Vehicle Mileage – An example of added wear is the mileage on some fire vehicles is Engine 5, which until recently did not dual-staff a medic unit. It has 103,000 miles on it, according to data. The unit is 11 years old which translates to 9,342 miles per year. Squad 2, which is 11 years old, has 154,344 miles - 14,031 miles per year. Even ladder trucks, which typically respond to fewer calls as they do not respond to medical calls as frequently as engines, have high mileage. Ladder 10, which is only two years old already, has 14,571 miles ((7,285 per year).

Reserve Units – First-line units do break down and they must be taken out-of-service for maintenance. For these reasons fire departments must have a reliable fleet of reserve units. Reserve units are used almost every day by a different station, so they often get less care then first-line units, which are assigned to one station.

SPFD has four reserve engines, three reserve ladders, and two reserve squads. There are nine reserve medic units. Two of the reserve engines are 26 years old and are to be replaced within the next month or so. The oldest reserve ladder is 21 years old and the oldest squad is 22. While the age of these units are beyond the 15-20 year replacement recommended for fire vehicles, it is the mileage that is of most concern. The average miles per year on the reserve engines is high (13,900) as it is also for the reserve squads (16,070).

The wear on fire vehicles is not usually related to mileage but engine hours. Typically, fire suppression vehicles respond to a call and then spend time idling or pumping. For most

[37] Rounded cost figures.

departments it is engine hours that are of most concern – and which drives the need to replace a vehicle because it is worn out or because maintenance costs become too high. For Saint Paul it is the mileage and wear and tear of daily driving over city streets that is causing the wear – not fire duty. A strategic change is needed so that the majority of medical calls are responded to by ambulances not fire trucks. Fire trucks can weigh between 15 and 20 tons and cost upwards of $.5M-$1.2M while medic units weigh about 1 ton and cost $250K. A two-person medic crew on a light-duty ambulance is a more cost-efficient method to handle the majority of calls responded to by the SPFD – medical calls.

Recommendation 30: Follow the current replacement plan for SPFD vehicles but change the model of dispatching a full assignment to automatic alarms.

SPFD Safety Committee – The safety committee is a subcommittee of the labor/ management group. It also participates with the city's safety committee. Major focus of the committee is to look at safety problems and accidents after the fact. There is no ongoing health program and most safety issues consider the problem "after the fact."

They stated concerns that the department does not follow through on issues of concern to firefighters. The group is also that the FC no longer meets with them to discuss issues, as was previously done. Major issue is that no one is identified to take responsibility for a safety/ health issue once it is identified.

Concerned about air quality at fire stations. The FD does not have an air quality measurement protocol. All fire stations are equipped with diesel exhaust removal systems. These are mechanical diesel exhaust systems where a hose must be connected to the exhaust pipe of the apparatus when it is being driven into a fire station.

Planning – Like many fire departments the SPFD does not have a planning section. The Executive Services Director is the individual responsible for gathering whatever data the Department needs for reports. However, this individual already has a full plate managing the budget and overseeing other administrative functions. To be able to continue the level and scope of analysis city officials expect of agencies (and completed as part of this project) it is essential that a planning section be initiated in the SPFD.

An effective planning section that can provide factual analysis on important topics such as staffing, response times, workloads, and other important deployment considerations should make it easier to make changes. Otherwise, SPFD may continue to defer changes that can improve services when they are politically unpopular. Without good analysis and information it is easy for those with agendas to nix changes when they 'spoil the soup' with false information. Recommendations to initiate a planning function were made in two previous studies (Buracker, 1989 and TriData, 2007).

Recommendation 31: Begin the process to create a planning section within the SPFD. The positions within this section initially should be an experienced manager and data/GIS analyst. It is essential that SPFD be able to continue the types of analyses conducted in this study, going forward.

APPENDIX 1. 2007 NEWS ARTICLE

Cop's father died waiting for help[38]

PUBLISHED: March 21, 2007 at 11:01 pm | UPDATED: November 14, 2015 at 4:06 am

Mike Ernster doesn't need a 326-page, six-month report to know there is something wrong with the St. Paul Fire Department. In August, he had his mom call them when his father fell ill in his parents' St. Paul home. Jerry Ernster, a 70-year-old retired city surveyor, had a previous bout with cancer but didn't appear to be in any imminent danger until he complained of trouble breathing, his son said.

An off-duty St. Paul police officer, Mike Ernster went to his parents' home and asked a 911 operator if the nearest ambulance, at White Bear Avenue and Burns Street, was on its way. The medic unit was on another call, a dispatcher said. He asked about the ladder company in the same station: The city's fire trucks carry defibrillators and firefighters are trained to make an initial response to a medical emergency. But the fire crew was on another assignment, and the dispatcher sent the next closest medic unit, from Herbert Street and Maryland Avenue, almost six miles and nearly twice as far away as Station 24.

Ernster soon realized that his father wasn't just ill but had gone into full cardiac arrest. He told his mom to tell the 911 operator that the fire department needed to "step it up," as the situation was growing more dire. "I started doing CPR on my dad," recalls Ernster, who has been on the force for about 13 years and had been trained in first aid and basic emergency response. "At some point, you know the job kind of takes over."

He tried to resuscitate his dad for as long as 14 minutes, he estimates now, while emergency medical personnel were on their way. It was to no avail. Ernster's father was pronounced dead at his home in the Highwood neighborhood after the paramedics arrived. Neither he nor his mom, he said, thinks anyone did anything but their best for his dad that day. Even today, he isn't sure paramedics or anyone else might have been able to save his father.

Even though he can't blame the fire department's rank and file, or the administration, "I think it's the system that's broken here," Ernster said in a recent interview. "Nobody should have to do CPR on their dad for 14 minutes, waiting for help."

And the Virginia-based consulting firm, TriData, which did the recent study of the fire department, agreed. It found:

St. Paul may be the only major U.S. city to "cross staff" its fire trucks and ambulances with the same personnel, a practice that consultant Stephen Brezler called "efficient, but no longer effective" in a briefing on the report.

[38] http://www.twincities.com/2007/03/21/cops-father-died-waiting-for-help/

Some areas of the city, particularly the southeastern corner where the Ernster's live, as well as an area around Como Park and parts of Macalester-Groveland and Highland are getting second-class EMS service because of the way the stations and crews are configured and the size of the areas they cover.

City budget cuts in 2003 have paramedics attending required continuing education classes on duty, further reducing emergency medical staffing. Round-the-clock scheduling is too grueling for the call load St. Paul's medic's handle.

Ann Mulholland, chief of staff for St. Paul Mayor Chris Coleman, acknowledged Wednesday that these were critical issues. Nearly four out of five calls the fire department takes are medical emergencies, and that service requires more focus from the department and the city, she said.

"That's the culture shift here, that the mayor is going to implement," Mulholland said. "We are all going to have to sit down and admit what we really are. The mission of the department needs to reflect the service that we provide, and today it does not."

APPENDIX 2. FIRE STATION IMPROVEMENTS & CONDITIONS 2007-2016[39]

Administration – New 2010, Condition excellent

Station 1 – New 2010, Condition excellent

Station 4 – Condition Good

- Kitchen remodel scheduled for 2016
- Replaced windows and entry doors, added brick knee wall to front entrance 2014
- Replaced overhead garage doors 2014
- Replaced carpet throughout and installed rubber flooring in workout room

Station 5 – Condition Fair/Good – Needs kitchen remodel

- Replaced windows 2008
- Replaced overhead garage doors 2011
- Replaced carpet throughout and installed rubber flooring in workout room
- Cleaned and tuck pointed exterior stone

Station 6 – Condition Good

- Replaced Boilers/Heating system 2008
- Kitchen remodeled 2010
- Replaced concrete font apron 2013
- Replaced carpet throughout, installed rubber flooring in workout room and VCT tile in commons area
- Replaced overhead garage doors 2014

[39] Report provided by SPFD.

Station 7 – Condition Fair

- Replaced concrete floor for L-7
- Replaced carpet throughout and installed rubber flooring in workout room
- Roof repairs scheduled for 2016

Station 8 – Condition Good/Excellent New 2005

- Needs painting and kitchen counter tops

Station 9 – Condition Good

- Replaced windows 2011
- Abated asbestos tile and installed rubber flooring in workout room
- Replaced overhead garage doors 2012

Station 10 – Condition POOR

Station 14 – Condition Good

- New roof 2007
- Replaced carpet throughout and installed rubber stair treads 2013
- Concrete Apron Door #3 replacement 2014
- Kitchen remodel scheduled 2016

Station 17 – Condition Fair

- Replaced carpet throughout and installed rubber flooring in workout room 2014
- Replaced overhead garage doors 2011

Station 18 Condition Fair/Good

- Kitchen remodeled 2010
- Replaced carpet throughout dorm area 2012
- Removed old carpet in workout room and installed new rubber flooring 2014
- Replaced concrete flooring in turnout gear area 2015
- Replaced rooftop A/C unit for dorm area, installed new split units in Kitchen and workout room 2015

Station 19 - Condition Good

- Replaced windows 2011
- Remodeled and add new Ladder bay 2016

Station 20 – Condition Fair/Good

- Remodeled workout room 2007
- Replaced carpet in captains room 2015

Station 22 – Condition Good

- New Ladder bay 2007/2008
- Replace windows 2011
- Pin existing structure to footings and pour new apparatus floor concrete in old Bay
- Removed old carpet in workout room and installed new rubber flooring 2014
- New Carpet in TV room 2nd fl.

Station 23 –Condition Good, Scheduled roof repair 2016

- Replaced carpet throughout dorm area, installed new VCT tiles in kitchen/watch office 2010
- Replaced windows and exterior doors 2013

Station 24 – Condition Good

- CDC room 2007?
- Replaced front concrete apron Engine/Ladder 2011
- Replaced overhead doors 2010
- Removed old carpet in workout room and installed new rubber flooring 2014
- Replaced carpet throughout Station, installed new VCT tiles in back hallway 2014
- Replaced windows and exterior doors 2014

Training – Condition Fair

- Remodeled kitchenette 2014 Gilman Hall
- Replaced roof on main office in 2009

Burn Building – POOR!

- Continue to replace shutters and fire proofing

Training Tower – Condition Good

- Replaced roof in 2007 install pavers for training purposes
- Installed shutters on all openings of building 2010

Reserve Storage Building – Condition Good

- Installed new unit heaters in Logistics bay and storage bay 2012
- Insulated and sheeted interior of building 2012