October 2017

Community Risk Assessment and Standards of Response Coverage Study

Standards of Cover Report

SNOHOMISH COUNTY FIRE DISTRICT 7
SNOHOMISH, WASHINGTON

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CONSULTANT REPORT

COMMUNITY RISK ASSESSMENT AND STANDARDS OF COVER
SNOHOMISH FIRE DISTRICT 7, WASHINGTON

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EXECUTIVE SUMMARY

The Snohomish County Fire District 7 (District) is a full-service fire agency providing fire suppression, fire prevention, technical rescue, hazardous materials mitigation, as well as advanced life support (ALS) paramedic services. The District sits primarily in the southwest quadrant of Snohomish County in the State of Washington. Snohomish County/Monroe Fire District 3 was merged into Snohomish County Fire District 7 in October 2016.

The District now serves a total population of approximately 110,000 within a geographic area of approximately 100 square miles. They also provide contract fire/EMS protection services to the City of Mill Creek. The City of Monroe reversed annexed into the legacy District 3. Service is provided from eight (8) fire stations with a force of 146 firefighters and chief officers and ten (10) support staff. A new fire station, Fire Station 33 (Fales Road) is currently under construction with an anticipated operational date in Fall 2018.

The merger provided a number of benefits, both in terms of increased operational effectiveness and enhanced cost efficiencies. However, the District has new challenges moving forward and is preparing for the next phases of the post-merger progression.

- Conducted a new stakeholder assessment process to include community members.
- Develop new response time measures specific to the expectations of the community and the capabilities of the District (Call processing, turnout and travel time benchmarks).
- Determine level of service for the District as a whole or establishing areas where service can be expected to be different based on population density (i.e. Urban @ 8 minutes/Rural @ 13 minutes).
- Revaluate data and performance one year or more after the opening of new Fire Station 33.

DESCRIPTION OF COMMUNITY SERVED

Introduction

The Snohomish County Fire District 7 (District) is a full-service fire agency providing fire suppression, fire prevention, technical rescue, water rescue, hazardous materials mitigation, as well as advanced life support (ALS) paramedic services. The District sits primarily in the southwest quadrant of Snohomish County in the State of Washington. Snohomish County/Monroe Fire District 3 was merged into Snohomish County Fire District 7 in October 2016.

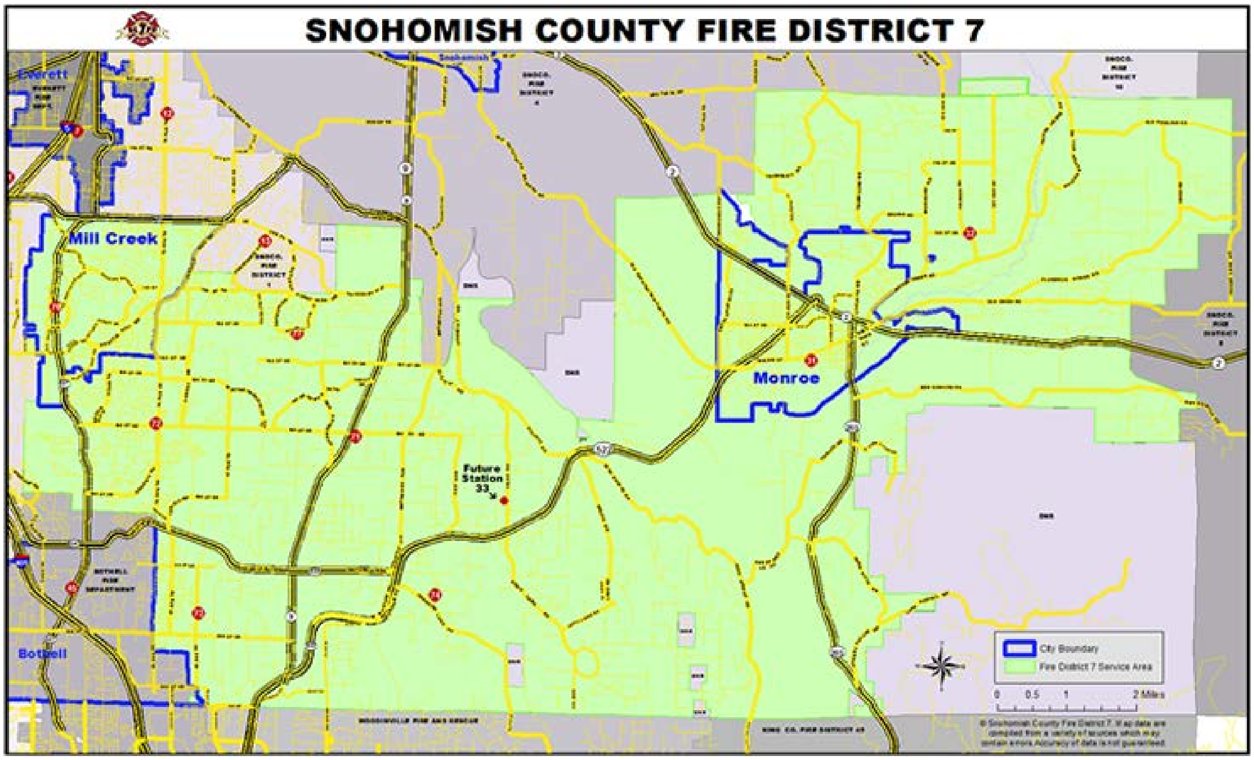
The County of Snohomish is located in the western part of Washington, about halfway between the state's north and south borders. Snohomish County is the third-most populous county in the State with the County Seat located in the City of Everett. Possession Sound and Puget Sound define the county's western border, while the eastern border is defined by the summits of the Cascade Range. Four counties are adjacent to Snohomish County: Skagit County to the north, Chelan County to the east, King County to the south, and Island County to the west. Plains in the west and mountainous terrain in the east cover the county's surface. The Cascade Range passes through the eastern part of the county and includes the highest point in Snohomish County, Glacier Peak at 10,541 feet (3,212.90 m) above sea level. Most of the eastern part of the county is preserved by the Mount Baker National Forest and Snoqualmie National Forest, which are consolidated into the Mount Baker-Snoqualmie National Forest. The mountains provide a source for several major rivers in the east, including the Snohomish, Snoqualmie, and Stillaguamish, that in turn form major bodies of water to the west.[1]

The District serves a total population of approximately 110,000 within a geographic area of approximately 100 square miles. They also provide contract fire/EMS protection services to the City of Mill Creek and City of Monroe has reverse annexed into the previous District 3. Service is provided from eight (8) fire stations with a force of 146 firefighters and chief officers and ten (10) support staff. A new fire station, Fire Station 33 (Fales Road) is currently under construction with an anticipated operational date in Fall 2018.

Administrative staff consists of seven (7) chief officers; four (4) fire officers (battalion chiefs) and ten (10) support positions with additional volunteer and part-time staff. The Fire Chief is the Chief Executive Officer of the District and currently reports to a nine-member Board of Commissioners that are elected from the community at-large. Due to the merger with Fire District 3 in October 2016, the board was temporarily expanded to ten commissioners. Since then, one commissioner as stepped down leaving nine. Over the next few years, the nine-member board will continue to attrition down to a five-member board to comply with traditional board governance standards in the State of Washington.

[1] Retrieved from https://en.wikipedia.org/wiki/Snohomish_County,_Washington.

Figure 1: Snohomish County Fire District 7



Legal Basis

The District, as it is today, is the result of a 2016 merger between Snohomish County/Monroe Fire District 3 and Snohomish County Fire District 7.

Fire District 3 was legally formed in 1942. Fire District 7 was legally formed in 1945.

The District is in compliance with the Revised Code of Washington (RCW) Title 52 which outlines the regulations applicable to fire districts, their formation, annexations, dissolution, powers, commissioners, finances, benefit charges, provisions, etc., as well as performance measures.

The Fire Chief is the Chief Executive Officer of the District and appointed by the Board of Commissioners, who have authority for policymaking, appointment and discipline, and budgetary accountability in accordance with RCW Title 52.

History of the Agency[2]

Prior to the formation and legal establishment of Snohomish County/Monroe Fire District 3, fire protection was provided by a group of volunteers serving the town of Monroe starting as early as 1902. In 1942, Fire District 3 was formed around the town and, over time, fire protection within the town of Monroe was eventually transitioned to District 3 to administer. Over the years, Fire District 3

[2]Retrieved from http://www.fireDistrict7.com/section1/about/history.html.

continued to provide fire protection services with funding assistance from the town, but only after some conflict between the agencies on funding sources and amounts.   In 2006, the town of Monroe reverse annexed into Fire District 3, which provided a more reliable funding source for fire protection across both entities.

Snohomish County Fire District 7 was officially established in 1945 after several local citizens pursued the idea of organizing a fire district to service their community. Washington State Legislature had developed RCW Title 52, which provided the ability to develop boundaries (jurisdictions) for the purpose of taxing property owners for fire protection services. Initially, the Fire District operated out of one station located at the same site where Station 71 is today and served the estimated population of 1,400.

As the area began to develop, District 7 sought the need to build Stations 72 and 73 in response to the growing needs of the community. The population of the District continued to increase with the accompaniment of some light industry in the Maltby area. As such, Station 74 was constructed to meet the service requirements of this area. Up until 1971, District 7 was run entirely through volunteer personnel.

With the introduction of fire department-based Emergency Medical Services (EMS) and the tremendous rate of growth through the 1970's, the District hired Rick West as its first full-time Fire Chief in 1977. This position was needed to administrate department operations to meet the growing demands of the community. The late 1970's and early 1980's brought about many more changes. First, Station 75 was constructed to better service the Lost Lake Area. Second, it was estimated that 70% of the alarms received were for emergency medical services and the population had grown to approximately 30,000. Third, newly constructed Stations 71 and 72 (replacing existing construction at Station 71 site; purchasing new property for new construction of Station 72) were upgraded to facilitate 24-hour staffing by full-time personnel. And fourth, the District saw an opportunity to expand the EMS Division to include an advanced life support (ALS) paramedic service.

After the City of Mill Creek officially incorporated in 1983, the City opted to continue to receive fire protection and emergency medical services under a contract with Fire District 7. Although growth of residential housing was primary during the late 1980's, light industry had grown steadily as well. Once again, the citizens realized the need for increased services. Therefore, they approved tax increases to fund improvements to fire and emergency medical services, which resulted in the purchase of new apparatus, and an increase in the number of full-time personnel. Property was also purchased to construct a new Station 73 to serve the residential area of Bear Creek. In 1998 two new stations were built to accommodate our continued growth and improve our level of service. Station 76 was built in the city of Mill Creek while Station 77 was built to service the new communities of Gold Creek and Silver Firs. In 1999, personnel moved out of the original Maltby fire station into a third new facility known as Station 74.

After the economic crisis of 2008, many fire/EMS agencies in Snohomish County and the region began exploring the feasibility of consolidations and mergers to help improve efficiency. Fire chief Gary Meek of District 7 and fire chief Jamie Silva of District 3 began discussions specifically on the benefits of a merger between their two agencies. In 2015 the proposal was presented to each district board of commissioners, which overwhelmingly supported the concepts. In October 2016, the process was completed with District 3 merging into District 7, including all governance. The merger provided a number of business efficiencies for both districts especially in the administrative and business functions.

District 3 operated two (2) fire stations providing fire protection for a population of approximately 30,000 over a geographic area of 55 square miles. Today, the consolidated agency protects a population of nearly 110,000 within a 99-square mile geographic area. The new District operates eight (8) fire stations with one fire station located in and serving the city of Mill Creek under a contract for service. The new District is experiencing steady growth with the purchase of a new headquarters building in Monroe and the addition of a new fire station (Fales Rd.) expected to open in Fall 2018. Currently, the District employs 141 personnel under fire suppression and 158 in total with support staff.

Area Description

Geography

The District is a mix of urban, suburban and rural generally east of the intersections of Interstate 5 and 405, both east and west of the Snohomish River, approximately 20 miles northeast of Seattle and 95 miles south of the Canadian border. State Route 9 bisects the District.

The District serves a total population of approximately 110,000 within a geographic area of approximately 99 square miles, this includes 3.6 square miles and over 19,000 people located with the City of Mill Creek.[3]

Topography

The District's topography is generally comprised of heavily wooded rolling hills and small valleys with an elevation range of approximately 200 to 600 feet in elevation. The planning area is essentially a glacial drift plain underlain by soils deposited by advancing and retreating glacial ice.

Hazards associated with the area include landslide, seismic activity, soil erosion, and wildland fire hazards.

[3] US Census. Retrieved from http://www.census.gov/quickfacts/table/PST045215/5345865,00

Climate

The climate of the District is heavily influenced by marine air masses, which tend to moderate temperatures with seasonal variations that get more pronounced moving into the inland areas. Based upon thirty-year averages, the average high temperature is 56°F and the average low temperature is 45°F. The area averages just over 35 inches of rainfall annually. Wind speeds average 7 mph but maximum speeds of over 30 mph are not uncommon due to the marine influence.

Population and Demographic Features

Table 1 below provides various metrics of census data for Snohomish County and the State of Washington.

Table 1: Census Data for District and State of Washington[4]

People Quick Facts	Snohomish County	Washington
Population estimates, July 1, 2014, (V2014)	759,583	7,061,530
Population estimates base, April 1, 2010, (V2014)	713,330	6,724,543
Population, percent change - April 1, 2010 (estimates base) to July 1, 2014, (V2014)	6.5%	5.0%
Population, Census, April 1, 2010	713,335	6,724,540
Persons under 5 years, percent, July 1, 2014, (V2014)	6.2%	6.3%
Persons under 18 years, percent, July 1, 2014, (V2014)	23.2%	22.7%
Persons 65 years and over, percent, July 1, 2014, (V2014)	12.1%	14.1%
Female persons, percent, July 1, 2014, (V2014)	49.7%	50.0%
White alone, percent, July 1, 2014, (V2014)	80.2%	80.7%
Black or African American alone, percent, July 1, 2014, (V2014)	3.1%	4.1%
American Indian and Alaska Native alone, percent, July 1, 2014, (V2014)	1.6%	1.9%
Asian alone, percent, July 1, 2014, (V2014)	10.2%	8.2%
Native Hawaiian and Other Pacific Islander alone, percent, July 1, 2014, (V2014)	0.5%	0.7%
Two or More Races, percent, July 1, 2014, (V2014)	4.4%	4.5%
Hispanic or Latino, percent, July 1, 2014, (V2014)	9.7%	12.2%
White alone, not Hispanic or Latino, percent, July 1, 2014, (V2014)	72.1%	70.4%
Living in same house 1 year ago, percent of persons age 1 year+, 2010-2014	83.9%	82.6%
Population per square mile, 2010	341.8	101.2
Language other than English spoken at home, percent of persons age 5 years+, 2010-2014	18.8%	18.8%
High school graduate or higher, percent of persons age 25 years+, 2010-2014	91.3%	90.2%
Bachelor's degree or higher, percent of persons age 25 years+, 2010-2014	29.3%	32.3%
Veterans, 2010-2014	55,677	575,746
Mean travel time to work (minutes), workers age 16 years+, 2010-2014	29.9	25.9
Housing units, July 1, 2014, (V2014)	297,734	2,963,141
Owner-occupied housing unit rate, 2010-2014	66.5%	62.7%
Median value of owner-occupied housing units, 2010-2014	$287,500	$257,200
Households, 2010-2014	271,514	2,645,396
Persons per household, 2010-2014	2.67	2.55
Per capita income in past 12 months (in 2014 dollars), 2010-2014	$31,782	$31,233
Median household income (in 2014 dollars), 2010-2014	$69,443	$60,294
Persons in poverty, percent	9.9%	13.2%

[4] US Census 2013 Estimates. Retrieved from http://www.census.gov/quickfacts/table/PST045215/53061,53

Disaster Potentials

The District is vulnerable to the natural hazards of drought, earthquake, flood, landslide, severe storm, tsunami, volcano, and wildland fire.

The District is also vulnerable to technological (human-caused) hazards associated with hazardous materials spills, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) terrorism, civil disturbances, transportation accidents, urban fire, and some risk associated with dam failure.

SERVICES PROVIDED

Service Delivery Programs

Fire Suppression

The District provides high quality fire suppression services within the jurisdiction as well as response to requests for service from adjacent municipalities and fire districts. Fire suppression services are provided from eight fixed facility fire stations distributed throughout the community. All District members are minimally trained as firefighters and emergency medical technicians (EMTs). Minimum staffing per day is 30 with adjusted staffing configurations for each additional firefighter up to 36. Each incremental increase to staffing is documented in a staffing policy that maximizes deployment efficiency. The following is a description of minimum and maximum staffing configurations; not including cross-staffed specialty units such as water tenders, technical rescue and vegetation fire vehicles or occasionally staffed Medical Service Officer (MSO) positions.

In total, the District operates the following response units: (maximum staffing of 36)

- 7 fire engines companies (all cross-staffed)
- 2 ladder companies (1 cross-staffed)
- 4 medic units (advanced life support ALS ambulances – 2 cross-staffed)
- 5 aid units (basic life support or BLS ambulance – 3 cross-staffed)
- 2 Battalion Chief command units

The District has also established minimum staffing levels in an effort to accommodate employee leave and budget constraints. Therefore, at a minimum, the department will deploy the following: (minimum staffing of 30)

- 7 fire engines companies (5 cross-staffed)
- 2 ladder companies (all cross-staffed)
- 4 medic units (advanced life support ALS ambulances – 2 cross-staffed)
- 4 aid units (basic life support or BLS ambulance - all cross-staffed)
- 2 Battalion Chief command units

Rescue

The District operates in conjunction with the Snohomish County Technical Rescue Team, which is capable of providing advanced rescue capabilities or risks such as high-angle, below-grade, confined-space, and water rescue.

Emergency Medical Services

The District provides emergency Advanced Life Support (ALS) level care and transport for the sick and injured throughout the District and to the City of Mill Creek under a contract for service. This is accomplished through the use of engine and ladder companies utilized as first responders followed by a BLS Aid Car or ALS Medic Unit for advanced care, treatment, and transport to the hospital. In total, the District operates four Medic Units and five Aid Cars, and all fire suppression apparatus provide first response for ALS level incidents.

Requests for service for Basic Life Support calls are responded to with the existing fire suppression apparatus and personnel and the Aid Units.

Hazardous Materials

The District operates as part of a regional Hazardous Materials (HazMat) response team that has advanced capabilities for detection of and mitigation of risks.

Current Deployment Strategy

Fire Stations

The District utilizes eight fixed fire station facilities to effect fire suppression, emergency medical, and special operation responses. Below is the brief overview of the fire station locations, capabilities, and staffing.

Station 31: Monroe is located at 163 Village Court, Monroe, WA 98272. **Fire Headquarters**.

Station 31's allocated capital and human resources are provided in Table 2.

Table 2: Station 31 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 31	3	3
Ladder 31	Cross-staffed	Cross-staffed
Medic 31	2	2
Aid 31	0	2
Battalion 31	1	1
Tender 31	Cross-staffed	Cross-staffed
Sprint 31	0	1
Technical Rescue 31	0	0
Brush 31	0	0
Boat 31	0	0

Station 32: Monroe is located at 22122 132nd Street, Monroe, WA

Station 32's allocated capital and human resources are provided in Table 3 below.

Table 3: Station 32 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 32	2	3
Medic 32	Cross-staffed	1

Station 71: Clearview is located at 8010 180th Street, Snohomish, WA

Station 71's allocated capital and human resources are provided in Table 4 below.

Table 4: Station 71 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 71	3	4
Medic 71	Cross-staffed	Cross-staffed
Battalion 71	1	1
Tender 71	Cross-staffed	0
HazMat 71	0	0

Station 72: Fernwood is located at 3431 180th Street, Snohomish, WA

Station 72's allocated capital and human resources are provided in Table 5 below.

Table 5: Station 72 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Ladder 72	3	3
Aid 72	Cross-staffed	2

Station 73: Bear Creek is located at 22225 45th Avenue S.E., Snohomish, WA

Station 73's allocated capital and human resources are provided in Table 6 below.

Table 6: Station 73 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 73	3	3
Aid 73	Cross-staffed	Cross-staffed

Station 74: Maltby is located at 21709 99th Ave. S.E., Snohomish, WA

Station 74's allocated capital and human resources are provided in Table 7 below.

Table 7: Station 74 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 74	3	3
Aid 74	Cross-staffed	Cross-staffed
Brush 74	Cross-staffed	Cross-staffed

Station 76: Mill Creek is located at 1020 153rd Street S.E.,

Station 76's allocated capital and human resources are provided in Table 8 below.

Table 8: Station 76 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 76	3	3
Medic 76	2	2

Station 77: Gold Creek is located at 6610 Snohomish/Cascade Drive, Snohomish, WA

Station 77's allocated capital and human resources are provided in Table 9 below.

Table 9: Station 77 Resources

Apparatus Identifier and Capability	Minimum Number of Personnel Assigned	Maximum Number of Personnel Assigned
Engine 77	3	3
Aid 77	Cross-staffed	Cross-staffed

Future Station 33: Fales Road is located at 19424 Fales Road. Snohomish, WA (Opening in Fall 2018).

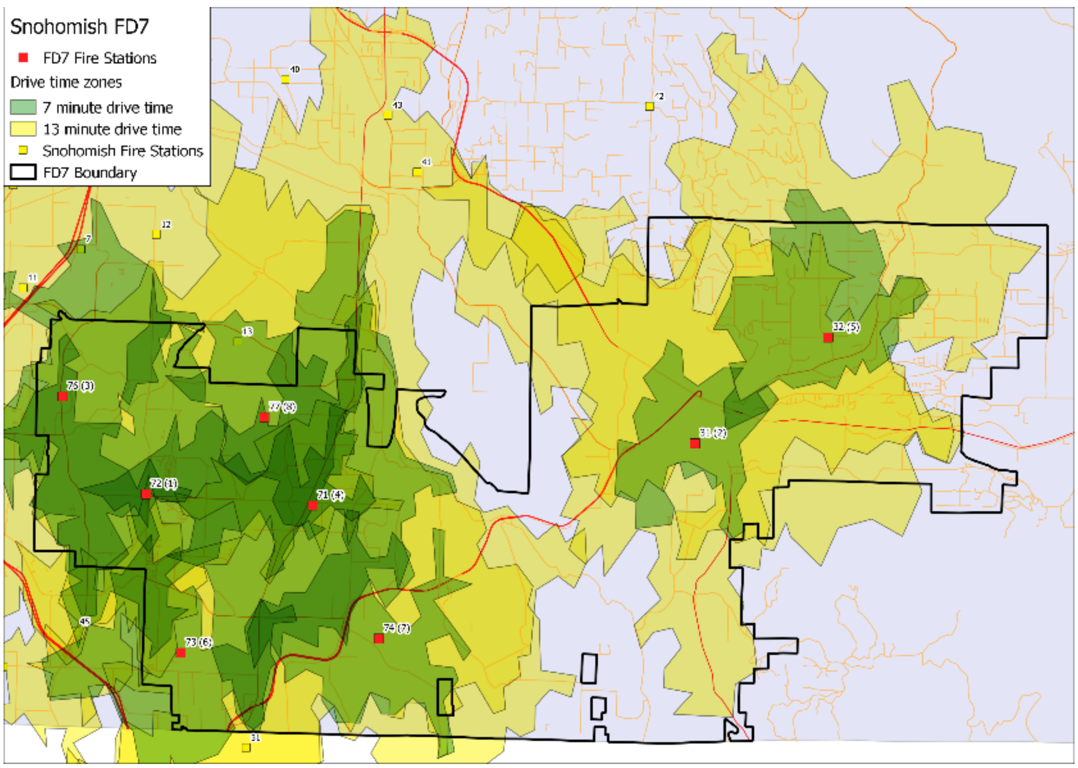
Opening in Fall 2018

Response Areas

Consistent with the station distribution model currently utilized by the District, there are eight distinct station response zones. Additionally, a legacy area has been maintained for a former Station 75, although the station is no longer staffed. Station 75's territory is covered primarily from Station 74 currently but will soon be reopened as new Station 33 – Fales Road.

The fire station response territories have been utilized as the station Fire Demand Zones (FDZ) or station still alarm area, for all planning aspects for managing risk, demand, and performance. A map of the fire department demand zones is provided as Figure 2 below.

Figure 2: Snohomish County Fire District 7 Response Areas

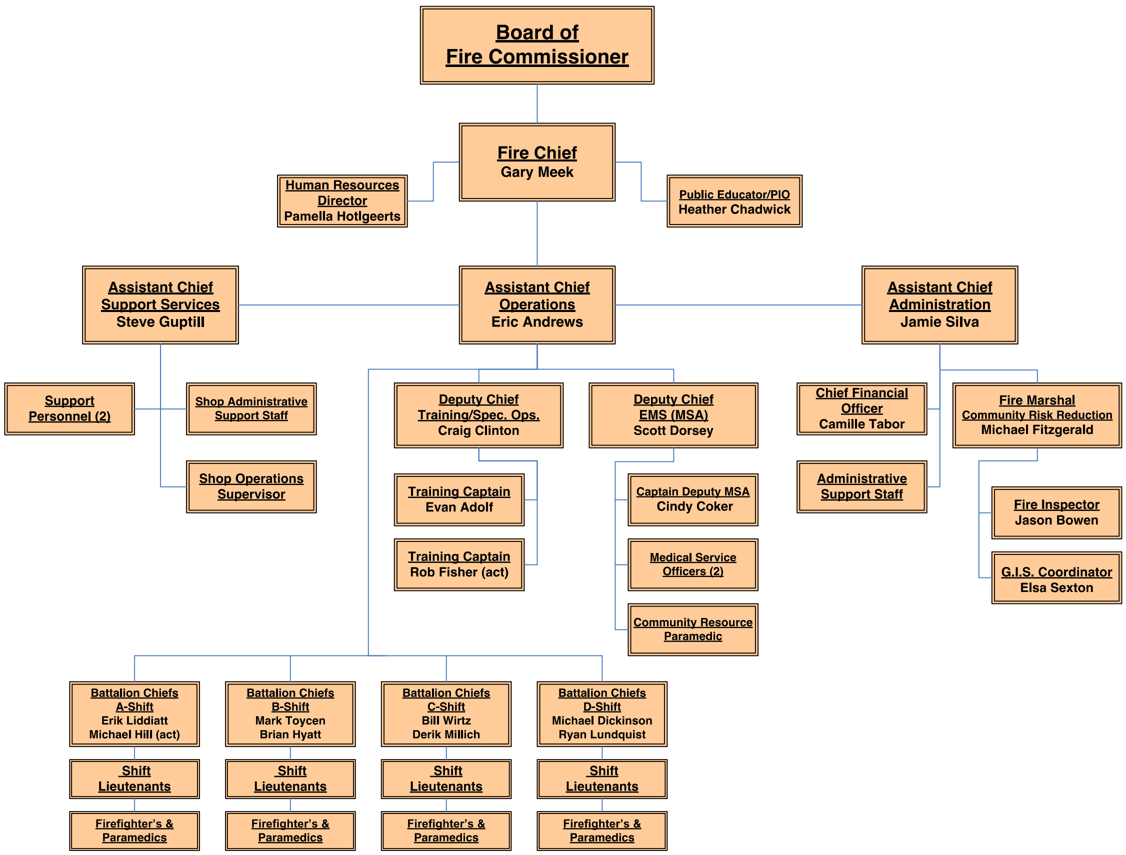


Current Staffing Strategy

Organizational Structure

The District operates from eight fire stations with its administrative building located in Monroe. The following organizational chart in Figure 3 below illustrates the general organizational structure of the District.

Figure 3: Snohomish County Fire District 7 Organizational Chart



The District's organizational structure reflects a fairly typical, paramilitary organization. The Executive Team is comprised of seven senior uniformed officers, including the Fire Chief, three Assistant Chiefs and three Deputy Chiefs. The Assistant and Deputy Chiefs are distinguished primarily by their functional areas of responsibility, which include Administration, Community Risk Reduction, EMS, Operations, Support Services, and Training. Primary responsibility for the administration and management of the department's budget rests with the Fire Chief.

Among the line/response personnel, the next level is the eight Battalion Chiefs (two per shift). Personnel at the rank of Captain are used in support roles within the EMS, Training and Community Risk Reduction divisions. Personnel at the rank of Lieutenant perform individual station / company supervision.

Administration, Emergency Services and Support Staff

The 2017 Budget allocates for following positions/classifications to carry out the mission of the District as reflected in Table 10 below. [5]

Table 10: Personnel by Title/Classification

Title/Classification	Number
Fire Chief	1
Assistant Fire Chief	3
Deputy Fire Chief	3
Battalion Chief	8
Captain	3
Captain Paramedic	3
Lieutenant	24
Lieutenant Paramedic	8
Diver Operator	24
Diver Operator Paramedic	9
Firefighter	40
Firefighter Paramedic	14
Administrative Assistants	9
HR Director	1
Chief Financial Officer	1
Public Information Officer/Public Educator	1
Mechanics	7
Number of Regular Employees	160
Part-Time Employees	18
Total Employees	**178**

[5] Provided by Snohomish County Fire District #7 2017.

COMMUNITY RESPONSE HISTORY

In 2016, the Fire District 7 responded to a total of 10,279 requests for service, or dispatches. A total of 48% incidents were in the jurisdiction of 31D07, 34% incidents were in the jurisdiction of 31M09, and 10% incidents were in the jurisdiction of 31D01.

EMS service requests totaled 8,467, accounting for 82.4% of the total number of incidents. The number of fire related calls were 1,260, which accounted for 12.3% of the dispatched incidents. For most agencies, it is of value to differentiate EMS service requests from all other types such as fires, water rescues, and vehicle entrapment since these are services, which require more resources, usually for a longer period of time as well as experience longer turnout times (for the donning of additional protective equipment). Again, the number of individual unit responses will be more reflective of total department workload since 42 percent of the calls resulted in multiple units dispatched. As summarized in Table 12, all units in the department combined made 17,005 responses, and were busy on emergency calls 9,759 hours. On average, each response lasted 34.4 minutes from dispatched to clear.

There is a countywide ballot measure pending for November 2017, which proposes to consolidate the county 911 Public Safety Answering Points (PSAP) into one consolidated Primary PSAP. If successful, this project would be followed up with a second ballot measure to also consolidate individual agency dispatch centers into one.

Table 11: Number of Incidents Dispatched by Category – 2016

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	5,241	14.4	51.0
EMS-ALS	3,226	8.8	31.4
Fire	1,260	3.5	12.3
Special Ops	43	0.1	0.4
Service	509	1.4	5.0
Total	**10,279**	**28.2**	**100.0**

Figure 4: Percentage of Total Incidents Dispatched by Category

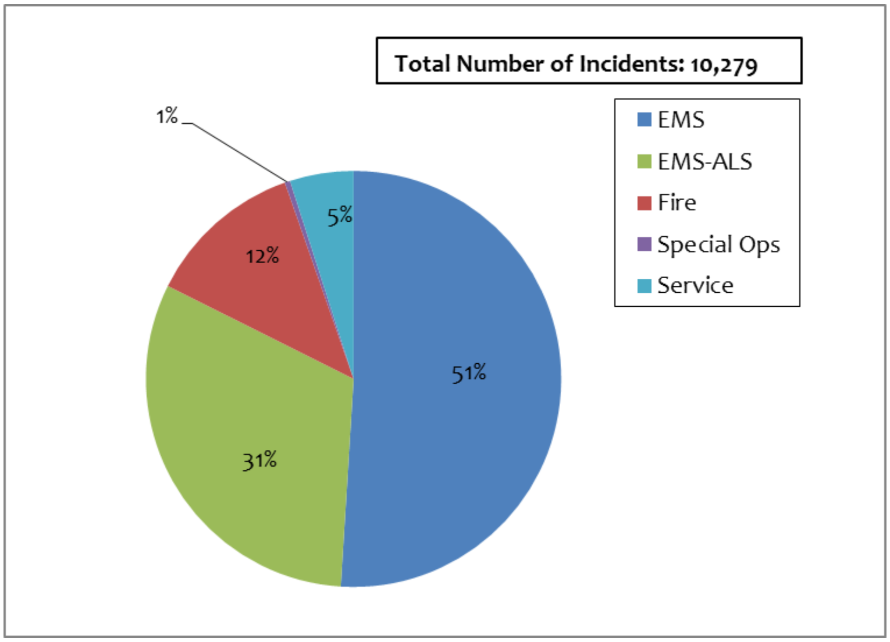


Table 12: Number of Responses, and Total Busy Time by Category – 2016

Call Category	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Avg. Busy Minutes per Response
EMS	5,241	8,119	1.5	4,462	33.0
EMS-ALS	3,226	6,024	1.9	4,020	40.0
Fire	1,260	2,195	1.7	969	26.5
Special Ops	43	97	2.3	97	60.0
Service	509	570	1.1	211	22.2
Total	**10,279**	**17,005**	**1.7**	**9,759**	**34.4**

In 2016, FD7 units have provided mutual aid to 1,028 FD1 calls, which totaled 514 unit hours. Of those mutual aid responses, E76/M76 responded 870 FD1 calls (85%). Conversely, FD1 units have provided mutual aids to 903 FD7 calls, which totaled 529 unit hours.

Table 13: Interaction between FD1 and FD7

Call Type	FD7 Units Responding to FD1 Calls			FD1 Units Responding to FD7 Calls		
	Number of Calls	Number of Responses	Total Busy Hours	Number of Calls	Number of Responses	Total Busy Hours
EMS	466	534	183	314	384	143
EMS-ALS	392	526	221	429	539	310
Fire	160	228	105	149	219	70
Special Ops	4	5	4	5	9	5
Service	6	6	1	6	6	1
Total	**1,028**	**1,299**	**514**	**903**	**1,157**	**529**

Dispatch time in this report is calculated from the time a request or incident was created by the dispatcher through the time a unit was dispatched. The time it took the dispatcher to answer the phone and create the incident was not captured in the dispatch time. This report mainly analyzes dispatch time, turnout time, travel time, and the sum of turnout and travel, and response time of the first arriving units. The mean (average) dispatch time was 132 seconds (two minutes and 12 seconds), turnout time was 96 seconds (one minute and 36 seconds), travel time was 270 seconds (four minutes and 30 seconds), and response time was 504 seconds (eight minutes 24 seconds).

However, a more conservative and reliable measure of performance is the fractile or percentile. This measure is more robust, or less influenced by outliers, than measures of central tendency such as the mean. Best practice is to measure at the 90th percentile. In other words, 90% of all performance is captured expecting that 10% of the time the department may experience abnormal conditions that would typically be considered an outlier. For example, if the department were to report an average response time of six minutes, then in a normally distributed set of data, half of the responses would be longer than six minutes and half of the responses would be less than six minutes. The 90th percentile communicates that 9 out of 10 times the department performance is predictable and thus more clearly articulated to policy makers and the community.

The 90th percentile dispatch time was 220 seconds (three minutes and 40 seconds). The performance for turnout time at the 90th percentile was 149 seconds (two minutes and 29 seconds), travel time is 484 seconds (eight minutes and four seconds), and response time was 820 seconds (13 minutes and 40 seconds). Tables 14 and 15 below present the average and 90th percentile performance by call category. Please note that the summation of 90th percentile dispatch time, 90th percentile turnout time and 90th percentile travel time is not the same as 90th percentile response time.

Table 14: Average Turnout and Travel Time by Category

Call Category	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
EMS	2.6	1.6	4.4	8.6	3,969
EMS-ALS	1.6	1.5	4.1	7.2	2,194
Fire	1.9	2.0	4.9	8.7	721
Special Ops	3.1	3.1	8.8	15.0	10
Service	2.8	1.9	6.9	11.5	389
Total	**2.2**	**1.6**	**4.5**	**8.4**	**7,283**

Figure 5: Average Turnout and Travel Time by Call Category

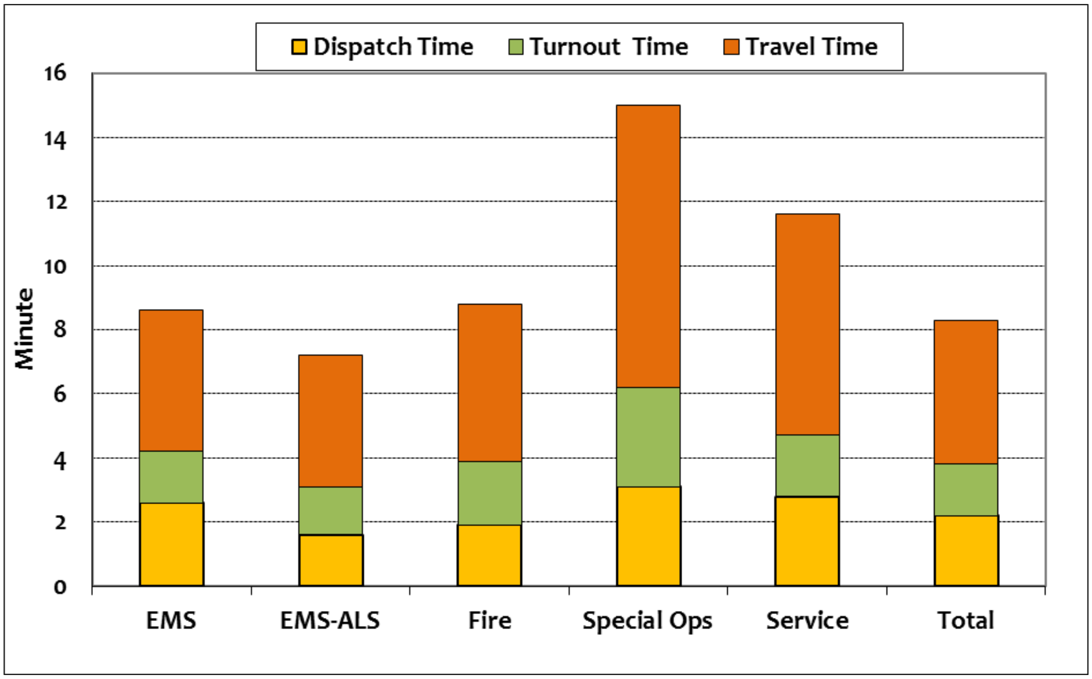


Table 15: 90th Percentile Turnout and Travel Time of First Arriving Units by Call Category

Call Category	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
EMS	4.5	2.4	7.8	14.3	3,969
EMS-ALS	2.6	2.4	7.2	11.2	2,194
Fire	3.1	2.8	8.3	13.4	721
Special Ops	4.3	8.7	11.1	14.7	10
Service	5.0	2.8	12.6	18.6	389
Total	**3.7**	**2.5**	**8.1**	**13.7**	**7,283**

Typically, performance varies across call types or categories due to a variety of reasons. For example, the turnout time may be longer for fire related calls because the crews have to dress in their personal protective ensemble (bunker gear) prior to leaving the station where as on an EMS incident they do not. Similarly, the larger fire apparatus may require longer response times due to their size and lack of maneuverability. However, the data only includes emergency responses; data does suggest mean and 90th percentile turnout time for fire calls were longer than EMS calls. As expected, significant variability is introduced in responses for special operation calls. Since there are only 10 special operation calls used in this analysis, the 90th percentile is essential the longest time.

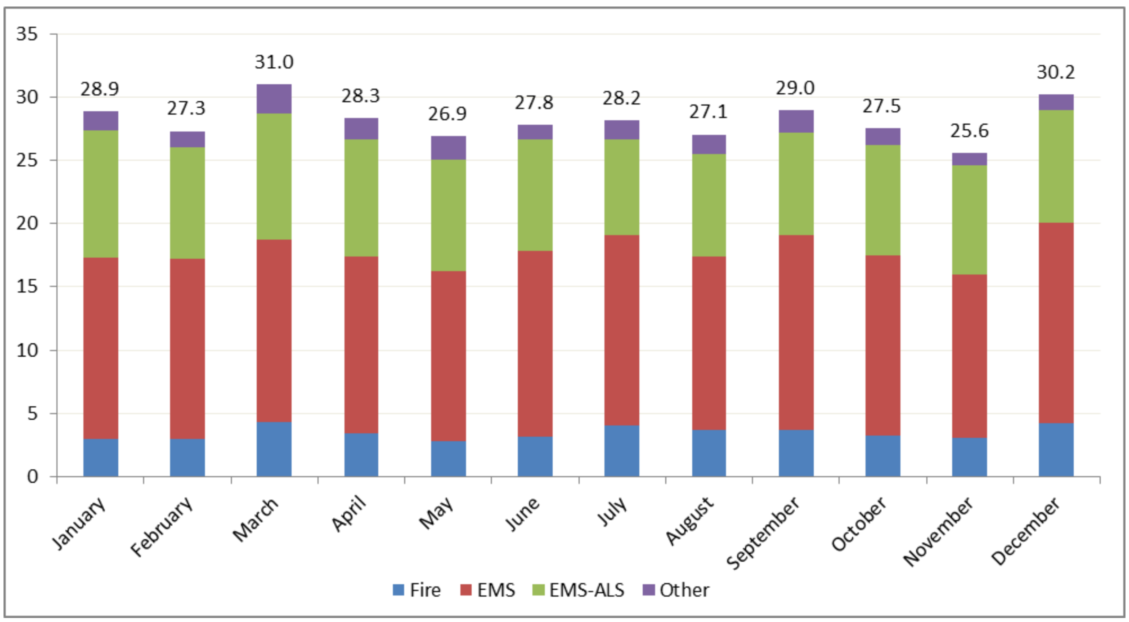
Temporal analyses were conducted to evaluate patterns in community demands. These measures examined the frequency of requests for service by month, day of week, and hour of day. In the following temporal analysis, special ops and service calls were grouped into the other category for presentation purpose.

Overall, average requests per month ranged from a low of 25.6 per day in November to a high of 31.0 per day in March. The top three months with the most demands in the descending order are: March (31.0 per day), December (30.2 per day) and September (29.0 per day).

Table 16: Overall: Average Calls per Day by Month

Month	Calls per Day				
	Fire	EMS	EMS-ALS	Other	Total
January	3.0	14.3	10.1	1.5	28.9
February	3.0	14.2	8.9	1.3	27.3
March	4.3	14.4	10.0	2.3	31.0
April	3.4	14.0	9.3	1.7	28.3
May	2.8	13.5	8.8	1.9	26.9
June	3.1	14.7	8.9	1.2	27.8
July	4.0	15.1	7.6	1.5	28.2
August	3.6	13.7	8.1	1.6	27.1
September	3.6	15.4	8.1	1.8	29.0
October	3.2	14.3	8.7	1.4	27.5
November	3.0	12.9	8.7	0.9	25.6
December	4.2	15.8	8.9	1.2	30.2
Total	**3.5**	**14.4**	**8.8**	**1.5**	**28.2**

Figure 6: Overall: Average Calls per Day by Month

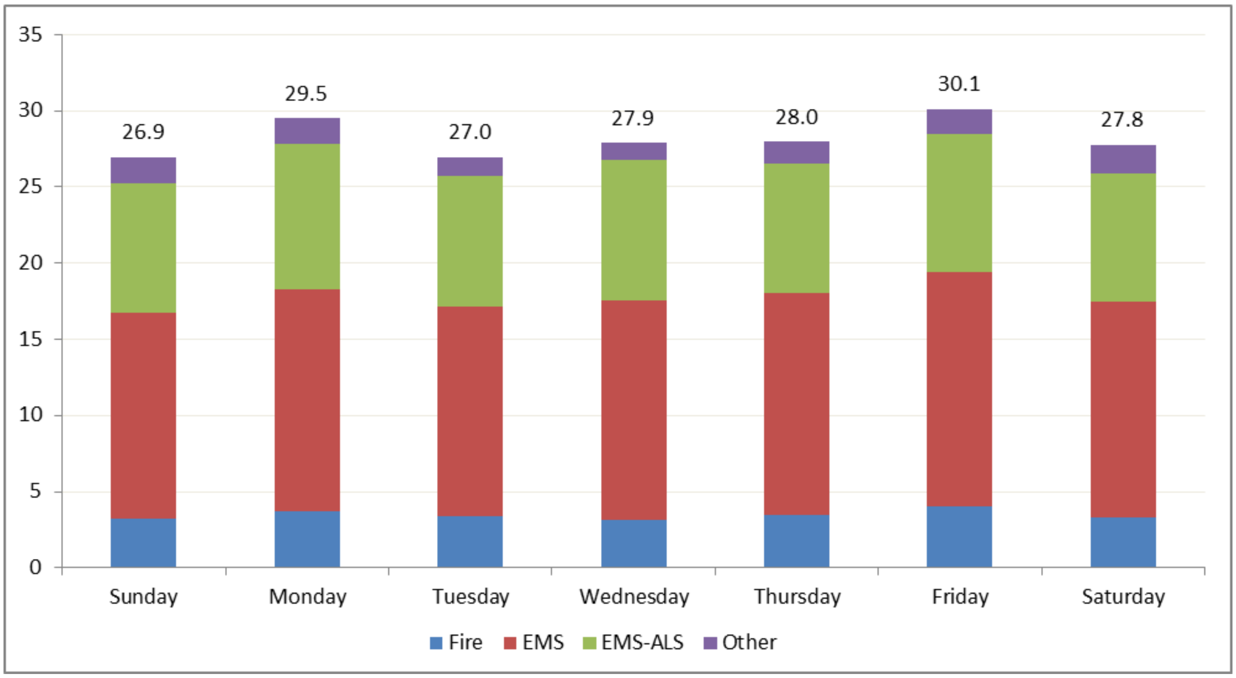


Similar analyses were conducted for requests by day of week. The data revealed that there is little variability in the demand for services by day of week. Sunday was the lowest for the week at 26.9 calls per day. Friday has the highest frequency of requests for services at 30.1 calls per day.

Table 17: Overall: Average Calls per Day by Weekday

	Calls per Day				
Weekday	**Fire**	**EMS**	**EMS-ALS**	**Other**	**Total**
Sunday	3.2	13.5	8.5	1.7	26.9
Monday	3.7	14.6	9.6	1.7	29.5
Tuesday	3.4	13.8	8.5	1.3	27.0
Wednesday	3.1	14.5	9.2	1.1	27.9
Thursday	3.5	14.5	8.5	1.4	28.0
Friday	4.0	15.4	9.1	1.6	30.1
Saturday	3.3	14.2	8.4	1.9	27.8
Total	**3.5**	**14.4**	**8.8**	**1.5**	**28.2**

Figure 7: Overall: Average Calls per Day by Weekday



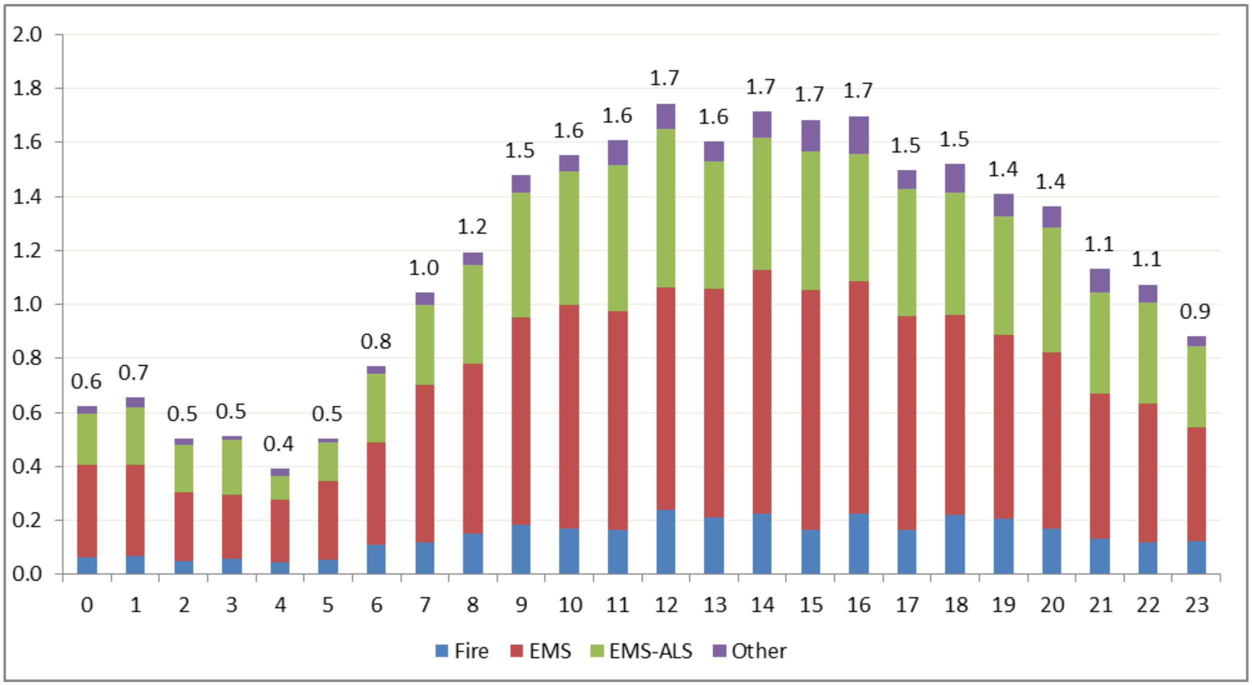
Overall demands were evaluated by the hour of the day. Considerable variability exists in the time of day that requests for emergency services are received. While the middle of the day has the greatest frequency of calls, specifically the hours that begin at 0900 and 1800 averaging above 1.5 calls per day and per hour. The average number of calls per hour is 428 or 1.2 per day and per hour. The data illustrates that the busiest times of the day are between noon and 1600. The hour with the peak demand is at noon.

To provide a more granular understanding of the community's demand for emergency services, this temporal analysis included the average number of calls per hour. In other words, when referring to the figure below, the busiest hour is at noon with 637 calls during that hour. The average number of calls per hour is a daily average for those 637 calls if they were equally distributed. Therefore, the busiest hour per day would be at noon with an average hourly call volume at 1.7 calls per day. The second busiest hour is at 1600 with 620 calls during the hour, and averaged 1.7 calls per hour.

Table 18: Overall: Average Calls per Day by Hour

	Calls per Day				
Hour	**Fire**	**EMS**	**EMS-ALS**	**Other**	**Total**
0	0.1	0.3	0.2	0.0	0.6
1	0.1	0.3	0.2	0.0	0.7
2	0.0	0.3	0.2	0.0	0.5
3	0.1	0.2	0.2	0.0	0.5
4	0.0	0.2	0.1	0.0	0.4
5	0.1	0.3	0.1	0.0	0.5
6	0.1	0.4	0.3	0.0	0.8
7	0.1	0.6	0.3	0.0	1.0
8	0.2	0.6	0.4	0.0	1.2
9	0.2	0.8	0.5	0.1	1.5
10	0.2	0.8	0.5	0.1	1.6
11	0.2	0.8	0.5	0.1	1.6
12	0.2	0.8	0.6	0.1	1.7
13	0.2	0.8	0.5	0.1	1.6
14	0.2	0.9	0.5	0.1	1.7
15	0.2	0.9	0.5	0.1	1.7
16	0.2	0.9	0.5	0.1	1.7
17	0.2	0.8	0.5	0.1	1.5
18	0.2	0.7	0.5	0.1	1.5
19	0.2	0.7	0.4	0.1	1.4
20	0.2	0.7	0.5	0.1	1.4
21	0.1	0.5	0.4	0.1	1.1
22	0.1	0.5	0.4	0.1	1.1
23	0.1	0.4	0.3	0.0	0.9
Total	**3.5**	**14.4**	**8.8**	**1.5**	**28.2**

Figure 8: Overall: Average Calls per Day by Hour



Overall, FD7's units made 17,005 unit responses, and the total busy hours were 9,759 hours. The station level demand is more reflective for deployment decisions. The unit level workload will help evaluate the utilizations of physical apparatus, and help apparatus procurement or maintenance decisions. Stations 31, 76 and 72 were the top three busiest stations. M76, M31, and A77 were the top three utilized BLS/ALS units, and each made more than 1,000 responses in a year. E76, E31, and L72 were the top three utilized fire apparatus, and each made more than 600 responses in a year.

Table 19: Overall Workload by Station

Station	Avg Busy Minutes per Run	Total Busy Hours	Number of Runs
Station 31	29.5	2,378	4,829
Station 32	37.4	612	982
Station 71	35.0	1,125	1,926
Station 72	27.8	1,114	2,408
Station 73	49.3	761	925
Station 74	39.4	451	686
Station 76	32.1	2,095	3,911
Station 77	54.9	1,223	1,338
Total	**34.4**	**9,759**	**17,005**

COMMUNITY EXPECTATIONS & PERFORMANCE GOALS[6]

Stakeholder Input Process

A process for stakeholder input was completed in 2014 and was officially presented in 2015 as part of the pre-merger Snohomish County Fire District 7's 2015-2017 Strategic Plan. The organization reviewed their process again since the merger and believes the expectations and goals are still valid, however they do have plans to initiate a new process within the next three years to resurvey the community and ensure the merged agency is still meeting expectations. A brief summary of the results of the stakeholder input process of the strategic planning process is provided here.

Community Expectations

The process utilized by the department to evaluate community expectations was through structured interviews and interaction with chief officers, District board members, and line personnel. The representativeness of the organizational structure and continuous community interactions was determined to provide the requisite assessment of community expectations.

Guiding Principles and Internal Performance Expectations and Goals

Vision

"A trusted leader serving the community with a commitment to innovation and improvement."

Slogan

"Earning trust through action"

Values

Continuous Improvement

- We seek feedback and learn and improve from experience
- We are willing to take risks and make changes in order to improve service
- We are committed to doing the work, and continuously improving the way work gets done

Integrity

- We are open, transparent, and accountable to the public we serve
- We acknowledge that public trust matters – and strive to be worthy of it
- We are respectful, effective and humble
- We do what's right for the right reason

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[6] Snohomish County Fire District Seven. (2015). 2015 -*2017 Strategic Plan.* Washington: Author. Retrieved from http://fireDistrict7.com/.

Teamwork

- We work cooperatively with one another to achieve our goals
- We strive for open and honest communications and value differing opinions
- Our managers coach, mentor, and develop a strong team culture

Compassion and Service

- We treat our customers with respect and dignity
- We appreciate the importance of caring for people in the most challenging of circumstances
- We are not here for ourselves, but for the community we serve

Goals

- Plan for technology improvements and maintenance to meet the operational needs of the District
- Develop and expand on existing partnerships to build trust and explore collaborative opportunities
- Deliver excellent service while focusing on innovation and improvement
- Exercise sound financial judgment and plan for fiscal sustainability
- Develop and manage infrastructure to support operations and innovations now and for the future
- Hire, develop, take care of and promote the best people
- Build community trust and resilience through education and engagement

COMMUNITY RISK ASSESSMENT AND RISK LEVELS

Risk Assessment Methodology

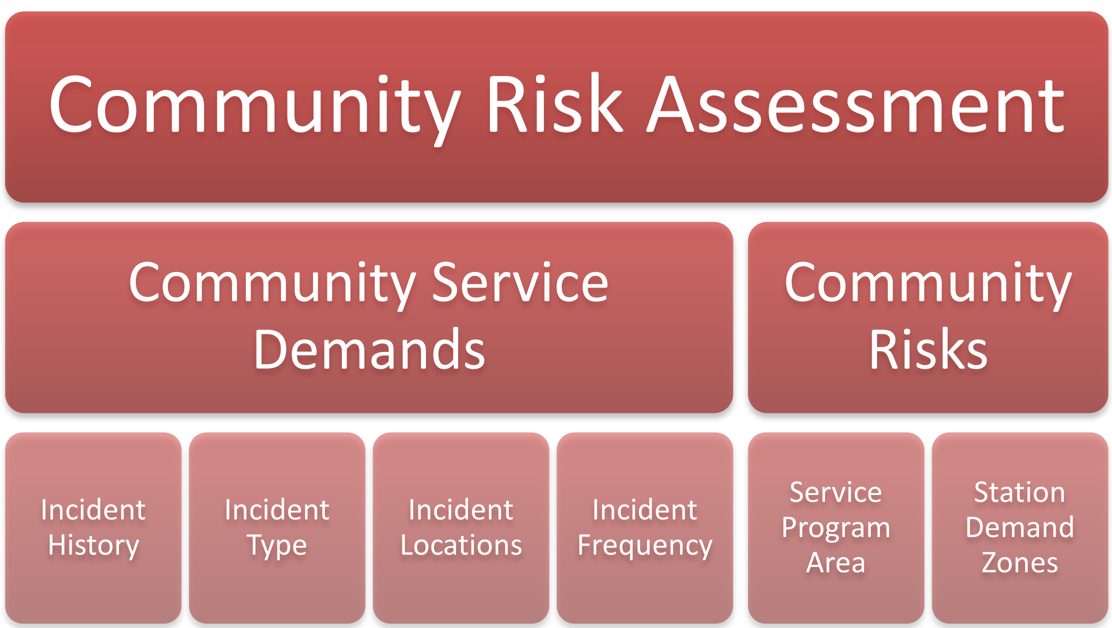
Methodology

The risk assessment process utilized a systematic methodology to evaluate the unique risks that are specific to the District. This process evaluated risk from two broad perspectives. First, risk is identified through retrospective analyses of historical data. Second, risk is evaluated prospectively providing the necessary structure to appropriately allocate personnel, apparatus, and fire stations that afford sufficient distribution and concentration of resources to mitigate those risks. This methodology also provides information for the District to consider alternative solutions to assist in the mitigation of risks.

Service areas that either had little quantitative data, or did not require that level of analysis, were evaluated through both retrospective analysis as well as structured interviews with District staff members. In an effort to improve clarity, the following terminology is used for the remainder of the risk assessment description and analyses: retrospective risk will use the term Community Service Demands and prospective risk will use the term Community Risks.

The overall community risk assessment process and methods utilized by the District is presented below as Figure 9.[7]

Figure 9: Community Risk Assessment Process

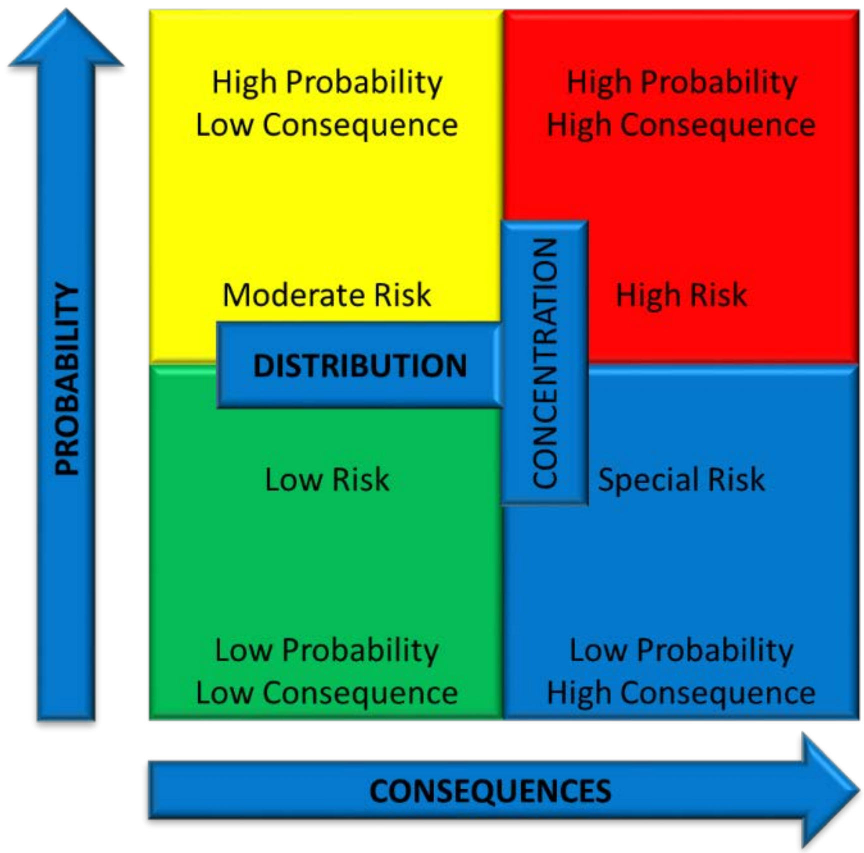


[7] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Community service demands were analyzed by the incident history, type, locations, and incident frequencies. Within this process a temporal analysis was completed for each major program area and evaluated by station demand zone and the frequency of incidents. Each program area evaluated community risks and risks are identified in each demand zone.

This methodology not only provides for sufficient allocation of resources to manage the readiness or preparedness aspects of the deployment strategy, but also balances the costs of readiness with an in-depth understanding of the probability of events through historical analyses. The combined results of this process were utilized to classify risk by severity utilizing a probability and consequence matrix for each program/risk area. Finally, the critical tasks required for each level of risk were identified. An example of the overall probability and consequence matrix is provided as Figure 10 below.[8]

Figure 10: Probability and Consequence Matrix



Planning Areas/Zones

The District utilizes the existing station demand zones for their planning efforts. For example, the company officers from each fire station zone is responsible for fire prevention efforts, building familiarity, etcetera within the planning demand zone. Therefore, the planning zones remained

[8] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, 8th (ed.). Chantilly, Virginia: Author. (p. 49)

consistent throughout the risk assessment process. The station demand zones have served the department well in this process as risk has been evaluated for both the distribution of resources and the necessary concentration of resources to meet each demand zone's specific and unique risks. However, former Fire Station 75's (future Station 33) demand zone remains as a legacy planning area but does not have in-zone resources dedicated. Emergency responses and planning responsibilities remain primarily with Station 74.

Additional analyses per fire demand zone are presented under the heading "Comparison of Demand Zones."

Community Characteristics of Risk[9]

Geographic and Weather-Related Risks

Geologically hazardous areas in Snohomish County include landslide hazards, seismic hazards, erosion hazards, and slopes of 40% and greater.

1. Earthquakes
   - *Hundreds of earthquakes occur in the Puget Sound region each year, typically a magnitude 3 or lower on the Richter scale.*
   - *Recent studies suggest that earthquakes of a Magnitude 8 or greater have occurred in the region and that similar seismic events are possible in the future.*
   - *Several major faults are located in the vicinity.*
   - *Ranked as the highest risk for Snohomish County by Hazard Mitigation Plan.*
2. Severe Storms
   - *Severe storms generally occur in the winter months and principally include heavy rain; there are also periodic winter storms with ice and/or snow.*
   - *Probability of 58% for severe winter storm at least once every two years.*
   - *Generally, low frequency of fatalities associated with severe storms.*
   - *Ranked as second highest risk for Snohomish County behind Earthquakes.*
3. Pandemics
   - *The nature and extent of this threat contains no significant documentation.*
4. Climate Change
   - *The nature and extent of this threat contains limited documentation. The most important effect is that climate change will likely have a measurable impact on the occurrence and severity of natural hazards.*
   - *The change most closely associated with this risk is that projected temperature warming is expected to increase extreme heat events and decrease extreme cold events.*

[9] Snohomish County. (2015). 2015 *Hazard Mitigation Plan, Vol. 1.* Snohomish County, WA: Author. Retrieved from http://www.snohomishcountywa.gov/2429/Hazard-Mitigation-Plan

5. Fire
   - *The principal structural fire threats for the District stems from the built environment, both commercial and residential occupancies.*
   - *The wildland fire season typically begins in early July and ends in late September due to higher precipitation.*
   - *None of the State's major wildland fires have occurred in Snohomish County and the burning cycle is approximately every 100 to 150 years.*
6. Flooding
   - *The primary flooding threat comes from the Snohomish River, and specifically the confluence of the Snoqualmie and Skykomish rivers near the City of Monroe. Those areas most prone to flooding are zoned so as to minimize the risk to life and property.*
   - *Ranked as the third highest risk by the Hazard Mitigation Plan.*
7. Hazardous Materials
   - *The District faces potential risks of hazardous materials incidents, both fixed site and transportation related.*
   - *However, low frequency of historical events.*
8. Landslides
   - *Landslides and mudslides are caused by one or a combination of changes in slope of the terrain, increased load on the land, shocks and vibrations, changes in water content, groundwater movement, frost action, weathering, and changes in vegetation.*
   - *The month of January has the greatest probability after the wet months of November and December and during or after major storms.*
   - *Ranked fourth in risk ranking by the Hazard Mitigation Plan.*
9. Tsunami & Seiche
   - *While the threat of an earthquake-triggered tsunami continues to exist, current detection and warning systems are more sophisticated and reliable.*
   - *Ranked relatively low risk by Hazard Mitigation Plan.*
10. Volcanic Eruptions
    - *The most proximate threat to the District in Glacier Peak (10,541 ft.).*
    - *In addition, there are three major Cascade volcanoes that are relatively close to Snohomish County in Mount Rainier, Mount St. Helens, and Mount Baker.*

The overall hazard risk rankings for Snohomish County are provided as Figure 11 below.

Figure 11: Hazard Risk Rating for Snohomish County[10]

19-2. HAZARD RISK RANKING				
Rank	**Snohomish County**	**Southwest**	**Snohomish**	**Stillaguamish**
1	Earthquake	Earthquake	Earthquake	Flooding, Dam Failure[5]
2	Severe Weather	Severe Weather	Severe Weather	Earthquake, Climate Change, Volcano
3	Flooding	Landslide & Mass Movements	Flooding, Landslide &Mass Movement	Landslide & Mass Movement, Wildland Fire
4	Landslide & Mass Movements	Flooding	Severe Weather	Severe Weather, Tsunami/Seiche, Avalanche
5	Climate Change	Tsunami/Seiche	Climate Change	
6	Dam Failure	Dam Failure, Avalanche	Dam Failure	
7	Tsunami/Seiche	Volcano	Tsunami/Seiche	
8	Wildland Fire	Climate Change	Wildland Fire	
9	Avalanche, Volcano	Wildland Fire	Avalanche, volcano	
Other hazard mentioned	Hazardous Materials- Tier II/ Pipelines	Pandemic/Infectious Disease	Pandemic/Infectious Disease	Levee Failure
Other hazard mentioned	Levee Failure		Hazardous Materials- railroad and pipelines	

[10] Ibid.

Prospective Fire Risk Analysis

Insurance Services Office, Inc.

The Insurance Services Office, Inc. (ISO) is a subsidiary of Verisk Analytics, a provider of statistical, actuarial, underwriting and claims information. ISO in particular serves insurers, agents, brokers, insurance regulators, risk managers and other participants in the property/casualty insurance marketplace.

ISO provides agencies with a Fire Suppression Rating Schedule (FSRS) that assigns credit points to recognize a community's performance on measures related to fire suppression. The schedule objectively evaluates each item and uses the evaluations in a mathematical calculation to determine the accurate amount of credit for each category. Using the FSRS, ISO develops an overall Public Protection Classification (PPC) number for each community. The PPC number represents the average class of fire protection for the jurisdiction. The PPC assigns each community a rating of 1 through 10, where 1 indicates exemplary fire protection capabilities, and 10 indicates the capabilities, if any, are insufficient for insurance credit.

ISO provides services throughout the United States and a number of other nations, however, domestically Hawaii, Idaho, Louisiana, Mississippi, Washington have rating agencies in their respective states and do not formally participate with the ISO system of rating risk. For the state of Washington, the Washington Surveying and Rating Bureau is the entity that provides fire risk rating for jurisdictions within.

Washington Surveying and Rating Bureau

The Washington Surveying and Rating Bureau (WSRB) is a non-profit, public-service institution the provides rating services to all companies licensed to sell property insurance in Washington, and to organizations involved in promoting sound fire protection practices. WSRB evaluates all Washington communities for their fire protection/suppression capabilities. Each community is assigned a Protection Class of 1 through 10, where 1 indicates exemplary fire protection capabilities, and 10 indicates the capabilities, if any, are insufficient for insurance credit.

All areas of Snohomish County Fire District 7 have been designated a Protection Class of 3, including Monroe and Mill Creek. This rating suggests the fire risk in the future will be lower for District 7 than jurisdictions that have a Protection Class of 4 to 10.

Transportation Risks

Aviation

Several airports are in the region beginning with Paine Field operated by Snohomish County. In addition, the cities of Arlington and Darrington provide general aviation use. Finally, several smaller privately owned airports exist in Granite Falls, Marysville, Monroe, Snohomish, and Sultan.[11]

Railroad

The principal rail transportation risk for the area centers on the trackage owned / operated by the Burlington Northern Santa Fe Railroad (BNSF). A single mainline track between Seattle, WA and Vancouver, BC follows a north-south corridor that generally parallels Interstate 5.

The freight cargoes are diverse and include coal, crude oil, LPG, grain and mixed cargoes originating from or destined to area seaports. The exact volume of hazardous materials rail shipments is elusive as a result of railroad security concerns. Based upon local observations of railroad freight activity, it appears that there is sufficient evidence that the hazardous nature and volume of these cargoes introduces some risk.

Highway

Significant road structures, including highways and interstates, provide access for the population of Snohomish County Fire District 7. Therefore, the inherent risk of motor vehicle accidents, vehicle fires, and hazardous materials releases exist.

Population Density, Development, and Growth

Overall, the density for the District is of suburban density as defined by the Commission on Fire Accreditation International (CFAI).[12] The Commission has traditionally recognized that rural designations are populations less than 1,000 per square mile and suburban is for populations between 1,000 and 2,000 per square mile. The District has a population density of approximately 1,200 per square mile with the inclusion the City of Mill Creek. When partitioning Mill Creek from the District, the population density is approximately 970 per square mile. Traditionally recommended service levels for suburban population is that the first due unit is capable of arriving within 6 minutes and 30 seconds travel time with a goal of 5 minutes.[13] However, the CFAI has combined urban and suburban densities for first arriving apparatus at a baseline of 5:12 in the most recently released 9th Edition Interpretation Guide that accompanies the 9th Edition Self-Assessment Manual.[14] The time to assemble the effective response force has remained at a baseline of 13-minutes for suburban densities.[15]

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[11] Snohomish County Public Works. (2015). Inventory *of transportation facilities and services: Catalog of maps and databases.* Snohomish County, Washington: Author.

[12] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, 8th (ed.). Chantilly, Virginia: Author. (p. 71)

[13] Ibid.

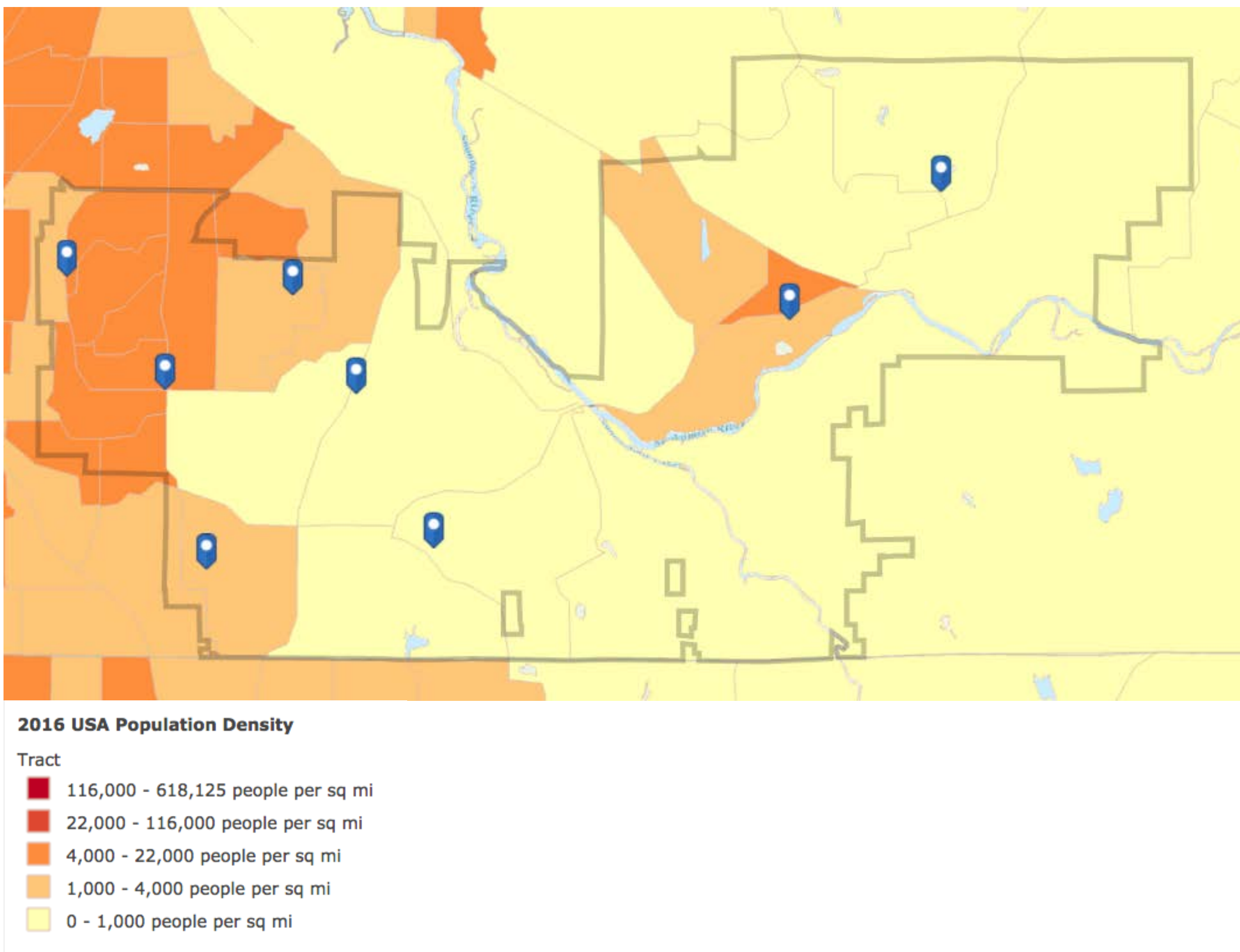
[14] CFAI. (2016). Fire & Emergency Service Self-Assessment Manual: Interpretation Guide, 9th (ed.). Chantilly, Virginia: Author. (p. 99)

[15] Ibid.

At a population of approximately 5,000 per square mile, the City of Mill Creek qualifies as a metropolitan/urban population density.[16] CFAI's traditional recommendations for travel time performance is the same for both metropolitan and urban population densities with a baseline service of 5 minutes and 12 seconds travel time for the first arriving unit and a goal of 4 minutes.[17] The CFAI's definition for an urban density is an incorporated area with over 30,000 people and a population density over 2,000 people per square mile. The metropolitan threshold is over 3,000 people per square mile.[18]

United States Census data is utilized to approximate the distribution of population throughout the District. The population density in the District is differentiated with urban/suburban densities in the west side of the district and in and around Station 31. The east side of the district, with the exception of Station 31, is largely rural with less than 1,000 population per square mile.

Figure 12: Population Density by Census Block - 2016



[16] Ibid.
[17] Ibid.
[18] Ibid.

The lack of a uniform density such as is available in the City of Mill Creek, affords the District governance flexibility to establish policy related to meeting or exceeding the community's expectations for service. Overall, the aggregate current performance for the District does not meet the traditionally accepted baseline recommendations for Urban and Suburban densities from the Commission on Fire Accreditation International (CFAI). An individual analysis of each fire station's performance is provided as Tables 29 and 30 in the Data Report. A comparison table of the current performance and national recommendations is provided as Table 20 below.

Table 20: Comparison of Response Times by Agency to Best Practices and National Experience

Call Category	Average Travel Time	90th Percentile Travel Time	CFAI[19] 90th Percentile Urban/Suburban Travel Time	CFAI[20] 90th Percentile Rural Travel Time	NFPA 1710[21] 90th Percentile Travel Time	USFA[22] 90th Percentile Turnout and Travel
Fire	4:54	8:18	5:12	13:00	4:00	10:59
BLS	4:24	7:48	5:12	13:00	4:00	10:59
ALS	4:06	7:12	5:12	13:00	8:00	10:59

Projected Growth

The Fire District and the city of Mill Creek are experiencing considerable growth, primarily in higher density residential occupancies. Previous estimates from the US Census suggest a 6.5% increase in population for Snohomish County between April 2010 and July 2014.[23] During this same period, Mill Creek has been estimated to have increased by 5.3%.[24]

More recent projections between 2016 and 2021 anticipate that the population change is increasing with the greatest increases in the western portions of the District. For example, the fastest growing areas are in and around Station's 71 and 72 at 2.6 to 3% growth, respectively. Much of the district is between 0.7% and 1.3% growth. There are no reductions in population projected in this data set.

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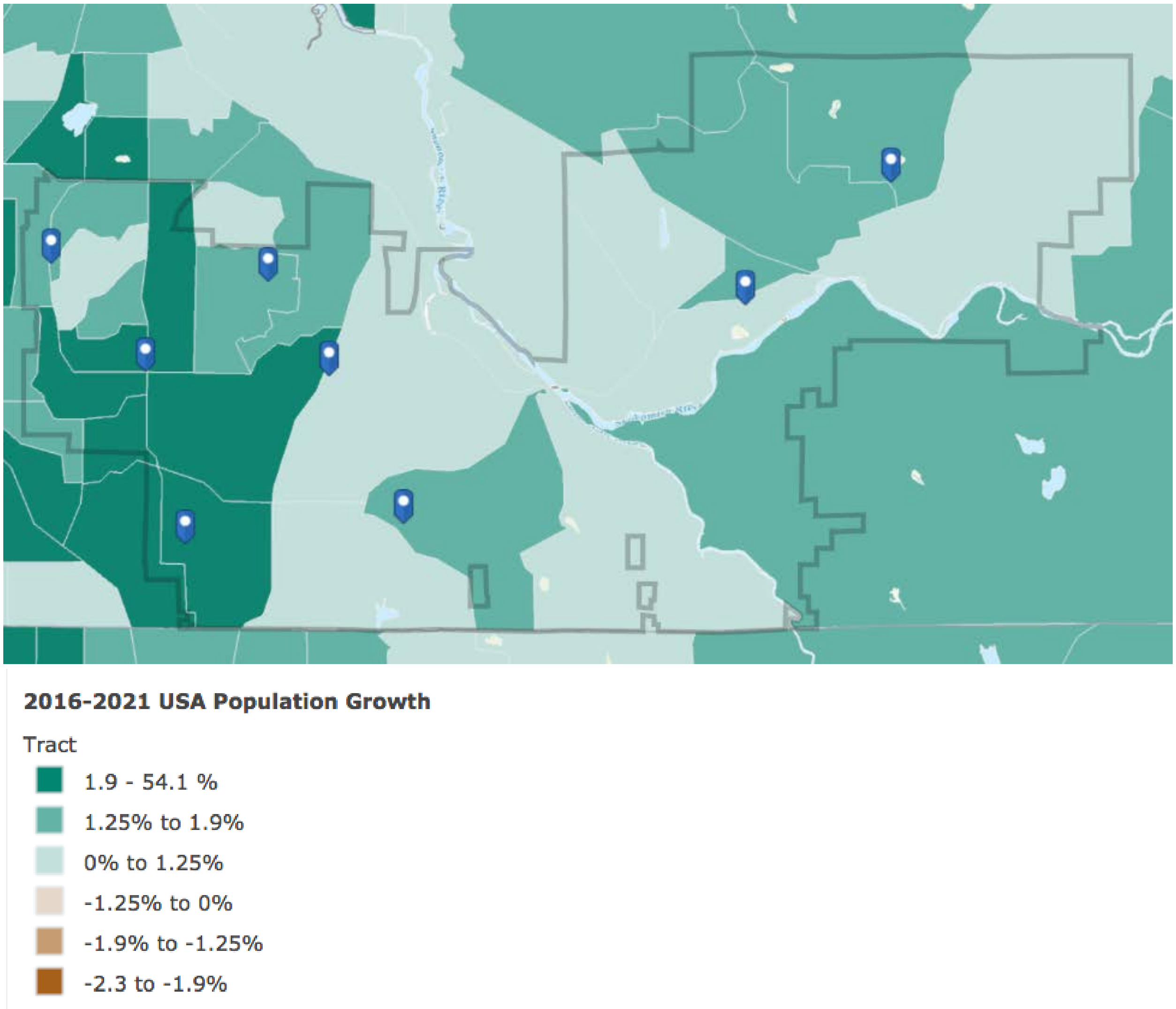
[19] CFAI. (2009). Fire & *emergency service self-assessment manual*, (8th ed.). Chantilly, Virginia: Author.
[20] Ibid.
[21] National Fire Protection Association. (2016). NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Boston, MA: National Fire Protection Association.
[22] USFA. (August 2006). Structure fire response times: Topical fire research series, 5(7). Emmitsburg, Maryland: Author.
[23] US Census 2013 Estimates. Retrieved from http://www.census.gov/quickfacts/table/PST045215/53061,53
[24] US Census. Retrieved from http://www.census.gov/quickfacts/table/PST045215/5345865,00

Figure 13: Annual Population Change 2016-2021



The District boundaries are not expected to change significantly other than through mergers or regional consolidation efforts. From this perspective, increases in population density may only serve to eventually require a greater concentration of resources to meet the demand rather than expanding the distribution model. In other words, if the District does not anticipate creating a larger geographic coverage area through annexations, the likely result of population growth will require additional resources within the existing distribution model rather than by expanding the number of stations.

The City of Mill Creek does have the potential to expand into the City's urban growth boundary. However, if the City exercised their option, it would have the same operational impact as in the District since the District is the service provider; economic and revenue impacts aside. In other words, the increased population and demand for services may drive a greater concentration of resources but not a greater concentration of stations. Similarly, since the District is the provider, the distinction between District and City ownership will not impact the necessity to cover the geographic area.

Risk Assessment

Fire Suppression Services

The District's fire department provides services for the suppression of fires through the use of a minimum of eight fire stations, seven fire engines fully equipped with water supply, hoses, portable ladders, and various tools such as axes. In addition, a dedicated ladder truck is deployed for operating at incidents where elevated fire streams and rescuing trapped victims from upper floors is needed. The Medic units respond to reported fires to fully participate in firefighting activities. There are two Battalion Chiefs assigned each day that provides command and control activities at significant fires. Finally, the Department provides response capabilities and personnel for wildland fire risks.

Community Service Demands - Fire

In 2016, the District was dispatched to 10,279 distinct incidents for all hazards. While the fire suppression resources fully participate in all department activities, the community's demand for fire related services accounted for 1,260 calls, or 12.3% of the department's distinct dispatches. The number of individual unit responses will be more reflective of total department workload as a significant percentage of the District responses include more than one unit. Tables 21 and 22 below summarize the District's unique incidents and responses, respectively.

Table 21: Number of Incidents Dispatched by Category – 2016

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	5,241	14.4	51.0
EMS-ALS	3,226	8.8	31.4
Fire	1,260	3.5	12.3
Special Ops	43	0.1	0.4
Service	509	1.4	5.0
Total	**10,279**	**28.2**	**100.0**

Table 22: Number of Responses, and Total Busy Time by Category – 2016

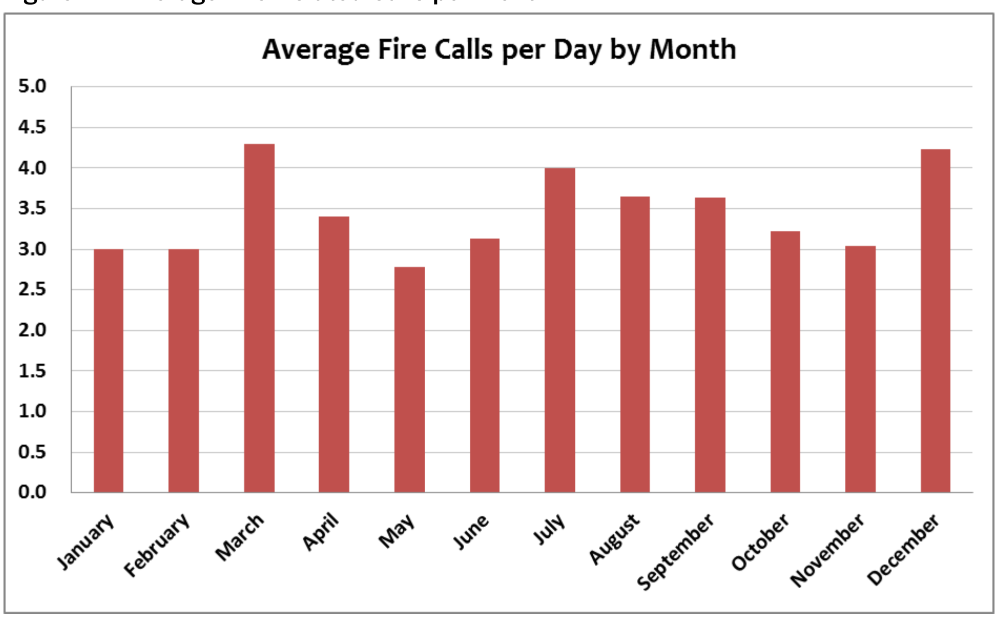
Call Category	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Avg. Busy Minutes per Response
EMS	5,241	8,119	1.5	4,462	33.0
EMS-ALS	3,226	6,024	1.9	4,020	40.0
Fire	1,260	2,195	1.7	969	26.5
Special Ops	43	97	2.3	97	60.0
Service	509	570	1.1	211	22.2
Total	**10,279**	**17,005**	**1.7**	**9,759**	**34.4**

Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These measures examined the frequency of requests for service in 2016 year by month, day of week, and hour of day. Results found that there was variability by month. The three months with most fire calls in order were: March (4.3 per day), July (4.0 per day), and December (4.2 per day). The three months with least fire calls in order were: February (3.0 per day), May (2.8 per day), and November (3.0 per day). Results are presented below.

Table 23: Total Fire Related Calls per Month

Month	Number of Calls	Calls per Day	Call Percentage
January	93	3.0	8.5
February	84	3.0	6.2
March	133	4.3	7.9
April	102	3.4	7.0
May	86	2.8	7.3
June	94	3.1	7.7
July	124	4.0	9.4
August	113	3.6	9.2
September	109	3.6	8.1
October	100	3.2	7.3
November	91	3.0	9.2
December	131	4.2	12.2
Total	**1,260**	**3.5**	**100**

Figure 14: Average Fire Related Calls per Month

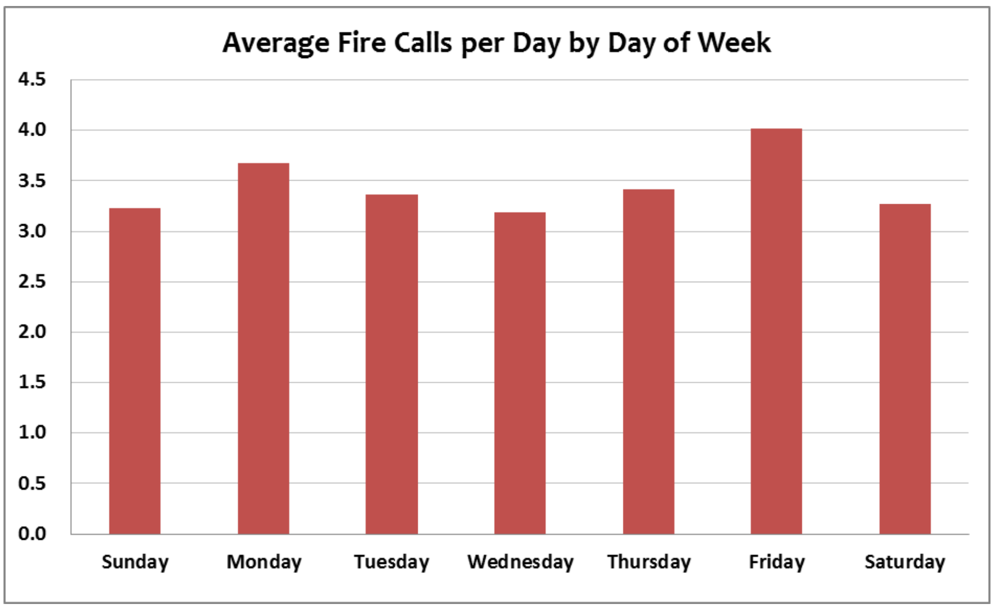


Similar analyses were conducted for fire related calls per day of week. The data revealed that there is minor variability in the demand for services by day of week. Saturday, Sunday and Wednesday were the lows for the week. Friday has the highest frequency of requests for fire related services at 209 calls or 16.6 percent of the weekly total. Results for this analysis are presented below.

Table 24: Total Fire Related Calls by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	168	3.2	13.3
Monday	191	3.7	15.2
Tuesday	175	3.4	13.9
Wednesday	166	3.2	13.2
Thursday	181	3.4	14.4
Friday	209	4.0	16.6
Saturday	170	3.3	13.5
Total	**1,260**	**3.5**	**100.0**

Figure 15: Average Fire Related Calls by Day of Week



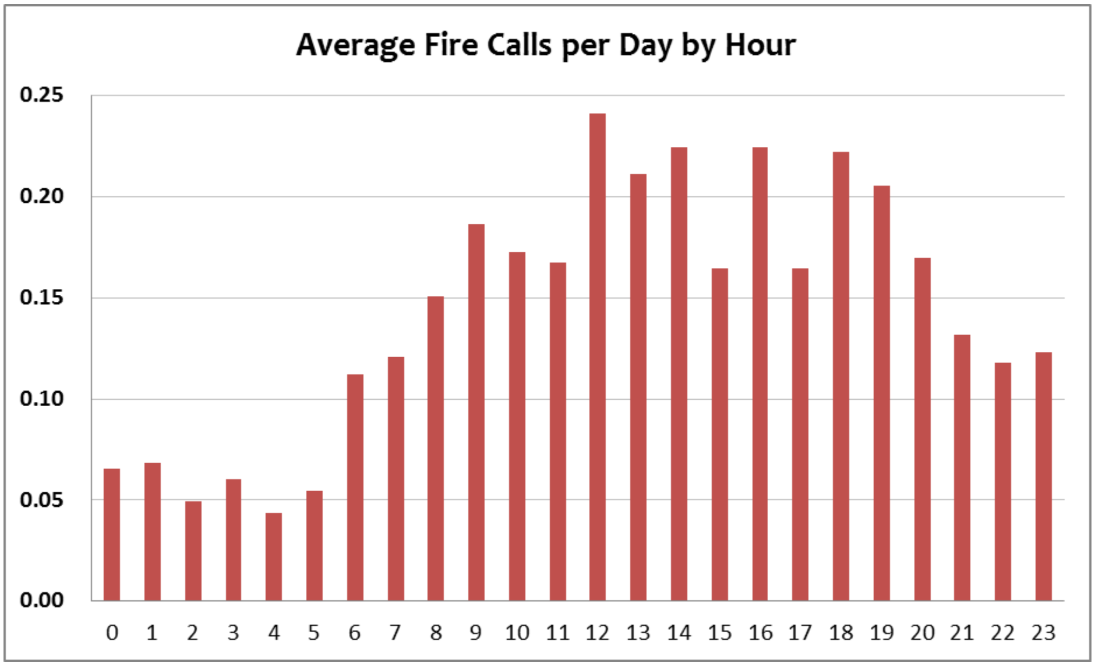
Fire related calls were evaluated by the hour of the day. Considerable variability exists in the time of day that requests for fire related services are received. The hours that include midnight to 0500 are significantly lower than the rest of the day. While the middle of the day has the greatest frequency of calls, specifically the hours that begin at 1200, 1300, 1400, 1600 and 1800 are higher. The average number of calls per hour is 53. The data illustrates that the busiest times of the day for fire related incidents are between noon and 1400.

Finally, in an effort to provide a more granular understanding of the community's demand for fire related services, this temporal analysis included the average number of calls per hour. In other words, when referring to Table 12 below, the busiest hour is at noon with 88 calls during that hour. The average number of calls per hour is a daily average for those 88 calls if they were equally distributed. Therefore, the busiest hour per day would be at noon with an average hourly call volume of less than 1 at 0.24 calls per hour.

Table 25: Total and Average Fire Related Calls by Hour of Day

Hour of Day	Number of Calls	Calls per Day	Call Percentage
0	24	0.07	1.9
1	25	0.07	2.0
2	18	0.05	1.4
3	22	0.06	1.7
4	16	0.04	1.3
5	20	0.05	1.6
6	41	0.11	3.3
7	44	0.12	3.5
8	55	0.15	4.4
9	68	0.19	5.4
10	63	0.17	5.0
11	61	0.17	4.8
12	88	0.24	7.0
13	77	0.21	6.1
14	82	0.22	6.5
15	60	0.16	4.8
16	82	0.22	6.5
17	60	0.16	4.8
18	81	0.22	6.4
19	75	0.21	6.0
20	62	0.17	4.9
21	48	0.13	3.8
22	43	0.12	3.4
23	45	0.12	3.6
Total	**1,260**	**3.45**	**100.0**

Figure 16: Average Fire Related Calls per Day by Hour of Day



For these analyses, "Fire Related" incidents are an aggregated category of the various final incident types available in the Computer Aided Dispatch (CAD) database. The department utilizes these CAD incident types to accurately dispatch and categorize fire related call types. In 2016, the most frequent community demand for fire suppression services was for fire single engine response at 269 requests, followed by fire alarm commercial at 212 and fire alarm residential at 198. According to the final call incident type captured at the end of the call, full responses to commercial fires totaled 69 and full responses for residential fires totaled 112. The CAD final incident types included in "Fire" dispatches with the corresponding number of calls and their percentages are provided in Table 26 below.

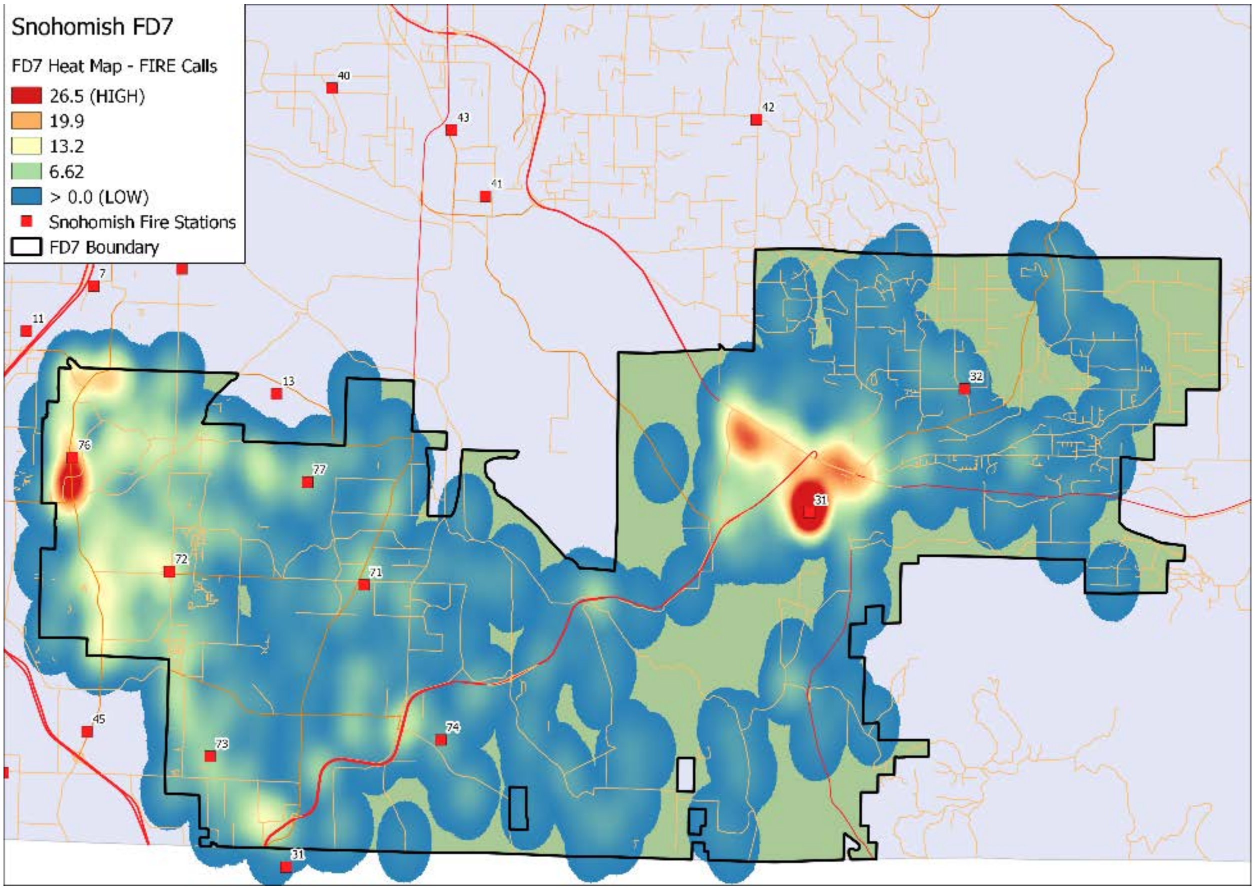
Table 26: Fire Related Final CAD Incident Types

Final Type	Final Type Description	Number of Calls	Percentage of Total Fire Service Demands
FS	Fire Single Engine response	269	21.3
FAC	Fire Alarm Commercial	212	16.8
FAR	Fire Alarm Residential	198	15.7
FR	Fire Residential	112	8.9
FC	Fire Commercial	69	5.5
MAF	Mutual Aid Fire	55	4.4
FS NONCODE	FS NONCODE	47	3.7
FAS	Fire Alarm Sprinkler Water flow	40	3.2
COA	Carbon Monoxide Alarm	39	3.1
GLI	Gas Leak Inside	38	3.0
GLO	Gas Leak Outside	37	2.9
FTU	Fire Type Unknown	36	2.9
MU	Move Up	31	2.5
FB	Fire Brush	30	2.4
MVCE	Motor Vehicle Collision with Entrapment	22	1.7
MVCF	Motor Vehicle Collision with Fire	7	0.6
COAM	Carbon Monoxide Alarm w/ Medical	6	0.5
NOTICE PRIORITY	NOTICE PRIORITY	3	0.2
FOLLOW UP	FOLLOW UP	2	0.2
NEW CALL	NEW CALL	2	0.2
SUBJECT CONTACT	SUBJECT CONTACT	2	0.2
SUSPICIOUS	SUSPICIOUS	2	0.2
ASSIST FIRE	ASSIST FIRE	1	0.1

The department made a total of 2,195 responses to fire related calls. The total time on task was 969 hours, and the average time on task was 26.5 minutes. Engine E76 is the most utilized unit in fire related calls, followed by Engine E31 and Ladder L72.

It is evident that District's fire related historical risks are concentrated most heavily in the northwestern portions of the District including Mill Creek and in and around Station 31 in the City of Monroe. The remaining fire related incidents are generally distributed throughout the perimeter of the District with the least frequent events in the center core, and eastern boundary, of the District. When referring to Figure 17 below, the higher the frequency of events, the darker the red color. Specifically, the higher concentrations of fire related incidents are in station demand zones of 76, 31, 72, and 73 on the Western parameter and Station 74 to the Southeast. Station demand zones 32, 71 and 77 had the lowest incident frequency of fire related incidents.

Figure 17: Fire Related Incidents - 2016



Community Risks - Fire

Snohomish Fire District #7's internal data for occupancy risk was not robust at the time of this first edition risk assessment. This is primarily due to the lines of authority for fire inspections and plans review for the District areas excluding the City of Mill Creek remain with Snohomish County. Snohomish County provided access to their data set; however, while the data serves the County's internal needs well, the data available from other sources are better aligned for a community risk assessment. Sufficient data was available externally through the Washington Surveying and Rating Bureau (WSRB) to conduct a quantifiable process for this risk assessment. The WSRB is Washington's equivalency of the Insurance Services Organization (ISO). The WSRB made their most recent site evaluation in mid to late 2015.

The WSRB provided specific building occupancy information for the needed fire flow, the number of stories, location, building construction, burning degree, and the presence of automatic sprinklers. Ultimately, a quantifiable risk-rating matrix was developed and approved by the District's fire department that categorized 594 occupancies (267 in old District 7, 69 in Mill Creek, 198 in Monroe, and 60 in old District 3) within the jurisdiction into high, moderate, and low risks. Summaries of the risk matrices are presented as Tables 27 and 28 below.

Due to the relatively higher demands for personnel and apparatus required for fire events that have a large square footage, higher elevation (stories), and specific types of occupancy and construction risks garnished the highest numeric values. Conversely, the presence of an automatic sprinkler system elicited a negative numeric value. In this manner, the fact that 96% of the fires are controlled with sprinkler activation is included into the matrix for a more realistic risk factor rating. The results of the risk assessment process categorized the 594 occupancies into 75 high-risk structures, 330 moderate structures, and 189 low risk structures.

Geospatial analyses were completed to map the locations of each of the commercial occupancies included in the risk matrix process and specifically overlaid within each of the fire station locations. This analysis lends validity to the risk assessment matrix and the process utilized by the Department as the concentration of risks is correlated with the historical demand for fire related services. The results of the geospatial analyses of high, moderate, and low risk structures are presented below as Figures 18, 19, and 20, respectively.

Other fire related risks that were evaluated were mobile/transportation risks, wildland risks, and single/multi-family residential fire risks. The mobile/transportation and wildland risks were previously presented in the community risk profile. The single/multi-family residence structures are correlated with the population densities previously presented. Finally, the residential fire risk was categorized as low/moderate severity. Therefore, the Department's preparedness for their highest risks necessitates that the department is well resourced for the lower risks of similar expertise, personnel, and apparatus.

Table 27: Summary of Risk Matrix — Snohomish Fire District 7 (Old), City of Mill Creek, and City of Monroe

Risk Class	Full Credit Sprinkler System (Yes/No)	Fire Flow		Number of Stories		Square Footage		Construction Type		Burning Degree		Total Risk Score
		Value	Scale	Value	Scale	Value	Scale	Value	Scale	Value	Scale	Scale
High	-10	3	≥ 1500 gpm	5	≥ 4	5	>=100k GPM	5	Combustible or Frame	5	Quick Intense Flash Burning	≥ 18
Moderate	-10	2	> 499 and < 1500 gpm	3	> 1 and < 4	3	> 10k GPM < 100k GPM	3	Joisted Masonry	3	Free Burning	>7 and <18
Low	-10	1	≤ 499 gpm	1	1	1	<10k GPM	1	Non-Combustible and Masonry Non-Combustible	1	Slow Moderate In-Combustible	≤ 7

Table 28: Summary of Risk Matrix — Snohomish Fire District 3 (Old)[25]

Risk Class	Automatic Sprinkler System (Yes/No)	Fire Flow		Number of Stories		Total Risk Score
		Value	Scale	Value	Scale	Scale
High	-2/0	3	≥ 1500 gpm	5	≥ 4	≥ 7
Moderate	-2/0	2	> 499 and < 1500 gpm	3	> 1 and < 4	>3 and <7
Low	-2/0	1	≤ 499 gpm	1	1	≤ 3

[25] Information for the Snohomish Fire District 3 was not as robust as with Snohomish 7 and the municipalities of Mill Creek and Monroe

Figure 18: High Risk Occupancies

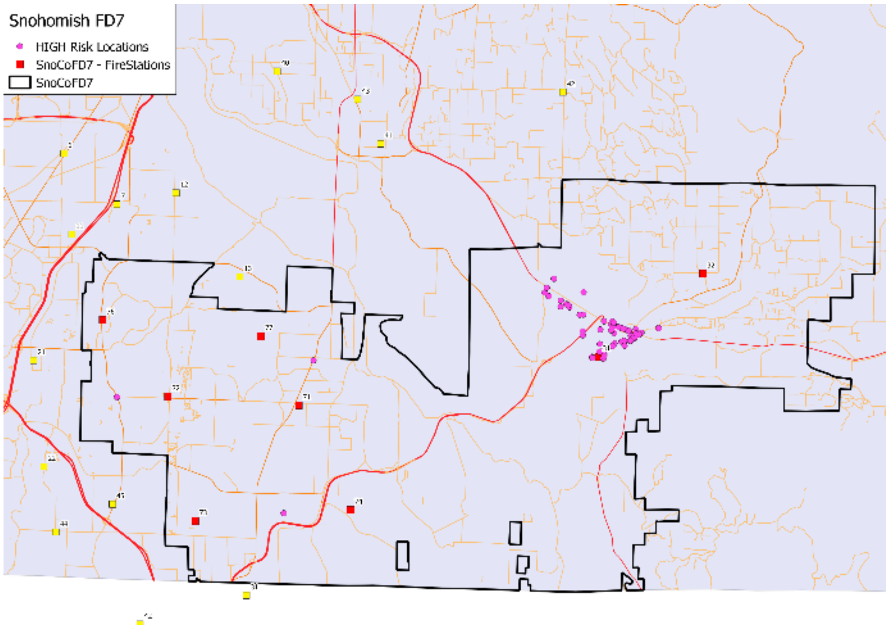


Figure 19: Moderate Risk Occupancies

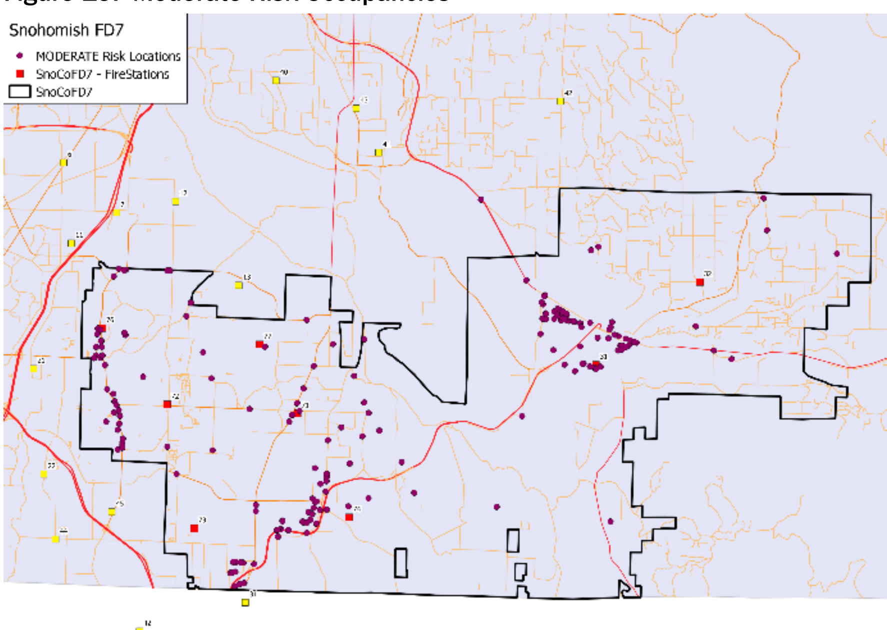
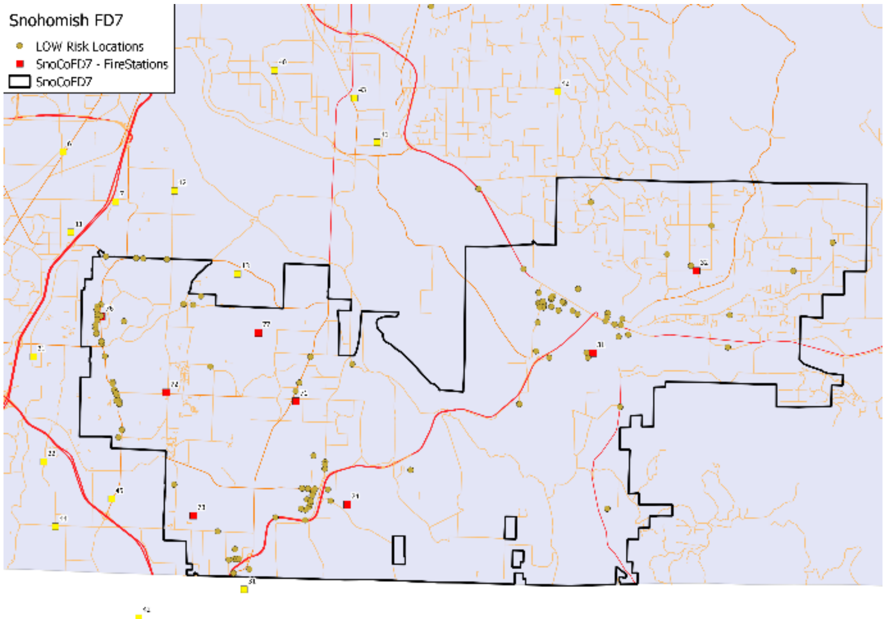


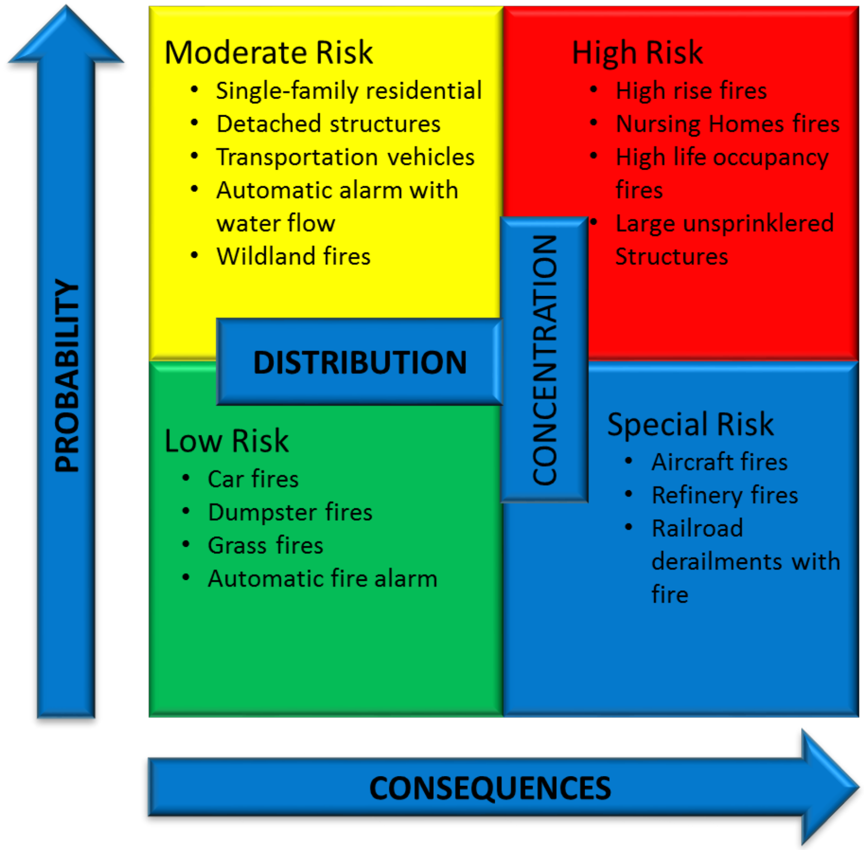
Figure 20: Low Risk Occupancies



Probability/Consequence of Fire Event Risk

The relatively low frequency of fire related events required the Department to rely more heavily on the consequences of the events than the probability of the event occurring. For example, according to the Department's CAD final incident typing, the department responded to 69 full commercial structure fire and 112 full response residential structure fires. The resulting probability and consequence matrix is presented as Figure 21 below.

Figure 21: Probability and Consequence Matrix for Fire Risk



Critical Task Analysis

The critical tasks were developed through a collaborative effort with the Department's staff. Critical tasks were developed for low, moderate, and high-risk fire events. Low risk events that single engines responses would typically handle such as vehicle fires, dumpster fires, and residential automatic fire alarms. Moderate risk responses require additional resources to mitigate the event effectively and efficiently. High-risk events required considerable resources to effectively and efficiently mitigation the events. In addition to the critical tasks for personnel requirements, a similar process was conducted to establish the appropriate apparatus required to assemble the requisite personnel and equipment. Tables 29 through 38 below provide the critical task development.

Table 29: Critical Tasks for Low Fire Risks - Single Engine Responses

Critical Task	Needed Personnel
Incident Command / Safety	1
Investigation / Extinguishment	2
Total	**3**

Table 30: Apparatus and Personnel Requirements for Low Risk - Fires

Responding Units	Minimum Staffing
Engine	3
Total Response Provided	3
Personnel Required by Critical Tasks	**3**

Table 31: Critical Tasks for Moderate Risks - Structure Fire

Critical Task	Needed Personnel
Incident Command / Safety	1
Pump Operator	1
Fire Attack	2
Water Supply	2
Search	2
Ventilation	2
I-RIT	2
Medical / Aid	2
Total	**14**

Table 32: Apparatus and Personnel Requirements for Moderate Risk - Structure Fire

Responding Units	Minimum Staffing
Engine	3
Engine	3
Engine	3
Ladder Truck*	3
Medic Unit	2(3)
Battalion Chief	1
Total Response Provided	**15 (16)**
Personnel Required by Critical Tasks	**14**

*Note: * Cross Staffed with BLS Aid Car*

Table 33: Critical Tasks for High Risk - Structure Fire

Critical Task	Needed Personnel
Incident Command	1
Fire Attack	2
Water Supply	4
Pump Operator	1
Search	4
Ventilation	4
RIT	3
Aerial Operations	2
Medical	2
Safety	1
Backup Line	2
Total	**26**

Table 34: Apparatus and Personnel Requirements for High Risk - Structure Fire

Responding Units	Minimum Staffing
Engine	3
Engine	3
Engine	3
Engine	3
Ladder Truck	3
Ladder Truck	3
Medic	2
Medic	2
Battalion Chief	1
Total Response Provided	**23**
Personnel Required by Critical Tasks	**22**

Table 35: Critical Tasks for Low/Moderate Risk - Fire Alarms

Critical Task	Needed Personnel
Investigation	3
Total	**3**

Table 36: Apparatus and Personnel Requirements for Low/Moderate Risk - Fire Alarms

Responding Units	Minimum Staffing
Engine	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Table 37: Critical Tasks for Moderate - Commercial Fire Alarms with Water Flow Alarm

Critical Task	Needed Personnel
Investigation	4
Panel	1
Total	**5**

Table 38: Apparatus and Personnel Requirements for Moderate Risk - Commercial Fire Alarms with Water Flow Alarm

Responding Units	Minimum Staffing
Engine	3
Truck/Engine	3
Total Response Provided	**6**
Personnel Required by Critical Tasks	**5**

Emergency Medical Services

The District provides emergency Medical Services (EMS) in a multi-tiered system. The first layer is a first responder layer provided primarily by the fire engines and ladder trucks. Requests for EMS are categorized as either Basic Life Support (BLS) or Advanced Life Support (ALS). The vast majority of BLS patients are either treated and released or treated and transported by the department. An EMS request for ALS services also receives one of the Department's medic units that provide both treatment and all ALS patient transportation services. In total, the department wholly participates in the delivery of EMS and, at full staffing, has eight (8) fire suppression units, five (5) aid units, and four (4) medic units geographically deployed to meet the service demands and the District's current performance goals. Finally, the District participates in mutual and automatic aid agreements and closest unit dispatching with the surrounding municipalities and fire districts.

Community Service Demands

The majority of the community's requests for services are for emergency medical services. Analyses reveal that approximately 51% of the Department's call volume is allocated for BLS incidents and an additional 31% of the total call volume is allocated to ALS incidents. In total, 82.4% of all District requests for services are for EMS. A summary of all dispatched calls in 2016 is provided again as Table 39 below.

Table 39: Number of Incidents Dispatched by Category – 2016

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	5,241	14.4	51.0
EMS-ALS	3,226	8.8	31.4
Fire	1,260	3.5	12.3
Special Ops	43	0.1	0.4
Service	509	1.4	5.0
Total	**10,279**	**28.2**	**100.0**

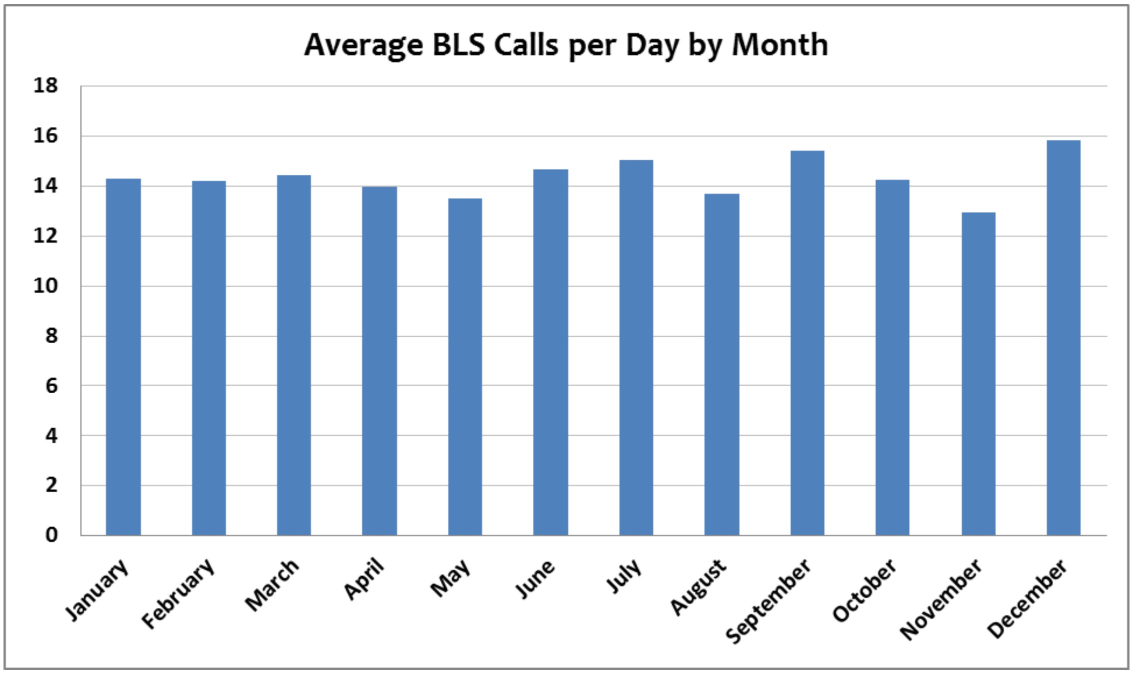
Basic Life Support

Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed for BLS and ALS calls. First, month of year, day of week, and hour of day for BLS calls are categorized for 2016. There is minor variability between months of the year with December receiving the most requests for service and November the least. Results are presented as Table 40 and Figure 22 below.

Table 40: Annual Total and Average per Day of BLS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
January	443	14.3	8.5
February	398	14.2	6.2
March	447	14.4	7.9
April	419	14.0	7.0
May	418	13.5	7.3
June	440	14.7	7.7
July	467	15.1	9.4
August	425	13.7	9.2
September	463	15.4	8.1
October	442	14.3	7.3
November	388	12.9	9.2
December	491	15.8	12.2
Total	**5,241**	**14.4**	**100**

Figure 22: Average BLS Calls per Day by Month of Year

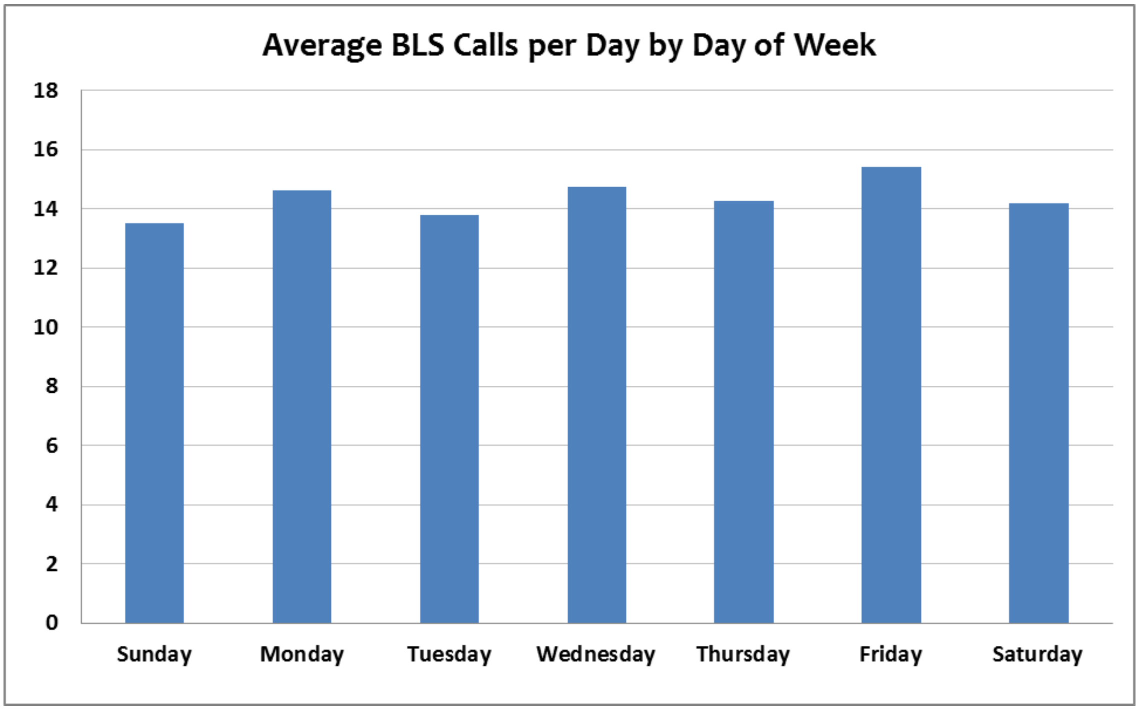


Similar analyses were conducted examining the frequency of requests for service by the day of the week. Once again, there is only minor variability in the demand for services by the day of the week. However, Friday and Wednesday receive the most requests for service and Sunday and Tuesday the least. Results are provided below as Table 41 and Figure 23, respectively.

Table 41: Annual Total and Average per Day of BLS Calls by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	703	13.5	13.4
Monday	760	14.6	14.5
Tuesday	717	13.8	13.7
Wednesday	766	14.7	14.6
Thursday	756	14.3	14.4
Friday	801	15.4	15.3
Saturday	738	14.2	14.1
Total	**5,241**	**14.4**	**100.0**

Figure 23: Average BLS Calls per Day by Day of Week

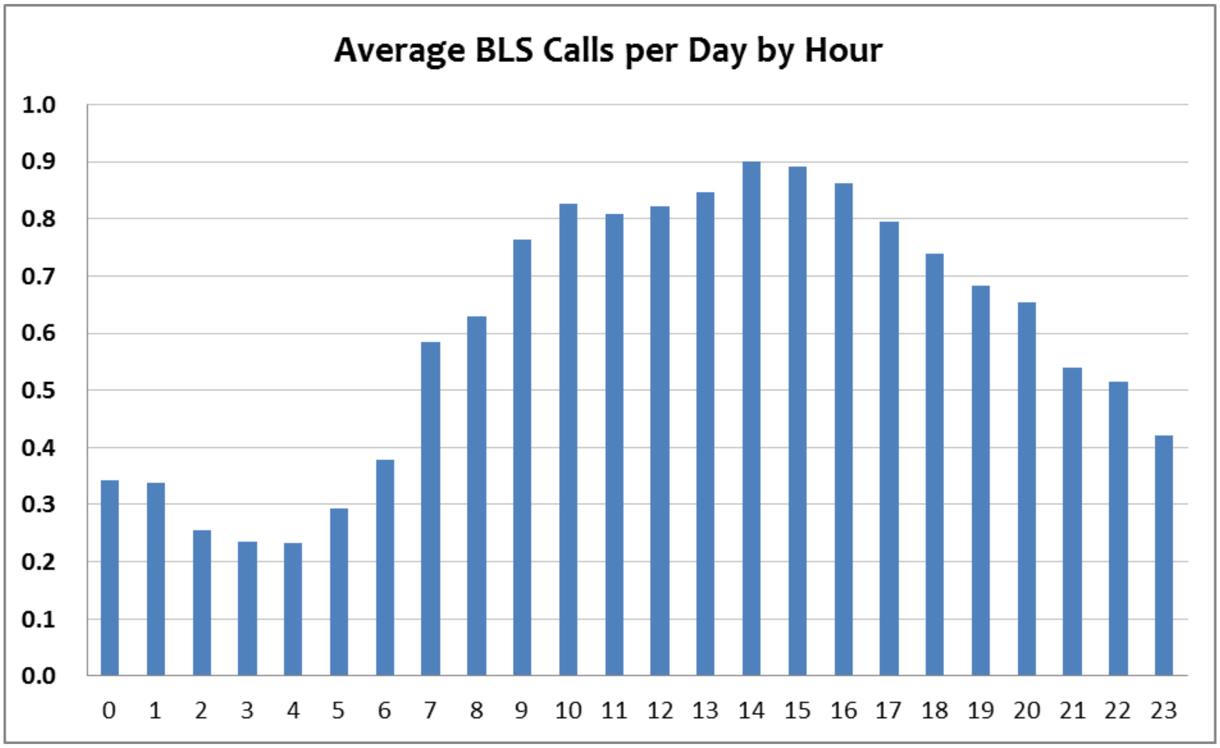


Finally, the analyses for BLS services are concluded by identifying the BLS calls by hour of day and the average hourly rate of BLS calls per hour. The demand curve for requests for BLS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls was between 1000 and 1600. The average hourly rate of service requests does not exceed 0.9 for any hour during the day with the peak occurring at 1400 and 1500. There are 0.60 calls on average and a low at 0400 of 0.23 calls on average during that hour. During the 6-hour period from midnight to 0600, the average per day is 2.1, which means the department on average responded to 2.1 BLS call per day in the six hours period from midnight to 0600. Results are provided below as Table 42 and Figure 24.

Table 42: Annual Total and Average per Day of BLS Calls by Hour of Day

Hour of Day	Number of Calls	Calls per Day	Call Percentage
0	125	0.3	2.4
1	123	0.3	2.3
2	93	0.3	1.8
3	86	0.2	1.6
4	85	0.2	1.6
5	107	0.3	2.0
6	138	0.4	2.6
7	213	0.6	4.1
8	230	0.6	4.4
9	279	0.8	5.3
10	302	0.8	5.8
11	295	0.8	5.6
12	300	0.8	5.7
13	309	0.8	5.9
14	329	0.9	6.3
15	325	0.9	6.2
16	315	0.9	6.0
17	290	0.8	5.5
18	270	0.7	5.2
19	249	0.7	4.8
20	239	0.7	4.6
21	197	0.5	3.8
22	188	0.5	3.6
23	154	0.4	2.9
Total	**5,241**	**14.4**	**100.0**

Figure 24: Average BLS Calls per Day by Hour of Day



In addition to the demand for EMS, the department contributes considerable resources to the service area. The department sends multiple units to 38 percent of the BLS incidents responded to by the department. On average, 1.5 units were dispatched per BLS call.

The department made a total of 8,119 responses to BLS calls. The total time on task was 4,462 hours, and the average time on task was 33.0 minutes. E76 is the most utilized unit, followed by A31, A77 and M31.

Advanced Life Support

Temporal analyses were completed for requests for ALS service as well. The annual calls per month provided little variability; however, January and March have the greatest frequency of calls. Similarly, the calls were analyzed by day of week with identical findings that Monday is the busiest of the days of the week and Saturday the least busy. The following tables and figures below provide the summary of this data.

Table 43: Annual Total and Average per Day of ALS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
January	313	10.1	8.5
February	248	8.9	6.2
March	311	10.0	7.9
April	278	9.3	7.0
May	272	8.8	7.3
June	266	8.9	7.7
July	235	7.6	9.4
August	252	8.1	9.2
September	244	8.1	8.1
October	270	8.7	7.3
November	260	8.7	9.2
December	277	8.9	12.2
Total	**3,226**	**8.8**	**100**

Figure 25: Average ALS Calls per Day by Month

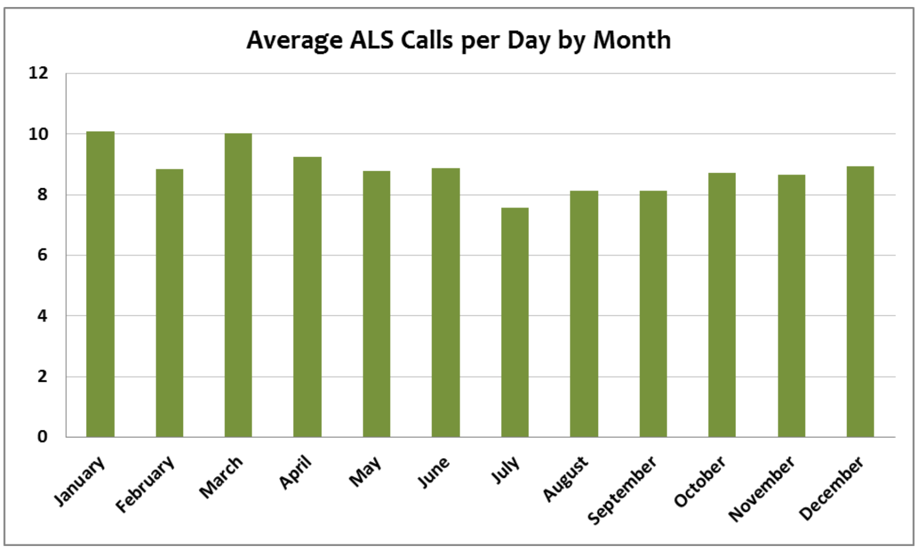
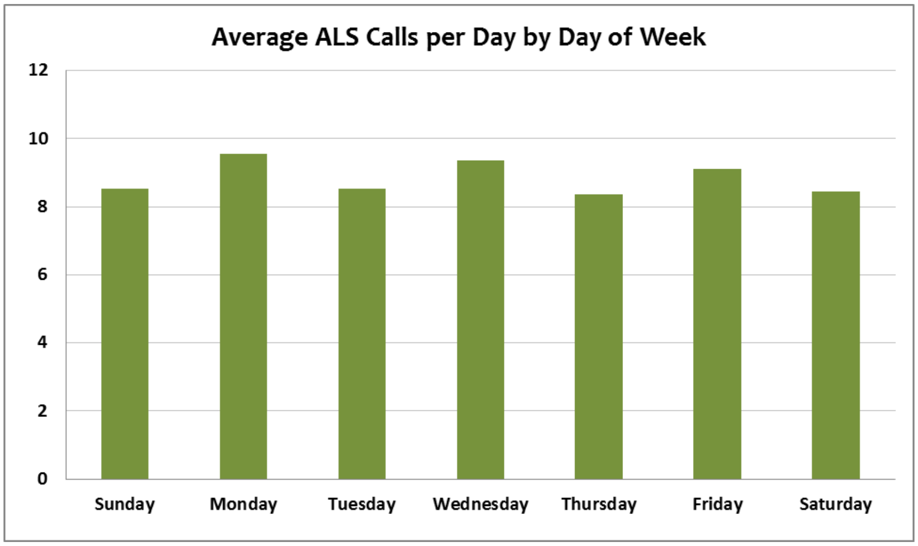


Table 44: Annual Total and Average per Day of ALS Requests by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	443	8.5	13.7
Monday	497	9.6	15.4
Tuesday	444	8.5	13.8
Wednesday	487	9.4	15.1
Thursday	443	8.4	13.7
Friday	473	9.1	14.7
Saturday	439	8.4	13.6
Total	**3,226**	**8.8**	**100.0**

Figure 26: Average ALS Calls per Day by Day of Week



Requests for ALS service were analyzed by the hour of the day and the average hourly rate of requests. The annual frequency of ALS calls by the hour of day follows a similar pattern as the BLS demand curve previously presented with the busiest period between 0900 and 2000. The average hourly call rate did not exceed 0.59 calls per hour at noon. Requests by hour of the day are represented in Figure 27 and Table 45 below.

Figure 27: Average ALS Calls per Day by Hour of Day

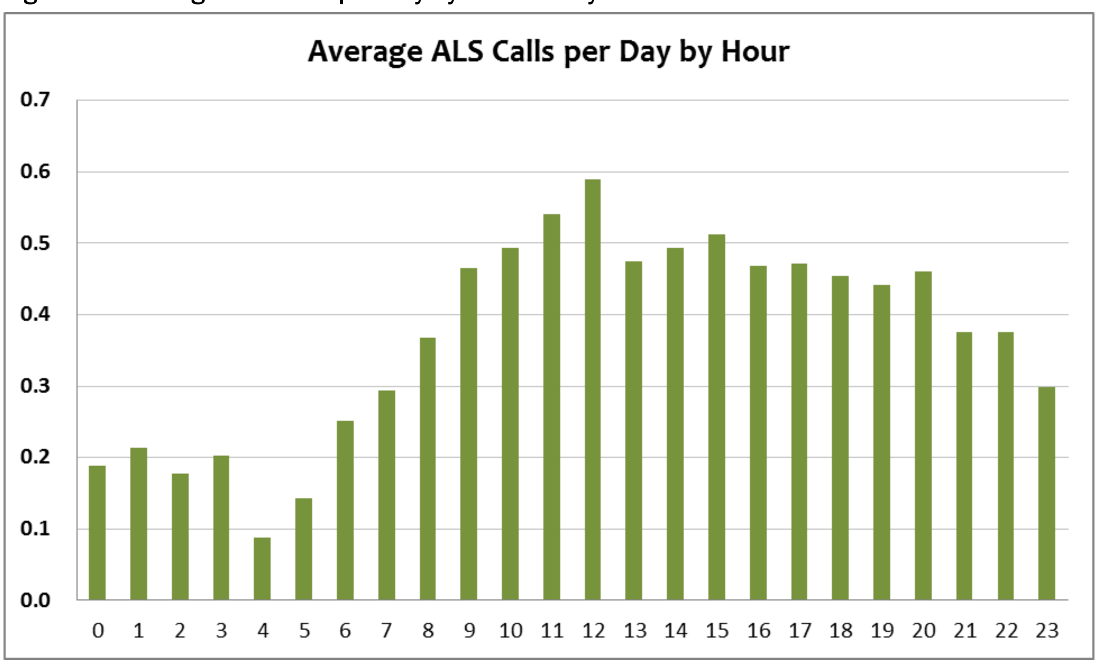


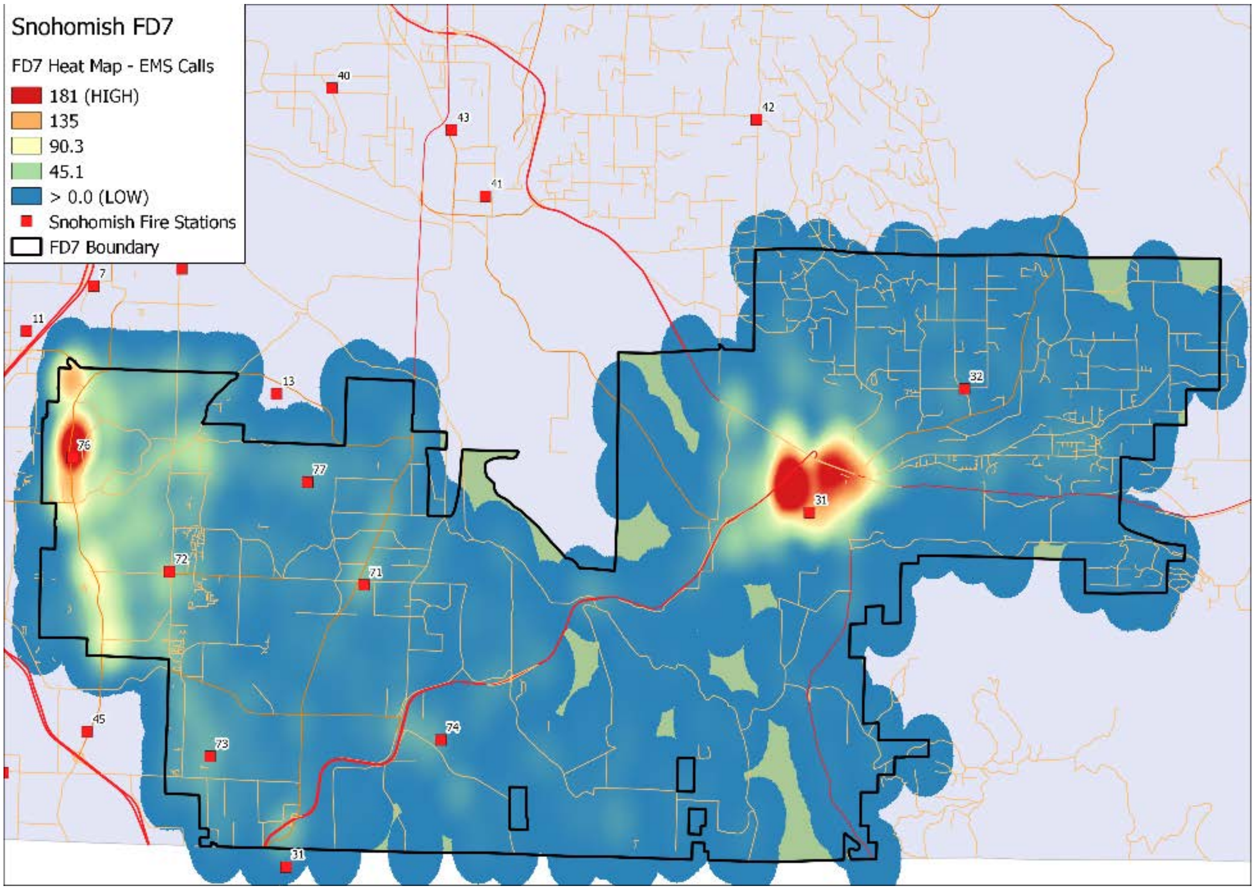
Table 45: Annual Total and Average per Day of ALS Requests by Hour of Day

Hour of Day	Number of Calls	Calls per Day	Call Percentage
0	69	0.2	2.1
1	78	0.2	2.4
2	65	0.2	2.0
3	74	0.2	2.3
4	32	0.1	1.0
5	52	0.1	1.6
6	92	0.3	2.9
7	107	0.3	3.3
8	134	0.4	4.2
9	170	0.5	5.3
10	180	0.5	5.6
11	197	0.5	6.1
12	215	0.6	6.7
13	173	0.5	5.4
14	180	0.5	5.6
15	187	0.5	5.8
16	171	0.5	5.3
17	172	0.5	5.3
18	166	0.5	5.1
19	161	0.4	5.0
20	168	0.5	5.2
21	137	0.4	4.2
22	137	0.4	4.2
23	109	0.3	3.4
Total	**3,226**	**8.8**	**100.0**

The department sends multiple units to 57 percent of the EMS ALS incidents responded to by the department. On average, 1.9 units were dispatched per ALS call. The department made a total of 6,024 responses to ALS calls. The total time on task was 4,020 hours, and the average time on task was 40 minutes. Medic/ALS M76 is the most dispatched unit, followed by M31 and E76.

Geospatial analyses were completed on all EMS incidents, separated by BLS and ALS dispatch identifiers. The GIS analyses mapped historical call volume with the fire station locations identified. When reviewing the maps, the darker the shade (red) the greater frequency of calls. For example, the greatest density of BLS calls for this period is disproportionately found in fire station demand zones 76 and 31, followed by Station 72. The BLS demand map is presented below as Figure 28.

Figure 28: BLS Demand Map



Analyses of the ALS requests for service found a similar pattern to the BLS demand as the greatest frequency of calls is located in the station fire demand zones 76 and 31, followed by Station 72. Results are presented as Figure 29 below.

Finally analyses of all combined EMS incidents (BLS/ALS) confirmed the general observations that a consistent distribution is experienced from both the BLS and ALS demand for services.

Figure 29: ALS Demand Map

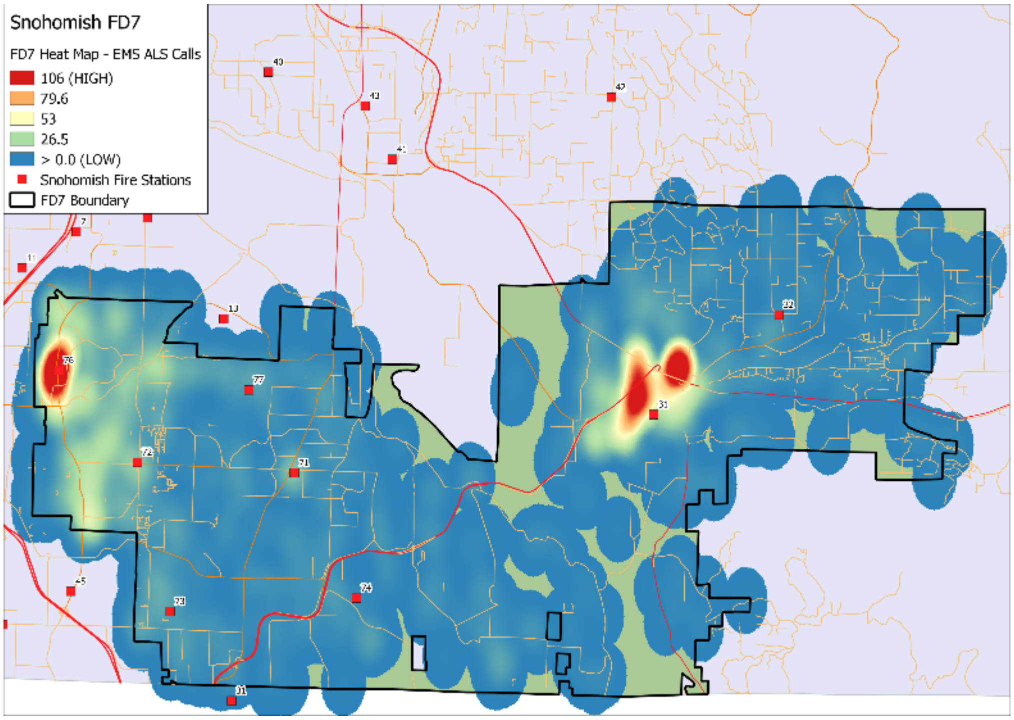
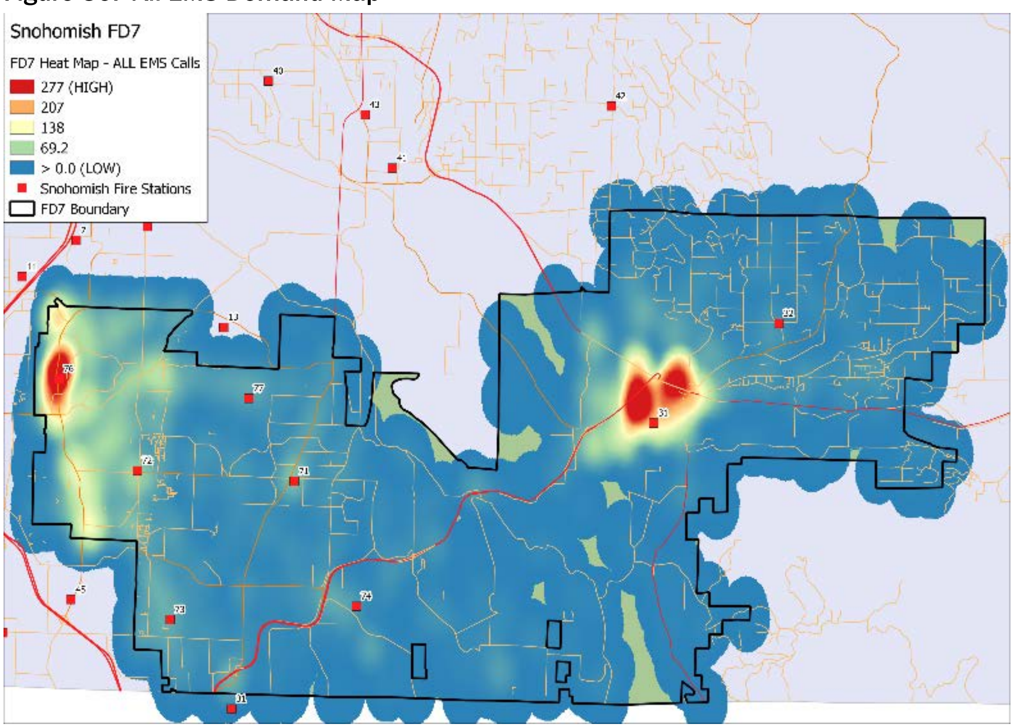


Figure 30: All EMS Demand Map



Community Risks

Snohomish County Fire District #7 is located within Snohomish County, WA and has a population of approximately 110,000 dispersed over approximately 100 square miles resulting in a population density of over 1,000 per square mile (110,000/100).

A 2011 report provided by the Snohomish Health District titled, *Intentional & Unintentional Injuries in Snohomish County* was utilized to describe some of the community risks associated with injuries. The leading cause of unintentional injury mortality in Snohomish County is poisonings (34%) followed by motor vehicle crashes (25%) and falls (23%). Unintentional deaths due to fire and smoke account for 1.6% of the deaths. A summary of these results is reproduced below from the Snohomish Health District report as Figure 31.[26]

Figure 31: Leading Causes of Unintentional Injury Mortality in Snohomish County 2003-2007

Type of Injury	Number of Deaths	Age-Adjusted Mortality per 100,000	% of Unintentional Injury Deaths	Average Years of Potential Life Lost per Death (<65)
Total	1,225	39	100	18.4
Poisonings	420	12	34.3	23.2
Motor vehicle crashes	308	10	25.1	25.9
Falls	280	10	22.9	2.8
Suffocations	42	1	3.4	14.0
Drownings	41	1	3.3	31.4
Fire/smoke	19	1	1.6	8.8

Data source: Death Certificate Data, Washington State Department of Health, Center for Health Statistics.

In addition, the Snohomish Health District's report provided a summary of the differentiation in age groups and the type of injury. The population's age is correlated to the type of injuries and deaths. For example, motor vehicle crashes are the lead causes of injury and mortality under age 24 and falls are the leading injury type for the 65 and older population. Results are reproduced below as Figure 32.[27]

[26] Snohomish Health District. (2011). Intentional & Unintentional Injuries in Snohomish County. Snohomish County, Washington: Health Statistics & Assessment. (p. 22)
[27] Ibid. (p. 9)

Figure 32: Leading Injury Fatalities by Age Group in Snohomish County, 2003-2007

Age <15 (N = 289)		**Age 15-24** (N =288)		**Age 25-44** (N = 1,081)	
Type of Injury	**% of All Deaths**	**Type of Injury**	**% of All Deaths**	**Type of Injury**	**% of All Deaths**
Motor vehicle crashes	4.5	Motor vehicle crashes	24.3	Poisonings	18.3
Drownings	2.8	Suicides	15.3	Suicides	12.5
Homicides	1.7	Poisonings	12.5	Motor vehicle crashes	9.3
		Homicides	7.6	Homicides	2.9
		Drownings	3.1	Falls	1.2
Age 45-64 (N = 4,141)		**Age 65+** (N = 15,243)		**Overall** (N = 21,042)	
Type of Injury	**% of All Deaths**	**Type of Injury**	**% of All Deaths**	**Type of Injury**	**% of All Deaths**
Poisonings	4.3	Falls	1.5	Poisonings	2.0
Suicides	3.6	Suicides	0.4	Suicides	1.8
Motor vehicle crashes	1.9	Motor vehicle crashes	0.3	Motor vehicle Crashes	1.5
Falls	0.7	Poisonings	0.1	Falls	1.3
Homicides	0.4			Homicides	0.4

Data source: Death Certificate Data, Washington State Department of Health, Center for Health Statistics.

With regards to unintentional poisoning, the hospitalization rates and the mortality rates are the highest in North Everett than any other Health Planning Area (HPA). The maps as produced by the Snohomish Health District are presented below as Figures 33[28] and 34.[29]

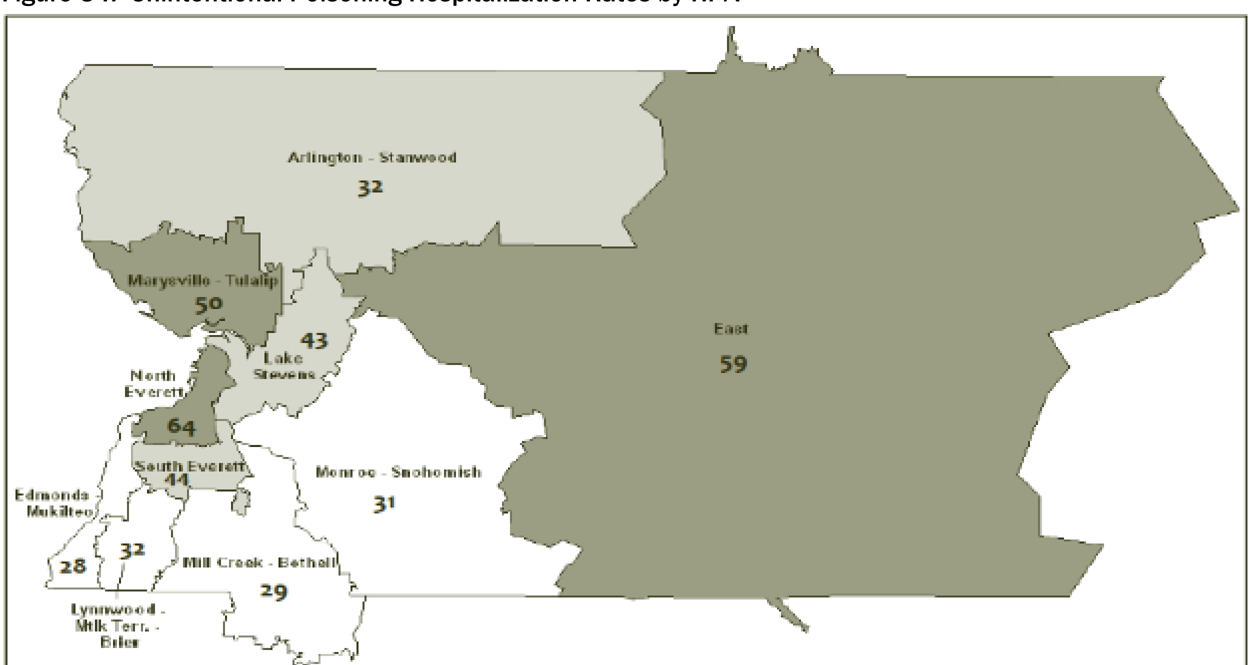
Finally, the leading causes of death in Snohomish County are compared with that of the State of Washington and the United States. The leading cause of death in Snohomish County is cancer followed by heart disease. Unintentional injuries are the third leading cause of death, but the leading cause of non-childbirth hospitalizations in Snohomish County. A comparison table is reproduced below from the Snohomish Health District report as Figure 35.[30]

[28] Ibid. (p. 30)
[29] Ibid. (p.38)
[30] ibid. (p.3)

Figure 33: Unintentional Poisoning Mortality Rates by HPA

*Rates are age-adjusted per 100,000 people.
Data source: Death Certificate Data, Washington State Department of Health, Center for Health Statistics.

Figure 34: Unintentional Poisoning Hospitalization Rates by HPA



*Rates are age-adjusted per 100,000 people.
Data source: Washington State Comprehensive Hospital Abstract Reporting System.

Figure 35: Comparison of Top 10 Leading Causes of Death in Snohomish County

	Snohomish County 2007[1] (n = 4,305)	%	Washington State 2007[1] (n = 47,114)	%	United States 2006[2] (n = 2,426,264)	%
1	Cancer	24.1	Cancer	24.5	Heart disease	26.0
2	Heart disease	23.6	Heart disease	23.3	Cancer	23.1
3	**Injuries** *Unintentional* 6.1% *Intentional* 2.1%	8.2	Dementia	7.9	**Injuries** *Unintentional* 5.0% *Intentional* 2.1%	7.1
4	Dementia	8.2	**Injuries** *Unintentional* 5.5% *Intentional* 2.2%	7.8	Dementia	6.1
5	COPD	5.5	Stroke	5.7	Stroke	5.7
6	Stroke	5.1	COPD	5.7	COPD	5.1
7	Diabetes	2.9	Diabetes	3.2	Diabetes	3.0
8	Chronic liver disease	1.7	Influenza/pneumonia	1.6	Influenza/pneumonia	2.3
9	Influenza/pneumonia	1.6	Chronic liver disease	1.4	Nephritis	1.9
10	Septicemia	1.2	Parkinson's disease	1.1	Septicemia	1.4

COPD, chronic obstructive pulmonary disease.

1. Death Certificate Data, Washington State Department of Health, Center for Health Statistics.

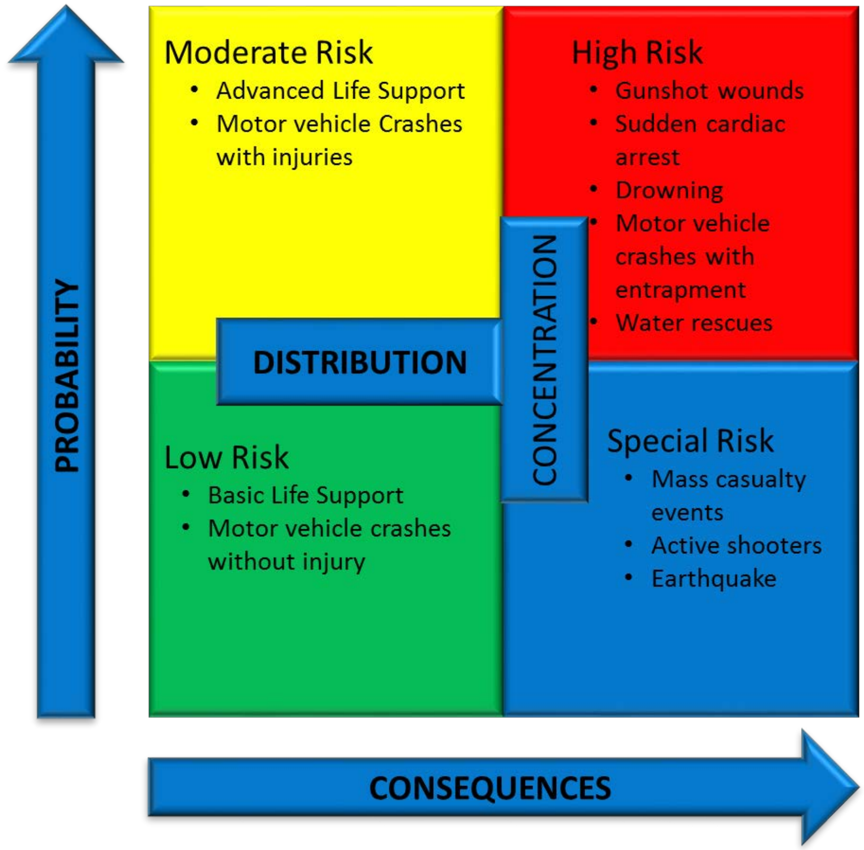
2. Centers for Disease Control and Prevention. Deaths: Final Data for 2006. *National Vital Statistics Reports*, vol. 57, #14, 2009. More current data are not available at this time.

Probability/Consequence of EMS Risk

The probability and consequence process used for the EMS risk assessment built upon the existing King County Criteria Based Dispatching (CDB) process. There are 25 primary EMS dispatch codes that are sub-divided based on patient acuity into an ALS response, BLS emergency response, BLS non-emergency response, and the transfer to a nurse hotline (no response). These medical priority determinants and sub-determinants are the framework for the SNOPAC and SNOCOM 911 CAD call types of ALS and BLS responses and for recommendations for emergent or non-emergent responses.

Therefore, the resulting condensed determinants are utilized by Department to compare the probability and consequence of the EMS incidents. The results are presented as Figure 36 below.

Figure 36: Probability and Consequence Matrix for EMS Risk



Critical Task Analysis

In order to align resource allocation and risk for emergency medical services, the DEPARTMENT staff completed a critical task analysis. Results found that the most efficient and effective utilization of resources is to send the most efficient resources to the level of risk and patient acuity identified. Therefore, low risk events may receive a single BLS resource while a moderate risk incident may receive a single resource and support. As a matter of pre-determined dispatch, high risks required multiple resources to effectively mitigate the identified risk. Similarly, a process was completed to identify the resources allocated in order to ensure that the personnel required for the critical tasking is accomplished. Tables 46 through 57 below reflect call types and resource allocations.

Table 46: BLS Emergency Response - Low Risk

Critical Task	Needed Personnel
BLS -Treatment	2
Total	**2**

Table 47: Resource Allocation for BLS Emergency Response - Low

Responding Units	Minimum Staffing
Snohomish Fire Department Aid Unit – Treat and Transport	2 (3)
Total Response Provided	**2 (3)**
Personnel Required by Critical Tasks	**2**

Table 48: Motor Vehicle Crash Without Injuries - Low Risk

Critical Task	Needed Personnel
BLS Care / hazard abatement	3
Total	**3**

Table 49: Resource Allocation for Motor Vehicle Crash Without Injuries - Low Risk

Responding Units	Minimum Staffing
Engine	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Table 50: ALS Emergency Medical Response - Moderate Risk

Critical Task	Needed Personnel
ALS – Treatment Care	1
BLS – Care and Support	1
Total	**2**

Table 51: Resource Allocation for ALS Emergency Medical Response - Moderate Risk

Responding Units	Minimum Staffing
Snohomish Fire Department Medic Unit	2 (3)
BLS Unit (Closest Aid, Engine, or Truck)	2 (3)
Total Response Provided	**4 (6)**
Personnel Required by Critical Tasks	**2 (3)**

Table 52: Motor Vehicle Crash with Injuries - Moderate Risk

Critical Task	Needed Personnel
BLS Care	2
Hazard Abatement	3
Command and Control	*1*
Total	**6**

Table 53: Resource Allocation for Motor Vehicle Crash with Injuries - Moderate Risk

Responding Units	Minimum Staffing
Aid Unit	2
Engine	3
Battalion Chief	1
Total Response Provided	**6**
Personnel Required by Critical Tasks	**6**

Table 54: Med X (GSW, SCA, Drowning) - High Risk

Critical Task	Needed Personnel
ALS Care	2
BLS Care and Support	4
Total	**6**

Table 55: Resource Allocation for Med X (GSW, SCA, Drowning) - High Risk

Responding Units	Minimum Staffing
Snohomish Fire Department Medic Unit	2 (3)
BLS Unit (Closest Aid, Engine, or Truck)	2 (3)
BLS Unit (Closest Aid, Engine, or Truck)	2 (3)
Total Response Provided	**6 (9)**
Personnel Required by Critical Tasks	**6**

Table 56: Motor Vehicle Crash with Fire / Entrapment - High Risk

Critical Task	Needed Personnel
BLS Care	2
Hazard Abatement	1
Extrication	3
ALS Transport	*2*
Incident Command	1
Total	**9**

Table 57: Resource Allocation for Motor Vehicle Crash with Fire / Entrapment – High Risk

Responding Units	Minimum Staffing
Battalion Chief	1
Snohomish Fire Department Medic Unit	2 (3)
Aid Unit	2 (3)
Closest Extrication Unit	3 (6)
Total Response Provided	**8 (13)**
Personnel Required by Critical Tasks	**9**

*Note: * Closest engine may respond if not equipped*

Hazardous Materials Services

Snohomish County is located in the Seattle area and has hazardous materials risk potential from fixed facilities and transportation of materials. The Department utilizes a three-tiered system to respond to and mitigate hazardous materials incidents. All fire department personnel are trained to the operations level for hazardous materials, thus making the fire suppression force the first line of response for low-risk events. Low risk events would receive a response for early size-up and hazard abatement within their level of training and resources.

More significant hazardous materials events that require additional resources for decontamination, entry, and medical monitoring receive a 2nd tiered (2nd alarm) response to effectively and efficiently mitigate the event. Moderate risk events are primarily answered by the Department with mutual aid from the Snohomish County HazMat Team Technical Decon Unit. However, for high-risk events that require considerable duration and relief, the Department participates and utilizes the full countywide compliment of hazardous materials resources to assemble the appropriate effective response force.

Community Service Demands

Fortunately, for the District the community's demand for hazardous materials services is limited. While there is a potential exposure to hazardous materials risk, the demand for responses is low. As previously presented, hazardous materials falls into the "special operations" CAD call type. This category accounted for 43 unique dispatches in 2016. Hazardous materials responses are included in this category as well as the technical rescue responses. Data are reproduced below as Table 58.

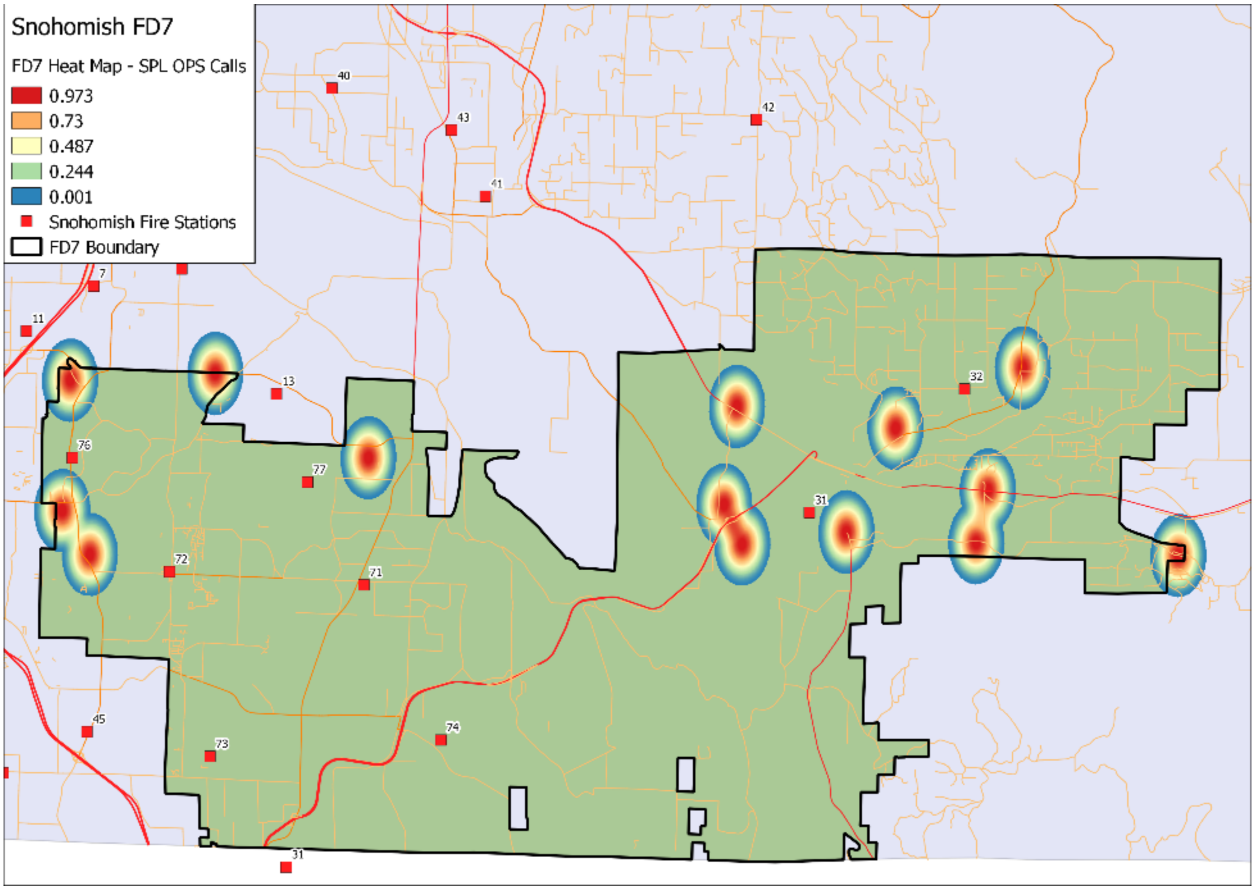
Table 58: Number of Incidents Dispatched by Category – 2016

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	5,241	14.4	51.0
EMS-ALS	3,226	8.8	31.4
Fire	1,260	3.5	12.3
Special Ops	43	0.1	0.4
Service	509	1.4	5.0
Total	**10,279**	**28.2**	**100.0**

The relative low call volume renders temporal analyses unreliable since the events will be much more random than in larger data sets. In other words, the results would not be intuitive for decision-making and no further analytical analyses were conducted.

However, a geospatial analysis of the requests for special operations incidents that include hazardous materials responses was conducted and is represented in Figure 37 below. The distribution of calls is generally distributed throughout the North, West, and East of the District. Due to the relatively low frequency of hazardous materials incidents, the geospatial analysis does not suggest a more appropriate location to deploy resources for hazardous materials.

Figure 37: Hazardous Materials (Special Operations) Demand Map



Community Risks

Snohomish County and the District have existing hazardous materials risks between the fixed facilities and the transportation routes to move materials. A report released in 2009 by the State of Washington's Department of Ecology titled *2007 Chemicals in Washington State Summary Report*, provides information about the community exposure. For example, Snohomish County has the second highest quantity of reporting Sara Title III facilities behind King County. However, Snohomish County is third to last for the quantity of chemicals stored on site. Figures 38[31] and 39[32] below are reproduced from the Department of Ecology report.

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[31] Washington State Emergency Response Commission. (2009). 2007 Chemicals in Washington State Summary Report: Tier Two-Emergency and Hazardous Chemical Inventory and Toxics Release Inventory Data. Olympia, Washington: Department of Ecology, State of Washington. (p. 5)

[32] Ibid. (p.6)

Figure 38: Top Ten LEPCs with the Most Reporting Facilities

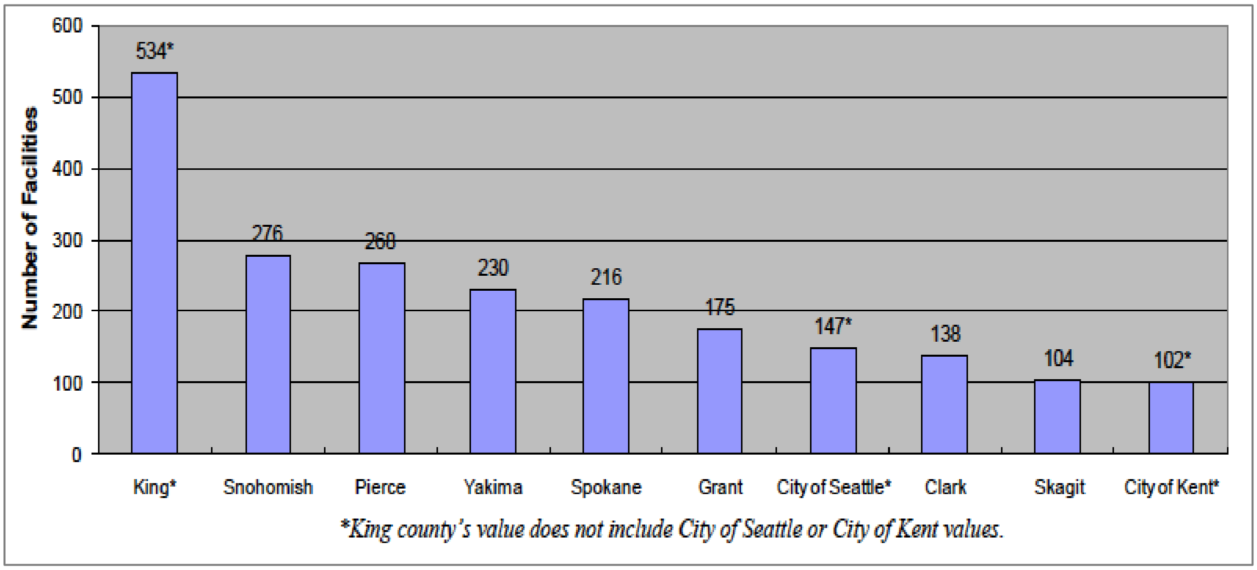
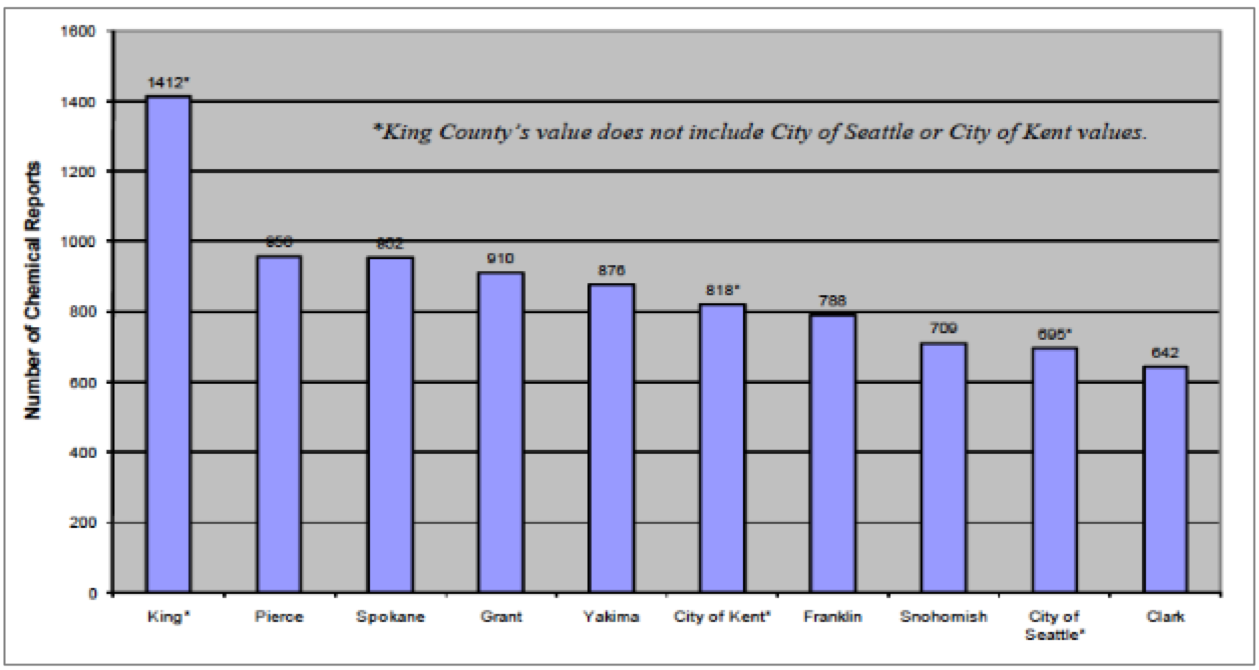


Figure 39: Top Ten LEPCs by Chemicals Stored On Site



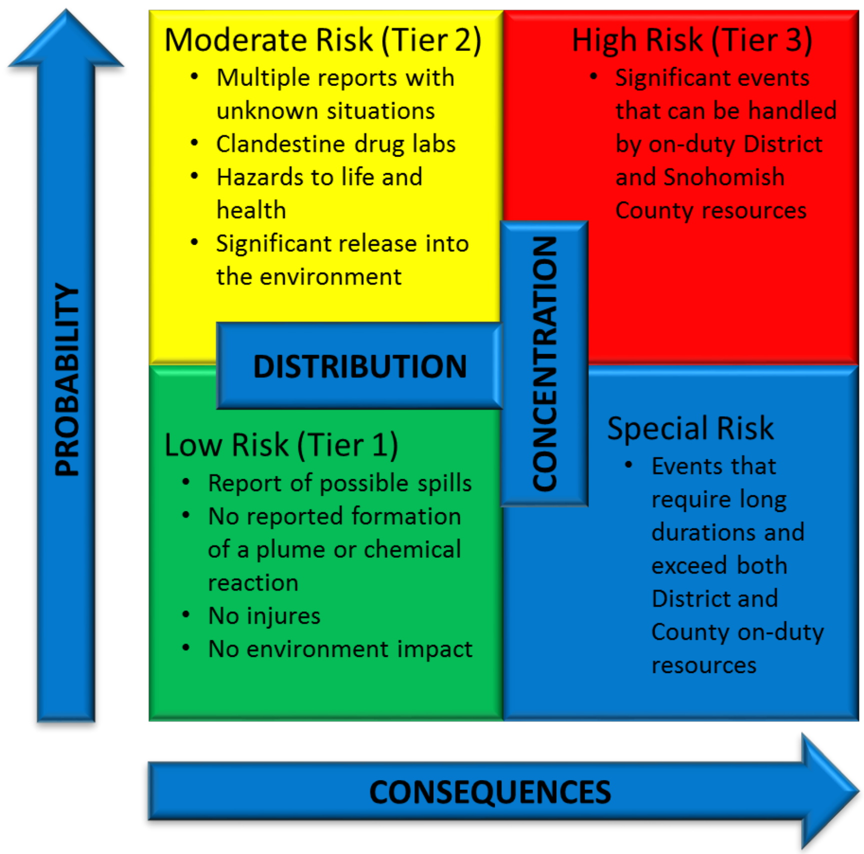
Finally, the most prevalent hazardous materials reported in storage were diesel fuel, gasoline, and lube oil. The most prevalent extremely hazardous materials reported in storage are sulfuric acid, ammonia, and chlorine.

Probability/Consequence of Hazardous Materials Risk

The Department staff completed analyses for the probability and consequence of hazardous materials events. In this case, the risks for hazardous materials are greater than the historical experience. Therefore, the consequence portion of the matrix had greater influence on the risk classification than the probability. All hazardous materials events are relatively low frequency as compared to other community service demands but the consequence of events could be significant.

A probability and consequences risk matrix was developed and is presented as Figure 40 below.

Figure 40: Probability and Consequences Hazardous Materials Risk Matrix



Critical Task Analysis

The Department staff analyzed the critical tasks required for the mitigation of the various hazardous materials risks in the community. Critical tasks for low, moderate, and high risk events are presented as well as the resources allocated to each event in Tables 59 through 64 below.

Table 59: Tier 1 Hazardous Materials Event - Low Risk

Critical Task	Needed Personnel
Recon / Hazard Abatement	3
Total	**3**

Table 60: Resource Allocation for a Tier 1 Hazardous Materials Incident - Low Risk

Responding Units	Minimum Staffing
Engine	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Table 61: Tier 2 Hazardous Materials Event - Moderate Risk

Critical Task	Needed Personnel
Incident Command / Safety	1
Recon Team	2
Backup Team	2
Decon	2
Technical Assistance	2
Medical	2
Total	**11**

Table 62: Resource Allocation for a Tier 2 Hazardous Materials Incident – Moderate Risk

Responding Units	Minimum Staffing
Engine	3
Battalion Chief	1
Hazmat Unit	2
Snohomish County Decon Unit	3
Medic Unit	2 (3)
Total Response Provided	**11**
Personnel Required by Critical Tasks	**11**

Table 63: Tier 3 Hazardous Materials Event - High Risk

Critical Task	Needed Personnel
Incident Command	1
Incident Safety	1
HazMat Group Supervisor (Technician)	1
HazMat Safety (Technician)	1
Entry Team Leader (Technician)	1
Entry Team (Technician)	3
Backup Team (Technician)	2
Decon (1 Technician)	3
Research (Technician)	1
Medical (1 Technician)	2
Support / Personnel	2
Total	**18**

Table 64: Resource Allocation for a Tier 3 Hazardous Materials Event - High Risk

Responding Units	Minimum Staffing
Engine	3
Battalion Chief	1
Hazmat Unit (3)	9
Medic Unit	2 (3)
Snohomish County Decon Unit	3
Total Response Provided	**18**
Personnel Required by Critical Tasks	**18**

Rescue Services

The Department has several members trained as technicians for the Technical Rescue Program and both relies on and participates with the Countywide Technical Rescue Team. Technical rescue is a relatively broad term and includes responses to a wide variety of incidents such as water rescue, confined space rescue, high angle rescues, and structural collapse. Due to the critical tasking elements necessary for technical rescue events the District utilizes a tiered response process that begins at Tier 2 with the exception of rope rescue incidents.

A Tier 2 response includes operations level response from the Department in addition to available technicians. A Tier 3 response includes additional staffing and resources commensurate with a high-risk fire structure fire response and on-duty Snohomish County Rescue Team units.

Community Service Demands

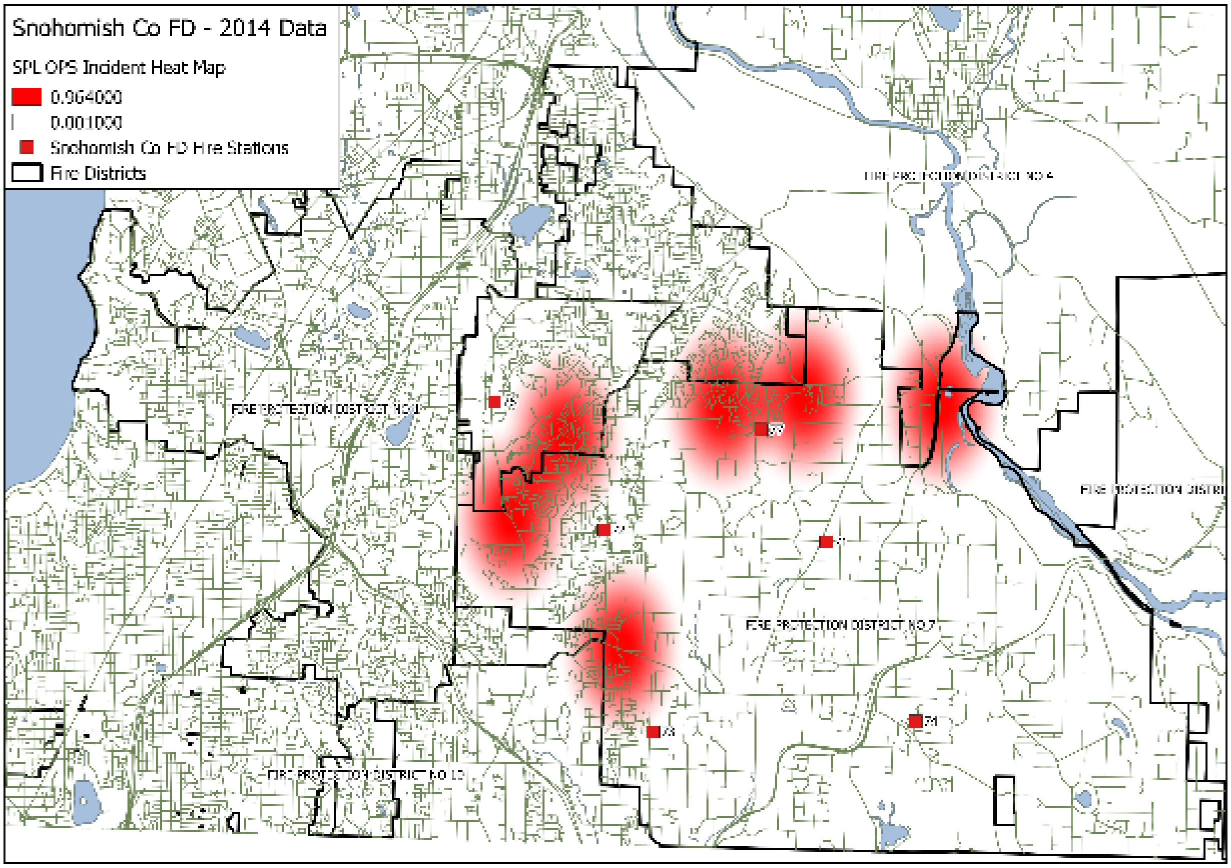
Similar to the analyses for hazardous materials, the demand for technical rescue services is low in relation to the primary service areas. In 2016, there were 43 special operations incidents dispatched, inclusive of hazardous materials and technical rescue events. The District is experiencing an upswing in building, so there is potential risk for high angle rescues, trench emergencies, and structural collapses. Due to the relatively low community demand for services temporal analyses would not produce intuitive results for decision-making. Therefore, no additional analytical assessments were conducted.

Table 65: Number of Incidents Dispatched by Category – 2016

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	5,241	14.4	51.0
EMS-ALS	3,226	8.8	31.4
Fire	1,260	3.5	12.3
Special Ops	43	0.1	0.4
Service	509	1.4	5.0
Total	**10,279**	**28.2**	**100.0**

However, a geospatial analysis was completed for special operations incidents and is reflected in Figure 41 below. The frequency of data does not support trend assumptions.

Figure 41: Special Operations Demand Map



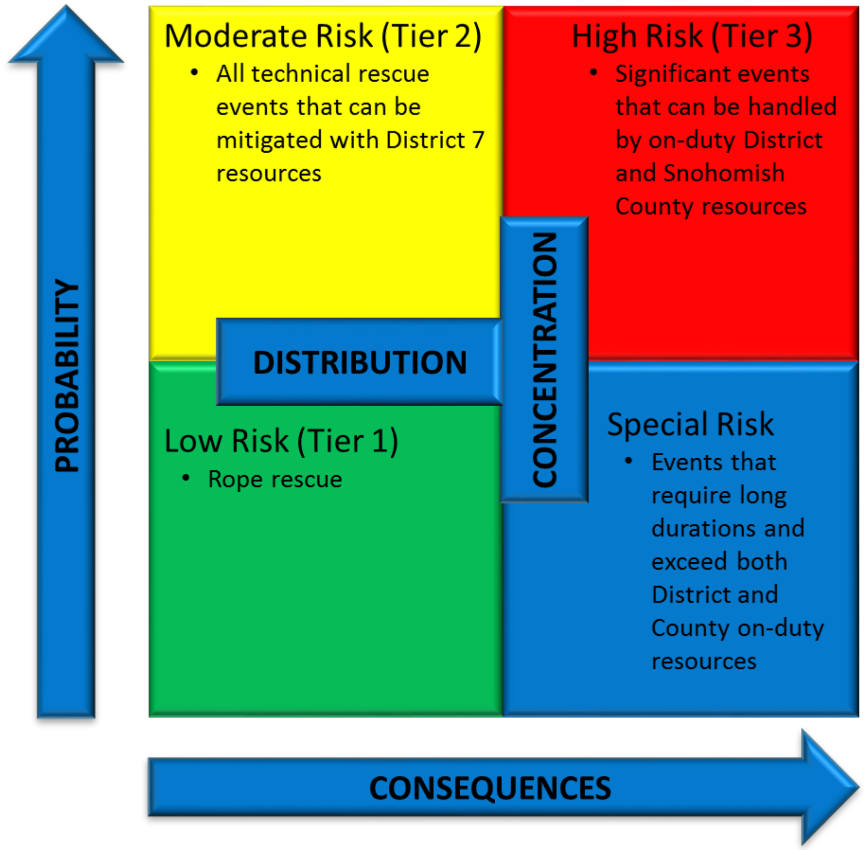
Community Risks

The Snohomish County Fire District 7 resides within Snohomish County, WA. As a mixed-density (Urban, Suburban, Rural) jurisdiction the District has some risk potential for technical rescue incidents due to the growing construction demands, ongoing repair to infrastructure, transportation route, and active railways.

Probability/Consequence of Technical Rescue Risk

The Department staff completed analyses for the probability and consequence of technical rescue events. In this case, the risks for technical rescue, and the District's technicians, are greater than the historical experience. Therefore, the consequence portion of the matrix had greater influence on the risk classification than the probability. All technical rescue events are relatively low frequency as compared to other community service demands. A probability and consequences risk matrix was developed and is presented as Figure 42 below.

Figure 42: Probability and Consequences Technical Rescue Risk Matrix



Critical Task Analysis

The Department staff analyzed the critical tasks required for the mitigation of the various technical rescue risks in the community. Critical tasks for moderate and high risk events are presented as well as the resources allocated to each event. Tables 66 through 71 below represent the critical tasks.

Table 66: Tier 1 Technical Rescue Incident (Rope Rescue) - Low Risk

Critical Task	Needed Personnel
Incident Commander/Safety	1
Rescue	3
Access and Stabilization	3
Medical	2
Total	**9**

Table 67: Tier 1 Technical Rescue Incident (Rope Rescue) - Low Risk

Responding Units	Minimum Staffing
Engine	3
Ladder	3
Battalion Chief	1
EMS Unit	2
Total Response Provided	**9**
Personnel Required by Critical Tasks	**9**

Table 68: Tier 2 Technical Rescue Incident - Moderate Risk

Critical Task	Needed Personnel
Incident Commander/Safety	1
Technicians	2
Operations	6
Medical	2
Total	**11**

Table 69: Resource Allocation for a Tier 2 Technical Rescue Incident - Moderate Risk

Responding Units	Minimum Staffing
Battalion Chief	1
Ladder Truck	3
Engine	3
Medic Unit	2
Zone Tech Rescue Unit (County Response)	2
Total Response Provided	**11**
Personnel Required by Critical Tasks	**11**

Table 70: Tier 3 Technical Rescue Incident - High Risk

Critical Task	Needed Personnel
Incident Commander	1
Incident Safety Officer	1
Rescue Group Supervisor (Technician)	1
Rescue Safety Officer (Technician)	1
Entry Team Leader (Technician)	1
Entry Team (Technician)	2
Backup Team (Technician)	2
Air Systems (Technician)	1
Communications Systems (Technician)	1
Support	3
Medical	2
Total	**16**

Table 71: Resource Allocation for Tier 3 Technical Rescue Incidents - High Risk

Responding Units	Minimum Staffing
Engine	3
Engine	3
Engine	3
Aerial Truck	3
Medic	2
County Support Personnel	8
Battalion Chief	1
Total Response Provided	**23**
Personnel Required by Critical Tasks	**16**

REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of District 7's deployment model is to establish baseline measures of performance. This analysis is crucial to the ability to discuss alternatives to the status quo and in identifying opportunities for improvement. This portion of the analysis will focus efforts on elements of response time and the cascade of events that lead to timely response with the appropriate apparatus and personnel to mitigate the event. Response time goals should be looked at in terms of total reflex time, or total response time, which includes the dispatch or call processing time, turnout time, and travel time, respectively.

Cascade of Events

The cascade of events is the sum of the individual elements of time beginning with a state of normalcy and continuing until normalcy is once again returned through the mitigation of the event. The elements of time that are important to the ultimate outcome of a structure fire or critical medical emergency begin with the initiation of the event. For example, the first on-set of chest pain begins the biological and scientific time clock for heart damage irrespective of when 911 is notified. Similarly, a fire may begin and burn undetected for a period of time before the fire department is notified. The emergency response system does not have control over the time interval for recognition or the choice to request assistance.

Therefore, the District utilizes quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing, turnout time, travel time, and the time spent on-scene. An example of the cascade of events and the elements of performance utilized is provided as Figure 43 below.[33]

Detection

The element of time between when an event occurs and someone detects it and the emergency response system has been notified. This is typically accomplished by calling the 911 Public Safety Answering Point (PSAP).

Call Processing

The element of time measured between when SNOPAC answers the 911 calls, processes the information, and subsequently dispatches units.

Turnout Time

The element of time that is measured between the time the fire department is dispatched or alerted of the emergency incident and the time when the fire apparatus or ambulance is enroute to the call.

[33] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

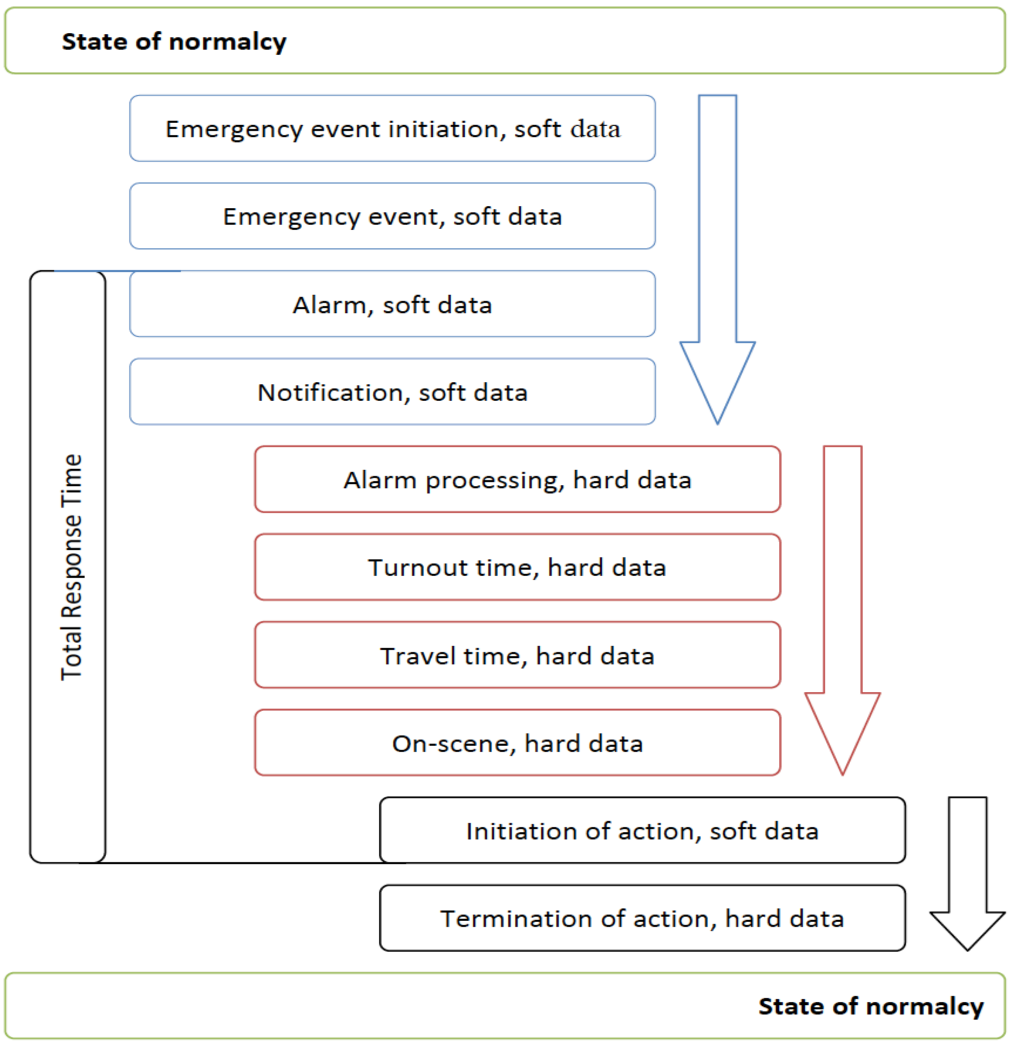
Travel Time

The travel time is the element of time between when the unit went enroute, or began to travel to the incident, and their arrival on-scene.

Total Response Time

The total response time, or total reflex time, is the total span of time required to arrive on-scene beginning with SNOPAC answering the phone request for service.

Figure 43: Cascade of Events



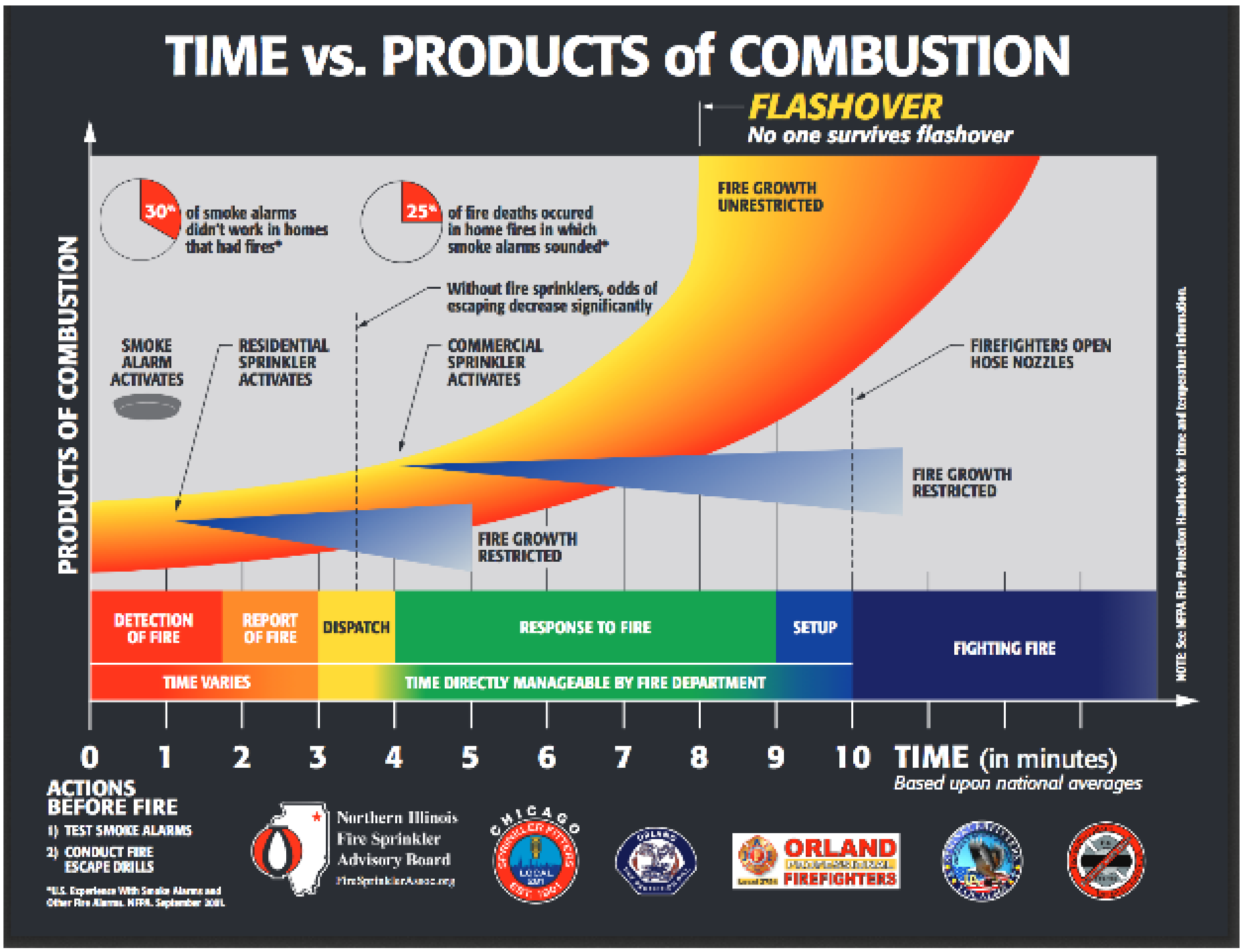
Response Time Continuum

Fire

The number one priority with structural fire incidents is to save lives followed by the minimization of property damage. A direct relationship exists between the timeliness of the response and the survivability of unprotected occupants and property damage. The most identifiable point of fire behavior is Flashover.

Flashover is the point in fire growth where the contents of an entire area, including the smoke, reach their ignition temperature, resulting in a rapid-fire growth rendering the area un-survivable by civilians and untenable for firefighters. Best practices would result in the fire department arriving and attacking the fire prior to the point of flashover. A representation of the traditional time temperature curve and the cascade of events are provided as Figure 44 below.[34]

Figure 44: Example of Traditional Time Temperature Curve



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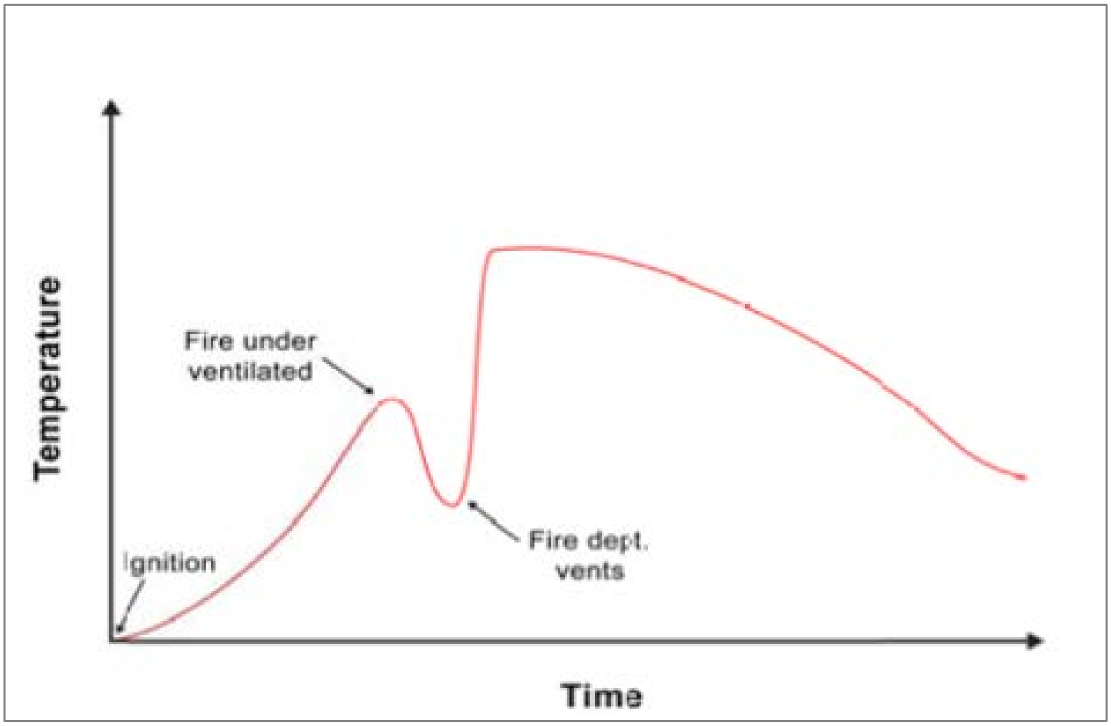
[34] Example of Traditional Time Temperature Curve. Retrieved at http://www.usfa.fema.gov/downloads/pdf/coffee-break/time-vs-products-of-combustion.pdf

Recent studies by Underwriter's Laboratories (UL) have found that in compartment fires such as structure fires, flashover occurs within 4 minutes in modern fire environment. In addition, the UL research has identified an updated time temperature curve due to fires being ventilation controlled rather than fuel controlled as represented in the traditional time temperature curve. While this ventilation controlled environment continues to provide a high risk to unprotected occupants to smoke and high heat, it does provide some advantage to property conservation efforts as water may be applied to the fire prior to ventilation and the subsequent flashover. An example of UL's ventilation controlled time temperature curve is provided as Figure 45 below.[35]

Figure 45: Ventilation Controlled Time Temperature Curve



EMS

The effective response to Emergency Medical Service (EMS) incidents also has a direct correlation to the ability to respond within a specified period of time. However, unlike structure fires, responding to EMS incidents introduces considerable variability in the level of clinical acuity. From this perspective, the association of response time and clinical outcome varies depending on the severity of the injury or the illness. Research has demonstrated that the overwhelming majority of requests for EMS services are not time sensitive between 5 minutes and 11 minutes for emergency and 13 minutes for non-emergency responses.[36] The 12-minute upper threshold is only the upper limit of the

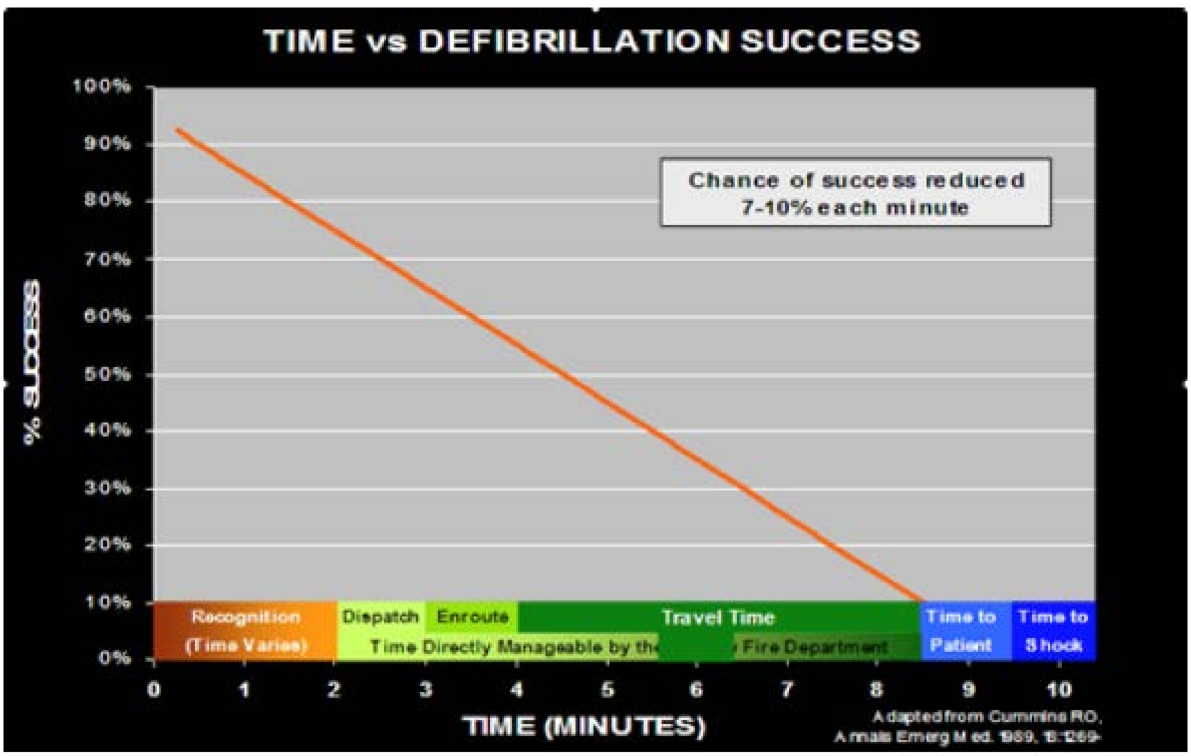
[35] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm
[36] Blackwell, T.H., & Kaufman, J.S. (April 2002). Response time effectiveness: Comparison of response time and survival in an urban emergency medical services system. *Academic Emergency Medicine,* 9(4): 289-295.

available research and is not a clinically significant time measure, as patients were not found to have a significantly different clinical outcome when the 12-minute threshold was exceeded.[37]

Out of hospital sudden cardiac arrest is the most identifiable and measured incident type for EMS. In an effort to demonstrate the relationship between response time and clinical outcome, a representation of the cascade of events and the time to defibrillation (shock) is presented as Figure 46 below. The American Heart Association (AHA) has determined that brain damage will begin to occur between four and six minutes and become irreversible after 10 minutes without intervention.

Modern sudden cardiac arrest protocols recognize that high quality Cardio-Pulmonary Resuscitation (CPR) at the Basic Life Support (BLS) level is a quality intervention until defibrillation can be delivered in shockable rhythms. Figure 46[38] below is representative of a sudden cardiac arrest that is presenting in a shockable heart rhythm such as Ventricular Fibrillation (V-Fib) or Ventricular Tachycardia (V-Tach).

Figure 46: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm



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37 Blackwell, T.H., et al. (Oct-Dec 2009). Lack of association between prehospital response times and patient outcomes. *Prehospital Emergency Care,* 13(4): 444-450.
38 Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Distribution Factors

Comparison of Demand Zones

Geospatial analyses were completed regarding drive times that incorporated the District's current performance and nationally recommended best practices. Drive times from each of the current fixed facility fire stations were created utilizing existing road miles and impedance for seven and eight minute increments. This analysis suggest that the majority of the District's jurisdiction should be able to be responded to within six (6) to eight (8) minutes for where the majority of the risk is located. The (green) shading indicates the estimated travel time capabilities from the existing road networks. The darker the (green) shading, the more overlap exists between response capabilities within the current configuration. Finally, the number in parenthesis "(1)" indicates the order of contribution to system performance at the specific travel time goal 90% of the time or less. For example, referring to Figure 42, Station 72 contributes the most to the overall success of the system and Station 77 contributes the least. However, as illustrated, all eight (8) stations combined may not be capable of delivering a seven (7) minute response time to 90% of the incidents. The planning analysis suggests that 85% could be captured in 7-minutes and 89% in 8-minutes. Results of this analysis are presented as Figure 47 to 48 below.

Figure 47: Drive Time Bleed Maps for 7-Minutes from Existing Stations

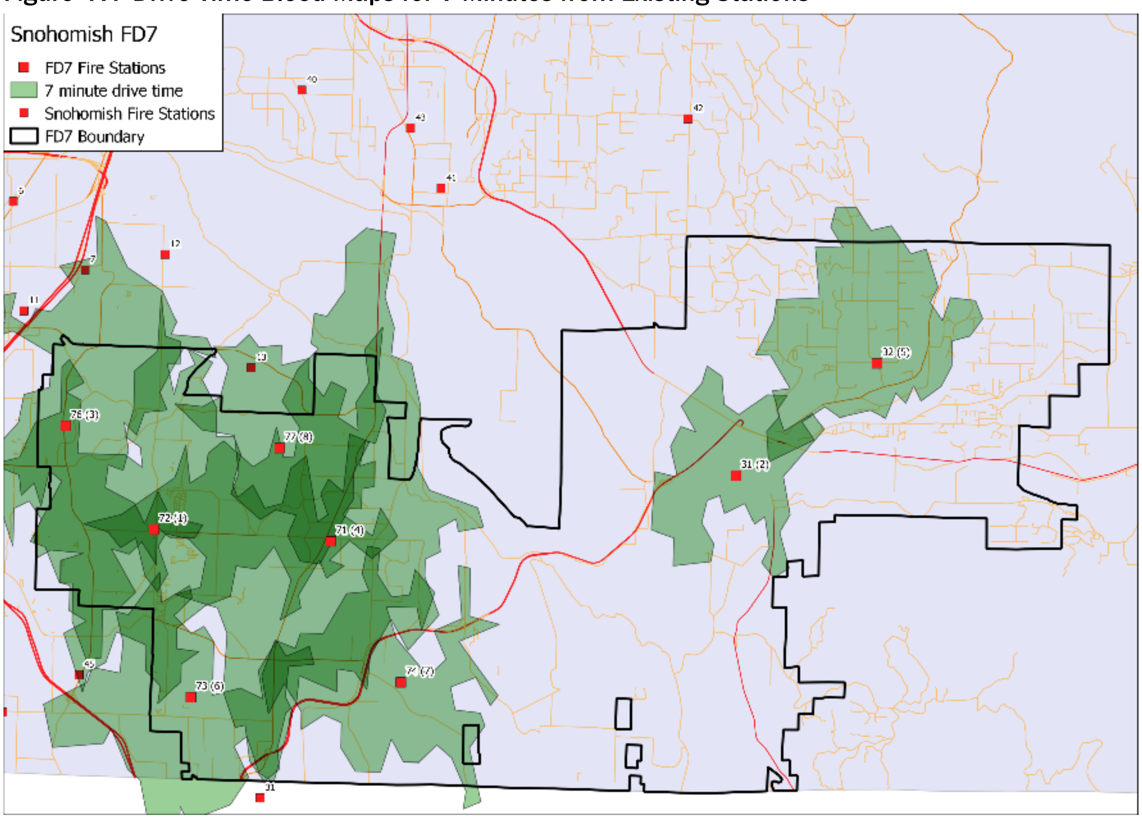
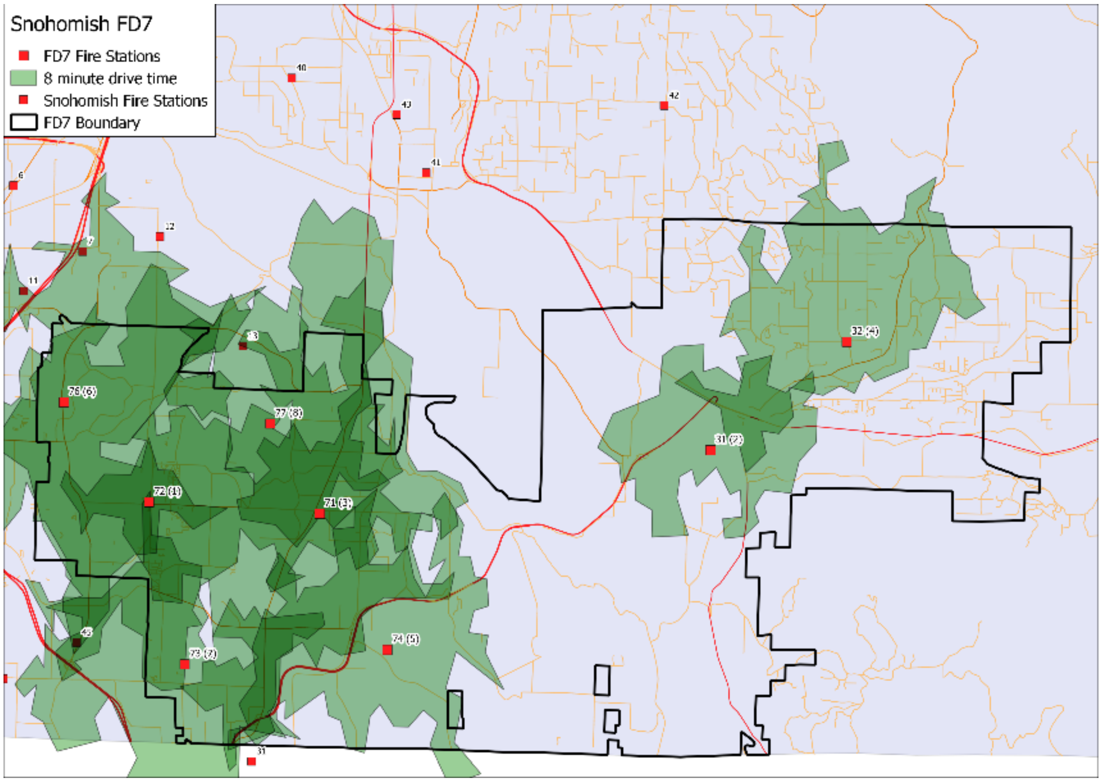
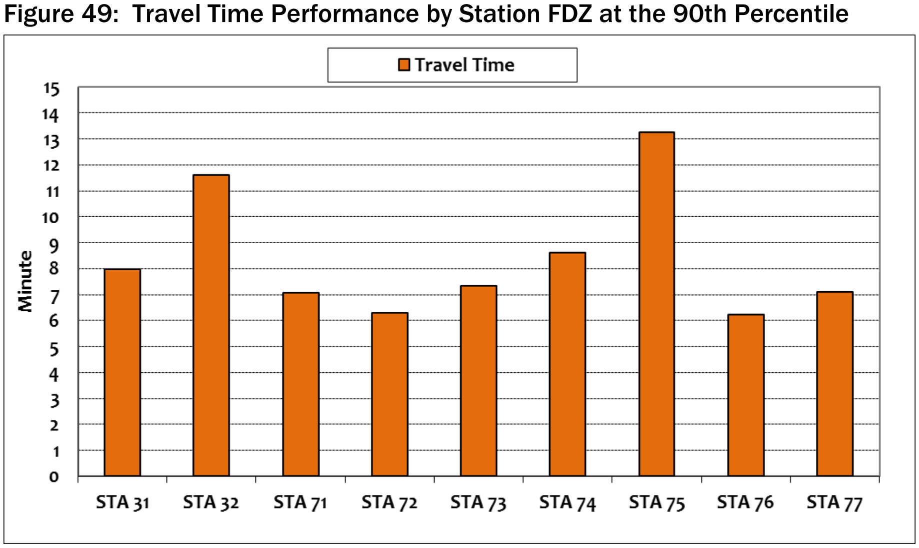


Figure 48: Drive Time Bleed Maps for 8-Minutes from Existing Stations



Finally, the geospatial analyses were validated through a review of annual historical performance across each of the fire demand zones. In general, the actual performance validates the planning assessments on potential performance. The historical travel time performance for each fire station demand zone is provided as Figure 49 below.

Figure 49: Travel Time Performance by Station FDZ at the 90th Percentile



Comparison of Workloads by Demand Zone

Another method of assessing the effectiveness of the distribution model is to analyze the demand for services across the distribution model. Workload is assessed at the station demand zone level and at the individual unit level.

Analyses illustrate that Station Demand Zones 31 and 76 each answer 28% and 20% of the total requests for services. Collectively these two demand zones accounted for 48% of the department's total workload. Station Demand Zone 75 (future Station 33) accounts for 2.0% of the department's total workload and is responded to by station 74. Thus, Station 74 answered 6.0% of the total requests. Station Demand Zone 32 had the fewest requests for service while accounting for approximately 3.6% of the department's total workload. Results are presented below.

Figure 50: Department Workload by Station Demand Zone

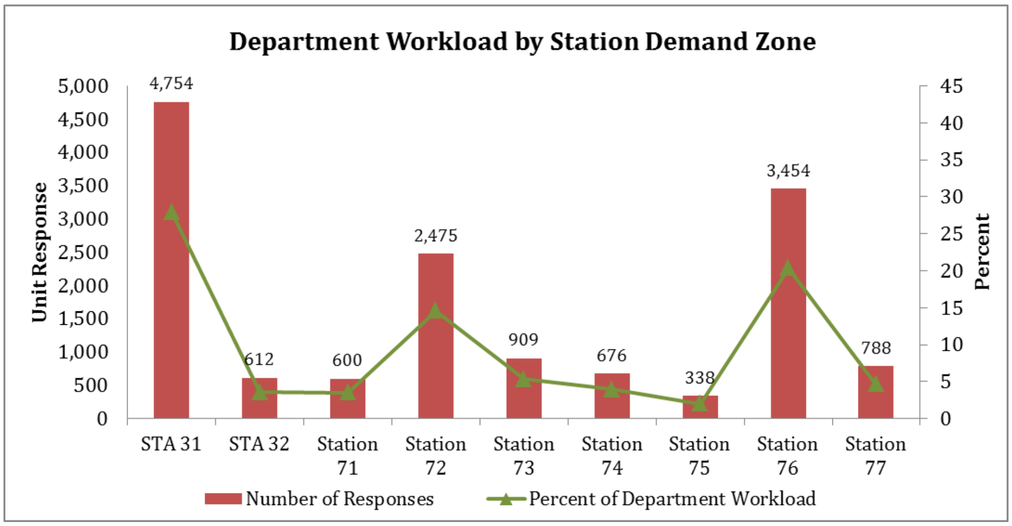


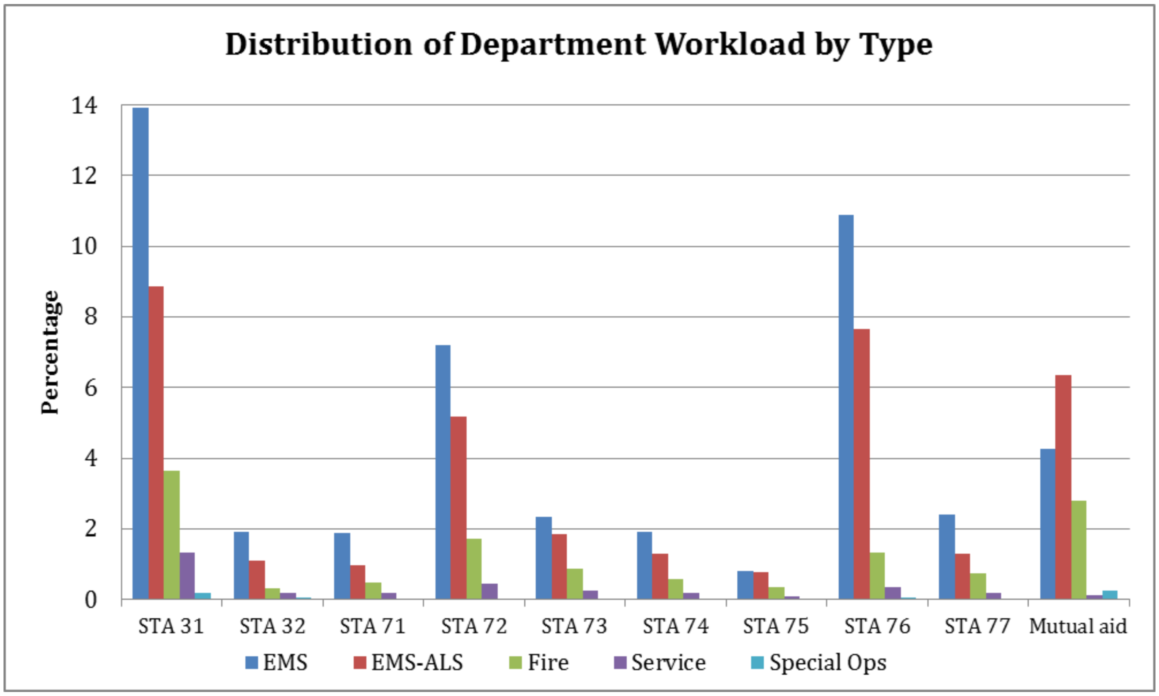
Table 72: Department Workload by Station Demand Zone

First Due Station	Number of Responses	Responses per Day	Percent of Department Workload
STA 31	4,754	13.0	28.0
STA 32	612	1.7	3.6
STA 71	600	1.6	3.5
STA 72	2,475	6.8	14.6
STA 73	909	2.5	5.3
STA 74	676	1.9	4.0
STA 75	338	0.9	2.0
STA 76	3,454	9.5	20.3
STA 77	788	2.2	4.6
Mutual aid	2,347	6.4	13.8
Unknown	52	0.1	0.3
Total	**17,005**	**46.6**	**100.0**

Note: 52 unit responses were missing first due station information.

Further analyses were completed identifying both the distribution of department workload by call type and within station proportion of workload by call types. The overall distribution of department workload supports earlier findings that greater than 83% of the requests for service are EMS related. Approximately 13% of the unit responses were associated with fire related incidents. The remaining 4% of the requests for service were associated with Special Operations and Service related responses. The Department's overall distribution of workload by call type and station demand zone is presented below.

Figure 51: Distribution of Department Workload by Call Type



The within station analyses did not reveal any significant deviations from the department's overall experience. Findings are presented as Figure 52 below. In addition, the total number of unit responses conducted in each station demand zone is presented below as Table 73.

Figure 52: Within Station Proportion of Workload by Call Type

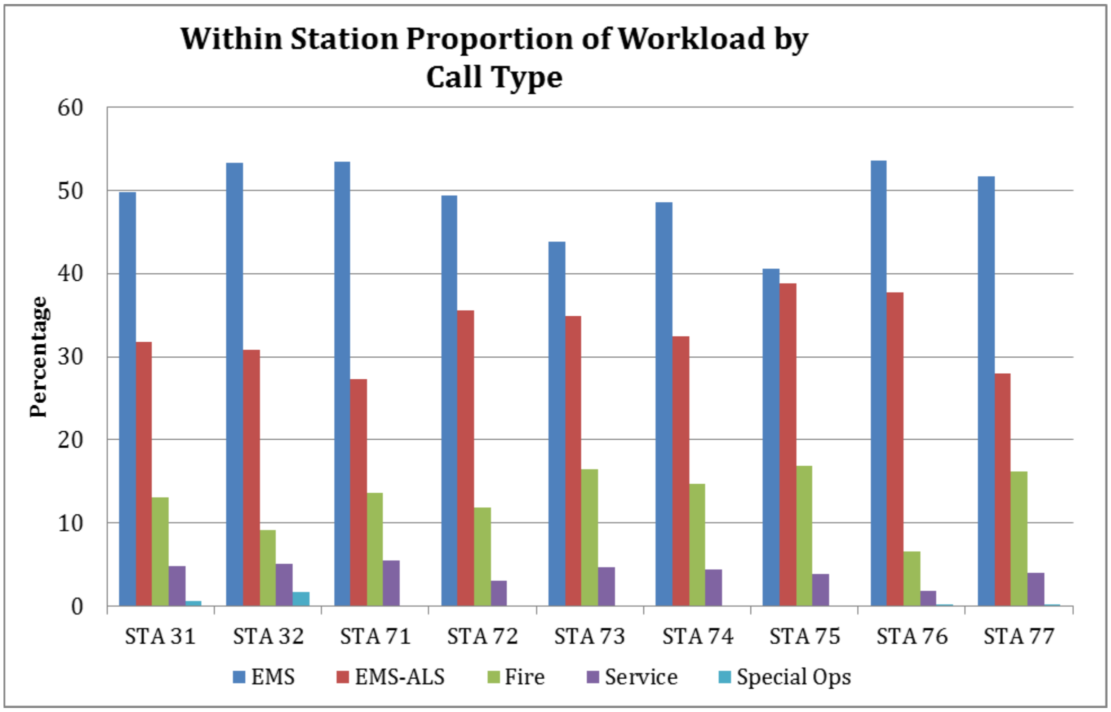


Table 73: Number of Responses by Station Demand Zone and Call Type

First Due Station	EMS	EMS-ALS	Fire	Service	Special Ops	Total Unit Responses
STA 31	2,367	1,508	620	227	32	4,754
STA 32	326	189	56	31	10	612
STA 71	321	164	82	33	0	600
STA 72	1,223	881	292	77	2	2,475
STA 73	399	317	150	43	0	909
STA 74	328	219	99	30	0	676
STA 75	137	131	57	13	0	338
STA 76	1,853	1,305	227	61	8	3,454
STA 77	407	220	128	31	2	788
Mutual aid	726	1,079	477	22	43	2,347
Unknown	32	11	7	2	0	52
Total	**8,119**	**6,024**	**2,195**	**570**	**97**	**17,005**

Note: 52 unit responses had an unknown station territory assignment and were not included.

Another measure, time on task, is necessary to evaluate best practices in efficient system delivery and consider the impact workload has on personnel. Unit Hour Utilization (UHU) determinants were developed by mathematical model. This model includes both the proportion of calls handled in each major service area (Fire, EMS, Special-Ops, and Service) and total unit time on task for these service categories in 2016. The resulting UHU's represent the percentage of the work period (24 hours) that is utilized responding to requests for service. Historically, the International Association of Fire Fighters (IAFF) has recommended that 24-hour units utilize 0.30, or 30% workload as an upper threshold.[39] In other words this recommendation would have personnel spend no more than eight (8) hours per day on emergency incidents.

These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections. The 4th edition of the IAFF EMS Guidebook no longer specifically identifies an upper threshold. However, *FITCH* recommends that an upper unit utilization threshold of approximately .30, or 30%, would be considered best practice. In other words, units and personnel should not exceed 30%, or eight (8) hours, of their workday responding to calls. These recommendations are also validated in the literature.

For example, in their review of the City of Rolling Meadows, the Illinois Fire Chiefs Association utilized a UHU threshold of .30 as an indication to add additional resources.[40] Similarly, in a standards of cover study facilitated by the Center for Public Safety Excellence, the Castle Rock Fire and Rescue Department utilizes a UHU of .30 as the upper limit in their standards of cover due to the necessity to accomplish other non-emergency activities.[41] These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections.

The department is currently operating within the boundaries of nationally recommended best practices with respect to workload. Overall, the department is performing at approximately 0.12, or 12% excluding Battalion chief, brush truck, HazMat unit and the tender unit. The most utilized unit is the E76 in station 76, at 0.25. Cross-staffed ALS M31/M33 in station 31 is the second most utilized unit, at 0.22. At the current workload utilization rates, the department should have a limited impact on their level of readiness or system performance. However, the department should anticipate reinvesting in resources in both Station 76, 31, and 72 in the near future.

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[39] International Association of Firefighters. (1995). Emergency *Medical Services: A Guidebook for Fire-Based Systems.* Washington, DC: Author. (p. 11)

[40] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)

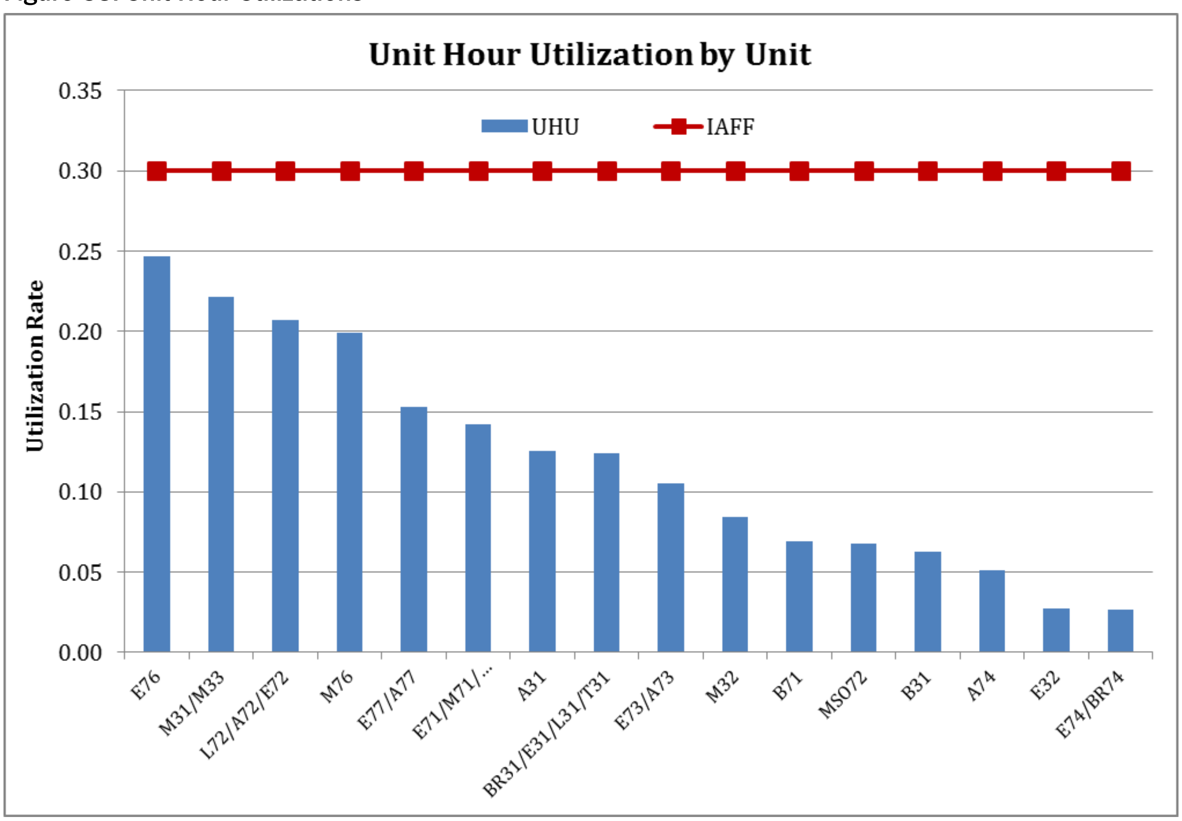
[41] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

Table 74: Unit Hour Utilizations

Station	Unit Report	Total Busy Hours	UHU	IAFF
Station 76	E76	2,164	0.25	0.30
Station 31	M31/M33	1,940	0.22	0.30
Station 72	L72/A72/E72	1,813	0.21	0.30
Station 76	M76	1,747	0.20	0.30
Station 77	E77/A77	1,338	0.15	0.30
Station 71	E71/M71/T71/BR71	1,245	0.14	0.30
Station 31	A31	1,098	0.13	0.30
Station 31	BR31/E31/L31/T31/TR31	1,085	0.12	0.30
Station 73	E73/A73	925	0.11	0.30
Station 32	M32	741	0.08	0.30
Station 71	B71	605	0.07	0.30
Station 72	MSO72	593	0.07	0.30
Station 31	B31	548	0.06	0.30
Station 74	A74	450	0.05	0.30
Station 32	E32	241	0.03	0.30
Station 74	E74/BR74	236	0.03	0.30
Station 71	CL71	13	0.00	0.30
Station 71	A71	9	0.00	0.30
Station 71	HZ71	8	0.00	0.30
Station 72	B72	2	0.00	0.30

Note: Cross-staffed units were grouped together.

Figure 53: Unit Hour Utilizations



Description of First Arriving Unit Performance

Analyses of the response characteristics of the first arriving units were conducted. This analysis utilized all emergency unit responses in 2016. Overall the department had a mean turnout time of 96 seconds, or 1 minute and 36 seconds, and 149 seconds, or 2 minutes and 29 seconds at the 90th percentile.

The travel time for all first arriving unit responses were calculated irrespective of their assigned station FDZ. In other words, this analysis describes the first arriving unit to the scene. The mean travel time was 270 seconds, or 4 minutes and 30 seconds. Performance at the 90th percentile was 484 seconds, or 8 minutes and 4 seconds. The mean response time is 504 seconds, or 8 minutes and 24 seconds. Performance at the 90th percentile is 820 seconds, or 13 minutes and 40 seconds. Results of first arriving unit performance are provided below.

Table 75: Description of First Arriving Unit Emergency Response Performance

Measure	Average	90th Percentile
Dispatch	2.2	3.7
Turnout Time	1.6	2.5
Travel Time	4.5	8.1
Response Time	8.4	13.7

In comparison, the original SOC found the average and 90th percentile turnout time to be marginally elongated as well as average and 90th travel time. The results from the original SOC in 2016 are reproduced for convenience below.

Table 76: Description of First Arriving Unit Emergency Response Performance – Prior SOC- 2016

Measure	Average	90th Percentile
Turnout Time	1.5	2.4
Travel Time	4.0	7.2
Turnout and Travel Time	5.5	8.8

First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted to measure the performance of the first arriving unit in each station. This analysis included all unit responses within each FDZ at the first arriving unit. Response times are reported below at both the mean and 90th percentile as Tables 77 and 78, respectively.

Examination of the overall performance at the 90th percentile reveals that Stations 71, 72, 73 and 76 have the quickest response times followed by Stations 74, 31, 77, 32, and 75/33 in order of performance. An illustrative comparison of FDZ performance at the 90th percentile is provided as Figure 54 below.

Table 77: Mean First Arrival Performance by First Due Station

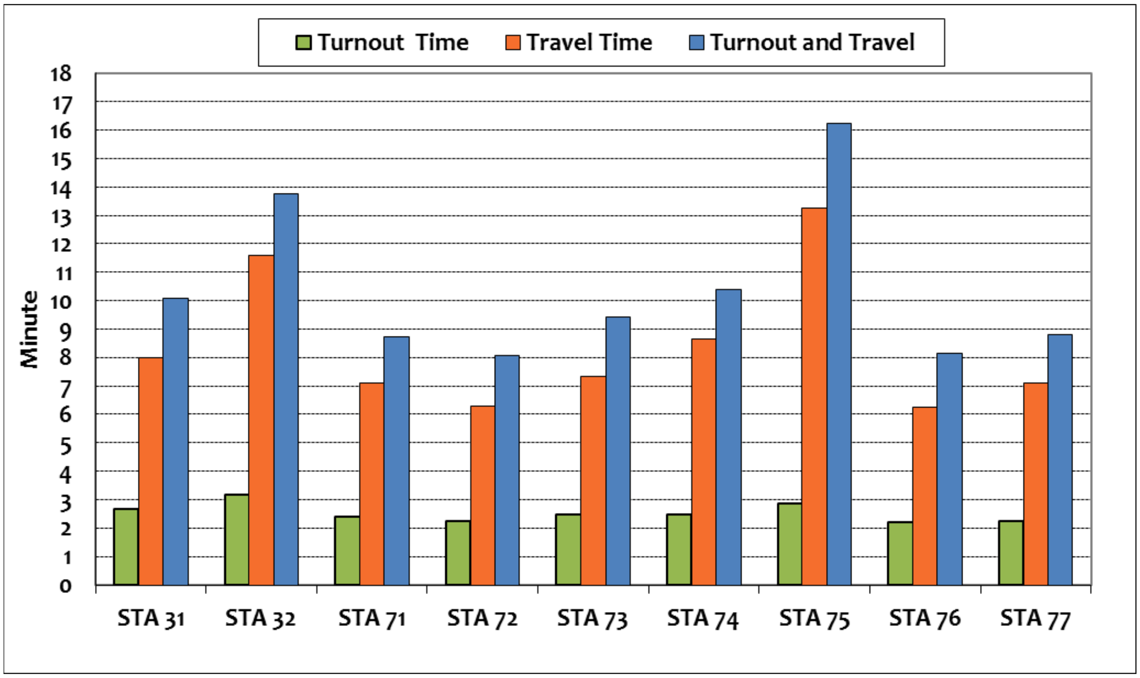
Fire Demand Zone	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
STA 31	2.2	1.7	4.5	6.2	8.4	2,641
STA 32	2.3	2.0	7.1	9.2	11.3	359
STA 71	2.1	1.6	4.1	5.8	7.9	253
STA 72	2.3	1.4	4.1	5.5	7.9	1,091
STA 73	2.2	1.6	4.6	6.3	8.5	466
STA 74	2.2	1.7	5.3	7.0	9.2	277
STA 75/33[42]	2.2	2.5	9.8	12.3	14.5	158
STA 76	2	1.5	3.5	4.9	7.0	1,631
STA 77	2.9	1.6	4.8	6.4	9.3	407
Total	**2.2**	**1.6**	**4.5**	**6.1**	**8.4**	**7,283**

Table 78: 90th Percentile First Arrival Performance by Station FDZ

Fire Demand Zone	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
STA 31	3.5	2.7	8.0	10.1	13.5	2,641
STA 32	3.5	3.2	11.6	13.8	16.4	359
STA 71	3.1	2.4	7.1	8.7	11.4	253
STA 72	3.7	2.2	6.3	8.1	11.1	1,091
STA 73	3.6	2.5	7.3	9.4	12.2	466
STA 74	3.7	2.5	8.6	10.4	13.1	277
STA 75/*33	3.4	2.9	13.3	16.2	18.8	158
STA 76	4.0	2.2	6.2	8.1	12.4	1,631
STA 77	5.4	2.2	7.1	8.8	15.3	407
Total	**3.7**	**2.5**	**8.1**	**10.1**	**13.7**	**7,283**

42 Station 75 was closed and a new Station 33 is under construction. There are no units in 75's area and is primarily served by Station 74.

Figure 54: 90th Percentile First Arrival Performance by Station FDZ



The data was further analyzed to compare the individual station FDZ performances. With respect to turnout time, station 32 is experiencing longer turnout times. Conversely, when examining the travel time performance, performances for calls in stations 32 and 75 are significantly longer than calls in other first due stations. Similarly, since travel time is the single largest indicator of overall response performance, the turnout plus travel time analysis revealed that 90th percentile measurements for calls in first due stations 32 and 75 are significantly longer than calls in the other stations.

Figure 55: 90th Percentile Turnout Time by Station FDZ

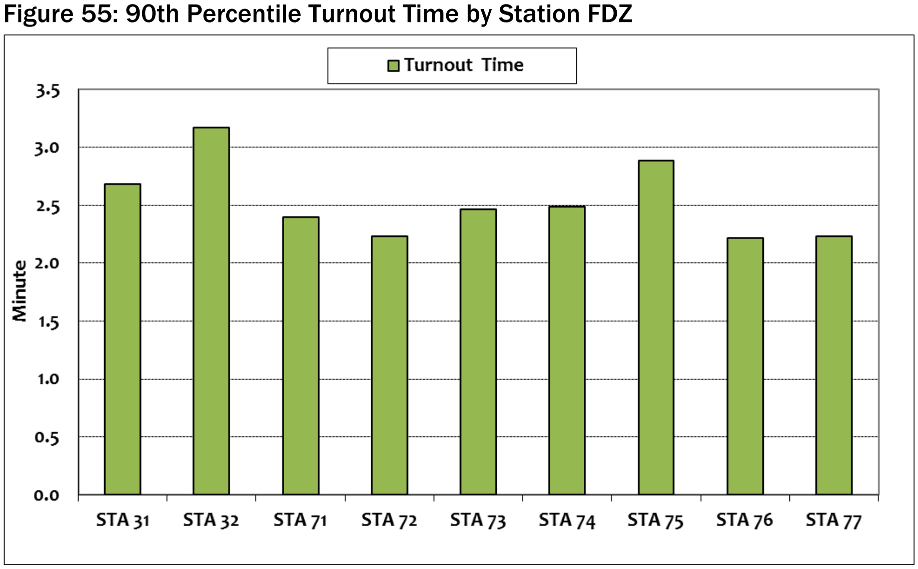


Figure 56: 90th Percentile Travel Time Performance by Station FDZ

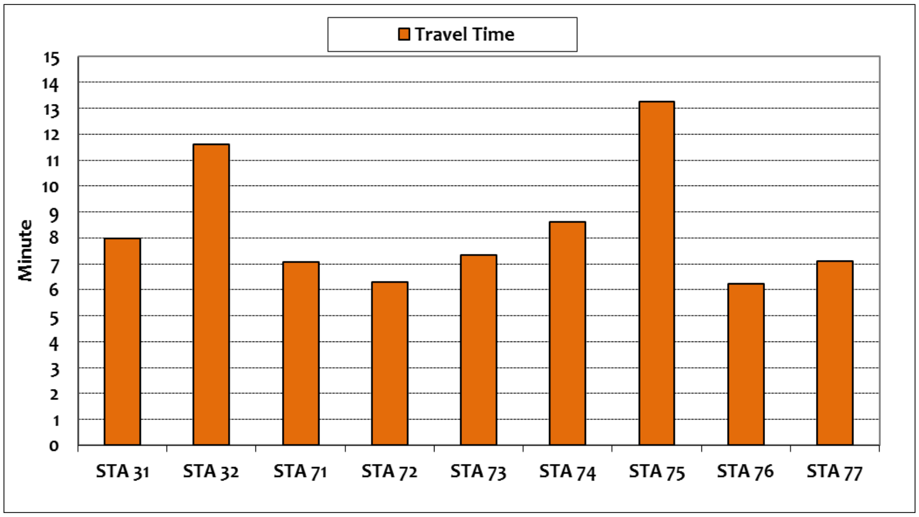
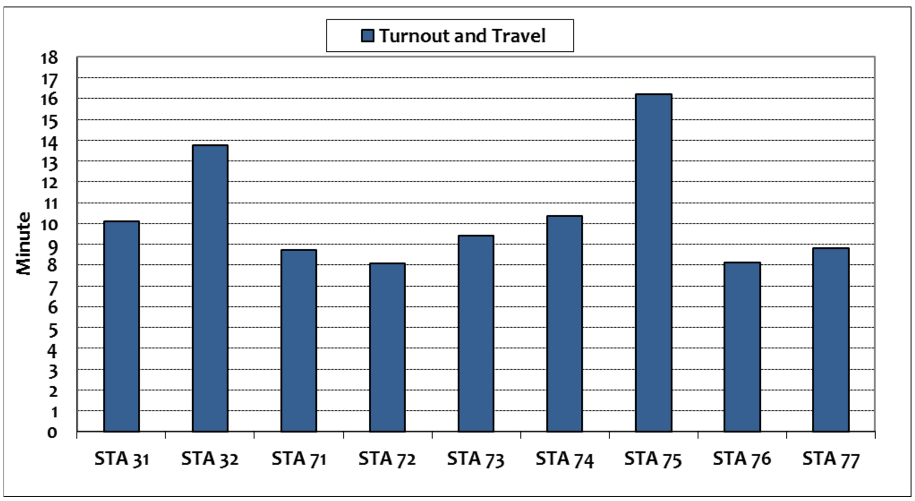


Figure 57: 90th Percentile Turnout and Travel Performance by Station FDZ



Concentration Factors

Concentration of Risks by Demand Zone

Analyses were conducted to describe and measure the relative concentration of risks in each of the fire station demand zones. Therefore, a station demand zone risk matrix was developed to quantitatively evaluate the relative risk by including measures for the frequency of moderate and high risk occupancies in each fire demand zone that are directly correlated to the necessity of higher concentrations of resources. In addition, two measures that both serves the distribution aspect of the risk evaluation, but also contributes to the need for higher concentrations of resources. For example, a higher call volume may serve to drive the need for additional resources to cover the community's demand.

The variables included in the risk matrix are the community demand, percentage of simultaneous events (call concurrency), and the number of moderate and high-risk occupancies. The measure for the existence of inherent or prospective risk accounts for approximately one third of the results. Conversely, measures for community demand and call concurrency was rated more heavily in an effort to provide a realistic balance to the risk potential with historical experience. The risk tool and the scoring template are provided as Tables 79 and 80 below.

Table 79: Station Demand Zone Risk Concentration Matrix

Station FDZ	Community Demand	Call Concurrency	High/Moderate Risk Occupancies	Total risk Score	Risk Rating
Station 31	10	10	4	81.24	Maximum
Station 32	3	2	1	4.95	Low
Station 71	5	4	1	14.85	Low
Station 72	6	10	1	43.22	High
Station 73	3	5	1	11.38	Low
Station 74	2	5	2	10.39	Low
Station 76	9	10	1	64.35	High
Station 77	3	4	1	9.19	Low

These analyses result in a three-dimensional model that illustrates the representativeness of each of the variables as they contribute to each station's risk profile. For example, one station may score heavily in potential risk and have moderate or low demand for services and another station may have little potential risk but have high demand and call concurrency that drives the necessity for a greater concentration of resources. Results for each of the stations are provided in Figures 58 through 65.

Table 80: Summary of Station Fire Demand Zone Risk Concentration Matrix

Risk Class	Community Demand (D)		Call Concurrency (C)		High/Moderate Risk Occupancies (R)		Total Risk Score
	Value	Scale (Calls)	Value	Scale (%)	Value	Scale (Occupancies)	$\sqrt{\frac{(DC)^2 + (DR)^2 + (RC)^2)}{2}}$
Maximum	≥10	≥4,050	≥10	≥ 22.5	≥10	≥450	≥72
High	7 to 9	≥ 2,700 and < 4,049	7 to 9	≥ 15 and < 22.5	7 to 9	≥ 300 and <449	≥ 39.35 and < 72
Moderate	4 to 6	≥ 1,350 and < 2,700	4 to 6	≥ 7.5 and < 15	4 to 6	≥ 150 and < 300	≥ 16.49 and < 39.35
Low	1 to 3	< 1,350	1 to 3	≥0 and < 7.5	1 to 3	< 150	< 16.49

Figure 58: 3-D Risk Profile for Station 31

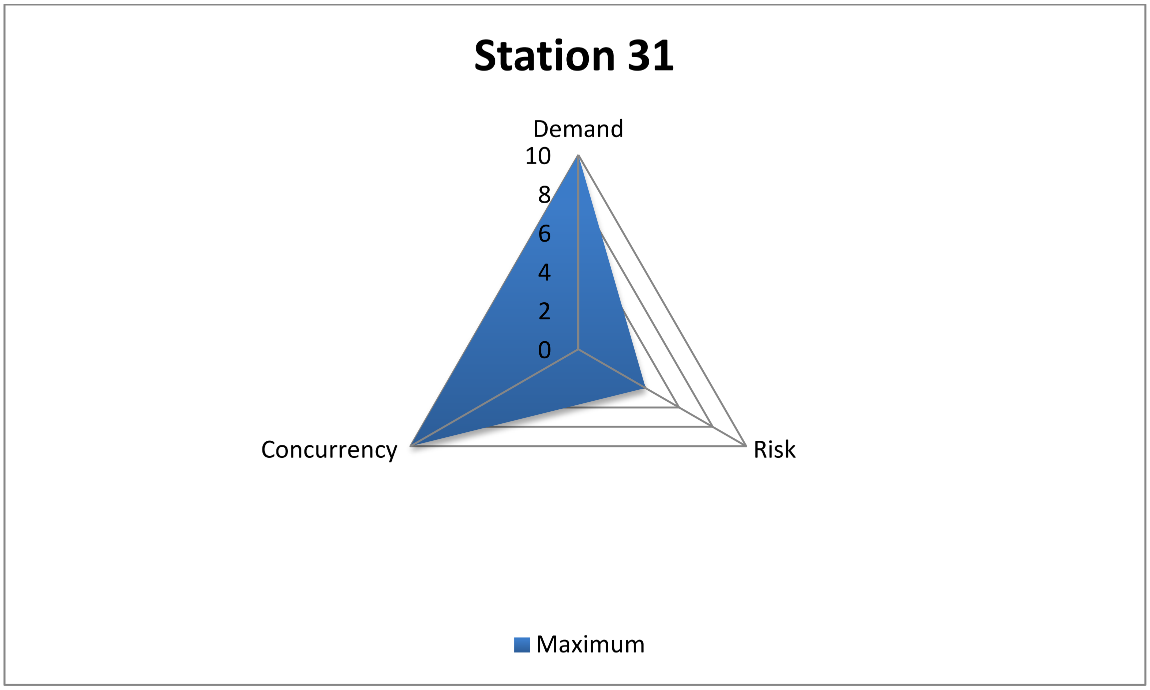


Figure 59: 3-D Risk Profile for Station 32

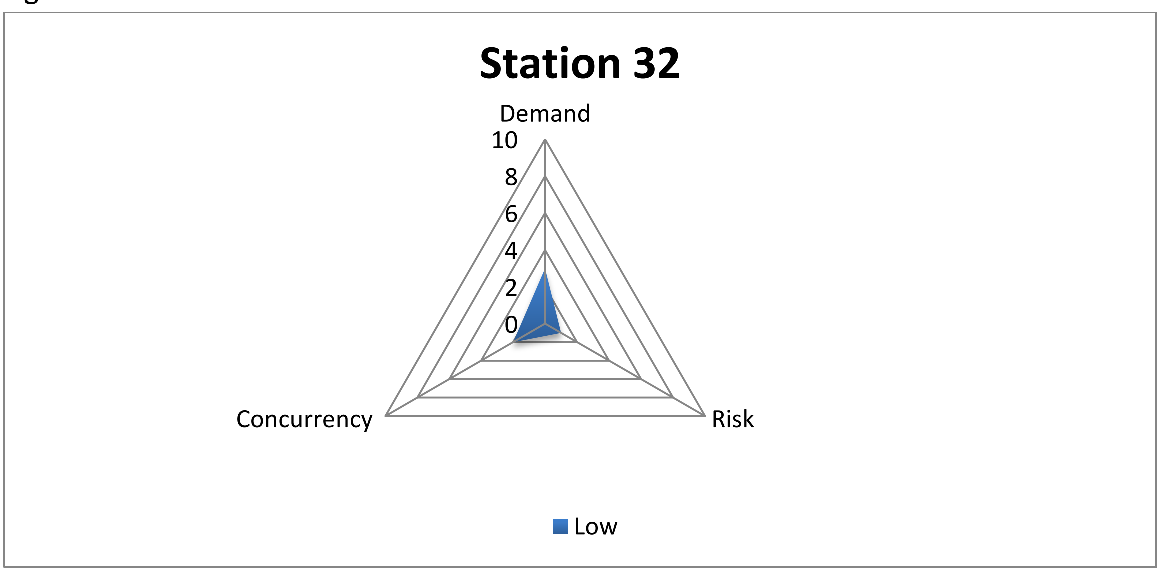


Figure 60: 3-D Risk Profile for Station 71

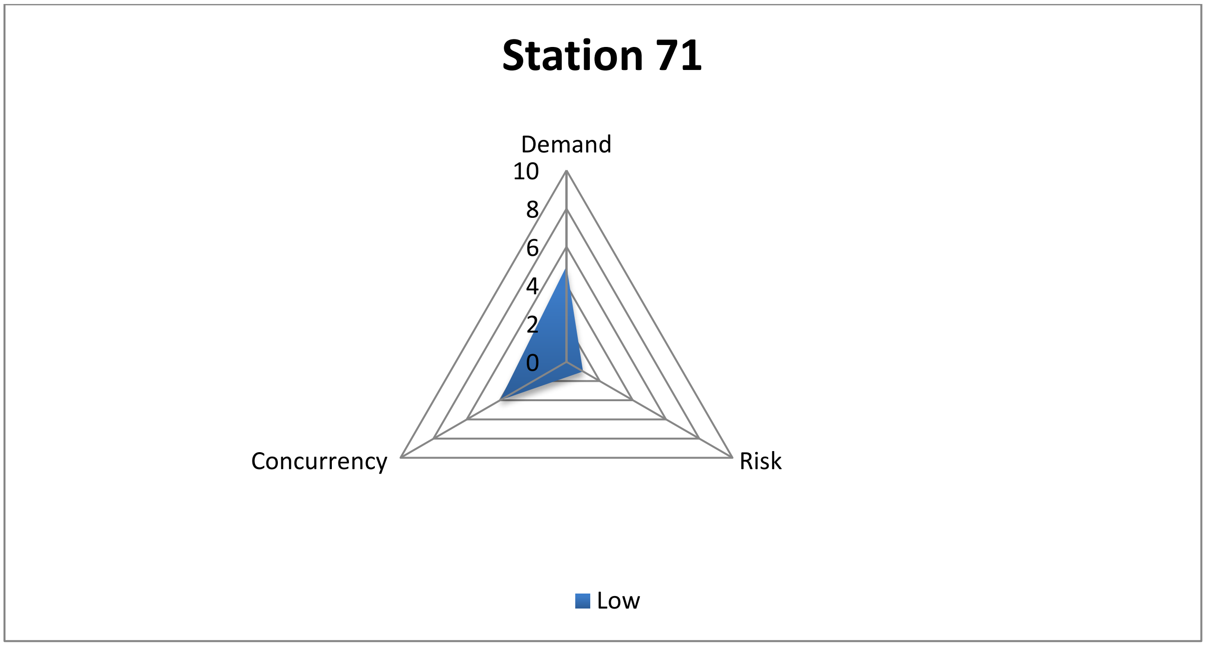


Figure 61: 3-D Risk Profile for Station 72

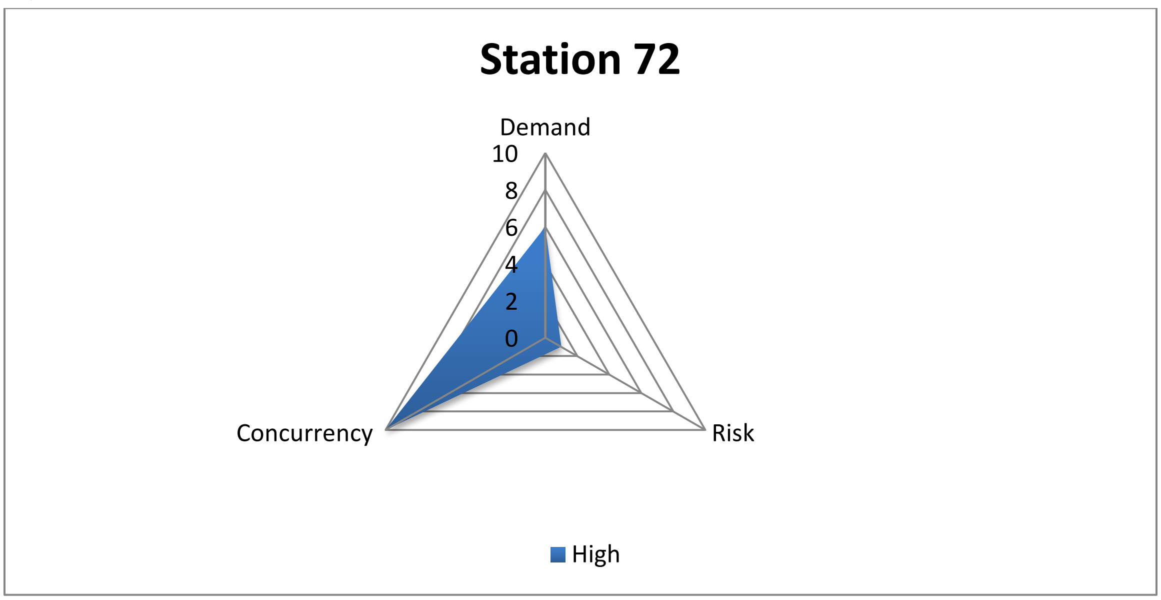


Figure 62: 3-D Risk Profile for Station 73

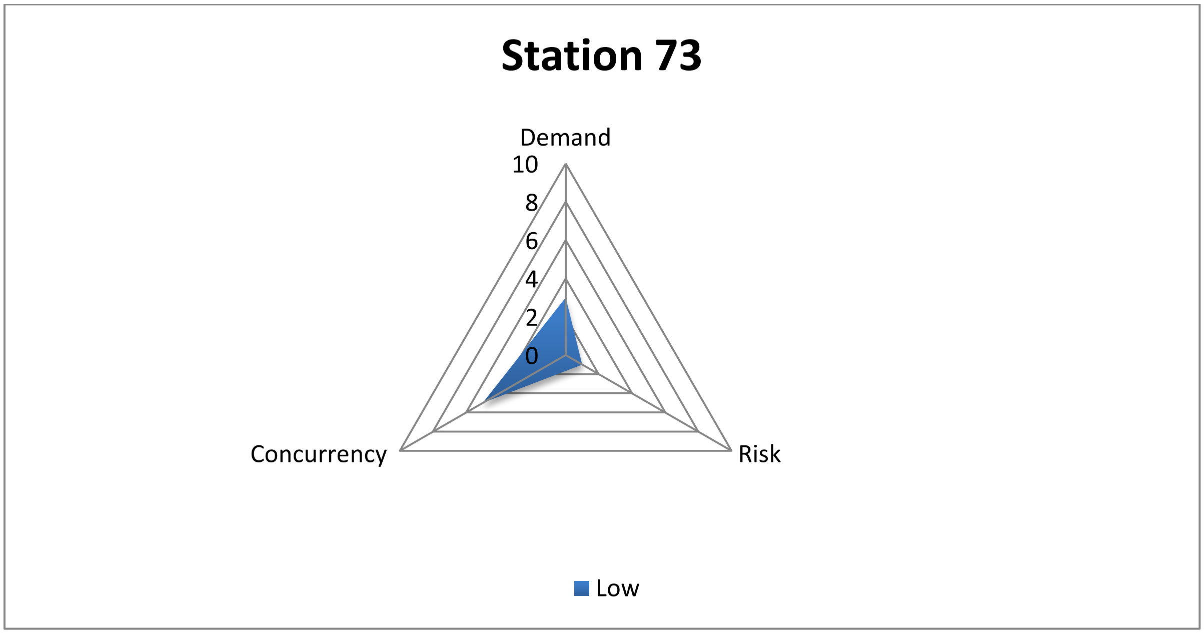


Figure 63: 3-D Risk Profile for Station 74

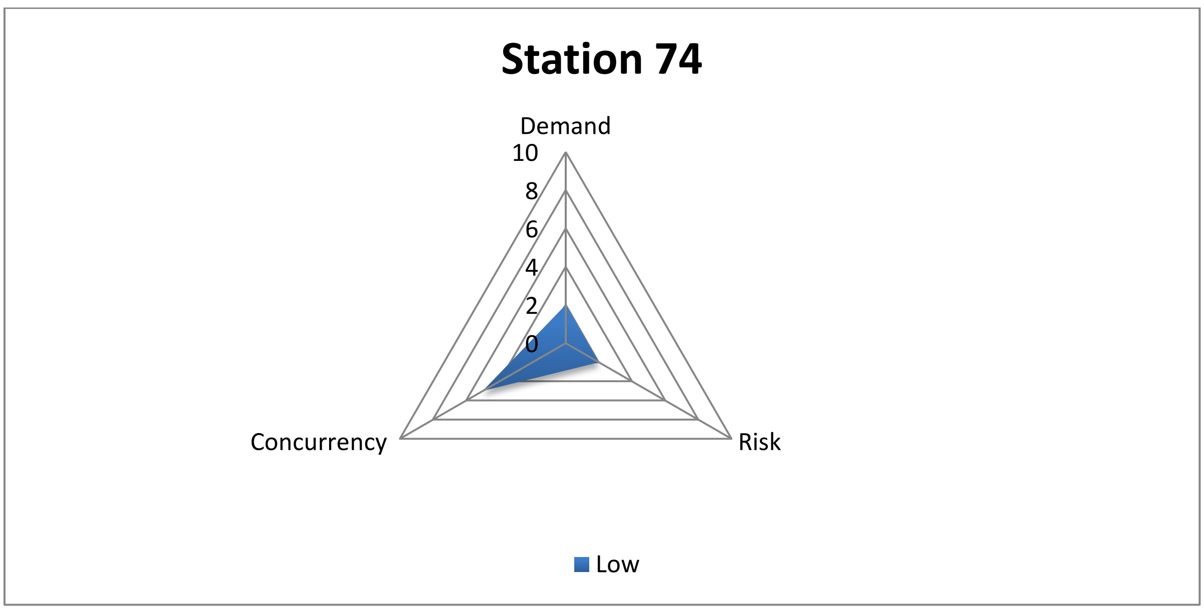


Figure 64: 3-D Risk Profile for Station 76

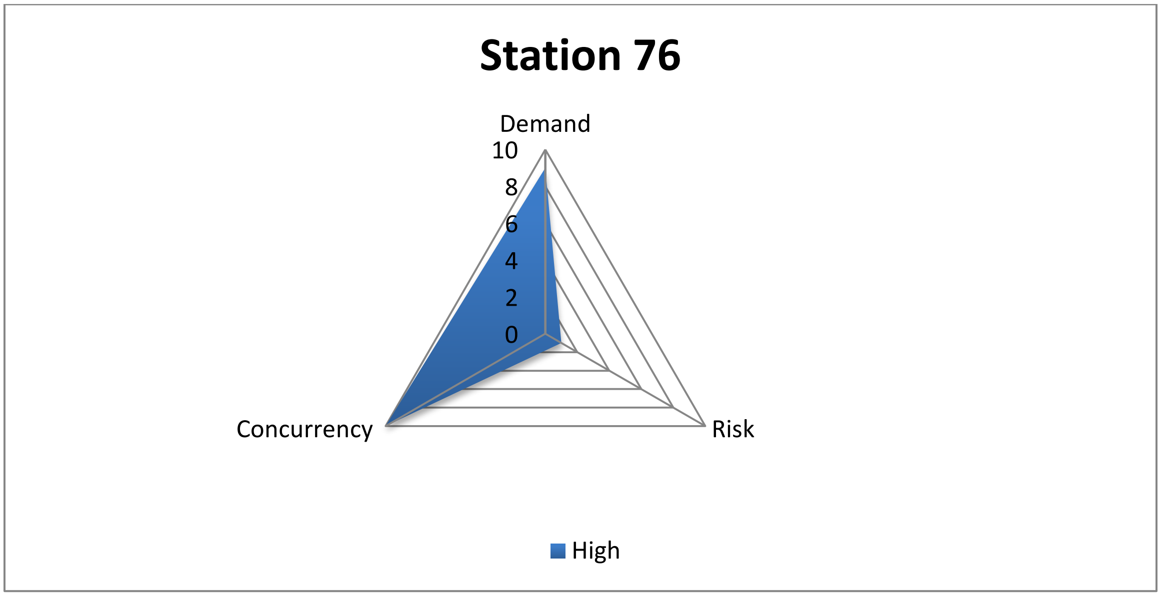
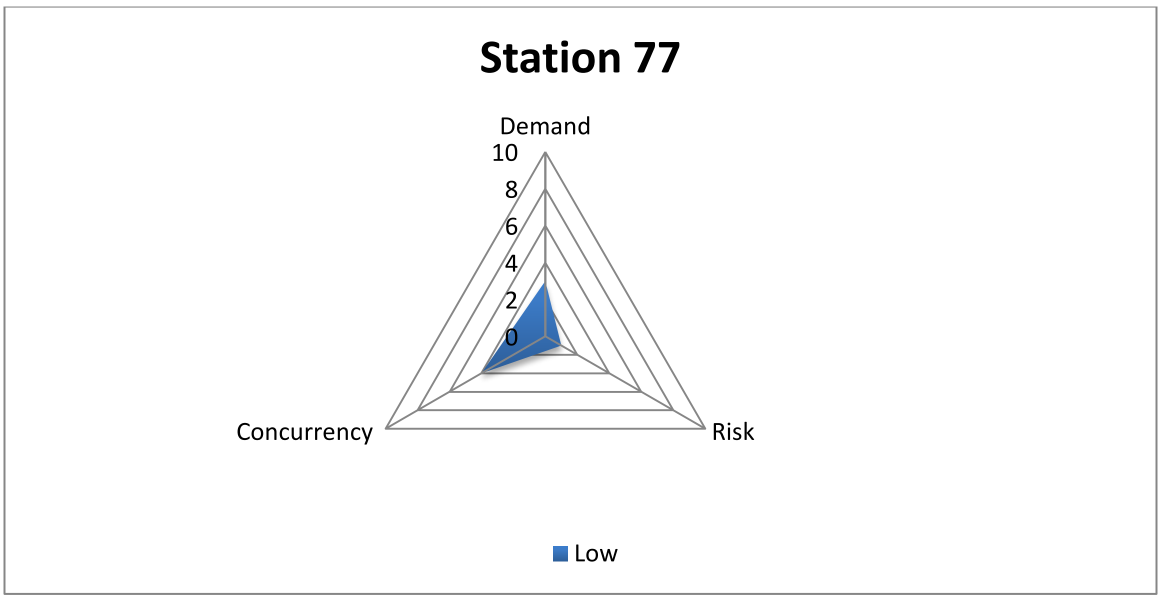


Figure 65: 3-D Risk Profile for Station 77



Concentration of Resources

The station fire demand zone risk matrix demonstrates that the risk associated with the District is generally moderate in nature and the demand can be appropriately handled within the umbrella of the current distribution model. However, in following a risk-based design, Station 72 may require a higher concentration of resources to cover risk in a similar manner as Stations 76 and 31.

Two high risk and one maximum risk FDZs are generated from the application of the risk matrix suggesting a greater concentration of resources should be assigned to assist in covering both the inherent risk as well as the community's demand for services. Station 72's and 76's FDZ risk rating is more influenced by demand for services than unprotected risk. Station 31, a maximum risk, has significant potential risk as well as high demand and call concurrency. In general, the distribution model that currently exists is capable of addressing the low and moderate concentrations of risk without increased concentrations of resources. Therefore, the competing demands for where these resources are placed are not necessarily driven by occupancy risk when the potential risk and the historical demand are not congruent. Table 81 below summarizes the concentration of resources.

Table 81: Summary of Concentration of Resources by Station FDZ and Risk Rating at Min. Staffing

Station FDZ	Engine	Ladder	Medic	Aid	Station Risk Concentration Identification
31	1	1*	1	1*	Maximum
32					Low
71	1		1*		Low
72		1		1*	High
73	1			1*	Low
74	1		1**	1**	Low
76	1		1		High
77	1			1*	Low

*Note: * denotes cross-staffed unit; ** cross-staffed depending on qualifications available*

Effective Response Force Capabilities

The capability of an Effective Response Force (ERF) to assemble in a timely manner with the appropriate personnel, apparatus, and equipment is important to the success of a significant structural fire event. Therefore, it is important to measure the capabilities of assembling an ERF. In most fire departments, the distribution model performs satisfactorily, but it is not uncommon to be challenged to assemble an ERF in the recommended timeframes.

Several factors affect the capabilities to assemble an ERF such as the number of fire stations, number of units, and number of personnel on each unit. Each of these policy decisions should be made in relation to community's specific risks and the willingness to assume risk. Similar to most communities, Fire District 7 has some difficulty meeting best practices for assembling an ERF. However, the performance is not significantly distant from baseline recommendations.

Analyses of historical performance for each station reveal all station demand had 90th percentile travel time longer than eight minutes from the second to the six arriving units. Results validate the distribution model currently utilized as in most of the stations demand zones' the first arriving units can arrive within eight minutes 90% of the time except stations 32, 74 and 75. However, the graphic results for each fire station demand zone are presented in the Figures below.

Figure 66: ERF Travel Performance for Station 31

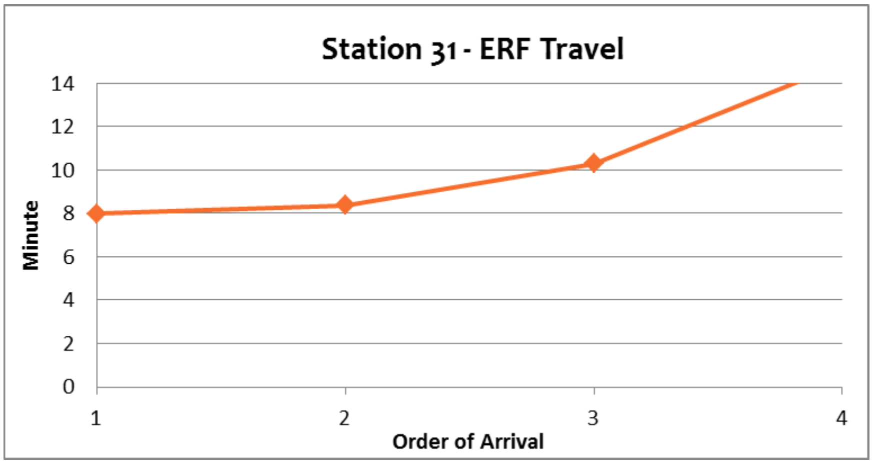


Figure 67: ERF Travel Performance for Station 32

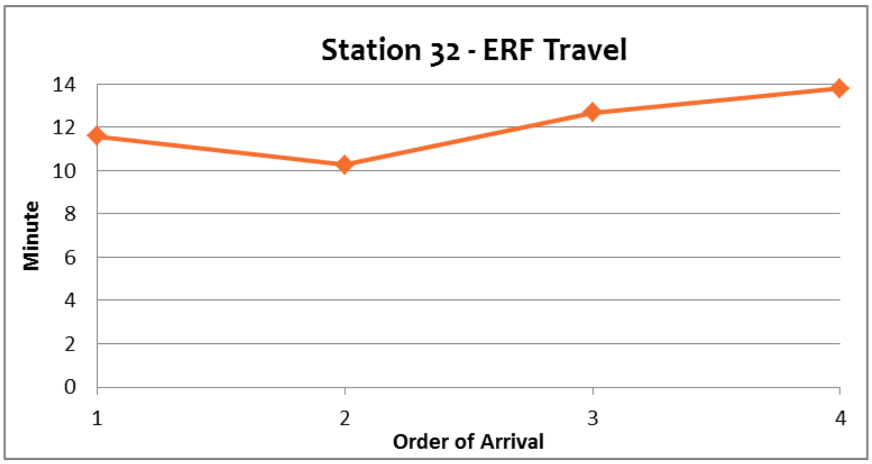


Figure 68: ERF Travel Performance for Station 71

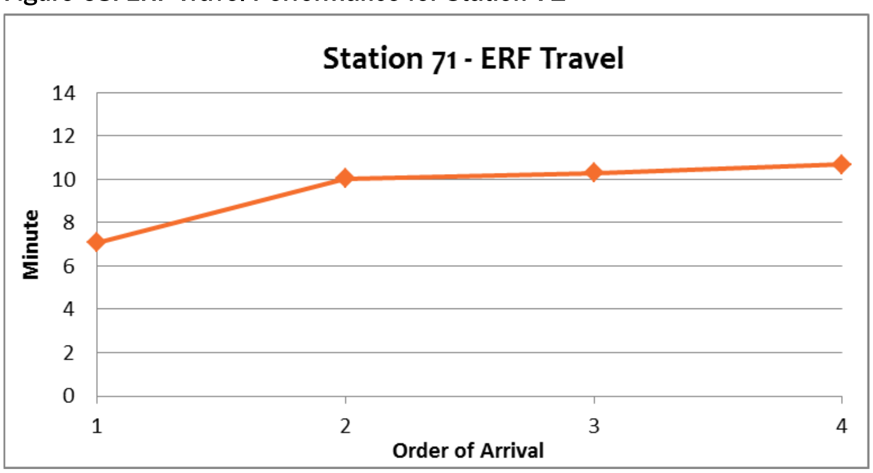


Figure 69: ERF Travel Performance for Station 72

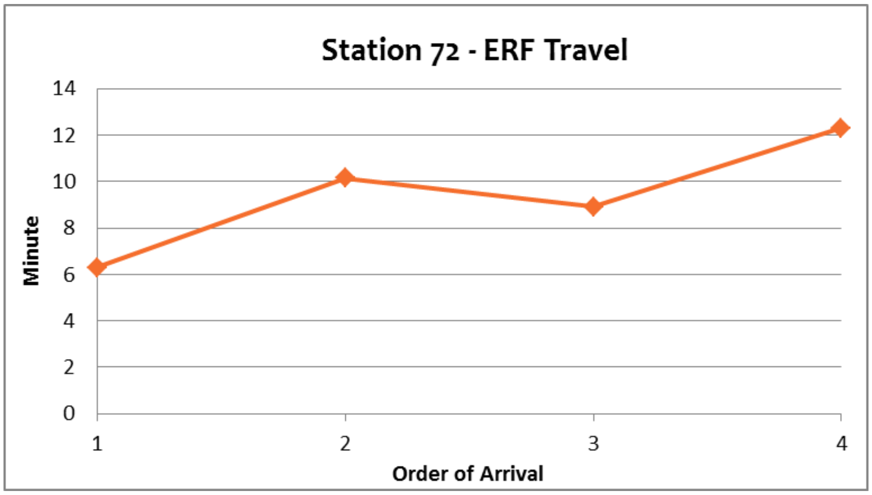


Figure 70: ERF Travel Performance for Station 73

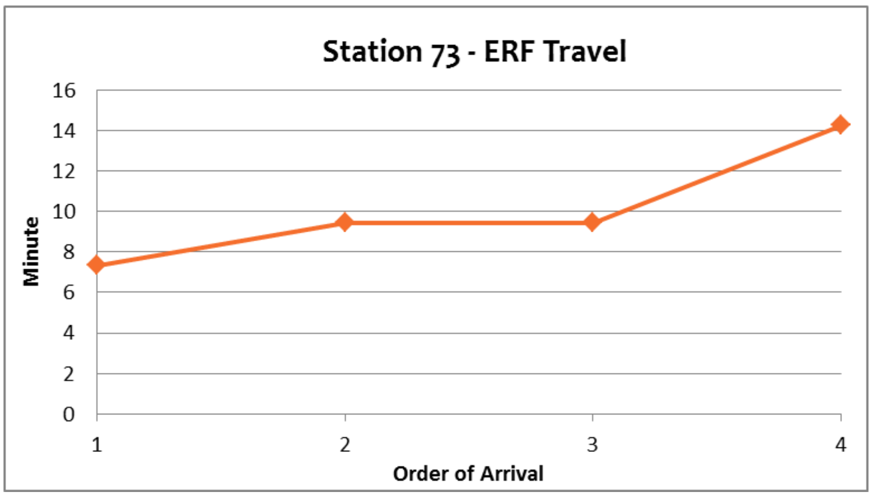


Figure 71: ERF Travel Performance for Station 74

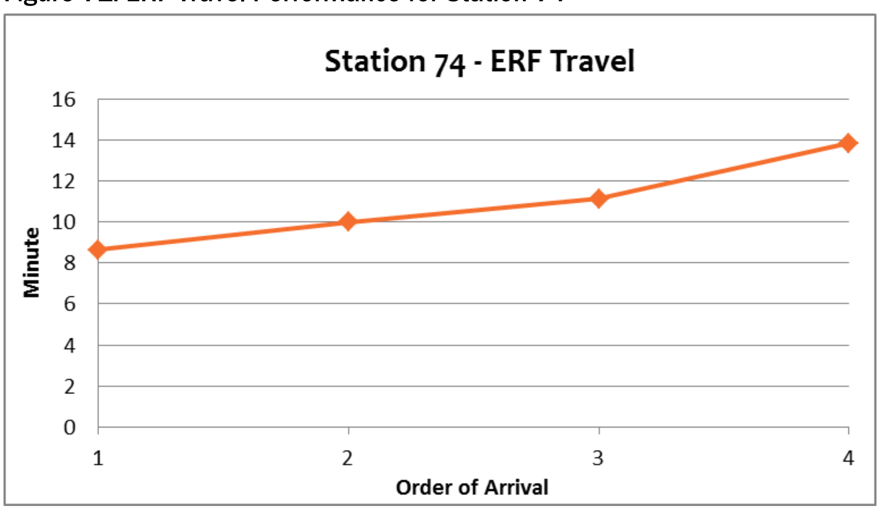


Figure 72: ERF Travel Performance for Station 75/*33

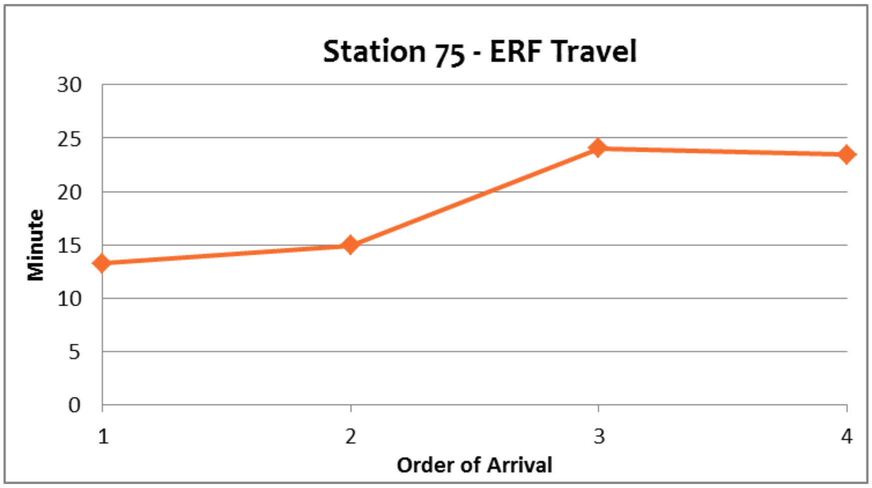


Figure 73: ERF Travel Performance for Station 76

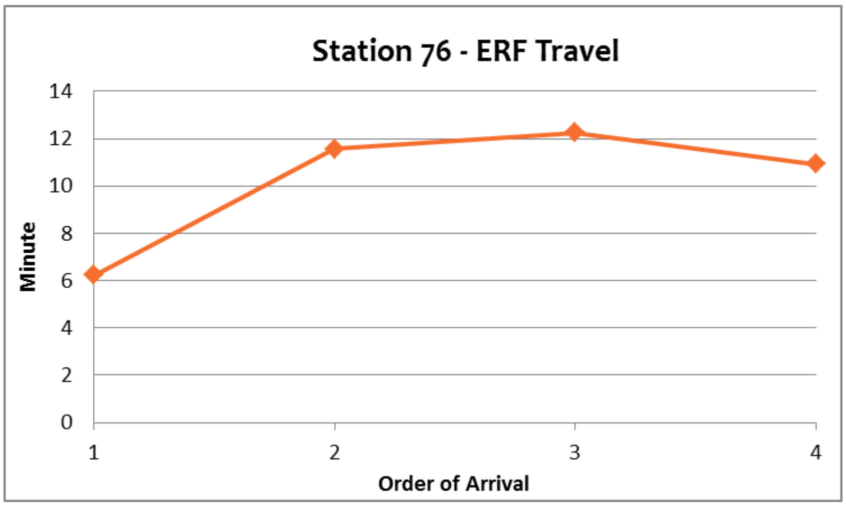
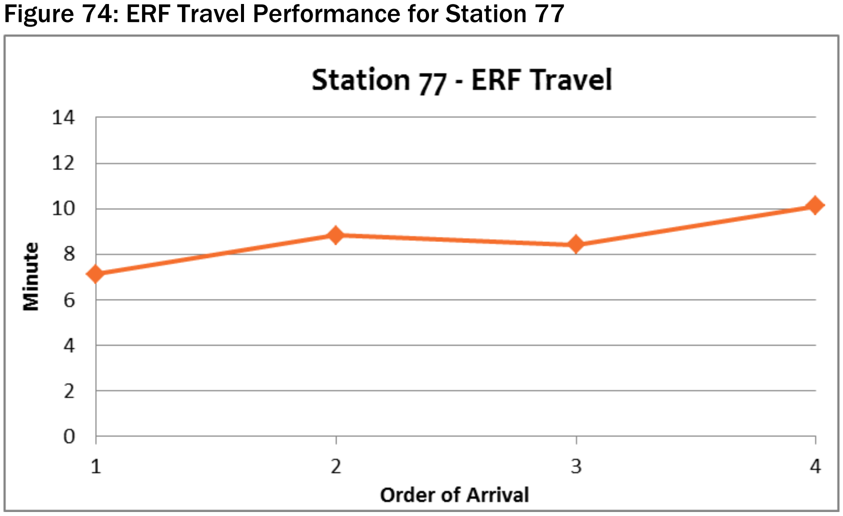


Figure 74: ERF Travel Performance for Station 77



In addition, the data is presented in tabular form as Table 83 below. Table 82 presents the historical mean travel times by the order of the arriving unit. Sample size is presented in Table 84.

Table 82: Historical Mean Travel Time Performance for ERF by Station FDZ

Order of Arrival	Station 31	Station 32	Station 71	Station 72	Station 73	Station 74	Station 75/33	Station 76	Station 77
1	4.5	7.1	4.1	4.1	4.6	5.3	9.8	3.5	4.8
2	4.7	7.3	6.2	6.8	6.9	7.4	11.2	7.0	6.1
3	5.6	7.6	6.1	7.0	6.8	7.9	12.2	7.8	6.0
4	8.8	9.2	7.4	7.5	10.4	10.6	14.9	8.3	7.5
5	11.0	15.2	8.4	9.0	17.0	11.7	10.4	10.3	7.4
6	14.5	25.5	10.1	9.2	9.2	9.3	NA	NA	9.6

Table 83: Historical 90th Percentile Travel Time Performance for ERF by Station FDZ

Order of Arrival	Station 31	Station 32	Station 71	Station 72	Station 73	Station 74	Station 75/33	Station 76	Station 77
1	8.0	11.6	7.1	6.3	7.3	8.6	13.3	6.2	7.1
2	8.4	10.3	10.0	10.2	9.5	10.0	14.9	11.6	8.8
3	10.3	12.7	10.3	8.9	9.5	11.1	24.1	12.3	8.4
4	14.9	13.8	10.7	12.3	14.3	13.9	23.5	10.9	10.1
5	19.2	15.2	11.1	13.6	40.6	32.6	10.4	21.0	9.8
6	21.2	25.5	13.8	15.4	9.2	11.4	NA	NA	9.6

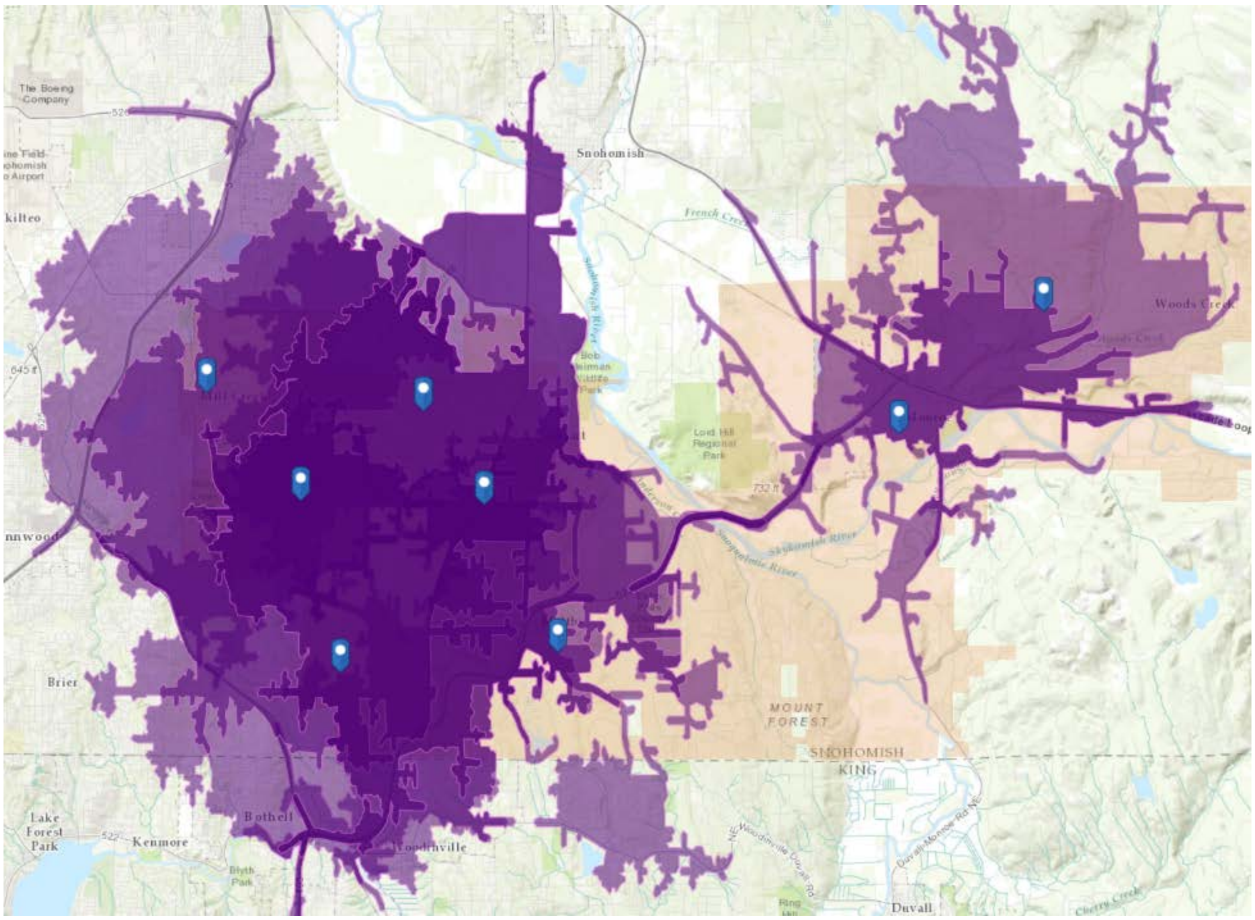
While it is best practice to measure performance to the 90th percentile, it is important to acknowledge that the number of calls drops significantly from the second unit to the third and beyond. For example, in Station 72 the second unit arrived on scene at 618 incidents, the third unit arrived on scene at 140 incidents, and then 41, 11, and 6 for the 4th, 5th, and 6th units, respectively. The low frequency of occurrences introduces more variability in the data as observed with the previous figures. Therefore, the mean becomes the more reliable measure with small data sets. The 2016 data is presented as Table 84 below.

Table 84: Sample Size for ERF Travel Time Analysis

Order of Arrival	Station 31	Station 32	Station 71	Station 72	Station 73	Station 74	Station 75/33	Station 76	Station 77
1	2,641	359	253	1,091	466	277	158	1,631	407
2	604	58	122	618	168	121	74	887	143
3	185	27	35	140	58	38	18	166	37
4	45	10	12	41	17	11	4	33	13
5	14	1	6	11	5	8	1	6	4
6	6	1	2	6	1	5	0	0	1

Finally, a geospatial analysis was completed for the jurisdiction as whole with each station fire identified. This analysis mapped the travel time utilizing existing road miles, infrastructure, and impedance at 8, 10, and 13-minute increments. The eight-minute travel time threshold is recommended as best practice and 10 minutes and 24 seconds is afforded as the baseline performance for the accreditation model offered by the Commission on Fire Accreditation International (CFAI)[43]. Similarly, the CFAI affords a 13-minute travel time for suburban areas and 18-minutes in rural areas.[44] When referring to the following maps, the darker the shading (green) the higher the density of units capable of arriving within the given time frame. The 10, 13, and 18-minute drive time bleed maps are provided below as Figures 75, 76, and 77, respectively.

Figure 75: 10-Minute Travel for ERF



43 CFAI. (2016). Fire & Emergency Service Self-Assessment Manual: Interpretation Guide, 9th (ed.). Chantilly, Virginia: Author. (p. 99)
44 Ibid.

Figure 76: 13-Minute Travel Time for ERF

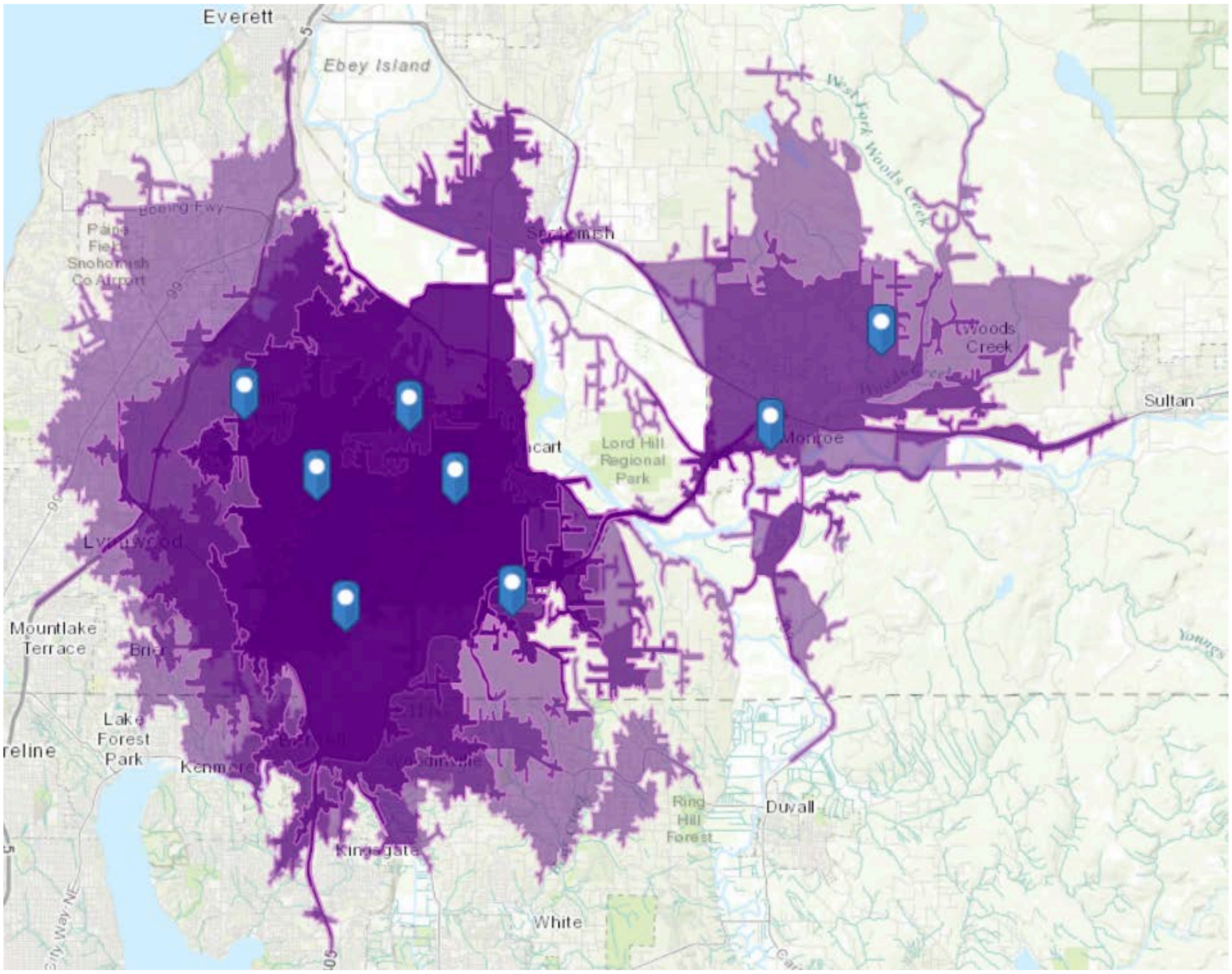
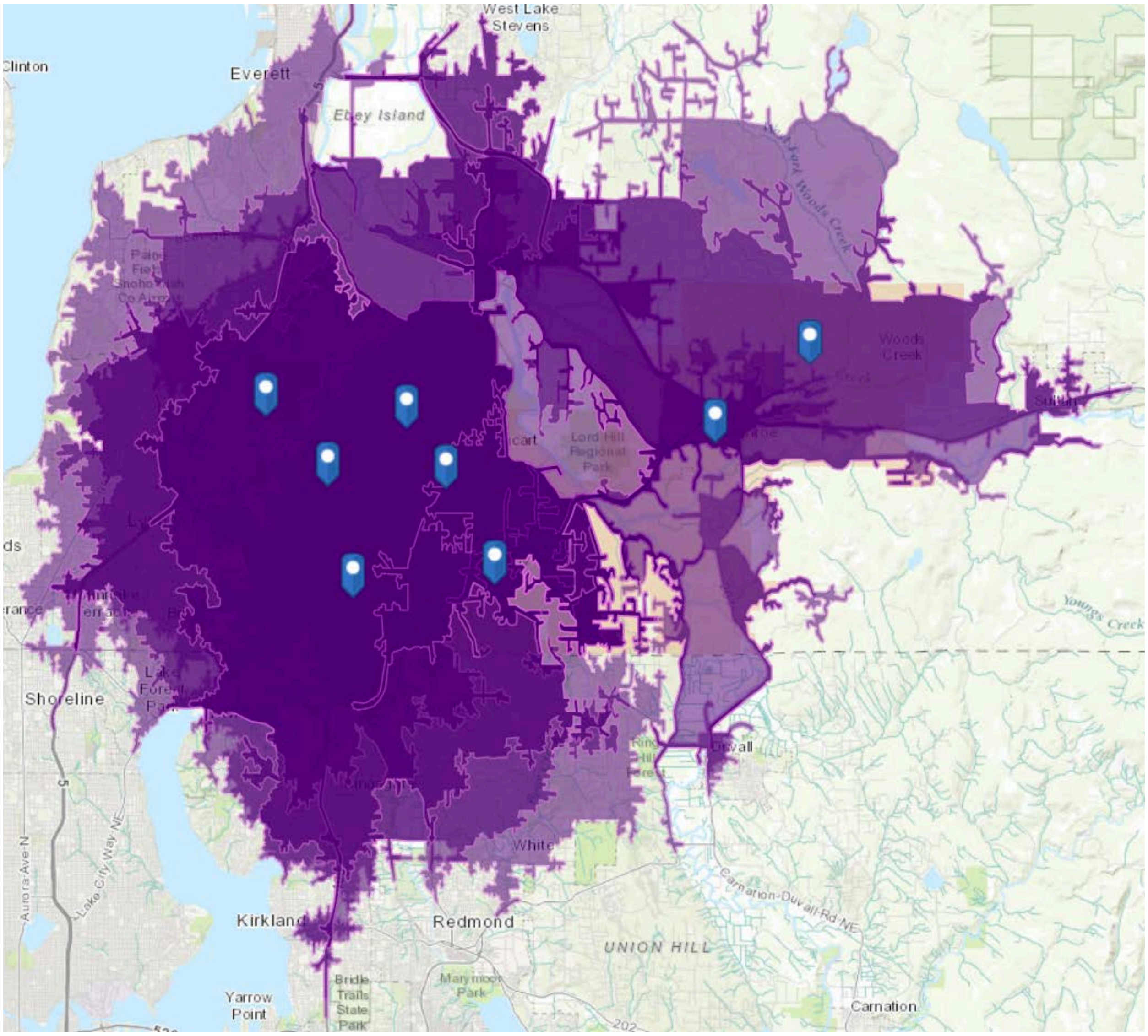


Figure 77: 18- Minute Travel Time for ERF



Reliability Factors

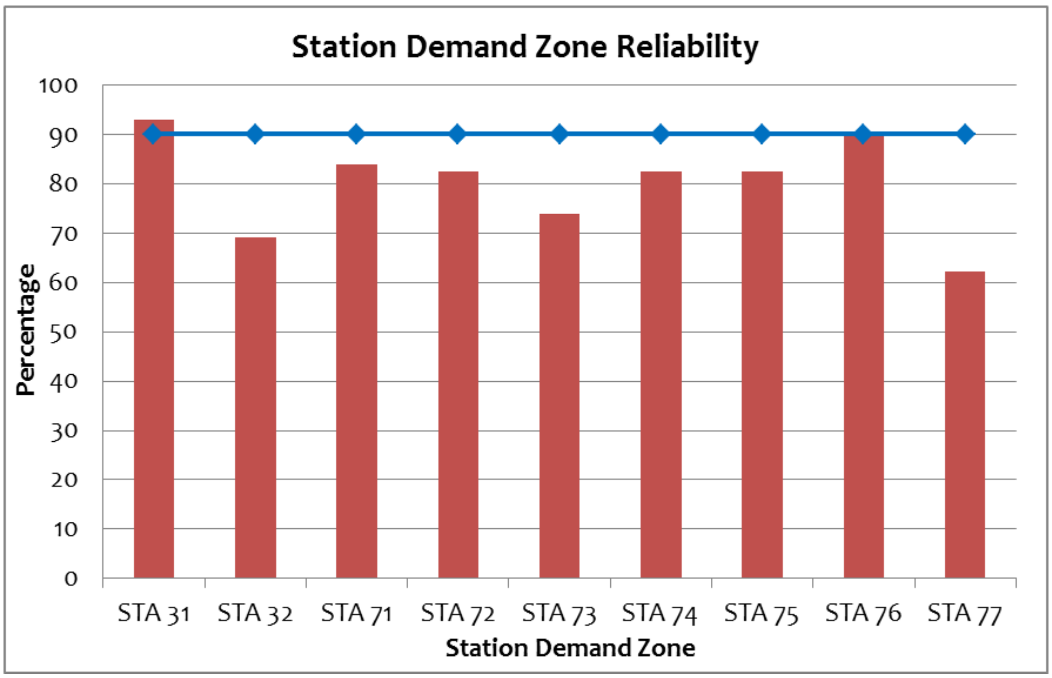
Percentage of Department Compliance

The first step in assessing the reliability of the deployment model or system performance is to understand the department's availability to handle the requests for service that occur within the city limits or jurisdiction. Fire District 7 is available to respond to 97.9% of the requests for service that are originating within the jurisdictions of 31D07 and 31M09. A total of 182 incidents were responded to by other agencies with no Fire District 7 units responding.

Percentage of First Due Compliance

The reliability of the distribution model is a factor of how often the response model is available and able to respond to the call within the assigned demand zone. If at least one unit from the first due station is able to respond to a call, we consider the station is able to response to the call within the assigned demand zone. Utilizing the department's Fire Station Demand Zones (FDZ), analyses reveal that stations 31 and 76 are capable of meeting their demand for services at the 90th percentile. In other words, when request for service is received FDZ 31 and 76 are available to answer the call nine out of 10 times. Station 32 and 77 have the lowest reliability, and are 69 and 62 percent respectively. This analysis utilized all dispatched calls within the jurisdiction and the performance included all assigned units to the specific FDZ.

Figure 78: Percentage Reliability by Station FDZ



Fire suppression companies (engine or ladder) are consistently staffed across each of the FDZs. Analyses were conducted to examine the ability of the specifically assigned engine or ladder company to answer the request for service. Eighty-two percent of the calls responded to by Engine 31 or Ladder 31 occurred in the first due station 31 area. Fifty-seven percent of the calls responded to by Engine 32 occurred in the first due station 31's area. Sixty-two percent of the calls responded to by Engine 71 were in first due station 71 area. Fifty-nine percent of the calls responded to by Ladder 72 occurred in the first due station 72 area. Forty-seven percent of the calls responded to by Engine 73 occurred in the Station 73 first due area. Of the Engine E74 calls responded to 54% of the first due station 74 calls. Engine 76 responded to 94% of the calls in the first due station 76 areas. Of the Engine E77 calls responded to, 34% were in the first due station area. The detailed engine responses are presented below.

Table 85: Frequency of Dispatched Calls by Engine/Ladder and First Due Station

Station Demand Zone	E31 /L31	E32	E71	L72	E73	E74	E76	E77	Total
Station 31	892 82%	142	7	5	0	32	1	3	1,082
Station 32	60	81 57%	0	0	1	0	0	0	142
Station 71	0	0	96 62%	16	6	22	0	14	154
Station 72	0	0	44	367 59%	18	5	179	7	620
Station 73	0	0	55	38	110 47%	27	0	2	232
Station 74	19	0	52	13	19	129 54%	1	8	241
Station 76	0	0	4	75	2	0	1470 94%	7	1,558
Station 77	0	0	45	51	1	2	23	63 34%	185
Total	971	223	303	565	157	217	1,674	104	4,214

BLS or ALS units are consistently staffed across each of the FDZs. Analyses were conducted to examine the ability of the specifically assigned EMS unit to answer the request for service. BLS and ALS units in Station 31 responded to 89% of the calls in the first due station area. Of the ALS unit M32 calls responded to, 55% were in the first due station 32 area. Of the ALS unit M71 calls responded to 47% of the calls occurred within the first due station 71 area. Of the BLS unit A72 calls responded to 45% of the calls occurred in the first due station 72 area. Of the BLS unit A73 calls responded to, 46% of the calls occurred in the first due station 73 area. Of the BLS unit A74 calls responded to, 48% occurred in the first due station 74 area. Of the ALS unit M76 calls responded to 46% occurred within the first due station 76 area. Of the BLS unit A77 calls responded to, 48% of the occurred in the first due station 77 area.

Table 86: Frequency of Dispatched Calls by BLS/ALS Unit and First Due Station

Station Demand Zone	A31/ M31/ M33	M32	M71	A72	A73	A74	M76	A77	Total
Station 31	2633 89%	298	6	1	1	27	0	3	2969
Station 32	164	201 55%	0	0	0	2	0	1	368
Station 71	0	0	166 47%	41	26	47	3	70	353
Station 72	0	0	146	721 45%	249	13	348	138	1,615
Station 73	0	0	168	63	257 46%	53	8	10	559
Station 74	26	1	212	15	42	293 48%	2	18	609
Station 76	0	0	7	155	107	4	737 46%	588	1,598
Station 77	0	0	66	137	21	2	31	238 48%	495
Total	2823	500	771	1,133	703	441	1,129	1,066	8,566

Overlapped or Simultaneous Call Analysis

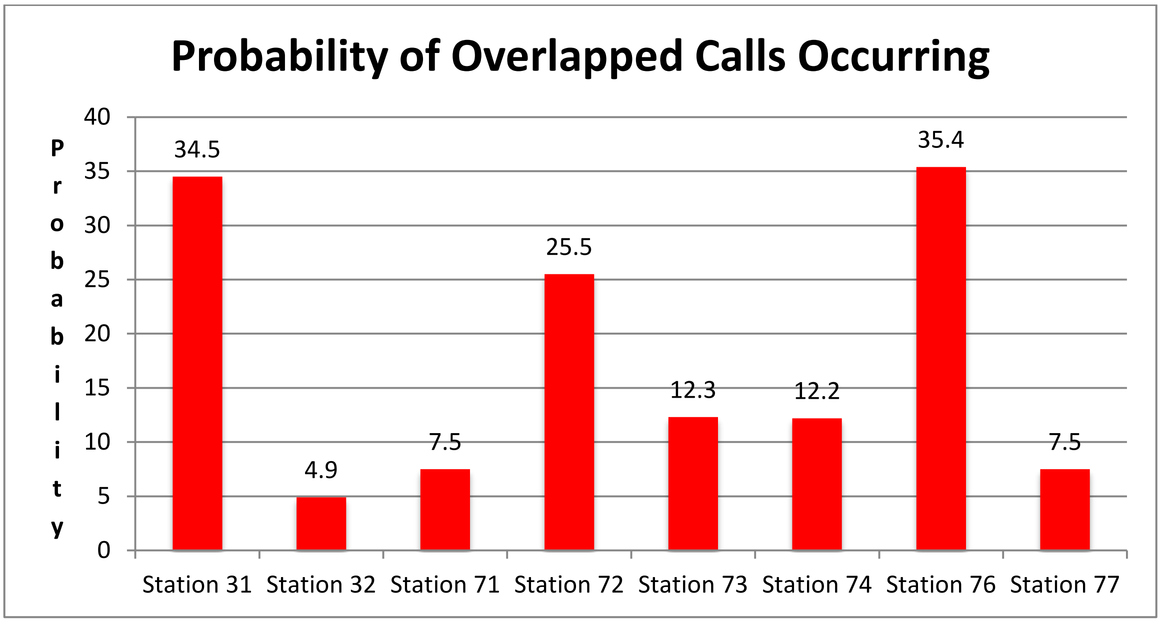
Overlapped calls are defined as the rate at which another call was received for the same first due station while there were one or more ongoing calls in the same first due station. For example, if there is one call in station 76's zone, before the call was cleared another request in station 76's zone occurred and those two calls would be captured as overlapped calls. Some studies also refer as simultaneous calls. Understanding the probability of overlapped or simultaneous calls occurs will help to determine the number of units to staff for each station. In general, the larger the call volume a first due station has, it is more likely to have overlapped or simultaneous calls. The distribution of the demand throughout the day will impact the chance of having overlapped or simultaneous calls. The duration of a call will also have major influences, since the longer time it takes to clear a request, the more likely to have an overlapped request.

Station 76 has the second most demand, and the duration of calls lasted at 57 minutes, which is significantly longer than calls in station 31, and thus it has the highest probability of having overlapped calls at 35.4%. This means that during the period of an active station 76 call, there is a 35% chance that another incident in station 76 will occur. Station 31 has the most demands (36 percent of the department's total requests for services), and thus the second highest probability of having overlapped calls at 34.5%, followed by station 72 at 25.5%. Results are presented below as Table 87 and Figure 79.

Table 87: Overlapped Calls by First Due Station

First Due Station	Overlapped Calls	Total Calls	Probability of Overlapped Calls Occurring	Duration (Minutes)
Station 31	1,055	3,057	34.5	35.4
Station 32	20	406	4.9	44.7
Station 71	24	318	7.5	49.9
Station 72	318	1,247	25.5	54.9
Station 73	66	537	12.3	47.6
Station 74	62	507	12.2	58.0
Station 76	652	1,840	35.4	57.1
Station 77	36	482	7.5	48.9

Figure 79: Probability of Overlapped Calls Occur by Station FDZ



PERFORMANCE OBJECTIVES AND MEASUREMENT

Performance Objectives – Benchmarks

Fire Suppression Services Program

For 90% of all priority structure fire incidents, the first-due unit shall arrive, with a minimum of three personnel, within 8 minutes and 30 seconds total response time. The first-due unit shall be capable of initiating a rescue, advancing a first attack line, or providing basic life support for victims.

For 90% of all priority structural fire incidents, the effective response force, with a minimum of 14 personnel, shall arrive within 12 minutes total response time. The effective response force should be capable of preventing further escalation of the fire incident.

Emergency Medical Services Program

For 90% of all priority ALS emergency medical incidents, the first-due Advanced Life Support (ALS) unit shall arrive within 10 minutes and 30 seconds total response time. The first-due unit shall be capable of providing advanced life support and transport for medical incidents. If an engine or ladder company is assigned the incident, it will be capable of providing Basic Life Support (BLS) with automated external defibrillator (AED) capability, until the ALS unit arrives on the scene. The ALS total response time is commensurate with the effective response force.

For 90% of all priority EMS incidents with a BLS first responder, the responder shall arrive within 8 minutes and 30 seconds total response time and be capable of providing BLS care with an automated external defibrillator (AED) capability.

Hazardous Materials Services Program

For 90% of all hazardous materials incidents, the first-due unit shall arrive, with a minimum of three personnel, in 8 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a hazardous materials incident at the operations level.

For 90% of all incidents, the effective response force, consisting of a minimum of 17 personnel, shall arrive within 12 minutes total response time. The effective response force should be capable of mitigation of a hazardous materials incident that may include entry, identification, recon, decontamination, and rehabilitation. A countywide response is available for major incidents.

Rescue Services Program

For 90% of all incidents, the first-due unit shall arrive, with a minimum of three personnel, in 8 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a technical rescue incident.

For 90% of all incidents, the effective response force, consisting of a minimum of 9 personnel, shall arrive within 12 minutes total response time. The effective response force should be capable of mitigation of a technical rescue incident that may include shoring, extrication, below-grade rescue, and high-angle rescue. A countywide response is available for major incidents.

Summaries of the District's benchmarks objectives are presented below in Table 88 below.

Table 88: Summary of District 7's Benchmark Objectives

Measured at the 90th Percentile		Suppression	BLS	ALS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	1:00	1:00	1:00	1:00	1:00
Turnout	Turnout Time 1st Unit	1:30	1:30	1:30	1:30	1:30
	Turnout Time for ERF	1:30	1:30	1:30	1:30	1:30
Travel	Travel Time 1st Due	6:00	6:00	8:00	6:00	6:00
	Travel Time ERF	10:30	8:00	8:00	10:30	10:30
Total Response Time	Total Response Time 1st Due	8:30	8:30	10:30	8:30	8:30
	Total Response Time ERF	12:00	12:00	12:00	12:00	12:00

Performance Objectives – Baselines

Fire Suppression Services Program

For 90% of all priority structure fire incidents, the first-due unit shall arrive, with a minimum of three personnel, within 12 minutes and 30 seconds total response time. The first-due unit shall be capable of initiating a rescue, advancing a first attack line, or providing basic life support for victims.

For 90% of all priority structural fire incidents, the effective response force, with a minimum of 14 personnel, shall arrive within 21 minutes total response time. The effective response force should be capable of preventing further escalation of the fire incident.

Emergency Medical Services Program

For 90% of all priority ALS emergency medical incidents, the first-due Advanced Life Support (ALS) unit shall arrive within 14 minutes total response time. The ALS unit shall be capable of providing advanced life support and transport for medical incidents. If an engine or ladder company is assigned the incident, it will be capable of providing Basic Life Support (BLS) with automated external defibrillator (AED) capability, until the ALS unit arrives on the scene.

For 90% of all priority EMS incidents with a BLS first responder, the first responder shall arrive within 12 minutes total response time and be capable of providing BLS care with an automated external defibrillator (AED) capability.

For 90% of all incidents, the effective response force, consisting of 6 personnel, shall arrive within 14 minutes and 30 seconds.

Hazardous Materials Services Program

For 90% of all hazardous materials incidents, the first-due unit shall arrive, with a minimum of three personnel, in 12 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a hazardous materials incident at the operations level.

For 90% of all incidents, the effective response force, consisting of a minimum of 17 personnel, shall arrive within 21 minutes total response time. The effective response force should be capable of mitigation of a hazardous materials incident that may include entry, identification, recon, decontamination, and rehabilitation. A countywide response is available for major incidents.

Rescue Services Program

For 90% of all incidents, the first-due unit shall arrive, with a minimum of three personnel, in 12 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a technical rescue incident.

For 90% of all incidents, the effective response force, consisting of a minimum of 9 personnel, shall arrive within 21 minutes total response time. The effective response force should be capable of mitigation of a technical rescue incident that may include shoring, extrication, below-grade rescue, and high-angle rescue. A countywide response is available for major incidents.

In summary, the department's baseline performance has been as follows when compared to the CFAI baseline objectives. When referring to the summary tables, there are some data elements that must be understood. First, the performance listed for "Total Response Time" for the District includes the combined dispatch, turnout, and travel time measures at the 90th percentile. Secondly, the data are presented as found in the CAD system. The first due performance for hazardous materials risks should be commensurate with the first due performance for all other fire related incidents. However, the sample size was very small and does not provide quality information to make any inferences or assumptions about performance. Third, both the hazardous materials and technical rescue programs did not have sufficient data to analyze the effective response forces. Therefore, they are submitted with an n/a. Finally, as previously discussed with respect to the ERF, the frequency of incidents where sufficient vehicles arrived to assemble a minimum of 14 personnel was relatively low and measures at the 90th percentile are problematic in small data sets. The ERF performance should be considered with caution and average times may be more appropriate until a much large sample size can be obtained. Tables 89 through 91 below provide a comparison of baseline performance to baseline objectives.

Table 89: Summary of Baseline Performance and Baseline Objectives for Fire Suppression

Suppression Fires - 90th Percentile Times		2016	CFAI BASELINE Objective	District 7 Baseline Objective
Call Processing	Pick-up to Dispatch	3:06	1:30	1:30
Turnout	Turnout Time 1st Unit	2:48	1:30	2:45
	Turnout Time for ERF	2:48	1:30	2:45
Travel	Travel Time 1st Due	8:18	5:12 -Urban/Suburban 13:00 - Rural	8:00
	Travel Time ERF	19:18	10:24 – Urban 13:00 – Suburban 18:12 - Rural	18:00
Total Response Time	Total Response Time 1st Due	13:24	8:12 – Urban/Suburban 16:00 – Rural	12:30
	Total Response Time ERF	25:12	13:24 – Urban 16:24 – Suburban 21:12 – Rural	21:00

Table 90: Summary of Baseline Performance and Baseline Objectives for EMS

EMS - 90th Percentile Times		2016	CFAI BASELINE Objectives	District 7 Baseline Objectives
Call Processing	Pick-up to Dispatch	2:24 – ALS 4:30 - BLS	1:30	1:30
Turnout	Turnout Time 1st Unit	2:24	1:30	2:30
	Turnout Time for ERF	2:24	1:30	2:30
Travel	Travel Time 1st Due	7:12 – ALS 7:48 – BLS	5:12 -Urban/Suburban 13:00 - Rural	8:00
	Travel Time ERF	10:24	10:24 – Urban 13:00 – Suburban 18:12 - Rural	13:00
Total Response Time	Total Response Time 1st Due	11:12 - ALS 14:18 – BLS	8:12 – Urban/Suburban 16:00 – Rural	12:00 – EMS 14:00 – Medic Unit
	Total Response Time ERF	17:30 – BLS 15:36 - ALS	13:24 – Urban 16:24 – Suburban 21:12 – Rural	14:30

Table 91: Summary of Baseline Performance and Baseline Objectives for Special Operations

Special Operations (Hazardous Materials and Technical Rescue) - 90th Percentile Times		2016	CFAI BASELINE Objective	District 7 Baseline Objective
Call Processing	Pick-up to Dispatch	4:18	1:30	1:30
Turnout	Turnout Time 1st Unit	8:42	1:30	2:45
	Turnout Time for ERF	n/a	1:30	2:45
Travel	Travel Time 1st Due	11:06	5:12 -Urban/Suburban 13:00 - Rural	8:00
	Travel Time ERF	n/a	10:24 – Urban 13:00 – Suburban 18:12 - Rural	18:00
Total Response Time	Total Response Time 1st Due	14:42	8:12 – Urban/Suburban 16:00 – Rural	12:30
	Total Response Time ERF	n/a	13:24 – Urban 16:24 – Suburban 21:12 – Rural	21:00

COMPLIANCE METHODOLOGY

This Standards of Response Coverage document is designed to guide the Department to continuously monitor performance, seek areas for improvement, and to clearly articulate service levels and performance to the community we have the privilege of serving. Therefore, the Fire Chief has established a Compliance Team to continuously monitor elements of this SOC and make recommendations for system adjustments or improvement quarterly.

Compliance Team / Responsibility

The Compliance Team will consist of the following department members (TBD) and will have the responsibility of continuously monitoring changes in risk, community service demands, and department performance in each program area, fire department demand zone, and/or risk category.

- Chair – Operations Chief
- Member – SOC Representative
- Member – Community Risk Reduction Representative
- Member – EMS Representative

Performance Evaluation and Compliance Strategy

Snohomish Fire District 7 will evaluate system performance by measuring first due unit performance at the 90th percentile quarterly and annually. In addition, the Department will evaluate first due performance by each individual fire station demand zone and by program area. Measures for the effective response force by each program area, fire station demand zone, and risk category will be evaluated annually. Annual reviews will be conducted in January of each year regarding the previous year. All response performance monitoring will exclusively evaluate emergency responses.

The compliance team will determine the strengths, weaknesses, opportunities, and threats of the system performance annually and make recommendations for system adjustments to the Fire Chief. Finally, the Department will annually update and evaluate the risk assessment matrices for relevancy and changes in community risk.

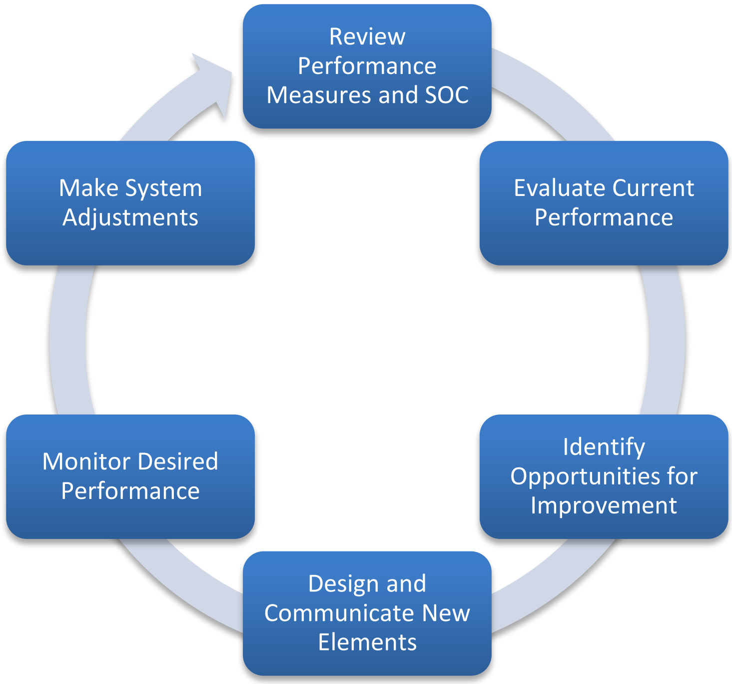
Compliance Verification Reporting

The compliance team will communicate results of the period evaluations to the Fire Chief. The Fire Chief will disseminate the quarterly and annual results and any system adjustments in a timely manner so that both performance measurement and continuous improvement becomes part of the organization's culture. All performance and risk measures will be reported to the Board of Directors and available to the community annually.

Constant Improvement Strategy

The Department utilizes the following conceptual model to facilitate both compliance and continuous improvement.

Figure 80: Continuous Improvement and Compliance Model



OVERALL EVALUATION, CONCLUSIONS, AND RECOMMENDATIONS

Overall Evaluation

The overall evaluation is the final component of the Standards of Cover (SOC) process. As a risk-based process that incorporates risk, mitigation, and outcomes measures, both the Department and the District leadership can more easily discuss service levels, outcomes, and the associated cost allocations based on community risk.

Overall, the department is performing well within the current system. The community enjoys high quality services from a professional and well-trained department. Predominantly, the department's distribution and concentration delivery models are appropriately aligned with the District's unique risks. In addition, the practice of cross-staffing units provides operational and fiscal efficiencies. However, there are areas that have been identified that the Department could make incremental system adjustments to improve.

General Observations

Total Response Time

The Department has established goals for system performance prior to the completion of this SOC. In most instances, the Department does not meet established goals. The aggregate performance is more representative of the system performance. The individual station demand zones performance provides understanding of the compartmentalized performance. While it is up to the department to establish policy related to meeting or exceeding community expectations, there are opportunities to better align goals and baseline objectives.

Observations and remedies:

- With the implementation of the new CAD system, the dispatch processing data is now included within the data set which has caused the total response to elongate considerably from the previous SOC
- In addition, the merger of Snohomish Fire District 3 has also stretched resources to a greater degree elongating travel times, and ultimately total response time.
- The department could impact the total response time in most instances with the improvement of crew turnout time and improved dispatch time that is more closely aligned with best practices.
- Turnout time performance is typically within personnel and management control
- Improvement of turnout times at no cost would receive the same system benefit as multi-million dollar investments in the response distribution model.

Internal Performance Goals and the Distribution of Resources

The Department's internal goal of an 8-minute travel time for all EMS and fire related events remains reasonably aligned after the merger with Snohomish Fire District 3 with an aggregated travel time of 8:06. The department's program area performance is 7:12, 7:48, and 8:24 for ALS, BLS, and fire related incidents, respectively. Overall, for all call-types only Stations 32 and 74 do not currently meet the 8-minute threshold at the 90th percentile. Data are reproduced in Tables 92 and 93 for clarity.

Table 92: 90th Percentile Turnout and Travel Time of First Arriving Units by Call Category

Call Category	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
EMS	4.5	2.4	7.8	14.3	3,969
EMS-ALS	2.6	2.4	7.2	11.2	2,194
Fire	3.1	2.8	8.3	13.4	721
Special Ops	4.3	8.7	11.1	14.7	10
Service	5.0	2.8	12.6	18.6	389
Total	**3.7**	**2.5**	**8.1**	**13.7**	**7,283**

Table 93: 90th Percentile First Arrival Performance by Station FDZ

Fire Demand Zone	Dispatch Time	Turnout Time	Travel Time	Turnout and Travel	Response Time	Sample Size
STA 31	3.5	2.7	8.0	10.1	13.5	2,641
STA 32	3.5	3.2	11.6	13.8	16.4	359
STA 71	3.1	2.4	7.1	8.7	11.4	253
STA 72	3.7	2.2	6.3	8.1	11.1	1,091
STA 73	3.6	2.5	7.3	9.4	12.2	466
STA 74	3.7	2.5	8.6	10.4	13.1	277
STA 75[45]	3.4	2.9	13.3	16.2	18.8	158
STA 76	4.0	2.2	6.2	8.1	12.4	1,631
STA 77	5.4	2.2	7.1	8.8	15.3	407
Total	**3.7**	**2.5**	**8.1**	**10.1**	**13.7**	**7,283**

The current performance is both expected and reasonable from a system design perspective when considering the differences in demand and population levels across the district. Urban/Rural call density is calculated based on the relative concentration of incidents based on approximately 0.5-mile geographic areas as well as the adjacent 0.5-mile areas. The results demonstrate an urban and rural designation based on call density for services and not based on population. The red areas are designated as urban service areas and the green areas are designated as rural service areas. Any area that is not colored has less than one call every six months in the 0.5-mile area and the adjacent areas. When referring to Figure 81 below, it is clear that the old 75 area, the new Station 33 area, Station 31, and the majority of Station 74's area are rural by definition of this analysis.

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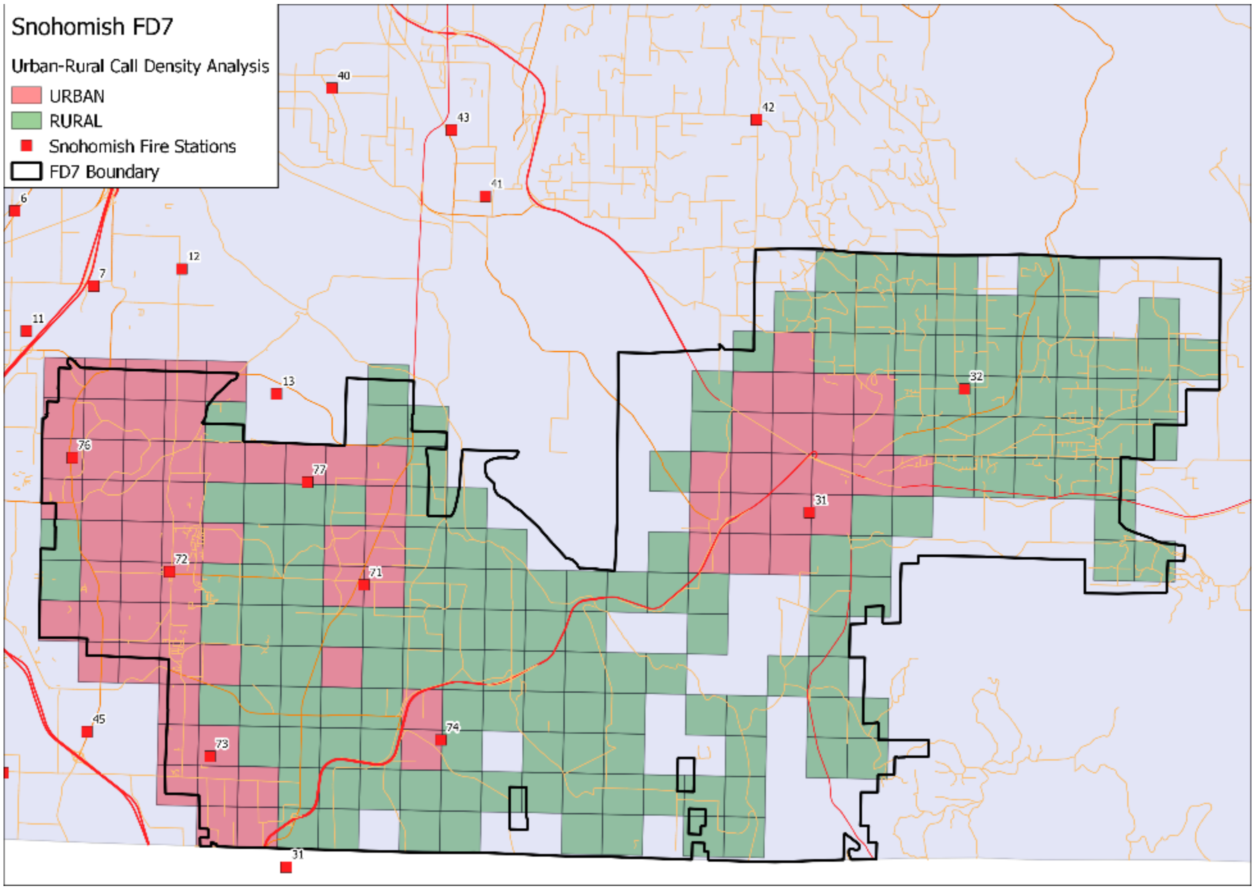
[45] Station 75 is a legacy area that was included in the data set. Station 74 primarily serves this area as Station 75 is no longer utilized.

Figure 81: Urban and Rural Call Density Map with Current Stations



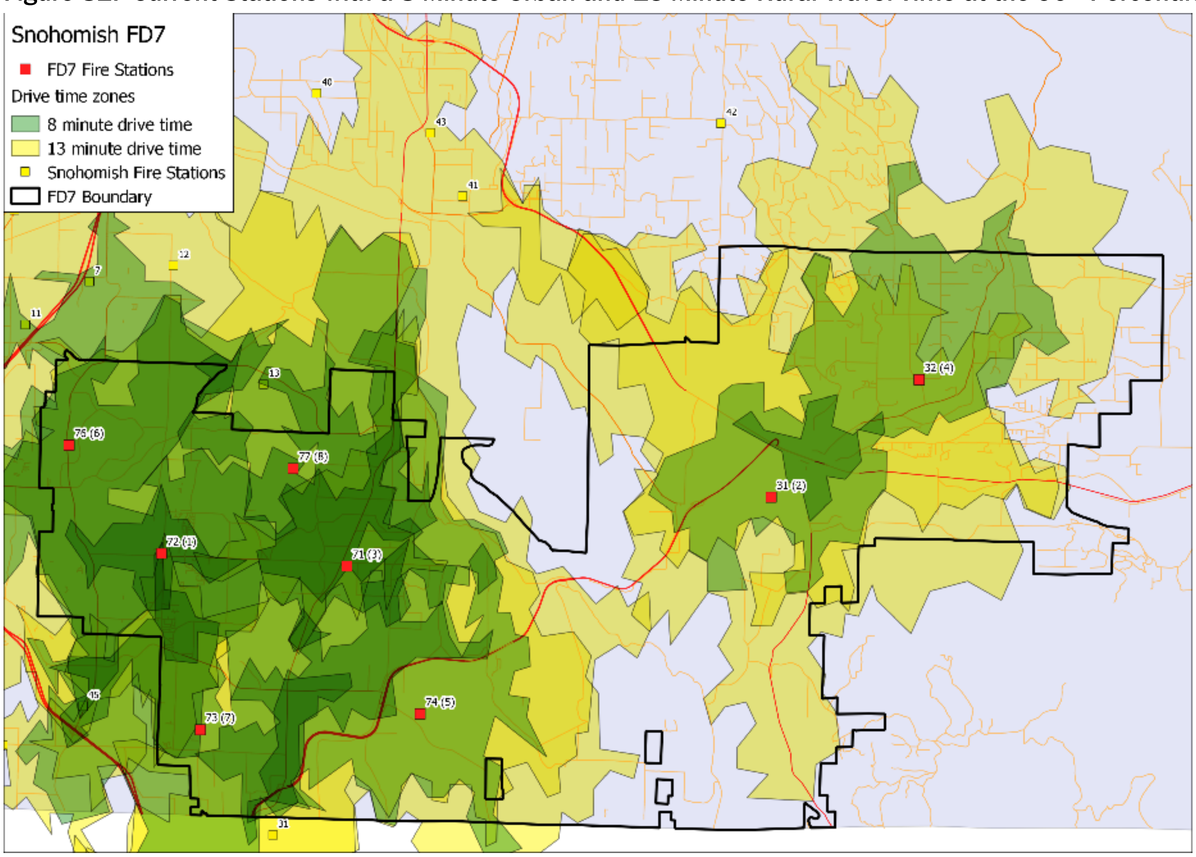
In addition to the quantitative analyses provided, Geographic Information System (GIS) analyzed the station locations and associated travel time capabilities. The current capabilities were evaluated to determine if, from a planning perspective, an 8-minute travel time is obtainable within the current configuration. Results found that the 8-minute travel time could be accomplished while covering 89% of the incidents, but fell short of achieving the 90th percentile. However, it is not uncommon, especially in rural areas, for actual performance to outperform the GIS modeling because average road impedance is used in the model.

When referring to the table below, the table can be interpreted as follows: The number one ranked station is station 72 and would be able to respond to 43.68% of the District's incidents within 8 minutes. Each station provides additional coverage, but diminishing return, until Station 77 brings the total system capability to 88.62%. All currently held eight stations are needed to attempt to achieve the 8-minute travel time for all incidents. However, it is important to understand the relative diminishing return for the last fire station. All stations repeated underneath the "blue" line are stations that could also contribute to a 13-minute rural travel time that will capture approximately 98% of all incidents within the desired performance. Data is presented as Table 94 and Figure 82 below.

Table 94: Marginal Fire Station Contribution for 8-Minute Urban and 13-Minute Rural Travel Time

Rank	Station Number	Urban/Rural	Station Capture	Total Capture	Percent Capture
1	72	U	3,684	3,684	43.68%
2	31	U	2,481	6,165	73.09%
3	71	U	494	6,659	78.94%
4	32	U	266	6,925	82.10%
5	74	U	256	7,181	85.13%
6	76	U	156	7,337	86.98%
7	73	U	87	7,424	88.01%
8	77	U	51	7,475	88.62%
9	31	R	507	7,982	94.63%
10	74	R	144	8,126	96.34%
11	32	R	63	8,189	97.08%
12	71	R	36	8,225	97.51%
13	76	R	15	8,240	97.69%

Figure 82: Current Stations with a 8-Minute Urban and 13-Minute Rural Travel Time at the 90th Percentile

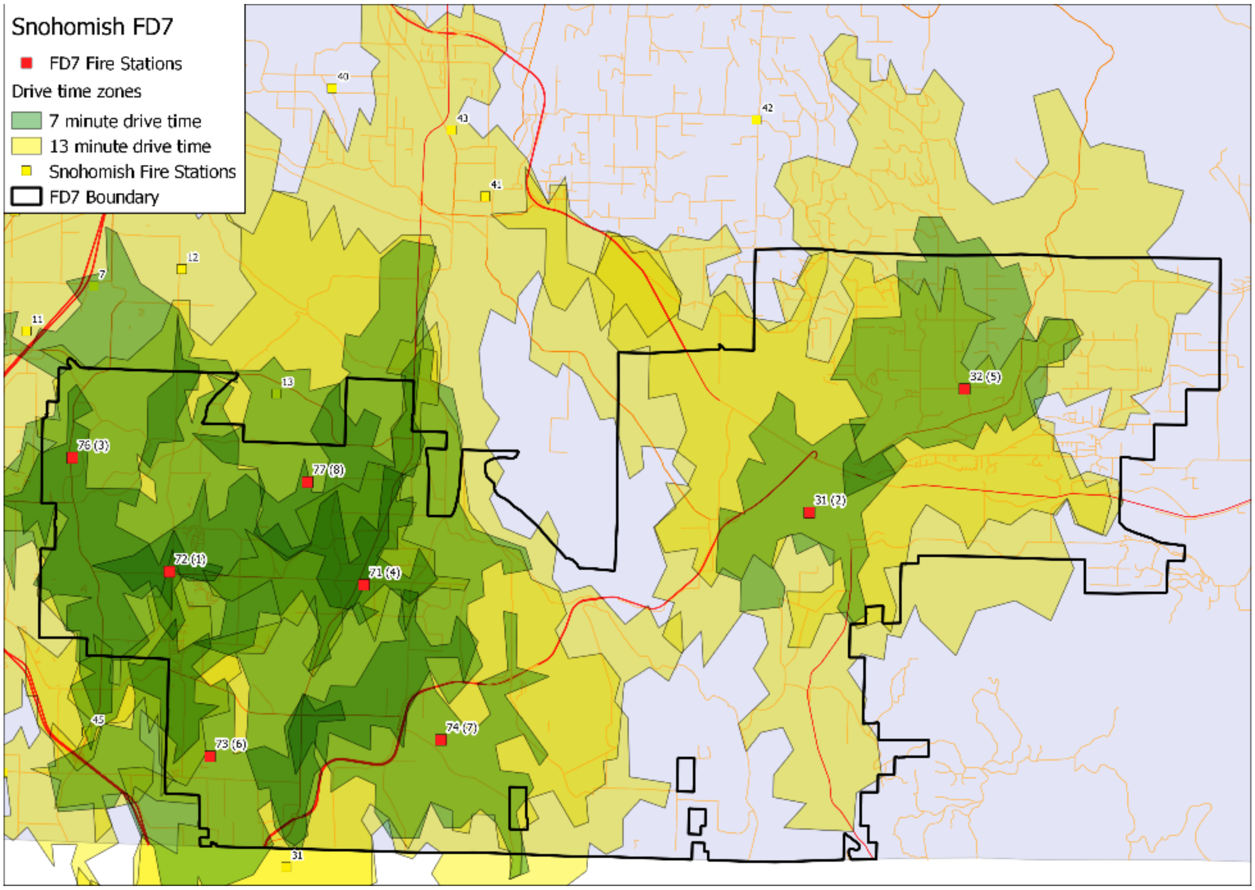


It is also important to understand that the District could meet a 7-minute travel time at approximately the 85th percentile. The distinction between 7 and 8 minutes travel time is nominal and only contributes to a net of 4% improvement in capture. Utilizing the existing locations and facilities, this model suggests that the urban performance of 7-minutes can be achieved nearly 85% of the time (blue line). However, the last 15% of the incidents do not go un-served, but rather these more rural events are covered as a rural response with a 13-minute travel time and increase coverage to approximately 98% coverage. In other words, only 5-percent of the urban areas are longer than the 7-minute travel time and only 2.3% of the rural areas are outside of the designed performance of 13-minutes utilizing the current facilities identified below.

Table 95: Marginal Fire Station Contribution for 7-Minute Urban and 13-Minute Rural Travel Time

Rank	Station Number	Urban/Rural	Station Capture	Total Capture	Percent Capture
1	72	U	2,938	2,938	34.83%
2	31	U	2,356	5,294	62.76%
3	76	U	652	5,946	70.49%
4	71	U	492	6,438	76.32%
5	32	U	236	6,674	79.12%
6	73	U	201	6,875	81.51%
7	74	U	168	7,043	83.50%
8	77	U	118	7,161	84.90%
9	32	R	629	7,790	92.35%
10	71	R	282	8,072	95.70%
11	31	R	96	8,168	96.83%
12	74	R	57	8,225	97.51%
13	76	R	15	8,240	97.69%

Figure 83: Current Stations with a 7-Minute Urban and 13-Minute Rural Travel Time at the 90th Percentile



Risk-based Approach to the Allocation of Resources

Following a risk-based approach to managing risk in the District, three FDZ's qualified as high or maximum-risk demand zones in Station's 31, 72 and 76 respectively. Stations 31 and 76 have two staffed units (Engine/Medic) assigned to the station to cover both the demand for services, but also provide a higher concentration of personnel to assist in risk mitigation. This works well since the simultaneous or concurrency of calls is nearly 35% and 36%, the two stations maintain 90% reliability to be available and answer calls in the territory, respectively.

However, the District's allocation of resources is not commensurate at this time with respect to Station 72. While utilizing a systematic approach to risk, it is recommended that the District consider placing another full time staffed Medic unit at Station 72. This will assist the District in multiple manners. First, the higher risk area should have a higher concentration of personnel and apparatus in a similar fashion as other high-risk demand zones, maintaining a commensurate approach to managing and mitigating risk. Second, the risk matrices created with this SOC can serve as planning tool as the community's risk profile evolves. In other words, there is a set of thresholds that will guide the Department and District in understanding when additional resources are required and why.

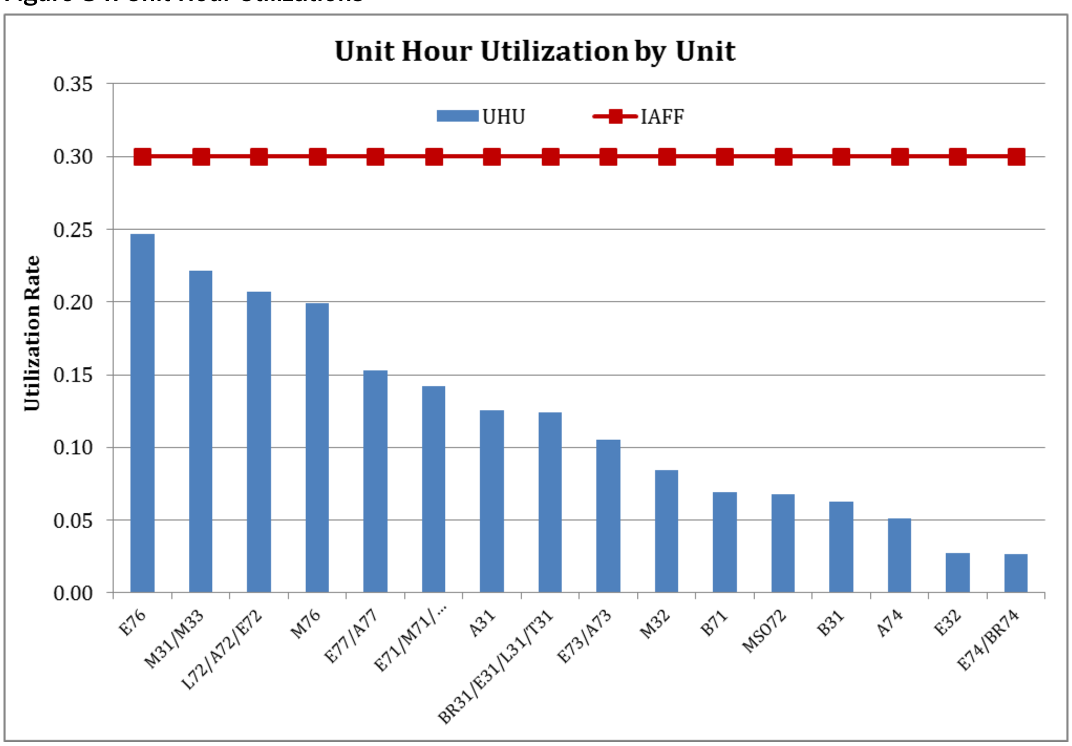
Thirdly, the EMS division has a goal of an 8-minute travel time for the first arriving ALS capable resource for all ALS incidents. Previous analyses demonstrated the overall system performance for ALS incidents that included first arriving first responders. However, the distribution model would improve the overall ALS-Medic Unit response time, since not all stations have a dedicated Medic unit and the distribution of calls in and around 72 would benefit considerably as well as increase Station reliability above the current 80%.

Workload Capacity – Reinvesting or Reallocating Resources

The department is currently operating within the boundaries of nationally recommended best practices with respect to workload. Overall, the department is performing at approximately 0.12, or 12% excluding Battalion chief, brush truck, HazMat unit and the tender unit. The most utilized unit is the E76 in station 76, at 0.25. Cross-staffed ALS M31/M33 in station 31 is the second most utilized unit, at 0.22. At the current workload utilization rates, the department should have a limited impact on their level of readiness or system performance. However, the department should anticipate reinvesting in resources in Station 76, 31, and 72 in the near future.

FITCH's recommendation is that workloads greater than 0.25 are not optimal on a 24-hour shift and should not exceed 0.30. The addition of a dedicated Medic unit at Station 72 would re-distribute the workload across the singular crew that cross-staffs each of the units. An additional Medic resource should be considered for Station 76 in the near future followed by Station 31 as the growth in call volume is increased.

Figure 84: Unit Hour Utilizations



APPENDICES, EXHIBITS, AND ATTACHMENTS

Only one year of data was available after the implementation of a new CAD system at SNOPAC/SNOCOM. Therefore, multi-year baseline tables could not be created or evaluated. These are provided from the original SOC, prior to the merger of Snohomish Fire District 7 and Snohomish Fire District 3, as a reminder that the District will need to re-create similar baseline tables if they desire to seek accreditation by the Commission on Fire Accreditation International.

Baseline Performance Tables

The data available during the development of this Standards of Coverage document did not include pick-up to dispatch data. The CAD software did not capture the event in a unique record and therefore could not be included. However, the dispatch centers are implementing new systems that will have an accurate accounting of the dispatch interval for future updates. Tables 96-99 represent the baseline performance for EMS and fire incidents. Since there are only 4 hazardous materials and 5 technical rescues in 2014, we did not report them separately. Please note that not all EMS incidents had two units responding, and not all fire incidents had 4 units responding, and that is why the sample size to calculate average and 90th percentile times for ERF is smaller than the first arriving on scene unit. For EMS calls, in the past three years, the average turnout and travel time was 5.6 minutes (5 minutes and 36 seconds). The average time of the ERF unit or second arriving unit was 9.0 minutes, which is 3.4 minutes longer than the first arriving unit. For fire suppression calls, in the past three years, the average turnout and travel time of the first arriving unit was 6.5 minutes (6 minutes and 30 seconds). The average time of the ERF unit or fourth arriving unit was 9.9 minutes (9 minutes and 54 seconds), which is 3.4 minutes longer than the first arriving unit.

Table 96: Baseline Performance for EMS (BLS/ALS) Incidents -2012/2014

EMS-BLS/ALS (Lights and Sirens) Average Time Average Time		2012 - 2014	2014	2013	2012
Alarm Handling	Pick-up to Dispatch	N/A	N/A	N/A	N/A
Turnout Time	Turnout Time - 1st Unit	1.4	1.5	1.4	1.4
Travel Time	Travel Time - 1st Unit	4.2	3.9	4.3	4.4
	Travel Time - ERF (2nd Arriving Unit)	7.6	7.3	7.8	7.7
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	5.6	5.4	5.7	5.8
	Turnout and Travel Time - ERF (2nd Arriving Unit)	9.0	8.8	9.2	9.1
Sample Size	Alarm Handling	N/A	N/A	N/A	N/A
	1st Unit	10,869	3,674	3,598	3,597
	ERF	7,768	2,908	2,394	2,466

Table 97: Baseline Performance for Fire Incidents -2012/2014

Fire (Lights and Sirens) Average Time		2012 - 2014	2014	2013	2012
Alarm Handling	Pick-up to Dispatch	N/A	N/A	N/A	N/A
Turnout Time	Turnout Time - 1st Unit	1.7	1.8	1.6	1.6
Travel Time	Travel Time - 1st Unit	4.8	4.5	4.9	4.9
	Travel Time - ERF (4th Arriving Unit)	7.9	7.4	7.9	8.4
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	6.5	6.4	6.5	6.5
	Turnout and Travel Time - ERF (4th Arriving Unit)	9.9	9.5	9.9	10.4
Sample Size	Alarm Handling	N/A	N/A	N/A	N/A
	1st Unit	1,630	545	554	531
	ERF	167	69	49	49

We also summarized 90th percentile performances for the 1st arriving and ERF units for EMS and fire incidents separately. For EMS calls, in the past three years, the 90th percentile turnout and travel time was 8.9 minutes (8 minutes and 54 seconds). The 90th percentile time of the ERF unit or second arriving unit was 14.8 minutes (14 minutes and 48 seconds). For fire suppression calls, in the past three years, the 90th percentile turnout and travel time of the first arriving unit was 9.7 minutes (9 minutes and 42 seconds). The 90th percentile time of the ERF unit or fourth arriving unit was 14.1 minutes (14 minutes and 6 seconds). The department can reference the historical performances and make reasonable targets to continuously improve the response process to meet recommended targets by industry standards or best practices.

Table 98: Summary of 90th Percentile Performance for EMS (BLS/ALS) Incidents – 2012/2014

EMS-BLS/ALS (Lights and Sirens) 90th Percentile Time		2012 - 2014	2014	2013	2012
Alarm Handling	Pick-up to Dispatch	N/A	N/A	N/A	N/A
Turnout Time	Turnout Time - 1st Unit	2.3	2.4	2.3	2.3
Travel Time	Travel Time - 1st Unit	7.4	7.1	7.5	7.8
	Travel Time - ERF (2nd Arriving Unit)	13.2	12.8	13.7	13.2
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	8.9	8.6	9.0	9.2
	Turnout and Travel Time - ERF (2nd Arriving Unit)	14.8	14.4	15.2	14.7
Sample Size	Alarm Handling	N/A	N/A	N/A	N/A
	1st Unit	10,869	3,674	3,598	3,597
	ERF	7,768	2,908	2,394	2,466

Table 99: Summary of 90th Percentile Performance for Fire Incidents – 2012/2014

Fire (Lights and Sirens) 90th Percentile Time		2012 - 2014	2014	2013	2012
Alarm Handling	Pick-up to Dispatch	N/A	N/A	N/A	N/A
Turnout Time	Turnout Time - 1st Unit	2.6	2.7	2.6	2.5
Travel Time	Travel Time - 1st Unit	7.9	7.8	7.6	8.5
	Travel Time - ERF (4th Arriving Unit)	12.2	12.7	11.3	13.6
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	9.7	9.7	9.2	10.2
	Turnout and Travel Time - ERF (4th Arriving Unit)	14.1	13.0	13.9	15.9
Sample Size	Alarm Handling	N/A	N/A	N/A	N/A
	1st Unit	1,630	545	554	531
	ERF	167	69	49	49

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