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Data Analysis Report

FIRE AND EMERGENCY MEDICAL SERVICES EFFICIENCY ASSESSMENT

EDMONDS, WASHINGTON

Prepared by:

FITCH & ASSOCIATES, LLC
2901 Williamsburg Terrace #G ▪ Platte City ▪ Missouri ▪ 64079
816.431.2600 ▪ www.fitchassoc.com

CONSULTANT FINAL REPORT

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METHODOLOGY

Requests for FD1 units are dispatched through SNOCOM 911 including Edmonds incidents. We collected three years of data from SNOCOM for all FD1's responses. We presented the total incidents and total unit responses of FD1 units in the figures below. In 2014, Edmonds calls accounted for 29 percent of the total calls FD1 units have responded to. Figure 6 below includes units at station 16, 17 and 20's responses to calls outside Edmonds. In the rest of the report, we limit our discussions to Edmonds calls in 2014. We provide dispatch time, turnout, and travel time performance benchmark using the three years of Edmonds calls in the last section.

In this report, we utilized two distinct measures of call volume and workload. First, is the number of requests for service that are defined as either "dispatches" or "calls." Dispatches/calls are the number of times a distinct incident was created for the Snohomish County Fire District 1. Conversely, "responses" are the number of times that an individual unit (or units) responded to a call. Responses will be utilized on all Unit and Station level analyses, which account for all elements of workload and performance. Calls have been categorized as EMS (BLS), EMS-ALS, Fire, Special Operations, and Service, respectively. The CAD system did not capture the time an emergency request was initiated by citizens for all incidents. Therefore, in our response time analysis, we did not provide analysis on dispatch time, and focused our discussions on turnout time, and travel time for lights and sirens responses. We only discussed the dispatch performances in the designated figures.

COMMUNITY RESPONSE HISTORY

In 2014, Fire District 1 responded to a total of 15,883 requests for service, or dispatches. EMS service requests totaled 13,407, accounting for 84.4% of the total number of incidents. The number of fire related calls were 1,841, which accounted for 11.6% of the dispatched incidents. Again, the number of individual unit responses will be more reflective of total department workload since 47 percent of the calls resulted in multiple units dispatched. As summarized below, all units in FD1 combined made 27,447 responses, and were busy on emergency calls 17,429 hours. On average, each response lasted 38 minutes from dispatched to clear.

Requests in Edmonds accounted for 29 percent of the total incidents FD1 units have responded to. Edmonds requests averaged 12.6 per day. EMS calls totaled 3,945, which accounted for 85.5% of the total Edmonds incidents. Fire calls totaled 450, which accounted for 9.8%. FD1 units made 7,372 responses to Edmonds calls and on average the busy minutes per response was 29 minutes, which was shorter than the other FD1 calls. In terms of busy hours. FD1 units spent 3,605 unit hours responding to calls in Edmonds, which accounted for 21 percent of FD1's 2014 annual busy hours. Forty percent (40%) of the Edmonds requests resulted in multiple FD1 units responding.

The figures below include FD1's all responses. Figure 6includes units at station 16, 17 and 20's responses to calls outside Edmonds. In the rest of the report, we limit our discussions for Edmonds calls.

Figure 1: FD1: Number of Incidents Dispatched by Category – 2014

Call Category	Number of Calls			
	Edmonds	District Fire	Other	Total
EMS	2,547	6,277	39	8,863
EMS-ALS	1,398	2,993	153	4,544
Fire	450	1,268	123	1,841
Special Ops	8	8	12	28
Service	210	395	2	607
Total	**4,613**	**10,941**	**329**	**15,883**
Percentage	**29%**	**69%**	**2%**	**100%**
Calls per day	**12.6**	**30.0**	**0.9**	**43.5**

Figure 2: FD1: Number of Responses, and Total Busy Time by Jurisdiction – 2014

Jurisdiction	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
Edmonds	4,613	7,372	1.6	3,605	29.3
District Fire	10,941	19,635	1.8	13,507	41.3
Other	329	440	1.3	317	43.3
Total	**15,883**	**27,447**	**1.7**	**17,429**	**38.1**

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Figure 3: Edmonds: Number of Incidents Dispatched by Category – 2014

Call Category	Number of Calls	Calls per Day	Call Percentage
EMS	2,547	7.0	55.2
EMS-ALS	1,398	3.8	30.3
Fire	450	1.2	9.8
Special Ops	8	0.0	0.2
Service	210	0.6	4.6
Total	**4,613**	**12.6**	**100.0**

Figure 4: Edmonds: Percentage of Total Incidents Dispatched by Category

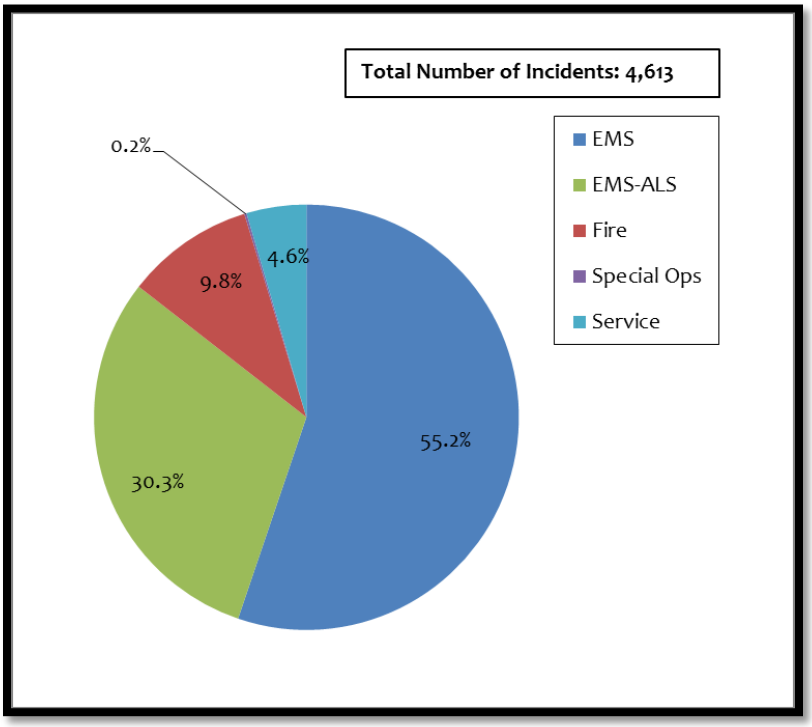


Figure 5: Edmonds: Number of Responses, and Total Busy Time by Category – 2014

Call Category	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
EMS	2,547	3,181	1.2	1,503	28.3
EMS-ALS	1,398	3,173	2.3	1,742	32.9
Fire	450	733	1.6	256	21.0
Special Ops	8	47	5.9	16	20.2
Service	210	238	1.1	87	22.0
Total	**4,613**	**7,372**	**1.6**	**3,605**	**29.3**

Stations 16, 17 and 20 are staffed to primarily respond to Edmonds emergency requests. The units in the three stations combined have made 784 responses to 583 incidents in the district. Please note those dispatches are outside Edmonds, and thus not included in the major body of the report. Units in other

FD1's stations have made 686 responses to calls in Edmonds, and units from other fire agencies have provided 314 responses to calls in Edmonds.

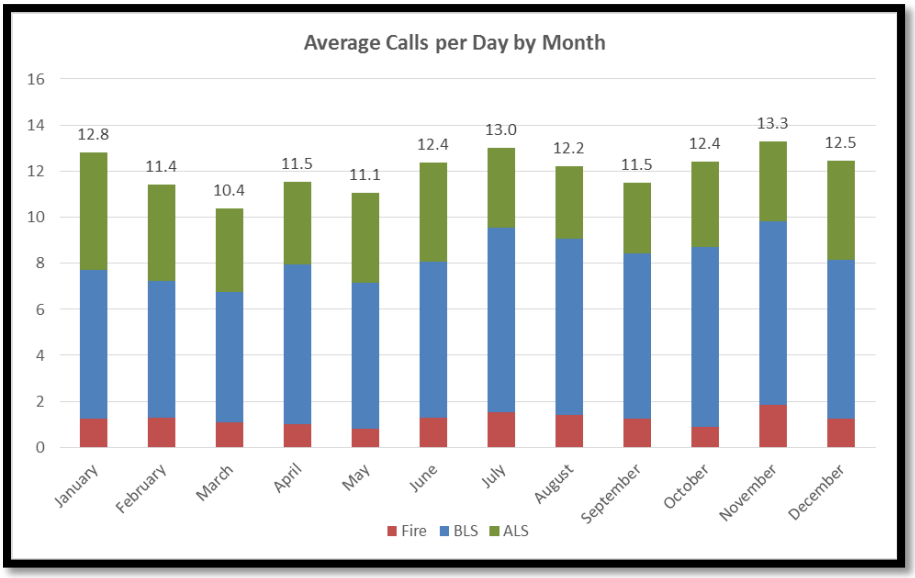
Figure 6: Mutual Aid in and out Edmonds by Category – 2014

Call Category	Stations 16, 17 and 20 into District Fire			Other FD1' stations into Edmonds			Other Fire Agencies into Edmonds		
	Number of Calls	Number of Runs	Total Busy Hours	Number of Calls	Number of Runs	Total Busy Hours	Number of Calls	Number of Runs	Total Busy Hours
EMS	226	265	108	248	271	135	126	137	62
EMS-ALS	270	349	130	106	189	181	111	118	52
Fire	74	149	38	162	206	117	42	49	9
Special Ops	7	15	4	7	9	29	4	4	1
Service	6	6	2	11	11	2	6	6	1
Total	**583**	**784**	**281**	**534**	**686**	**464**	**289**	**314**	**125**

Temporal analyses were conducted to evaluate patterns in community demands. These measures examined the frequency of requests for service in 2014 by month, day of week, and hour of day. In the following temporal analysis, special ops and service calls were grouped into fire category for presentation purpose.

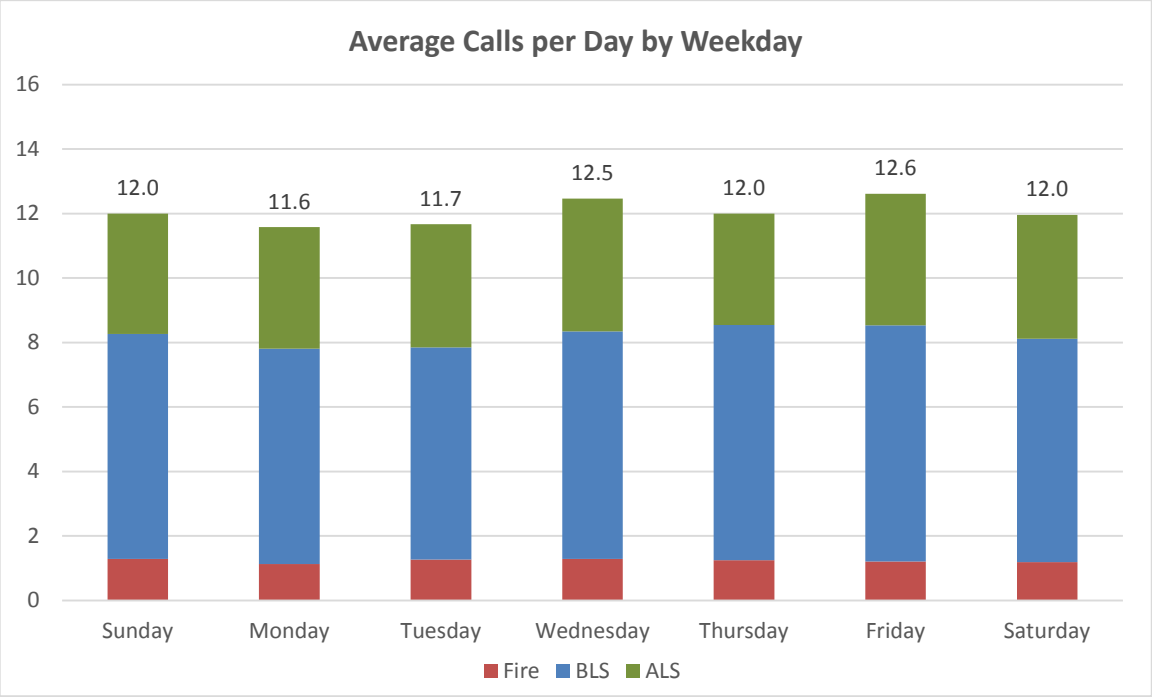
Overall, average calls per month ranged from a low of 10.4 per day in March to a high of 13.3 per day in November. The top three months with the most demands in the descending order are: November (13.3 per day), July (13.0 per day) and January (12.8 per day).

Figure 7: 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. Monday was the low for the week at 602 calls or 11.6 calls per day. Friday has the highest frequency of requests for services at 656 calls or 12.6 calls per day.

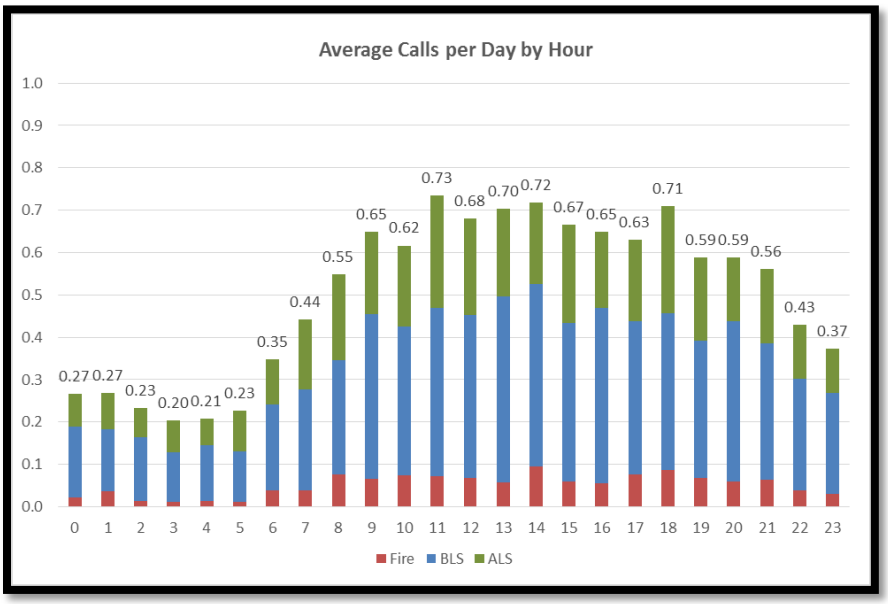
Figure 8: Overall: Average Calls per Day by Weekday



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. The hours that include midnight to 0500 are below one standard deviation for this data set. While the middle of the day has the greatest frequency of calls, specifically the hours that begin at 1100 and 1800 are above 225 calls in a year. The average number of calls per hour is 183. The data illustrates that the busiest times of the day are between 1100 and 1800.

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 1100 with 268 calls during that hour in 2014. The average number of calls per hour is a daily average for those 268 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1100 with an average hourly call volume of less than 1 at 0.73 calls per hour.

Figure 9: Overall: Average Calls per Day by Hour



Overall, FD1's units made 7,372 unit responses to incidents in Edmonds, and the total busy hours were 3,605 hours. Stations 16, 17 and 20's responses accounted for 89.5% of the total unit responses. M17, A17, and A16 were the top three busiest units, and their average responses per day were 3.8, 3.4 and 3.3 respectively.

Figure 10: Overall Workload by FD1 Stations for Edmonds Incidents– 2014

Station	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses	Percentage of Total Responses
10	32.8	65.5	120	1.6%
11	11.0	7.2	39	0.5%
12	15.5	1.3	5	0.1%
13	11.4	1.0	5	0.1%
16	25.9	794.3	1,839	24.9%
17	33.7	1,680.8	2,993	40.6%
18	20.0	6.7	20	0.3%
19	21.3	122.0	343	4.7%
20	29.0	848.3	1,756	23.8%
21	19.5	73.1	225	3.1%
22	6.7	2.2	20	0.3%
23	20.3	0.7	2	0.0%
NA	18.6	1.6	5	0.1%
FD1 Total	**29.3**	**3,604.5**	**7,372**	**100.0%**

Note: This table only reflects workload associated with calls run into Edmonds.

Figure 11: Overall Workload by Unit for Edmonds Incidents – 2014

Station	Description	Unit Report	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
10	Air light unit	AIR10	24.9	2.1	5
	Engine	E10	28.9	26.0	54
	Medic	M10	36.8	37.4	61
	Station 10 Total		**32.8**	**65.5**	**120**
11	Battalion	B11	11.0	7.2	39
12	Decon unit	DCON12	15.5	1.3	5
13	Engine	E13	11.4	1.0	5
16	Aid unit	A16	29.5	586.5	1,191
	Battalion	B16	18.1	94.9	314
	Engine	E16	19.5	99.0	304
	Marine boat	MAR16	46.2	6.2	8
	Medical Services Officer	MSO16	21.0	7.7	22
	Station 16 Total		**25.9**	**794.3**	**1,839**
17	Aid unit	A17	32.9	688.7	1,257
	Engine	E17	21.2	117.8	334
	Medic	M17	37.4	874.3	1,402
	Station 17 Total		**33.7**	**1,680.8**	**2,993**
18	Engine	E18	27.0	2.3	5
	Medic	M18	17.6	4.4	15
	Station 18 Total		**20.0**	**6.7**	**20**
19	Engine	E19	16.0	24.3	91
	Medic	M19	23.3	97.7	252
	Station 19 Total		**21.3**	**122.0**	**343**
20	Aid unit	A20	28.9	186.5	387
	Engine	E20	16.2	0.8	3
	Ladder(quint)	L20	21.2	129.6	367
	Medic	M20	31.9	531.3	999
	Station 20 Total		**29.0**	**848.3**	**1,756**
21	Aid unit	A21	23.0	1.9	5
	Battalion	B21	9.4	0.3	2
	Medic	M21	11.5	1.5	8
	Medical Services Officer	MSO21	21.1	63.9	182
	Technical Rescue	TR21	11.7	5.5	28
	Station 21 Total		**19.5**	**73.1**	**225**
22	Engine	E22	2.3	0.7	17
	Medic	M22	31.4	1.6	3
	Station 22 Total		**6.7**	**2.2**	**20**
23	Ladder(quint)	L23	20.3	0.7	2
NA	Bike	BK17	21.8	1.5	4
	Medical Services Officer	MSO11	6.2	0.1	1
Fire District 1 Total			**29.3**	**3,604.5**	**7,372**

Units staffed in Station 20 have made 1,756 responses, and of these, 175 responses were to calls in grids of 55, 56, 105 and 106, which accounted for 10% of the station total.

Figure 12: Workload Analysis for Station 20 by Unit – 2014

Description	Unit	Overall		Grids 55, 56, 105 and 106	
		Number of Runs	Total Busy Hours	Number of Runs	Total Busy Hours
Aid unit	A20	387	186.5	39	19.4
Engine	E20	3	0.8	1	0.2
Ladder (quint)	L20	367	129.6	38	15.1
Medic	M20	999	531.3	97	50.6
Station 20 Total		**1,756**	**848.3**	**175**	**85.3**
Percentage of Total		**100%**	**100%**	**10%**	**10%**

Note: The grids utilized most closely approximate the geographic area of Esperance

Currently, the CAD data from SNOCOM 911 only captures the dispatch interval as part of an integrated case number for 79 percent of incidents. For the purposes of this study, the dispatch interval is the time from phone ring at SNOCOM 911 to the dispatching and alerting of the unit. We discussed the dispatch time performances from 2012 to 2014 in the last four figures. The average dispatch time from 2012 to 2014 was 46 seconds, and the 90th percentile was 73 seconds (one minute and 13 seconds). It is recommended that SNOCOM 911 align their dispatch and call processing data with the incident data for all incidents. This would allow agencies to evaluate the entire continuum of response capability from the perspective of the person experiencing an emergency. This will be an important element for the District and City of Edmonds if they elect to seek accreditation through the Center for Public Safety Excellence's (CPSE) Commission on Fire Accreditation International (CFAI).

The major body of this report focuses on FD1's performance including turnout time, travel time, and the combined turnout and travel that best reflects total response time not including the dispatch interval.

This analysis utilized all distinct incidents dispatched for emergency (priority 1 and 2 calls) responses inclusive of all call categories. The mean (average) turnout time was 102 seconds (one minute and 42 seconds), travel time was 216 seconds (three minutes 36 seconds), and travel and turnout combined was 318 seconds (five minutes 18 seconds). The figure below reports the average response performance by call category.

However, a more conservative and reliable measure of performance is the 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 performance for turnout time at the 90th percentile is 153 seconds (two minutes and 33 seconds), travel time is 343 seconds (5 minutes and 43 seconds), and turnout and travel combined is 449 seconds (seven minutes and 29 seconds). Figure 15 below reports 90th percentile performance by call category. Please note that the summation of 90th percentile turnout time and 90th percentile travel time is not the same as 90th percentile turnout and travel time.

Figure 13. Average Turnout and Travel Time by Category

Call Category	Turnout Time	Travel Time	Response Time	Sample Size
EMS	1.6	3.8	5.4	2,471
EMS-ALS	1.6	3.2	4.8	1,376
Fire	2.1	3.9	6.0	422
Special Ops	1.8	2.1	4.0	8
Total	**1.7**	**3.6**	**5.3**	**4,277**

Figure 14: Average Turnout and Travel Time by Call Category

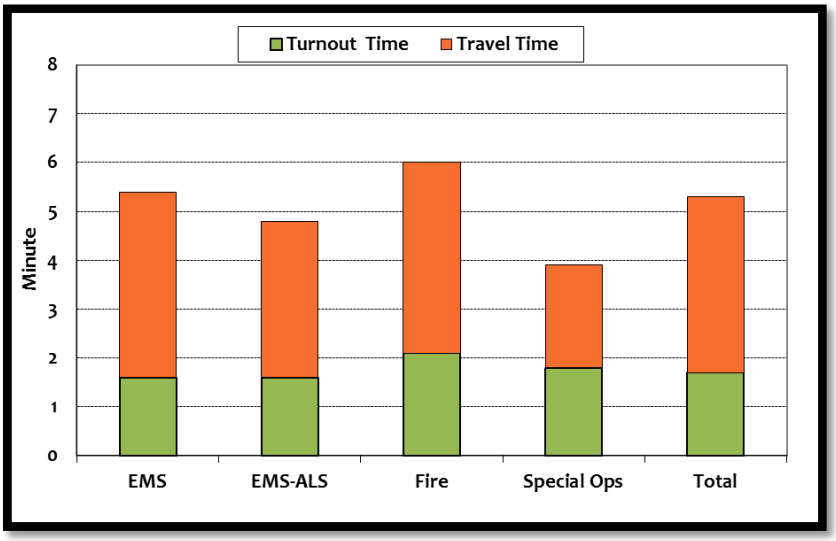


Figure 15: 90th Percentile Turnout and Travel Time of First Arriving Units by Call Category

Call Category	Turnout Time	Travel Time	Response Time	Sample Size
EMS	2.5	5.9	7.5	2,471
EMS-ALS	2.4	5.1	6.9	1,376
Fire	2.9	6.6	8.5	422
Special Ops	2.3	7.4	9.4	8
Total	**2.6**	**5.7**	**7.5**	**4,277**

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 8 special operation calls used in this analysis, the 90th percentile is essentially the longest time.

Potentially, the primary reason that there is variability between EMS, EMS-ALS, and Fire incident performance is that the department deploys different fire apparatus on different call types. The utilization of each apparatus type is provided in the figure below. BLS aid units have responded to 60.4 percent of the total requests, ALS medic units have responded to 50.3 percent of the total requests, and engines have responded to 16.4 percent of the total requests. Since a significant percentage of incidents receive multiple units and unit types responding on an individual call, the data will not sum to 100%.

Figure 16: Number and Percentage of Calls Responded by Apparatus Type

Apparatus Type	Number of Calls	Percentage
Aid unit	2,784	60.4
Medic	2,322	50.3
Engine	756	16.4
Ladder (quint)	368	8.0
Battalion	325	7.0
Medical Services Officer	191	4.1
Technical Rescue	28	0.6
Marine boat	8	0.2
Air light unit	5	0.1
Decon unit	5	0.1
Bike unit	4	0.1

Fire Related Services

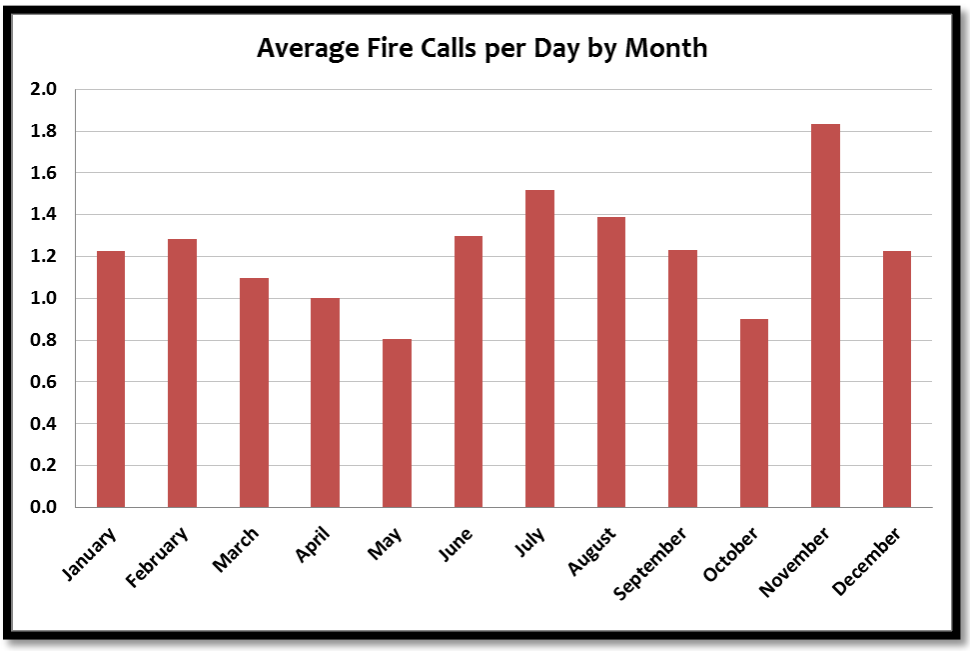
Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These measures examined the frequency of requests for service in 2014 by month, day of week, and hour of day.

Results found that there were slightly more fire related calls in the second half of the year (July to December), and peaked in November. Average calls per month ranged from a low of 0.8 in May to a high of 1.8 per day in November. Results are presented below in the figures below.

Figure 17: Total Fire Related Calls per Month of 2014

Month	Number of Calls	Calls per Day	Call Percentage
January	38	1.2	8.5
February	36	1.3	6.2
March	34	1.1	7.9
April	30	1.0	7.0
May	25	0.8	7.3
June	39	1.3	7.7
July	47	1.5	9.4
August	43	1.4	9.2
September	37	1.2	8.1
October	28	0.9	7.3
November	55	1.8	9.2
December	38	1.2	12.2
Total	**450**	**1.2**	**100.0**

Figure 18: Average Fire Related Calls per Month of 2014

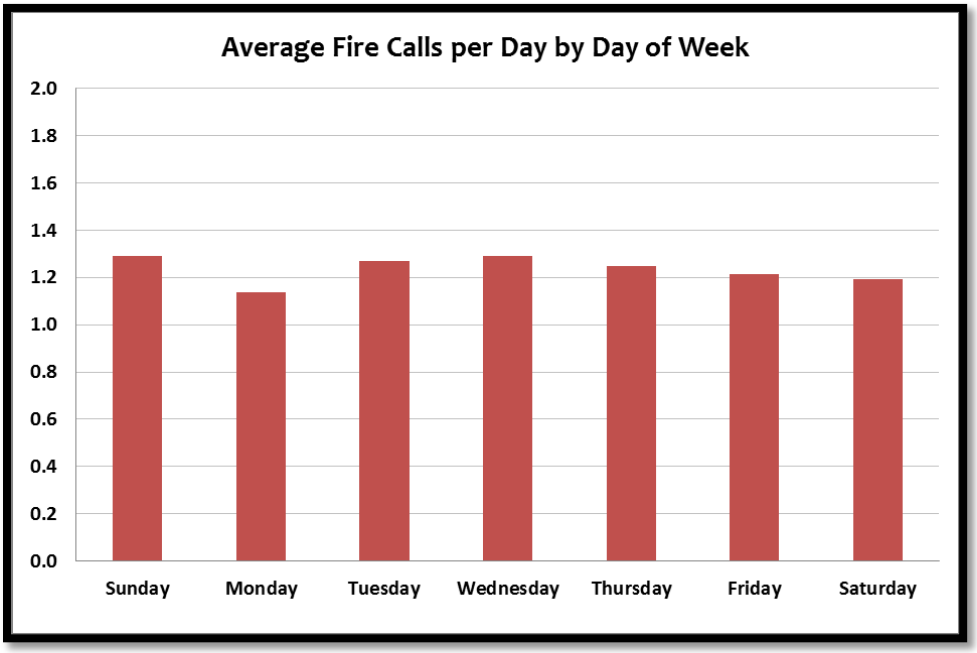


Similar analyses were conducted for fire related calls per day of week. The data revealed that there is little variability in the demand for services by day of week. Monday was the low for the week at 59 calls or 13.1% of the fire related calls for the week. Sunday and Wednesday have the highest frequency of requests for fire related services at 67 calls or 14.9%. Results for this analysis are presented in the figures below.

Figure 19: Total Fire Related Calls by Day of Week for 2014

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	67	1.3	14.9
Monday	59	1.1	13.1
Tuesday	66	1.3	14.7
Wednesday	67	1.3	14.9
Thursday	66	1.2	14.7
Friday	63	1.2	14.0
Saturday	62	1.2	13.8
Total	**450**	**1.2**	**100.0**

Figure 20: Average Fire Related Calls by Day of Week for 2014



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 0600 are below one standard deviation for this data set. While the middle of the day has the greatest frequency of calls, specifically the hours that begin at 1400 and 1800 are above 30 calls in a year. The average number of calls per hour is 19. The data illustrates that the busiest times of the day for fire related incidents are between 0800 and 2200.

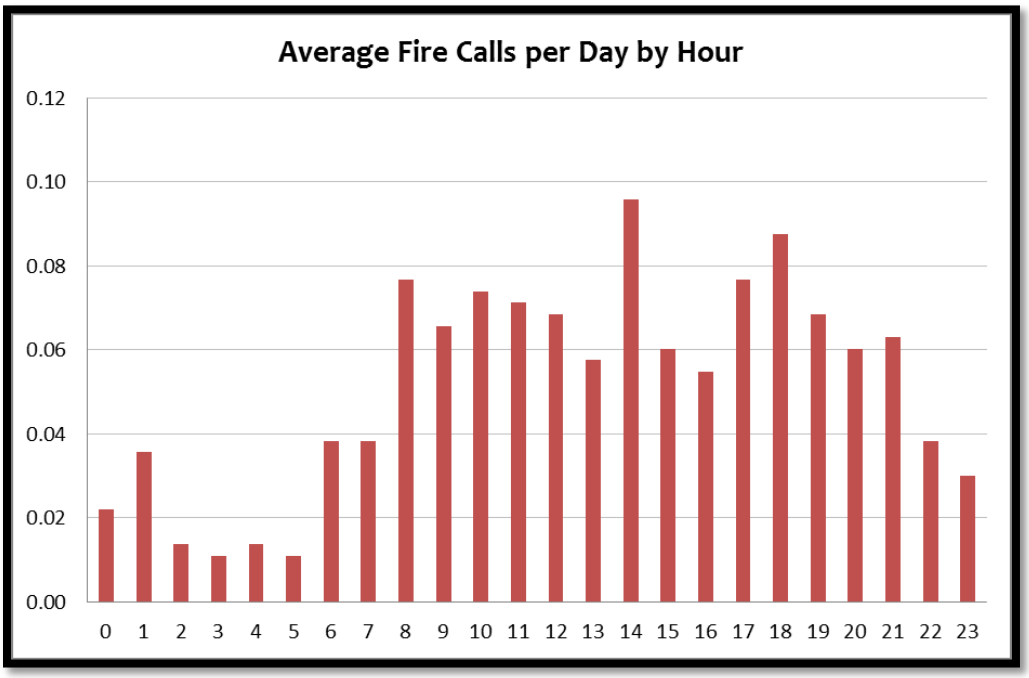
Finally, in an effort to provide a more granular understanding of the community's demand for fire related services, this temporal analysis included the average number of calls per hour. In other words, when referring to the figure below, the busiest hour is at 1400 with 45 calls during that hour in 2014. The average number of calls per hour is a daily average for those 35 calls if they were equally

distributed. Therefore, the busiest hour per day would be at 1400 with an average hourly call volume of less than 1 at 0.10 calls per hour. The results are in the figures below.

Figure 21: Total and Average Fire Related Calls by Hour of Day for 2014

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	8	0.02	1.8
1	13	0.04	2.9
2	5	0.01	1.1
3	4	0.01	0.9
4	5	0.01	1.1
5	4	0.01	0.9
6	14	0.04	3.1
7	14	0.04	3.1
8	28	0.08	6.2
9	24	0.07	5.3
10	27	0.07	6.0
11	26	0.07	5.8
12	25	0.07	5.6
13	21	0.06	4.7
14	35	0.10	7.8
15	22	0.06	4.9
16	20	0.05	4.4
17	28	0.08	6.2
18	32	0.09	7.1
19	25	0.07	5.6
20	22	0.06	4.9
21	23	0.06	5.1
22	14	0.04	3.1
23	11	0.03	2.4
Total	**450**	**1.23**	**100.0**

Figure 22: Average Fire Related Calls per Day by Hour of Day in 2014



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 final incident types to accurately dispatch and categorize fire related call types. In 2014, the most frequent community demand for fire suppression services was for fire single engine response at 148 requests, followed by fire alarm commercial at 136. According to the final call incident type captured at the end of the call, full responses to commercial fires totaled 12 and full responses for residential fires totaled 11. The CAD final incident types included in "Fire" dispatches with the corresponding number of calls and their percentages are provided below.

Figure 23: Fire Related Final CAD Incident Types

Final Type	Final Type Description	Number of Calls	Percentage of Fire Related Demands	Percentage of Total Call Volume
FS	Fire Single Engine response	148	32.9	3.2
FAC	Fire Alarm Commercial	136	30.2	2.9
FAR	Fire Alarm Residential	63	14.0	1.3
COA	Carbon Monoxide Alarm	27	6.0	0.6
MU	Move Up	20	4.4	0.4
GLO	Gas Leak Outside	18	4.0	0.4
FC	Fire Commercial	12	2.7	0.3
FR	Fire Residential	11	2.4	0.2
GLI	Gas Leak Inside	8	1.8	0.2
FAS	Fire Alarm Sprinkler Water flow	4	0.9	0.1
FB	Fire Brush	2	0.4	0.0
MVCE	Motor Vehicle Collision with Entrapment	1	0.2	0.0

When referring the figure above, fire single engine responses (FS) are incidents handled by a single engine such as a trash can fire or vehicle fire. Fire alarms for both residential structures (FAR) and commercial structures (FAC) are responses because the alarm sounded, however, if there was an actual fire it would typically be categorized as fire commercial (FC) or fire residential (FR), respectively. In total, structural fire incidents (FC/FR) accounted for just over 5% of the fire related incidents and less than 1% of the total demand for services from the community.

Eighty percent (80%) of the fire requests were responded to by a single FD1 unit. On average, 1.6 units were dispatched per BLS call. The department made a total of 733 unit responses to fire related calls. The total time on task was 257 hours, and the average time on task was 21 minutes. Ladder L20 is the most utilized unit in fire related calls, followed by Engines E17 and E16.

Figure 24: Number of Responding Units for Fire Calls

Number of Responding Units	Number of Calls	Percent of Total	Cumulative Percent	Average Call Duration (minutes)
1	361	80.2%	80.2%	17.4
2	45	10.0%	90.2%	22.4
3	13	2.9%	93.1%	31.9
4	5	1.1%	94.2%	64.3
5	1	0.2%	94.4%	10.2
6	2	0.4%	94.9%	52.2
7	3	0.7%	95.6%	55.1
8	6	1.3%	96.9%	32.1
9	10	2.2%	99.1%	77.5
10 or more	4	0.9%	100.0%	135.8
Total	**450**			**21.8**

Figure 25: Workload by Unit for Fire Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
17	Aid unit	A17	15.8	2.6	10
	Engine	E17	23.2	65.6	170
	Medic	M17	24.5	11.4	28
	Station 17 Total		**23.0**	**79.7**	**208**
16	Aid unit	A16	10.2	0.3	2
	Battalion	B16	29.8	22.4	45
	Engine	E16	20.9	49.5	142
	Medical Services Officer	MSO16	6.9	0.3	3
	Station 16 Total		**22.7**	**72.5**	**192**
20	Aid unit	A20	36.3	1.8	3
	Engine	E20	11.6	0.2	1
	Ladder (quint)	L20	21.6	63.7	177
	Medic	M20	11.2	0.6	3
	Station 20 Total		**21.6**	**66.3**	**184**
13	Engine	E13	1.3	0.1	4
21	Battalion	B21	9.4	0.3	2
	Medical Services Officer	MSO21	18.7	7.8	25
	Technical Rescue	TR21	13.2	4.8	22
	Station 21 Total		**15.9**	**12.9**	**49**
11	Battalion	B11	11.1	4.3	23
22	Engine	E22	2.3	0.7	17
	Medic	M22	0.0	0.0	1
	Station 22 Total		**2.2**	**0.7**	**18**
19	Engine	E19	17.8	6.8	23
	Medic	M19	39.6	5.9	9
	Station 19 Total		**23.9**	**12.8**	**32**
10	Air light unit	AIR10	24.9	2.1	5
	Engine	E10	19.8	2.0	6
	Medic	M10	18.9	0.3	1
	Station 10 Total		**21.8**	**4.4**	**12**
18	Engine	E18	28.2	1.9	4
	Medic	M18	6.2	0.3	3
	Station 18 Total		**18.7**	**2.2**	**7**
23	Ladder(quint)	L23	9.7	0.2	1
12	Decon unit	DCON12	9.8	0.5	3
Fire District 1 Total			**21.0**	**256.5**	**733**

Emergency Medical Services

The City of Edmonds provides Emergency Medical Services (EMS) in a multi-tiered system. The first layer is a first responder layer provided primarily by a BLS or ALS unit. 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 care is transferred to local hospitals. An EMS request for ALS services also receives one of the medic units that provide both treatment and all ALS patient transportation services.

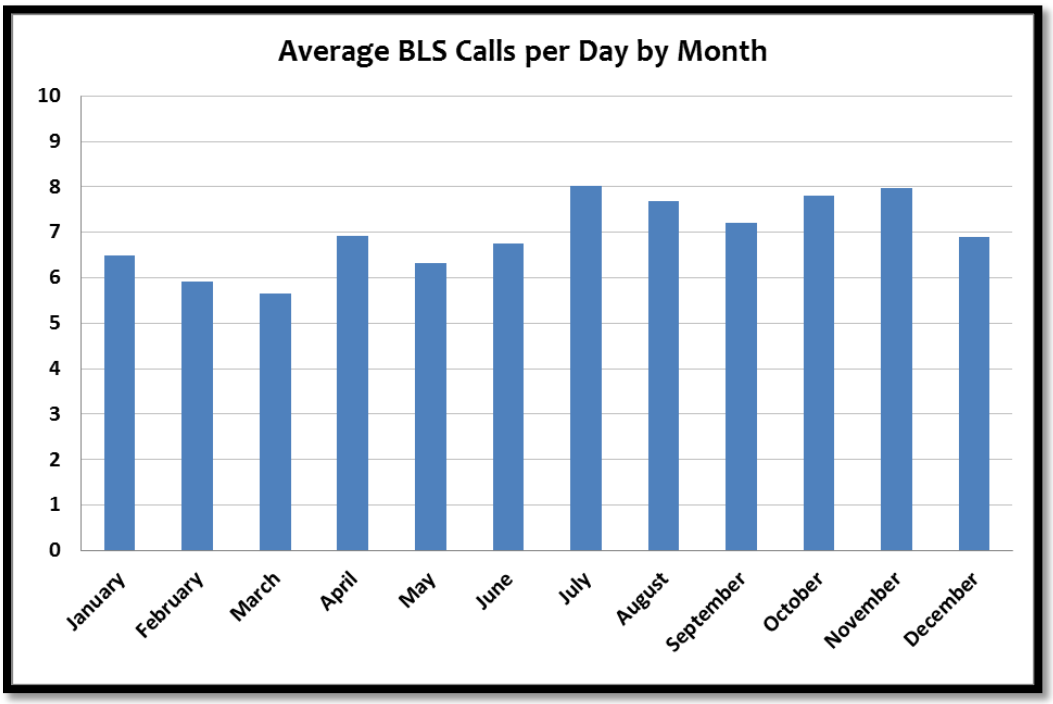
Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed for BLS and ALS calls. First, month of year, day of week, and hour of day BLS calls are categorized for 2014.

Results found that there were slightly more BLS related calls in the second half of the year (July to December), and peaked in July. Average calls per month ranged from a low of 5.6 in March to a high of 8.0 per day in July and November. Results are presented in tabular form as Table 18 and Figure 9 below.

Figure 26: Annual Total and Average per Day of BLS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
January	201	6.5	8.5
February	166	5.9	6.2
March	175	5.6	7.9
April	208	6.9	7.0
May	196	6.3	7.3
June	203	6.8	7.7
July	249	8.0	9.4
August	238	7.7	9.2
September	216	7.2	8.1
October	242	7.8	7.3
November	239	8.0	9.2
December	214	6.9	12.2
Total	**2,547**	**7.0**	**100.0**

Figure 27: Average BLS Calls per Day by Month of Year

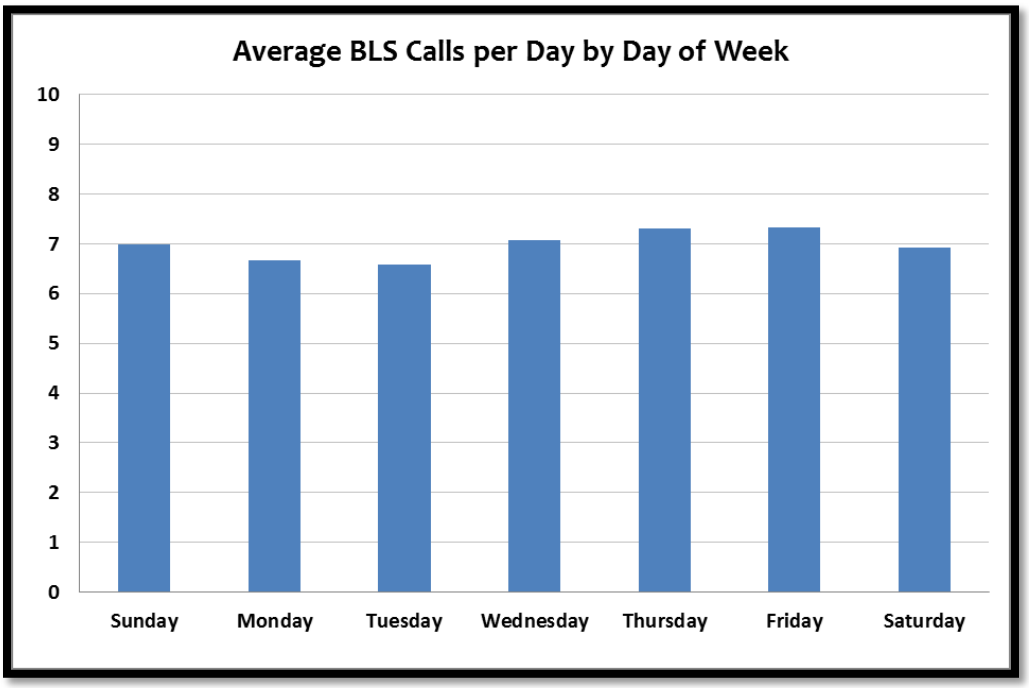


Similar analyses were conducted examining the frequency of requests for service by the day of the week. There is minor variability in the demand for services by the day of the week. Thursday and Friday receive the most requests for service and Monday and Tuesday the least. Results are provided in the figures below.

Figure 28: 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	363	7.0	14.3
Monday	347	6.7	13.6
Tuesday	342	6.6	13.4
Wednesday	367	7.1	14.4
Thursday	387	7.3	15.2
Friday	381	7.3	15.0
Saturday	360	6.9	14.1
Total	**2,547**	**7.0**	**100.0**

Figure 29: Average BLS Calls per Day by Day of Week

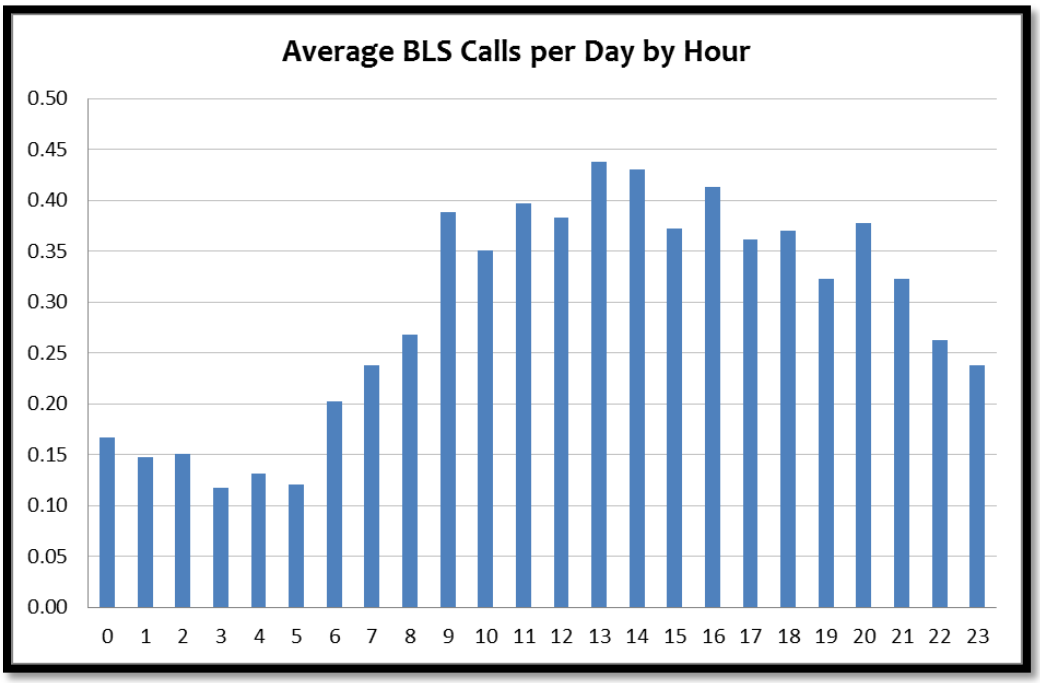


Finally, the analyses for BLS services are concluded by identifying the BLS calls by hour of day and the average hourly rate of BLS calls per hour. The demand curve for requests for BLS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls begins in the morning at 0900 and continues to increase and peaks at 1300, then starts to decrease. The average hourly rate of service requests does not exceed 0.44 for any hour during the day with the peak occurring at 1300. There are 0.29 calls on average and a low at 0300 of 0.12 calls on average during that hour. During the 6 hour period from midnight to 0600, the average per day is 0.83, which means the department on average responded to 0.83 BLS calls per day from midnight to 0600. Results are provided in the figures below.

Figure 30: Annual Total and Average per Day of BLS Calls by Hour of Day

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	61	0.17	2.4
1	54	0.15	2.1
2	55	0.15	2.2
3	43	0.12	1.7
4	48	0.13	1.9
5	44	0.12	1.7
6	74	0.20	2.9
7	87	0.24	3.4
8	98	0.27	3.8
9	142	0.39	5.6
10	128	0.35	5.0
11	145	0.40	5.7
12	140	0.38	5.5
13	160	0.44	6.3
14	157	0.43	6.2
15	136	0.37	5.3
16	151	0.41	5.9
17	132	0.36	5.2
18	135	0.37	5.3
19	118	0.32	4.6
20	138	0.38	5.4
21	118	0.32	4.6
22	96	0.26	3.8
23	87	0.24	3.4
Total	**2,547**	**6.98**	**100.0**

Figure 31: Average BLS Calls per Day by Hour of Day



Eighty-four (84%) percent of the BLS calls were responded to by a single FD1 unit. On average, 1.2 units were dispatched per BLS call. The department made a total of 3,181 responses to BLS calls. The total time on task was 1,503 hours, and the average time on task was 28 minutes. Aid/BLS A17 is the most utilized unit, followed by A16 and M20.

Figure 32: Workload by Unit for BLS Calls

Station	Description	Unit Report	Avg Busy Minutes per Run	Total Busy Hours	Number of Runs
10	Engine	E10	31.2	15.6	30
	Medic	M10	35.6	20.2	34
	Station 10 Total		**33.5**	**35.8**	**64**
11	Battalion	B11	9.0	1.2	8
12	Decon unit	DCON12	40.1	0.7	1
13	Engine	E13	51.6	0.9	1
16	Aid unit	A16	28.0	318.6	682
	Battalion	B16	14.1	39.0	166
	Engine	E16	14.8	18.7	76
	Marine boat	42,079.0	32.9	0.5	1
	Medical Services Officer	MSO16	23.1	1.2	3
	Station 16 Total		**24.4**	**378.0**	**928**
17	Aid unit	A17	32.6	436.8	804
	Engine	E17	17.8	17.8	60
	Medic	M17	31.9	62.7	118
	Station 17 Total		**31.6**	**517.3**	**982**
18	Engine	E18	22.4	0.4	1
	Medic	M18	21.1	1.4	4
	Station 18 Total		**21.3**	**1.8**	**5**
19	Engine	E19	17.1	7.4	26
	Medic	M19	24.8	50.5	122
	Station 19 Total		**23.5**	**57.9**	**148**
20	Aid unit	A20	28.5	122.7	258
	Engine	E20	18.5	0.6	2
	Ladder(quint)	L20	20.7	30.1	87
	Medic	M20	31.6	346.6	659
	Station 20 Total		**29.8**	**500.0**	**1,006**
21	Aid unit	A21	23.0	1.9	5
	Medic	M21	5.4	0.4	5
	Medical Services Officer	MSO21	10.8	4.0	22
	Station 21 Total		**11.9**	**6.3**	**32**
22	Medic	M22	47.1	1.6	2
NA	Bike	BK17	21.8	1.5	4
Fire District 1 Total			**28.3**	**1,502.8**	**3,181**

Temporal analyses were completed for requests for ALS service as well. January has the greatest frequency of calls, and September has the fewest number of ALS requests. Similarly, the calls were

analyzed by day of week showing that Wednesday and Friday were the busiest of the days of the week and Thursday the least busy. The figures below provide the summary of this data.

Figure 33: Annual Total and Average per Day of ALS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
January	158	5.1	8.5
February	118	4.2	6.2
March	113	3.6	7.9
April	108	3.6	7.0
May	122	3.9	7.3
June	129	4.3	7.7
July	107	3.5	9.4
August	97	3.1	9.2
September	92	3.1	8.1
October	115	3.7	7.3
November	105	3.5	9.2
December	134	4.3	12.2
Total	**1,398**	**3.8**	**100.0**

Figure 34: Average ALS Calls per Day by Month

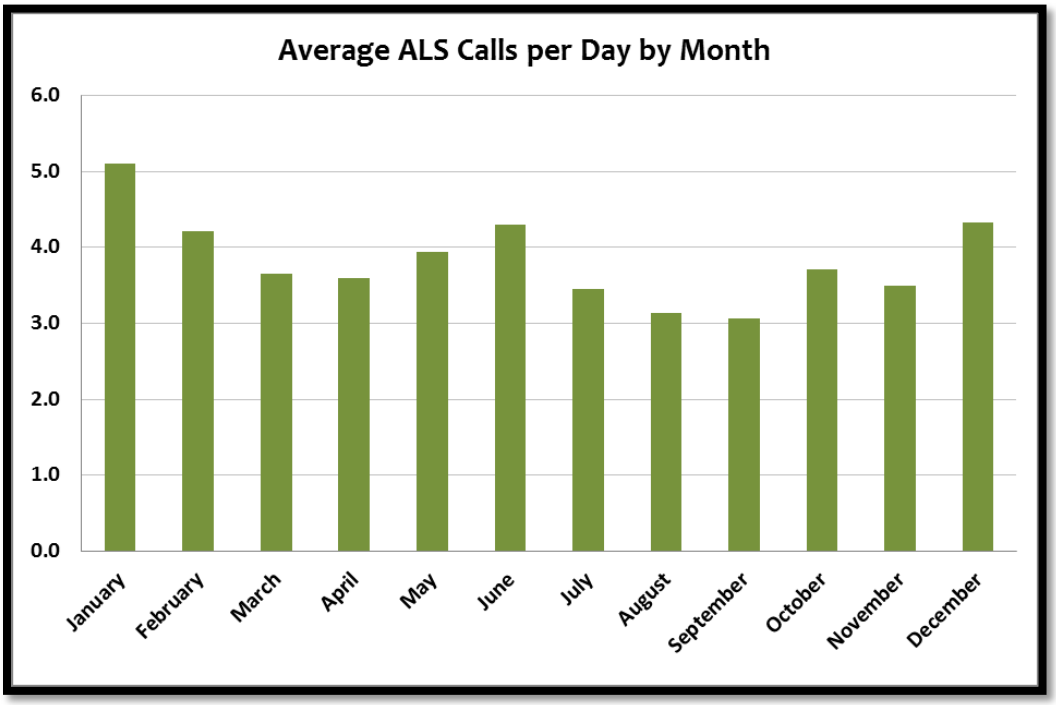
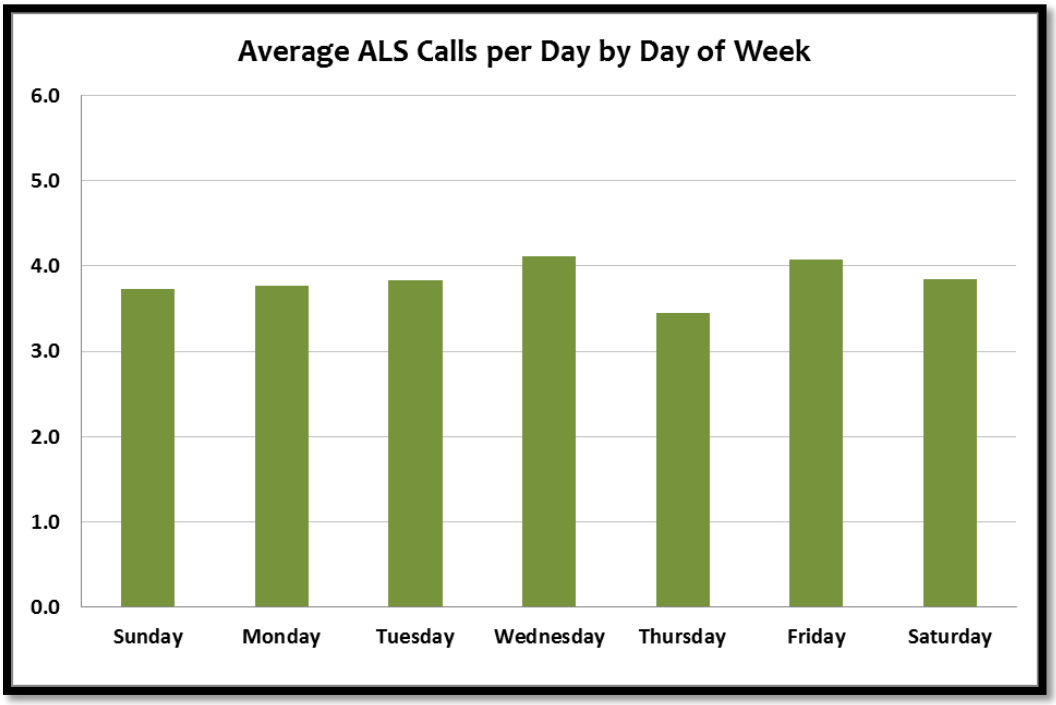


Figure 35: Annual Total and Average per Day of ALS Requests by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	194	3.7	13.9
Monday	196	3.8	14.0
Tuesday	199	3.8	14.2
Wednesday	214	4.1	15.3
Thursday	183	3.5	13.1
Friday	212	4.1	15.2
Saturday	200	3.8	14.3
Total	**1,398**	**3.8**	**100.0**

Figure 36: Average ALS Calls per Day by Day of Week

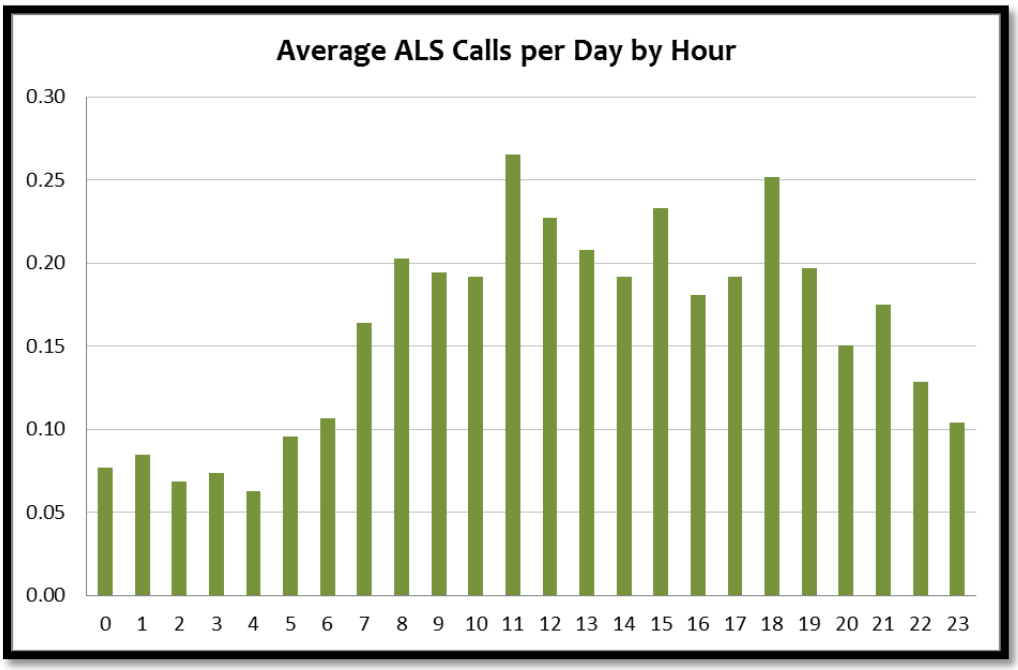


Requests for ALS service were analyzed by the hour of the day and the average hourly rate of requests. The annual frequency of ALS calls by the hour of day follows a similar pattern as the BLS demand curve previously presented with the busiest period between 0800 and 2200. The average hourly call rate did not exceed 0.27 calls per hour at the peak. Requests by hour of the day are represented in the figures below.

Figure 37: Annual Total and Average per Day of ALS Requests by Hour of Day

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	28	0.08	2.0
1	31	0.08	2.2
2	25	0.07	1.8
3	27	0.07	1.9
4	23	0.06	1.6
5	35	0.10	2.5
6	39	0.11	2.8
7	60	0.16	4.3
8	74	0.20	5.3
9	71	0.19	5.1
10	70	0.19	5.0
11	97	0.27	6.9
12	83	0.23	5.9
13	76	0.21	5.4
14	70	0.19	5.0
15	85	0.23	6.1
16	66	0.18	4.7
17	70	0.19	5.0
18	92	0.25	6.6
19	72	0.20	5.2
20	55	0.15	3.9
21	64	0.18	4.6
22	47	0.13	3.4
23	38	0.10	2.7
Total	**1,398**	**3.83**	**100.0**

Figure 38: Average ALS Calls per Day by Hour of Day



FD1 contributes a significant amount of resources responding to ALS requests within Edmonds. FD1 sends multiple units to 95 percent of the ALS requests. On average, 2.3 units were dispatched per ALS call. The agency made a total of 3,173 responses to ALS calls. The total time on task was 1,742 hours, and the average time on task was 33 minutes. M17 is the most dispatched unit, followed by A16, A17 and M20.

Figure 39: Workload by Unit for ALS Calls

Station	Description	Unit Report	Avg Busy Minutes per Run	Total Busy Hours	Number of Runs
10	Engine	E10	26.4	7.1	16
	Medic	M10	39.1	16.9	26
	Station 10 Total		**34.3**	**24.0**	**42**
11	Battalion	B11	19.5	1.3	4
16	Aid unit	A16	31.7	262.9	497
	Battalion	B16	18.3	25.0	82
	Engine	E16	15.3	7.2	28
	Medical Services Officer	MSO16	23.9	6.0	15
	Station 16 Total		**29.0**	**301.1**	**622**
17	Aid unit	A17	34.0	247.0	436
	Engine	E17	22.8	9.1	24
	Medic	M17	38.3	797.7	1,250
	Station 17 Total		**37.0**	**1,053.8**	**1,710**
18	Medic	M18	20.5	2.4	7
19	Engine	E19	14.5	9.2	38
	Medic	M19	20.4	41.2	121
	Station 19 Total		**19.0**	**50.4**	**159**
20	Aid unit	A20	30.1	61.2	122
	Ladder(quint)	L20	21.3	13.1	37
	Medic	M20	33.0	183.4	333
	Station 20 Total		**31.4**	**257.7**	**492**
21	Medic	M21	21.7	1.1	3
	Medical Services Officer	MSO21	22.7	49.7	131
	Technical Rescue	TR21	4.6	0.1	1
	Station 21 Total		**22.6**	**50.8**	**135**
23	Ladder(quint)	L23	31.0	0.5	1
NA	Medical Services Officer	MSO11	6.2	0.1	1
Fire District 1 Total			**32.9**	**1,742.1**	**3,173**

BLS/ALS Transport

We analyzed outcomes for the requests for BLS and ALS services. The number of EMS transports totaled 2,359, averaging 6.5 transports per day. Approximately 50% of the BLS calls and 78% of ALS calls have patients being transported to the hospital by Edmonds. However, nearly half of the requests for BLS did not result in a transport to the hospital, an indication that the sickness/illness is of lower acuity. Duration of a call is defined as the difference between the first unit dispatch time and the last unit clear time. On average, the duration of a BLS transport call was 45 minutes, which is 2.2 times of a non-transport BLS call (20 minutes). On average, the duration of an ALS transport call was 54 minutes, which is 1.7 times of a non-transport ALS call (32 minutes).

Figure 40: EMS Transports by Call Category

Call Category	Non-Transport		Transport		Transport Rate
	Duration	Number of Calls	Duration	Number of Calls	
EMS-BLS	20.0	1,275	44.8	1,272	49.9
EMS-ALS	32.0	311	53.9	1,087	77.8
EMS-Total	**22.3**	**1,586**	**49.0**	**2,359**	**59.8**

We combined BLS and ALS service requests, and analyzed their variation by the hour of the day and the average hourly rate of requests. The variation of total EMS requests and EMS transport reports follow a similar pattern. The busiest period for EMS and EMS transport requests was between 0800 and 2000. The average hourly call rate did not exceed 0.66 calls per hour at the peak, 1100. EMS transport demand peaked at 0.41 calls per hour at 1100. Requests by hour of the day are represented in the figures below.

Figure 41: Average BLS/ALS Calls and BLS/ALS Transports per Day by Hour of Day

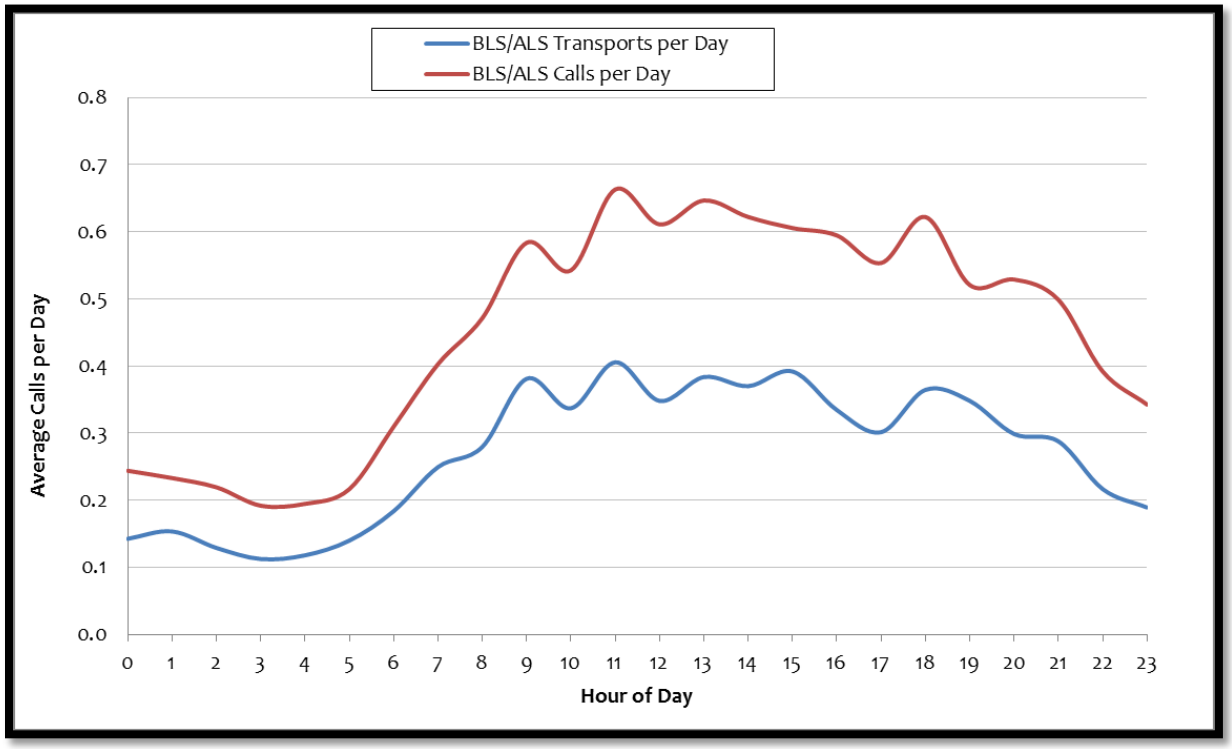


Figure 42: Total BLS/ALS Calls and BLS/ALS Transports and Average per Day by Hour of Day

Hour	Number of BLS/ALS Transports	Number of BLS/ALS Calls	BLS/ALS Transports per Hour	BLS/ALS Calls per Hour	Transport Rate
0	52	89	0.14	0.24	58.4
1	56	85	0.15	0.23	65.9
2	47	80	0.13	0.22	58.8
3	41	70	0.11	0.19	58.6
4	43	71	0.12	0.19	60.6
5	51	79	0.14	0.22	64.6
6	67	113	0.18	0.31	59.3
7	91	147	0.25	0.40	61.9
8	102	172	0.28	0.47	59.3
9	139	213	0.38	0.58	65.3
10	123	198	0.34	0.54	62.1
11	148	242	0.41	0.66	61.2
12	127	223	0.35	0.61	57.0
13	140	236	0.38	0.65	59.3
14	135	227	0.37	0.62	59.5
15	143	221	0.39	0.61	64.7
16	122	217	0.33	0.59	56.2
17	110	202	0.30	0.55	54.5
18	133	227	0.36	0.62	58.6
19	127	190	0.35	0.52	66.8
20	109	193	0.30	0.53	56.5
21	105	182	0.29	0.50	57.7
22	79	143	0.22	0.39	55.2
23	69	125	0.19	0.34	55.2

Review of System Performance

The first step in determining the current state of FD1'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 Fire District 1 utilizes quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing (with updated CAD), turnout time, travel time, and the time spent on-scene.

Detection

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

Call Processing

This is the element of time measured between when SNOCOM 911 answers the 911 calls, processes the information, and subsequently dispatches the units.

Turnout Time

This is 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.

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 time required to arrive on-scene beginning with SNOCOM 911 answering the phone request for service and the time that the units arrive on-scene.

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 the three stations in Edmonds, 16, 17 and 20, are planned to respond to 97 percent of the emergency requests. The other three percent of the requests are planned to be responded to by the closest station depending on the geographic grids. Station 16 accounted for 28.8 percent of the Edmonds workload, station 17 accounted for 33.3 percent of the workload, and station 20 accounted for 35.1 percent of the workload. Results are presented below.

Figure 43: FD1 Unit Workload by Station Demand Zone

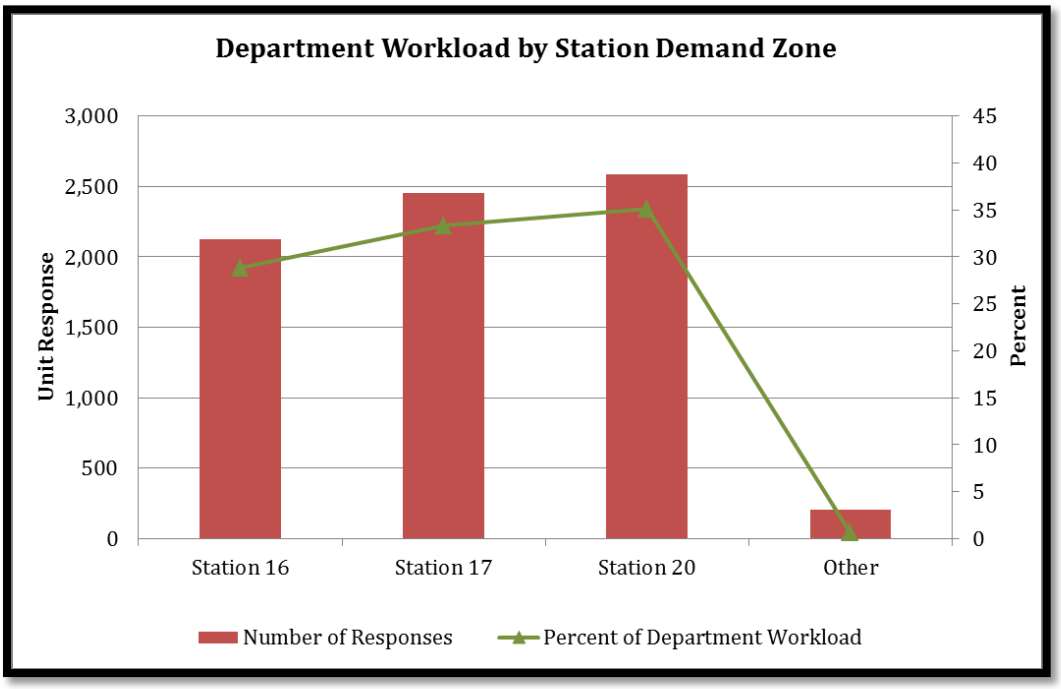


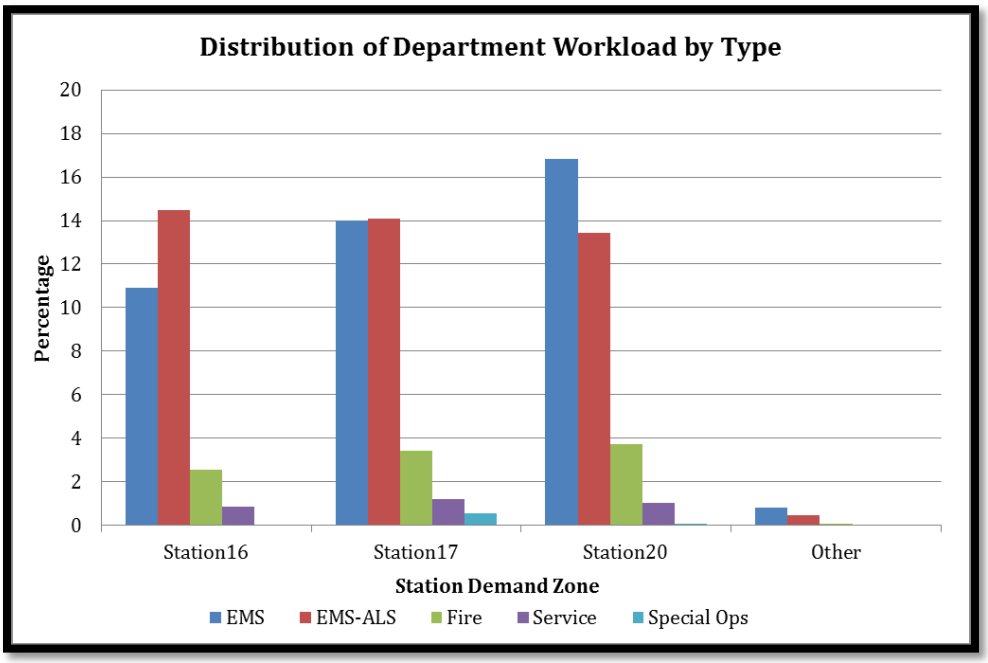
Figure 44: Department Workload by Station Demand Zone for Edmonds Incidents

First Due Station	Number of Calls	Calls per Day	Call Percentage	Number of Responses	Responses per Day	Percent of Department Workload
Station 16	1,348	3.7	29.2	2,123	5.8	28.8
Station 17	1,551	4.2	33.6	2,455	6.7	33.3
Station 20	1,574	4.3	34.1	2,589	7.1	35.1
Station 10	69	0.2	1.5	106	0.3	1.4
Station 14	35	0.1	0.8	51	0.1	0.7
Station 19	35	0.1	0.8	46	0.1	0.6
Missing	1	0.0	0.0	2	0.0	0.0
Total	**4,613**	**12.6**	**100**	**7,372**	**20.2**	**100**

Note: (1) A request might have been responded to by multiple units that is why the number of responses is more than the number of calls. (2) This data reflects calls run into Edmonds. For example, Stations 10, 14, and 19 will have considerable workload in their own districts that is not presented here.

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 86% of the requests for service are EMS related. Approximately 10 % of the unit responses were associated with fire related incidents. The remaining 3.9% 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. Station 20 is planned to respond to most BLS requests, and the three Edmonds stations have similar planned workload for ALS requests.

Figure 45: 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 below. In addition, the total number of unit responses conducted in each station demand zone is presented below.

Figure 46: Within Station Proportion of Workload by Call Type

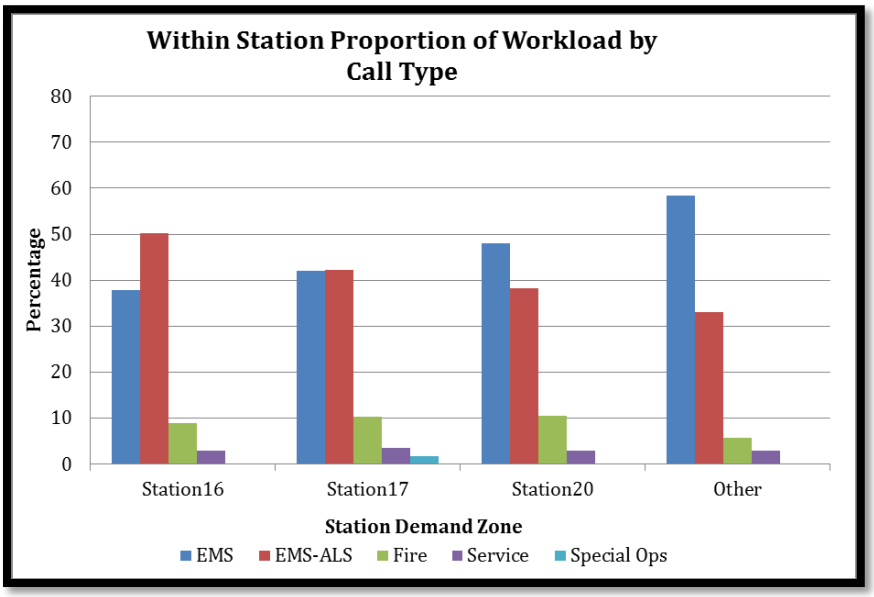


Figure 47: Number of Responses by Station Demand Zone and Call Type for Edmonds Incidents

First Due Station	EMS	EMS-ALS	Fire	Service	Special Ops	Total
Station16	803	1,067	189	64	0	**2,123**
Station17	1,033	1,038	254	88	42	**2,455**
Station20	1,241	992	274	77	5	**2,589**
Station10	62	35	6	3	0	**106**
Station14	18	25	5	3	0	**51**
Station19	24	16	5	1	0	**46**
Missing	0	0	0	2	0	**2**
Total	**3,181**	**3,173**	**733**	**238**	**47**	**7,372**

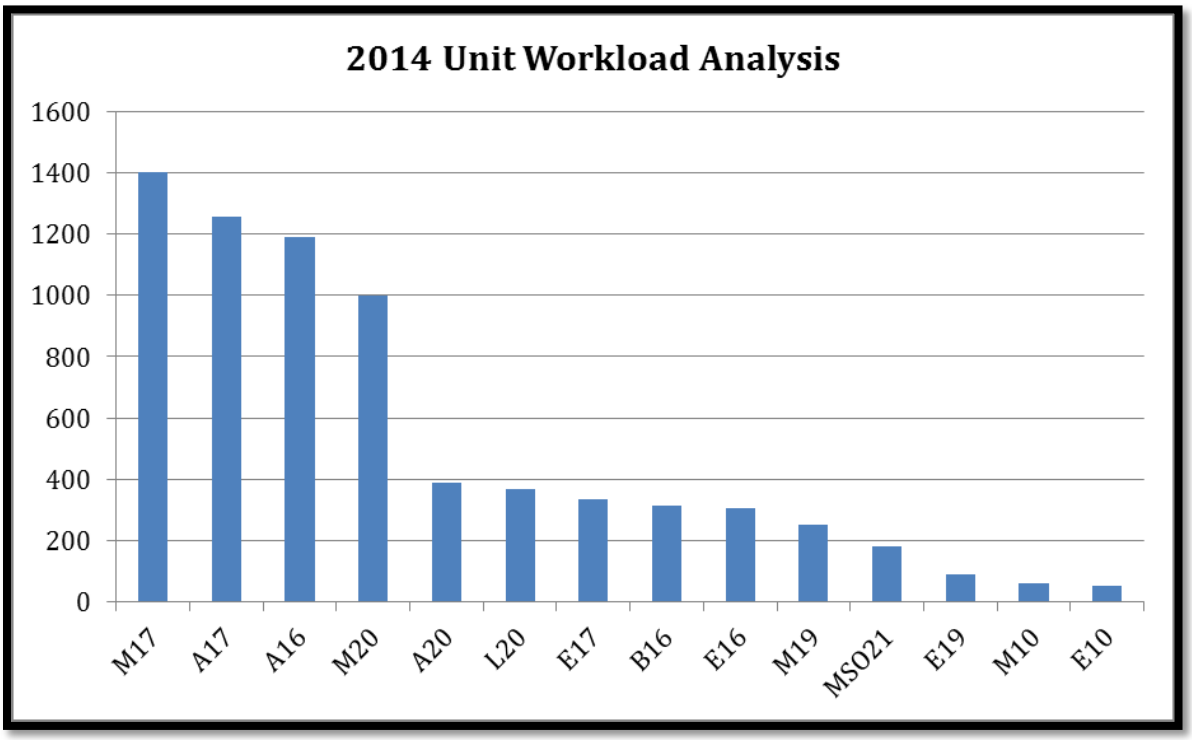
Finally, unit workload analyses were completed for both comparative purposes as well as for introspection into potential system failures. First, this analysis utilized the summation of individual unit workload from dispatch to clear. Of fire suppression units (engine and ladder), Ladder L20 was dispatched the most, a total of 367 runs in 2014, which accounted for almost 31% of the total fire suppression unit runs and averaged one run per day. The second and third most utilized fire suppression apparatus was Ladder E17 and E16. E17 made 334 run and E16 made 304 runs. Of the BLS and ALS units, M17 was utilized the most, which made 1,402 runs and accounted for 25% of BLS and ALS runs. M17 averaged 3.8 runs per day. A17, A16 and M20 each made 1,257, 1191 and 999 runs respectively in 2014.

A17, A16 and M20 averaged 3.4, 3.3 and 2.7 runs per day respectively in 2014. A total of 7,372 apparatus responses were included in this analysis and distributed across the various FD1 stations. This analysis is focused on the major staffed response resources, which have responded to Edmonds calls. Results of the unit workload analysis are presented below.

Figure 48: 2014 Unit Workload Analyses by Unit and Call Category for Edmonds Incidents

Station	Unit	Description	EMS	EMS ALS	Fire	Service	Special Ops	Total	Responses per day
10	AIR10	Air light unit	0	0	5	0	0	5	0.0
	E10	Engine	30	16	6	2	0	54	0.1
	M10	Medic	34	26	1	0	0	61	0.2
11	B11	Battalion	8	4	23	0	4	39	0.1
12	DCON12	Decon unit	1	0	3	0	1	5	0.0
13	E13	Engine	1	0	4	0	0	5	0.0
16	A16	Aid unit	682	497	2	7	3	1,191	3.3
	B16	Battalion	166	82	45	13	8	314	0.9
	E16	Engine	76	28	142	56	2	304	0.8
	MAR6	Marine boat	1	0	0	4	3	8	0.0
	MSO16	Medical Services Officer	3	15	3	0	1	22	0.1
17	A17	Aid unit	804	436	10	7	0	1,257	3.4
	E17	Engine	60	24	170	74	6	334	0.9
	M17	Medic	118	1,250	28	2	4	1,402	3.8
18	E18	Engine	1	0	4	0	0	5	0.0
	M18	Medic	4	7	3	0	1	15	0.0
19	E19	Engine	26	38	23	4	0	91	0.2
	M19	Medic	122	121	9	0	0	252	0.7
20	A20	Aid unit	258	122	3	4	0	387	1.1
	E20	Engine	2	0	1	0	0	3	0.0
	L20	Ladder(quint)	87	37	177	63	3	367	1.0
	M20	Medic	659	333	3	2	2	999	2.7
21	A21	Aid unit	5	0	0	0	0	5	0.0
	B21	Battalion	0	0	2	0	0	2	0.0
	M21	Medic	5	3	0	0	0	8	0.0
	MSO21	Medical Services Officer	22	131	25	0	4	182	0.5
	TR21	Technical Rescue	0	1	22	0	5	28	0.1
22	E22	Engine	0	0	17	0	0	17	0.0
	M22	Medic	2	0	1	0	0	3	0.0
23	L23	Ladder(quint)	0	1	1	0	0	2	0.0
NA	BK17	Bike	4	0	0	0	0	4	0.0
	MSO11	Medical Services Officer	0	1	0	0	0	1	0.0

Figure 49: 2014 Number of Dispatches by Unit to Edmonds Incidents



Note: units which had less than 50 responses in 2014 are not included in this Figure.

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, ALS, Special-Ops, and Service) and total unit time on task for these service categories in 2014. The resulting UHU's represent the percentage of the work period (24 hours) that is utilized responding to requests for service. The International Association of Fire Fighters (IAFF) recommends that 24-hour units do not surpass a 0.30, or 30% workload threshold. In other words, best practice would not have units and personnel exceeding 30%, of their workday responding to calls. This would equate to approximately 8 hours of the 24-hour period. These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections.

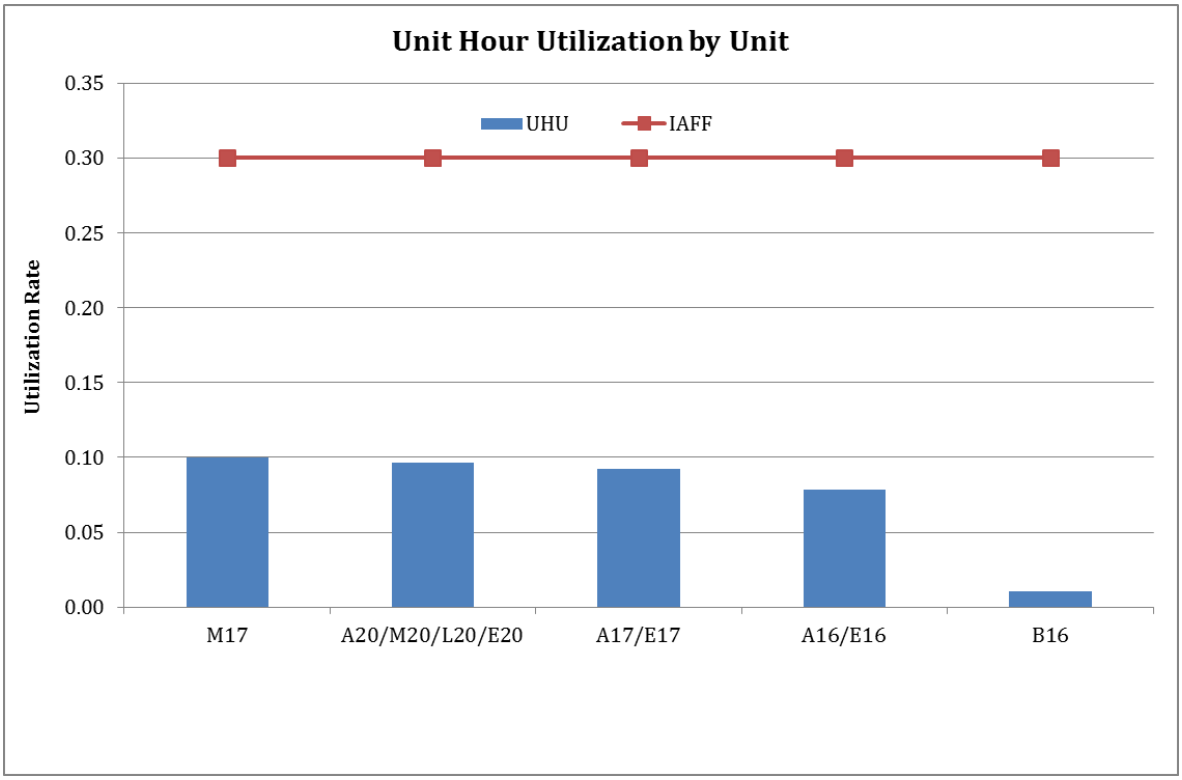
For the three stations (16, 17 and 20) in Edmonds, each shift has 12 firefighters to constantly staff 4 units. In Station 16, each shift has 4 firefighters and two units are constantly staffed. E16 and A16 are cross staffed and a battalion chief unit is staffed. In station 17, each shift has 5 firefighters and two units are constantly staffed. M17 is constantly staffed, and E17 and A17 are cross staffed. In station 20, each shift has 3 firefighters and A20, E20, M20 and L20 are cross staffed. Except the battalion chief unit, four constantly staffed units combined were deployed 3,215 hours, and had a utilization rate of 9.2% in 2014. The most utilized unit is the ALS unit M17 at approximately 10.0%, followed by cross staffed units in

station 20 at 9.7% and cross-staffed A16/E16 at 9.2%. At the current workload utilization rates, the three stations should have a limited impact on their level of readiness or system performance.

Figure 50: Fire District 1's Staffing Model

Station	Day (0800-2000)				Night (2000-0800)			
	Number of Firefighters	Staffed Unit Resources			Number of Firefighters	Staffed Unit Resources		
10	5	E10	M10		3	E10/M10		
11	6	E11	M11	B11	6	E11	M11	B11
12	3	E12/DCON12/M12			3	E12/DCON12/M12		
13	3	E13/M13			3	E13/M13		
16	4	E16/A16		B16	4	E16/A16		B16
17	5	E17/A17	M17		5	E17/A17	M17	
18	3	E18/M18			3	E18/M18		
19	3	E19/M19			3	E19/M19		
20	3	L20/M20/A20			3	L20/M20/A20		
21	6	E21/TR21	M21/A21	MSO21	4	E21/TR21		MSO21
22	3	E22/M22			3	E22/M22		
23	3	L23			3	L23		

Figure 51: Unit Hour Utilizations



Note: This analysis only includes units from stations 16, 17 and 20.

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 2014. Overall the department had a mean turnout time of 102 seconds, or 1 minute and 42 seconds, and 153 seconds, or 2 minutes and 33 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 216 seconds, or 3 minutes and 36 seconds. Performance at the 90th percentile was 343 seconds, or 5 minutes and 43 seconds.

As previously discussed the dispatch interval is not discussed in the major body of the report. Therefore, the "total response time" is defined as the sum of turnout and travel times. The mean turnout plus travel time is 318 seconds, or 5 minutes and 18 seconds. Performance at the 90th percentile is 449 seconds, or 7 minutes and 29 seconds. Results of first arriving unit performance are presented below

Figure 52: Description of First Arriving Unit Emergency Response Performance

Measure	Average	90th Percentile
Turnout Time	1.7	2.6
Travel Time	3.6	5.7
Turnout and Travel Time	5.3	7.5

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 to capture only emergency responses within each FDZ at the first arriving unit. Response times are reported below at both the mean and 90th percentile.

Examination of the overall performance at the 90th percentile reveals that Stations 17 have the quickest response times followed by Stations 16 and 20 in order of performance. The FDZ with the longest travel and total response times are stations 10 and 14. An illustrative comparison of FDZ performance at the 90th percentile is provided below.

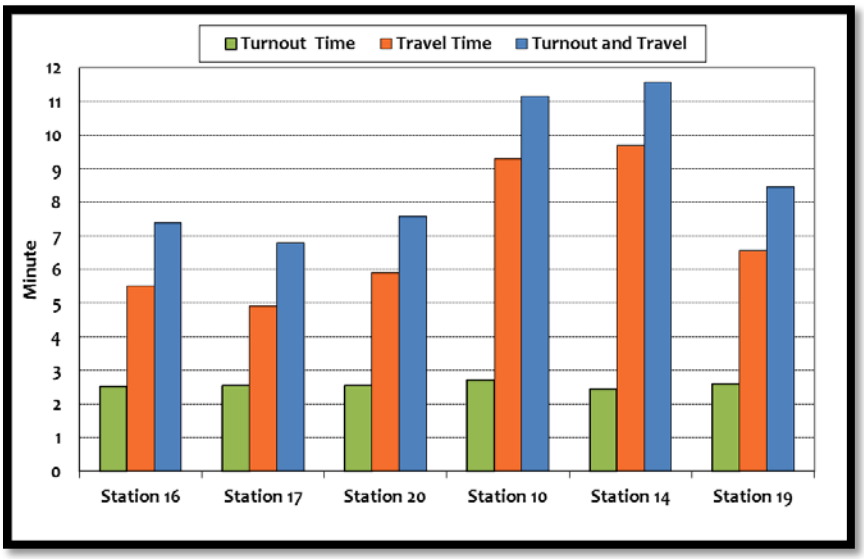
Figure 53: Mean First Arrival Performance by First Due Station

First Due Station	Turnout Time	Travel Time	Turnout and Travel	Sample Size
Station 16	1.7	3.7	5.4	1,235
Station 17	1.7	3.1	4.7	1,425
Station 20	1.7	3.8	5.5	1,485
Station 10	1.7	6.6	8.4	66
Station 14	1.8	6.6	8.3	32
Station 19	1.8	4.2	6.0	34

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

First Due Station	Turnout Time	Travel Time	Turnout and Travel	Sample Size
Station 16	2.5	5.5	7.4	1,235
Station 17	2.6	4.9	6.8	1,425
Station 20	2.6	5.9	7.6	1,485
Station 10	2.7	9.3	11.2	66
Station 14	2.5	9.7	11.6	32
Station 19	2.6	6.6	8.5	34

Figure 55: 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, each of the stations is experiencing similar average turnout times. Conversely, when examining the travel time performance, performances for calls in stations 10, 14 and 19 are significantly longer than calls in other first due stations. But those calls only accounted for 3 percent of the total. 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 10, 14 and 19 are significantly longer than calls in the other stations. But overall, for calls in stations 16, 17 and 20, the average and 90th percentile turnout and travel time are within 8 minutes.

Figure 56: 90th Percentile Turnout Time by Station FDZ

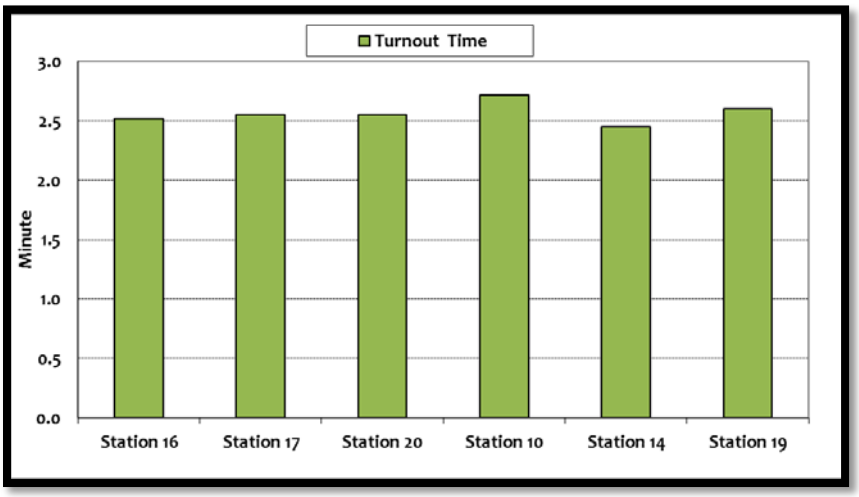


Figure 57: 90th Percentile Travel Time Performance by Station FDZ

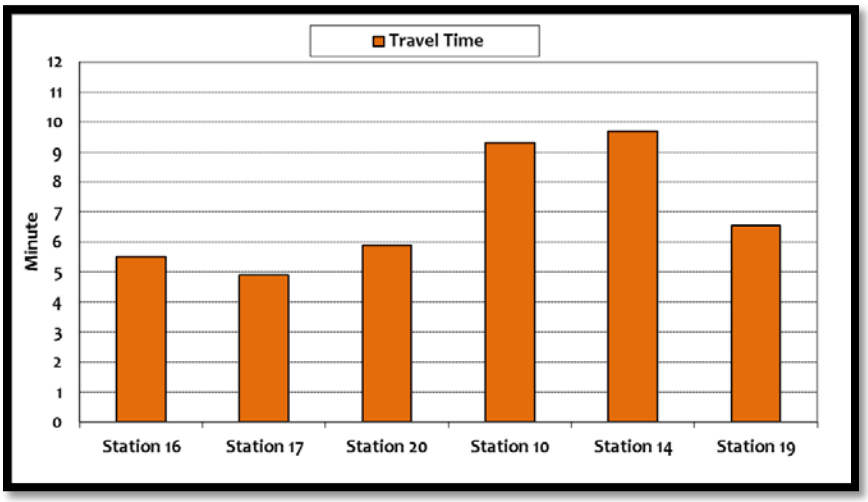
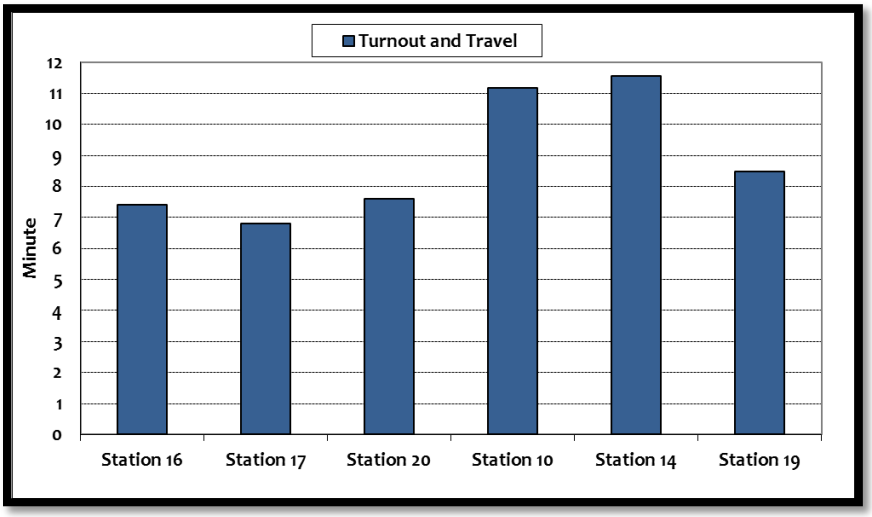


Figure 58: 90th Percentile Turnout and Travel Performance by Station FDZ



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.

Analyses of historical performance for each station reveal that stations 16, 17 and 20 can generally assemble five units on scene within an average travel time of eight minutes. However, the 90th percentile performance is outside of best practice of either eight (8) minutes for NFPA 1710 or 10 minutes and 24 seconds for the CFAI. The graphic results for each fire station demand zone are presented in the figures below.

Figure 59: ERF Travel Performance for Station 16

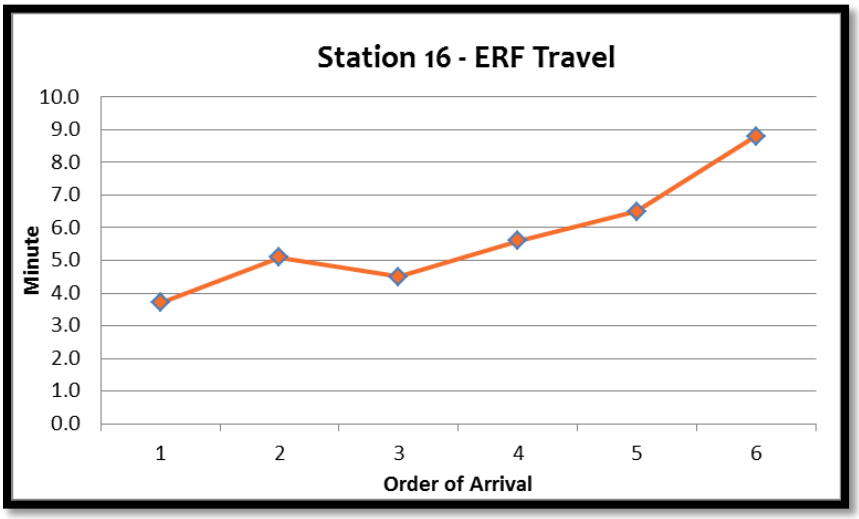


Figure 60: ERF Travel Performance for Station 17

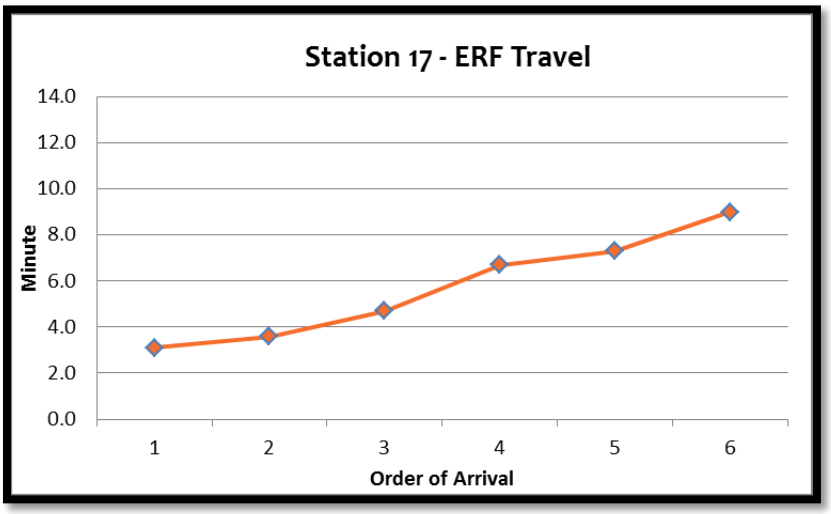


Figure 61: ERF Travel Performance for Station 20

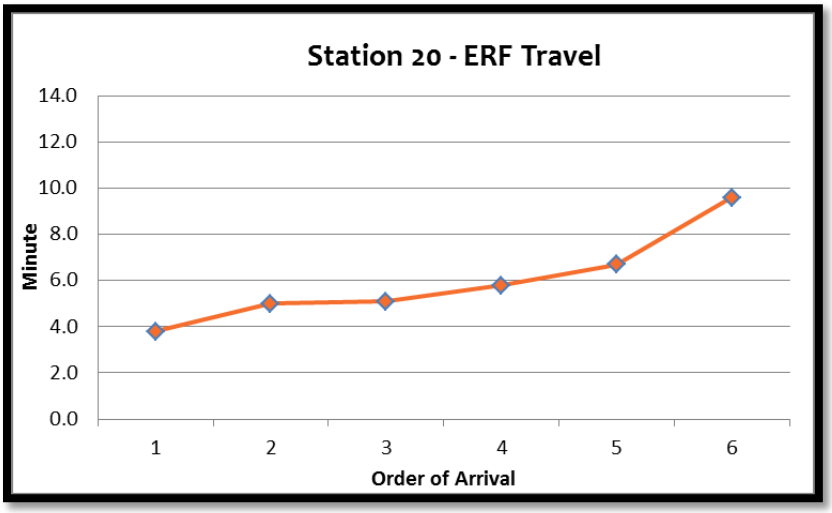


Figure 62: 90th Percentile ERF Travel Performance for Station 16

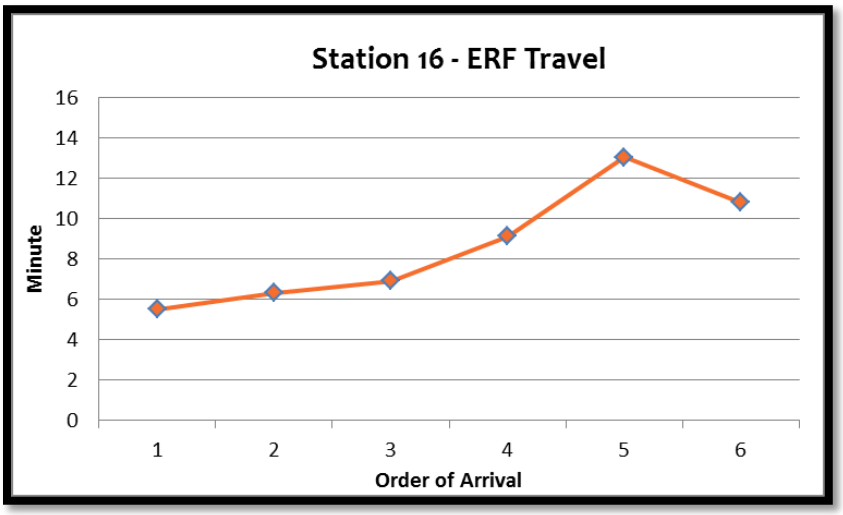


Figure 63: 90th Percentile ERF Travel Performance for Station 17

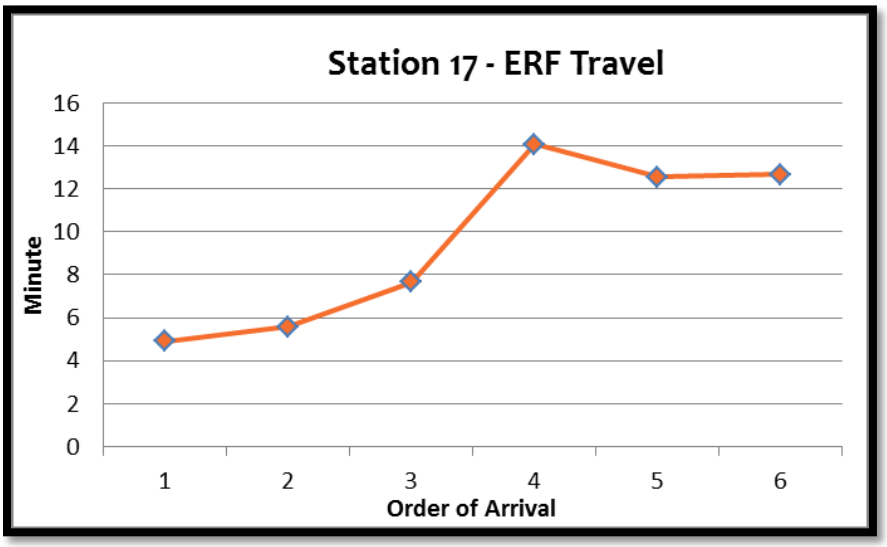
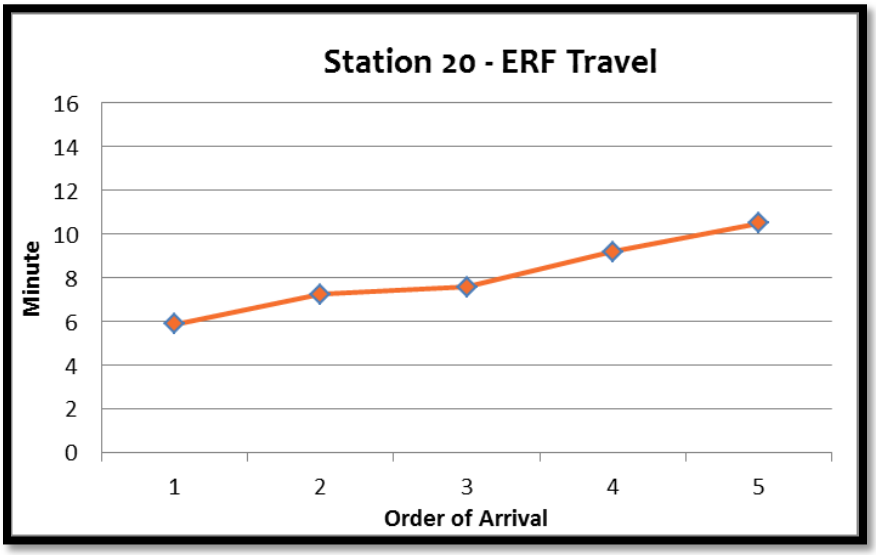


Figure 64: 90th Percentile ERF Travel Performance for Station 20



In addition, the data is presented in tabular form below. The figure presents the historical travel times by the order of the arriving unit. Please note the sample sizes vary by order of arrival.

Figure 65: Historical Mean and 90th Percentile Travel Time Performance for ERF by Station FDZ

Order of Arrival	Average			90th Percentile		
	Station 16	Station 17	Station 20	Station 16	Station 17	Station 20
1	3.7	3.1	3.8	5.5	4.9	5.9
2	5.1	3.6	5.0	6.3	5.6	7.3
3	4.5	4.7	5.1	6.9	7.7	7.6
4	5.6	6.7	5.8	9.1	14.1	9.2
5	6.5	7.3	6.7	13.0	12.5	10.5
6	8.8	9.0	9.6	10.8	12.7	28.3

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 1 is available to respond to 98.1% of the requests for service that are originating within Edmonds. A total of 90 incidents were responded to by other agencies with no Fire District 1 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 station 17 is capable of meeting their demand for services at the 90th percentile. In other words, when request for service is received FDZ 17 units are available to answer the call 9 out of 10 times. Station 16 and 20 each are reliable at 81 and 85 percent of the time. It is considered both best practice and the most reliable measure to perform at the 90th percentile as indicated by the "blue" line in the figure below. This analysis utilized all dispatched calls within Edmonds and the performance included all assigned units to the specific FDZ.

In Station 16, each shift has 4 firefighters and E16 and A16 are cross staffed. In station 17, each shift has 5 firefighters and two units are constantly staffed, M17 and E17 or A17 (cross staffed). In station 20, each shift has 3 firefighters and A20, E20, M20 and L20 are cross staffed.

Figure 66: Percentage Reliability by Station FDZ

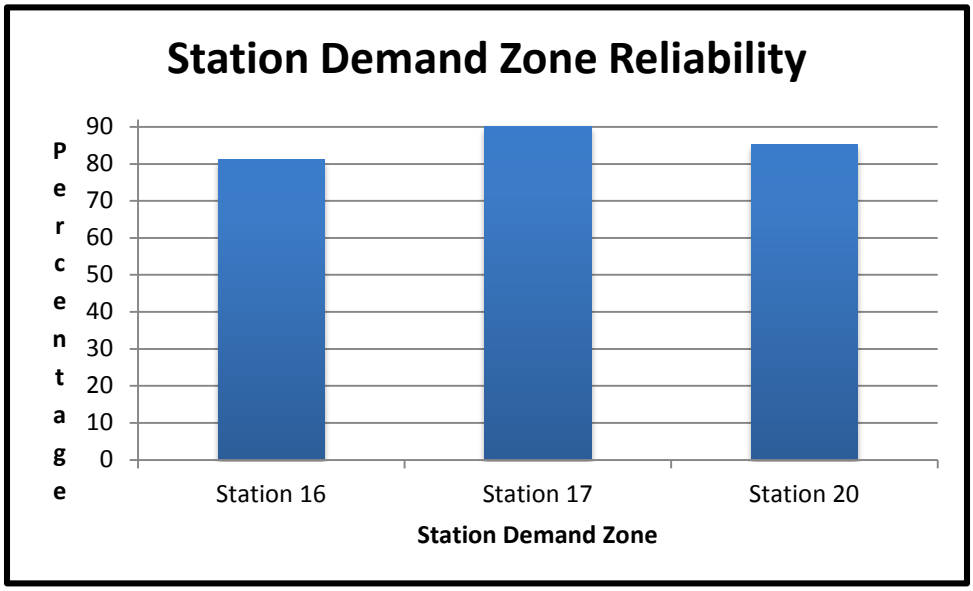


Figure 67: Percentage Reliability by Station FDZ

Station Demand Zone	Reliability Percentage	Number of Calls
Station 16	81.1	1,348
Station 17	90.1	1,551
Station 20	85.3	1,574

Note: This analysis only includes Edmonds stations 16, 17 and 20.

Call Concurrency

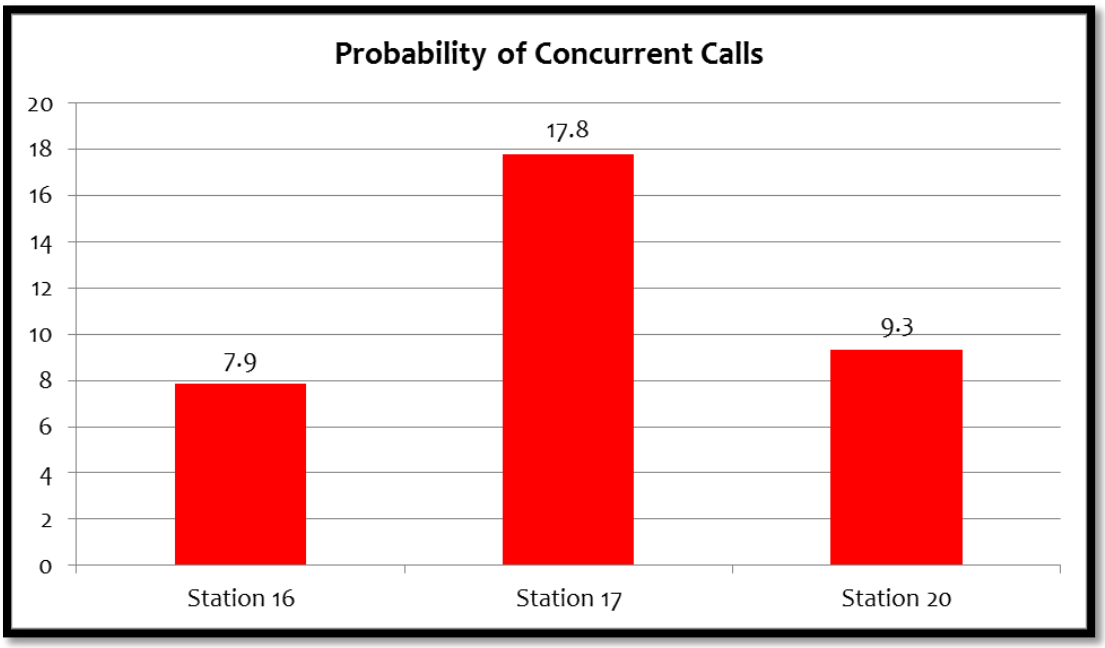
Call concurrency is defined as the rate at which another call was received for the same fire station demand zone while one of the station's apparatus was already on a call. In other words, if Engine 16 is on a call and another request for service is generated in Station 16's fire demand zone, then the second incident would be captured as a concurrent call. This is different from the reliability of the system, because call concurrency is restrictive to calls not served by the primary unit because they were already on a call. Alternatively, the system reliability presented in the previous section includes all calls not served by the primary station regardless of the cause. An example would be that Engine 16 was out of service for training for a portion of their 24-hour shift and didn't handle responses in their territory. Therefore, the combination of examining the system reliability and call concurrency provides a comprehensive understanding of the system's performance.

This analysis validated that the systems performance for requests for service as each of the fire station demand zones had less than 20% call concurrency for all unique incidents in 2014. Station 17 has concurrency percent nearly 18%, and station 16 has the lowest concurrency at 8%. Results are presented below.

Figure 68: Call Concurrency for 2014 by First Due Station

First Due Station	Concurrent Calls	Total Calls	Percent Concurrency
Station 16	106	1,348	7.9
Station 17	276	1,551	17.8
Station 20	147	1,574	9.3

Figure 69: Call Concurrency for 2014 by Station FDZ



Baseline Performance Tables

The data available during the development of this Standards of Coverage document only discuss pick-up to dispatch performance in the following four tables. The current CAD software does not capture the event in a unique record for all requests. The figures below represent the baseline performance for EMS and fire incidents. Since there are only 8 special operations calls, and all service calls were responded without lights and sirens, thus we did not include them. 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 time for ERF is smaller than the first arriving on scene unit. For EMS calls, in the past three years, the average dispatch time was 46 seconds or 0.8 minutes. The average turnout and travel time was 318 seconds (5 minutes and 18 seconds). The average time of the ERF unit or second arriving unit was 379 seconds (6 minutes and 19 seconds), which is one minute longer than the first arriving unit. For fire suppression calls, in the past three years, the average dispatch time was 1.0 minute. The average turnout and travel time of the first arriving unit was 372 seconds (6 minutes and 12 seconds). The average time of the ERF unit or fourth arriving unit was 462 seconds (7 minutes and 42 seconds), which is 90 seconds longer than the first arriving unit.

Figure 70: Baseline Performance for EMS (BLS/ALS) Incidents -2012/2014

EMS-BLS/ALS (Lights and Sirens) Average Time		2012 - 2014	2014	2013	2012
Alarm Handling	Pick-up to Dispatch	0.8	0.8	0.7	0.8
Turnout Time	Turnout Time - 1st Unit	1.7	1.6	1.7	1.9
Travel Time	Travel Time - 1st Unit	3.6	3.6	3.6	3.6
	Travel Time - ERF (2nd Arriving Unit)	4.6	4.6	4.6	4.7
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	5.3	5.2	5.3	5.5
	Turnout and Travel Time - ERF (2nd Arriving Unit)	6.3	6.3	6.2	6.5
Sample Size	Alarm Handling	9,712	3,238	3,241	3,233
	1st Unit	11,549	3,847	3,886	3,816
	ERF	5,058	1,670	1,717	1,671

Figure 71: Baseline Performance for Fire Incidents -2012/2014

Fire (Lights and Sirens) Average Time		2012 - 2014	2014	2013	2012
Alarm Handling	Pick-up to Dispatch	1.0	0.9	0.9	1.1
Turnout Time	Turnout Time - 1st Unit	2.2	2.1	2.2	2.3
Travel Time	Travel Time - 1st Unit	4.0	3.9	4.0	4.1
	Travel Time - ERF (4th Arriving Unit)	5.1	4.8	4.8	5.6
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	6.2	6.0	6.2	6.4
	Turnout and Travel Time - ERF (4th Arriving Unit)	7.7	7.3	7.6	8.2
Sample Size	Alarm Handling	725	237	247	241
	1st Unit	1,322	422	478	422
	ERF	103	30	39	34

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 90 percentile dispatch time was 69 seconds (1 minute and 9 seconds). The 90th percentile turnout and travel time was 449 seconds (7 minutes and 29 seconds). The average time of the ERF unit or second arriving unit was 530 seconds (8 minutes and 50 seconds). For fire suppression calls, in the past three years, the 90th percentile dispatch time was 106 seconds (1 minute and 46 seconds). The 90th percentile turnout and travel time of the first arriving unit was 531 seconds (8 minutes and 51 seconds). The 90th percentile time of the ERF unit or fourth arriving unit was 608 seconds (10 minutes and 8 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.

Figure 72: 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	1.2	1.2	1.1	1.1
Turnout Time	Turnout Time - 1st Unit	2.6	2.4	2.6	2.8
Travel Time	Travel Time - 1st Unit	5.6	5.6	5.5	5.6
	Travel Time - ERF (2nd Arriving Unit)	6.8	6.9	6.7	7.0
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	7.5	7.3	7.4	7.7
	Turnout and Travel Time - ERF (2nd Arriving Unit)	8.8	8.8	8.6	9.2
Sample Size	Alarm Handling	9,712	3,238	3,241	3,233
	1st Unit	11,549	3,847	3,886	3,816
	ERF	5,058	1,670	1,717	1,671

Figure 73: 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	1.8	1.4	1.7	2.2
Turnout Time	Turnout Time - 1st Unit	3.0	2.9	3.0	3.2
Travel Time	Travel Time - 1st Unit	6.6	6.6	6.8	6.6
	Travel Time - ERF (4th Arriving Unit)	7.7	7.5	7.2	8.9
Turnout and Travel Time	Turnout and Travel Time - 1st Unit	8.9	8.5	9.2	9.1
	Turnout and Travel Time - ERF (4th Arriving Unit)	10.1	10.0	10.1	11.2
Sample Size	Alarm Handling	725	237	247	241
	1st Unit	1,322	422	478	422
	ERF	103	30	39	34

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