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Draft Data Analysis

Martin County Fire Rescue and Stuart Fire Rescue
Fire and EMS Consolidation Feasibility Study
Martin County, Florida

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CONSULTANT DRAFT REPORT

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METHODOLOGY

We collected three different data sets: CAD, MCFR NFIRS, and SFR NFIRS. We cross validated CAD and NFIRS databases. In this report, we used NFIRS incident type to accurately categorize call types, and then we primarily used CAD data in our analysis. In this report, we focused our analysis on the 2014 fiscal year from October 2013 through September 2014.

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 involving either MCFR or SFR units. 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, Fire, Rescue, Hazard, Mutual aid, and Canceled, respectively. Since we are studying two agencies together, mutual aid calls are outside of both MCFR and SFR's jurisdictions. A canceled call means that all responding agencies indicated the incident was canceled. Thirty-one percent (31%) of the total emergency requests are from 911, and the majority requests are either transferred from the sheriff's office, or other sources. For 911 calls, the CAD system only captures the time an incident was created in the system. However, if a transferred request was dialed via a cell phone, the system captures the call received time. In our response time analysis, we compared dispatch time by call source and pointed out that the dispatch time of 911 calls is not complete. Instead, we focused our discussions on turnout time, and travel time. Since MCFR is contracted to provide emergency services to Jupiter Island and SFR is contracted to provide emergency services to Sewall's point, we discussed the demand and workload distribution and response time performances by jurisdiction.

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COMMUNITY RESPONSE HISTORY

In the 2014 fiscal year, MCFR and SFR responded to a total of 22,268 requests for service, or dispatches. EMS service requests totaled 17,384, accounting for 78.1% of the total number of incidents. The number of fire related calls was 3,161, which accounted for 14.2% of the dispatched incidents. A total of 17,058 incidents (76.6 percent) were in MCFR's jurisdiction; 4,520 incidents (20.3 percent) were in SFR's jurisdiction; 164 incidents (0.7 percent) were in Sewall's point; 136 incidents (0.6 percent) were in Jupiter Island; and 390 (1.8 percent) were mutual aid incidents outside Martin County. MCFR and SFR have both responded to 714 calls (3.2 percent), MCFR individually responded to 17,302 calls (77.7 percent), and SFR individually responded to 4,252 calls (19.1 percent).

The number of individual unit responses will be more reflective of total department workload since 71 percent of the calls resulted in multiple units dispatched. As summarized in Table 4, all units in MCFR and SFR combined made 46,403 responses, and were busy on emergency calls 26,894 hours. On average, each response lasted 35 minutes from dispatched to clear. MCFR units made 37,446 responses (80.7 percent), and SFR units made 8,957 responses (19.3 percent).

Table 1: Number of Incidents Dispatched by Category

Call Category	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	2,685	7.4	12.1%
Seizure and unconsciousness	1,696	4.6	7.6%
Breathing difficulty	1,929	5.3	8.7%
Overdose and psychiatric	638	1.7	2.9%
MVA	1,275	3.5	5.7%
Fall and injury	4,535	12.4	20.4%
Illness and other	4,626	12.7	20.8%
EMS Total	**17,384**	**47.6**	**78.1%**
Structure fire	79	0.2	0.4%
Outside fire	226	0.6	1.0%
Vehicle fire	69	0.2	0.3%
Marine fire	6	0.0	0.0%
False alarm	1,013	2.8	4.5%
Good intent	190	0.5	0.9%
Public service	1,325	3.6	6.0%
Fire other	253	0.7	1.1%
Fire Total	**3,161**	**8.7**	**14.2%**
Rescue	18	0.0	0.1%
Hazmat	89	0.2	0.4%
Mutual aid	390	1.1	1.8%
Canceled	1,226	3.4	5.5%
Total	**22,268**	**61.0**	**100.0%**

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Figure 1: Percentage of Total Incidents Dispatched by Program

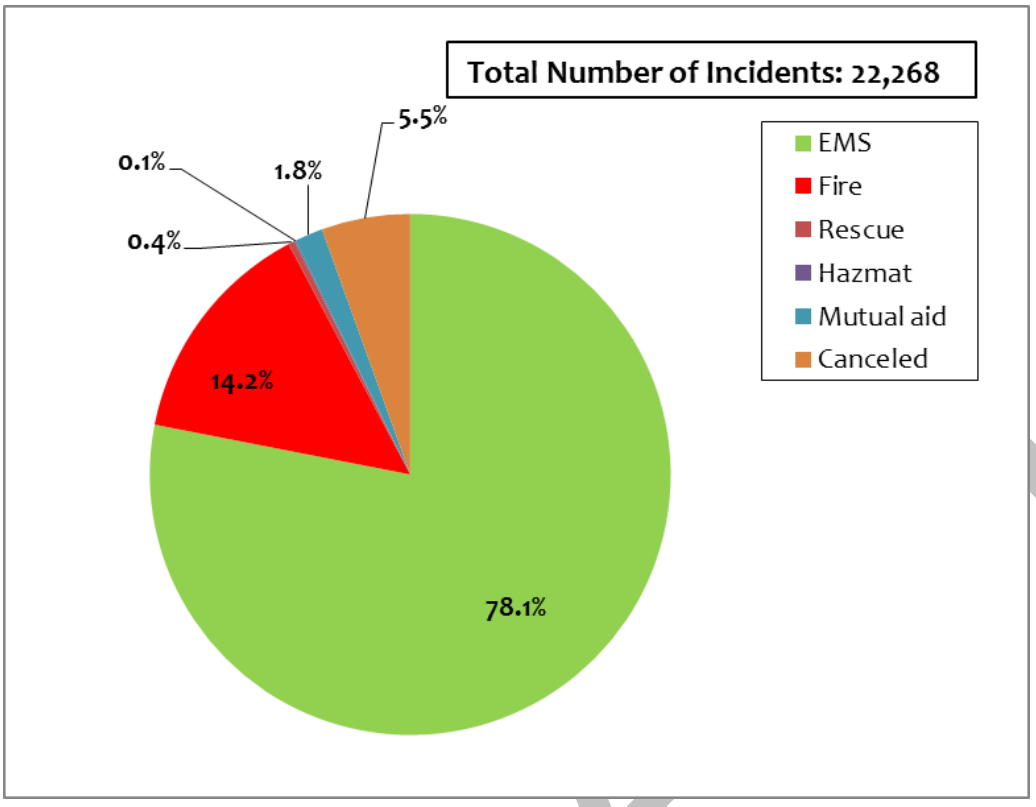

Table 2: Number of Incidents Dispatched by Category and Jurisdiction

Call Category	MCFR	SFR	Sewall's Point	Jupiter Island	Other
Cardiac and stroke	2,096	558	13	18	0
Seizure and unconsciousness	1,298	382	12	4	0
Breathing difficulty	1,460	450	9	10	0
Overdose and psychiatric	495	139	3	1	0
MVA	1,043	220	9	3	0
Fall and injury	3,311	1,150	40	34	0
Illness and other	3,513	1,049	28	36	0
EMS Total	**13,216**	**3,948**	**114**	**106**	**0**
Structure fire	66	10	1	2	0
Outside fire	198	26	1	1	0
Vehicle fire	62	7	0	0	0
Marine fire	6	0	0	0	0
False alarm	737	243	21	12	0
Good intent	176	13	1	0	0
Public service	1,237	79	5	4	0
Fire other	205	44	2	2	0

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Call Category	MCFR	SFR	Sewall's Point	Jupiter Island	Other
Fire Total	**2,687**	**422**	**31**	**21**	**0**
Rescue	8	10	0	0	0
Hazmat	69	14	4	2	0
Mutual aid	0	0	0	0	390
Canceled	1,078	126	15	7	0
Total	**17,058**	**4,520**	**164**	**136**	**390**
Percentage	**76.6**	**20.3**	**0.7**	**0.6**	**1.8**
Calls per Day	**46.7**	**12.4**	**0.4**	**0.4**	**1.1**

Table 3: Number of Incidents Requested by Jurisdiction and Source

Jurisdiction	Number of Calls	
	911	Other
MCFR	5,192	11,866
SFR	1,239	3,281
Sewall's Point	67	97
Jupiter Island	102	34
Mutual aid	370	20
Total	**6,970**	**15,298**
Percentage	**31.3**	**68.7**

Table 4: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response
EMS	17,384	35,646	2.1	21,078	35.5
Fire	3,161	7,082	2.2	4,267	36.1
Rescue	18	33	1.8	11	20.7
Hazmat	89	339	3.8	292	51.7
Mutual aid	390	576	1.5	839	87.4
Canceled	1,226	2,727	2.2	408	9.0
Total	**22,268**	**46,403**	**2.1**	**26,894**	**34.8**

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Table 5: Number of Calls, Number of Responses, and Total Busy Time by Responding Agency

	MCFR			SFR		
Program	Number of Calls	Number of Responses	Total Busy Hours	Number of Calls	Number of Responses	Total Busy Hours
EMS	13,667	27,908	17,216	4,210	7,738	3,862
Fire	2,769	6,230	3,850	547	852	417
Rescue	9	17	6	12	16	6
Hazmat	74	304	267	22	35	26
Mutual aid	388	559	833	10	17	7
Canceled	1,109	2,428	348	165	299	59
Total	**18,016**	**37,446**	**22,519**	**4,966**	**8,957**	**4,376**

Note: A total of 714 incidents have both MCFR and SFR units responding.

MCFR units made 1,464 unit responses to a total of 447 incidents in SFR's jurisdiction, among which 79% were EMS requests. Whereas, SFR units made 1,530 unit responses to a total of 356 incidents in MCFR's jurisdiction, among which EMS requests were 59% of the total and fire requests were 31% of the total.

Table 6: Number of Calls and Number of Responses by Jurisdiction and Responding Agency

	MCFR Units Responding to SFR Calls		SFR Units Responding to MCFR Calls	
Call Category	Number of Calls	Number of Responses	Number of Calls	Number of Responses
EMS	353	944	210	737
Fire	65	421	109	621
Rescue	2	3	5	5
Hazmat	1	4	2	45
Canceled	26	92	30	122
Total	**447**	**1,464**	**356**	**1,530**

Overall, a total of 46% of EMS calls were hot responses (Bravo, Delta and Echo). For non-transport EMS requests, Bravo calls were the largest category, which accounted for 38 of the total non-transport EMS requests. For transport EMS requests, Alpha calls were the largest category and had 31% of the total requests.

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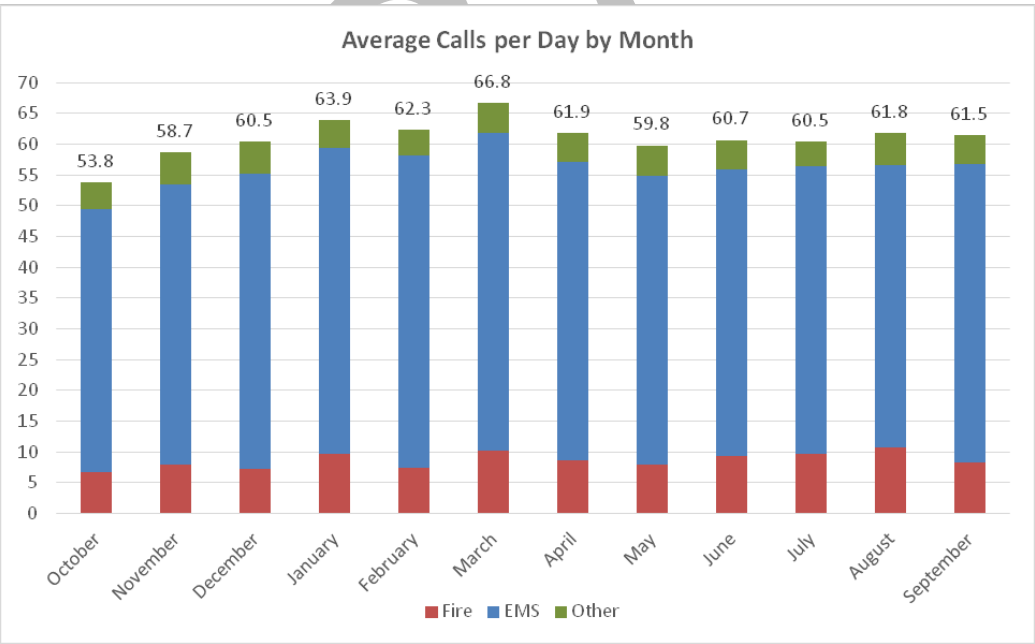
Table 7: Number of EMS Calls by Response Determinant and Transport

Response Determinant	Number of EMS Calls			Call Percentage
	Non-Transport	Transport	Total	
Alpha	1,110	4,319	5,429	31.2%
Bravo	1,305	3,012	4,317	24.8%
Charlie	435	3,479	3,914	22.5%
Delta	478	3,028	3,506	20.2%
Echo	62	98	160	0.9%
Omega	13	37	50	0.3%
Missing	6	2	8	0.0%
Total	**3,409**	**13,975**	**17,384**	**100.0%**

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, rescue, hazmat, mutual aid and canceled calls were grouped into the other category for presentation purpose.

Overall, average requests per month ranged from a low of 53.8 per day in October 2013 to a high of 66.8 per day in March 2014. The top three months with the most demands in the descending order are: March (66.8 per day), January (63.9 per day) and February (62.3 per day).

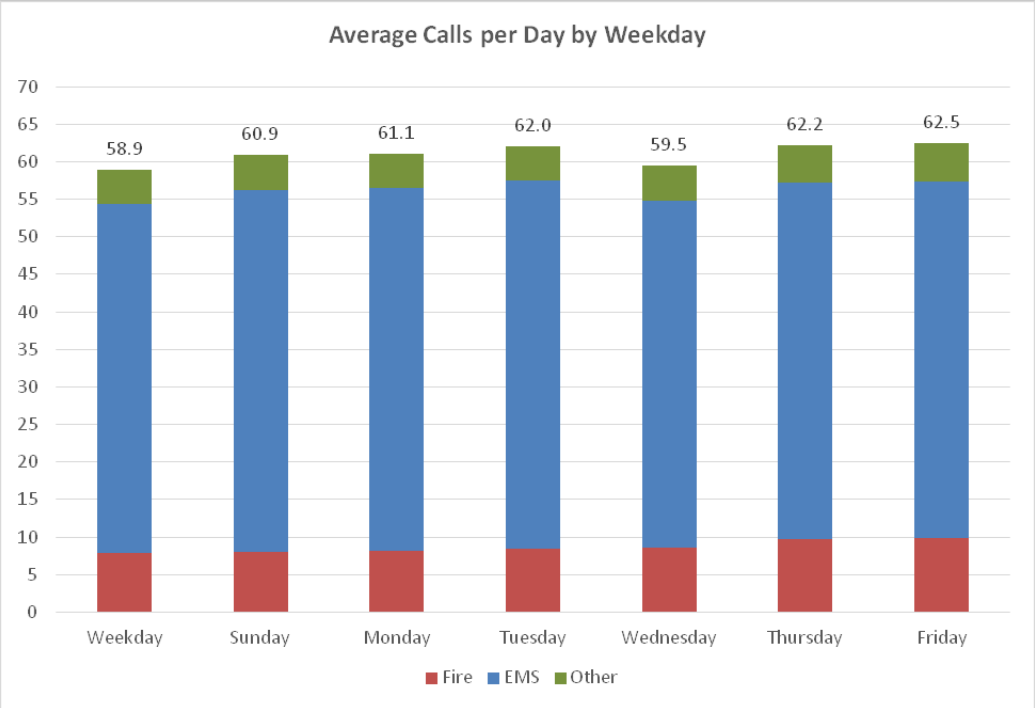
Figure 2: Overall: Average Calls per Day by Month



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 lows for the week at 3,061 calls

or 58.9 calls per day. Wednesday has the highest frequency of requests for services at 3,286 calls or 62.0 calls per day.

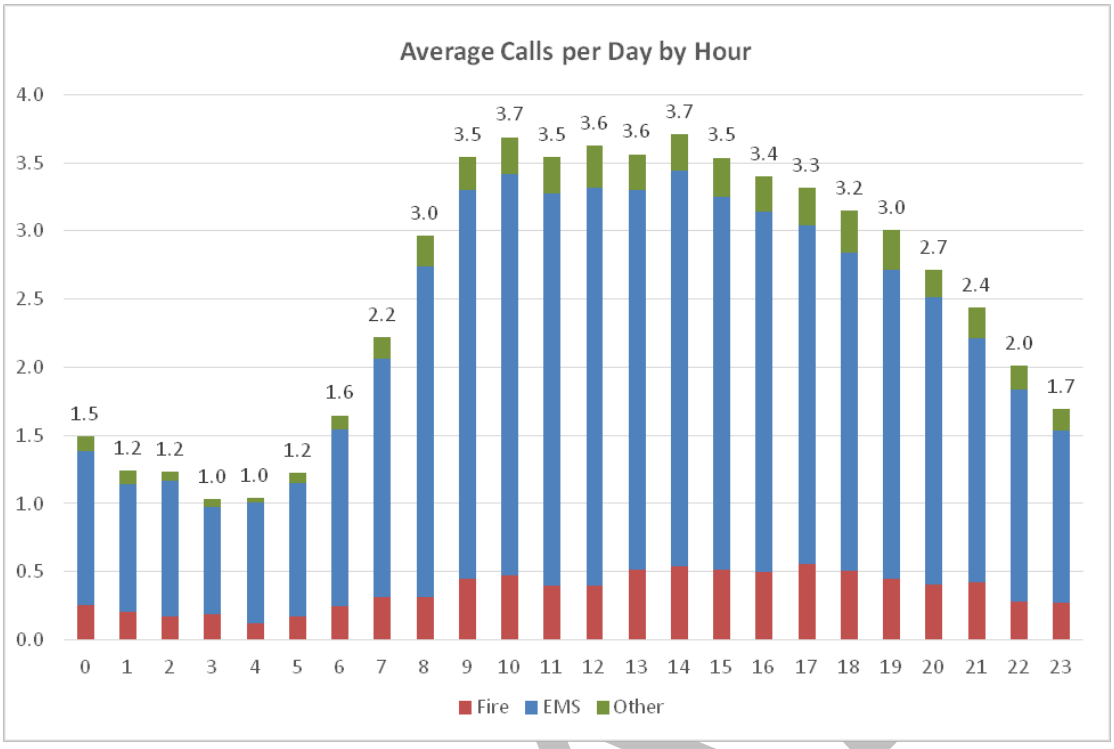
Figure 3: Overall: Average Calls per Day by Weekday



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 0900 and 1800 are above 1,150 calls in a year. The average number of calls per hour is 928. The data illustrates that the busiest times of the day are between 0900 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 1400 with 1,353 calls during that hour. The average number of calls per hour is a daily average for those 1,353 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1400 with an average hourly call volume at 3.7 calls per hour. The second busiest hour is at 1000 with 1,346 calls during the hour, and averaged 3.7 calls per hour.

Figure 4: Overall: Average Calls per Day by Hour



Overall, MCFR's units made 37,446 unit responses, and the total busy hours were 22,519 hours. Stations 30, 21 and 23 were the top three busiest stations. Rescue 30, rescue 21, engine 21, engine 30, and rescue 23 each made more than 2,000 responses, and were the top 5 most utilized units. SFR's units made 8,957 unit responses, and the total busy hours were 4,376 hours. Rescue R1, and engine E2 were the two most utilized units in SFR.

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Table 8: Overall Workload by Agency and Station

Agency	Station	Avg. Busy Minutes per Unit Response	Annual Busy Unit Hours	Annual Total Unit Responses
MCFR	11	68.9	136	118
MCFR	14	35.1	943	1,613
MCFR	16	35.2	2,217	3,776
MCFR	18	37.8	1,658	2,630
MCFR	21	35.3	2,832	4,818
MCFR	22	43.9	1,817	2,482
MCFR	23	31.9	2,189	4,120
MCFR	24	48.7	1,722	2,120
MCFR	30	31.5	2,600	4,952
MCFR	32	38.8	1,545	2,387
MCFR	33	36.5	2,152	3,540
MCFR	34	27.1	62	137
MCFR	36	43.4	899	1,243
MCFR	HQ	29.9	1,749	3,510
MCFR Total		**36.1**	**22,519**	**37,446**
SFR	One	28.6	2,322	4,864
SFR	Two	30.1	2,054	4,093
SFR Total		**29.3**	**4,376**	**8,957**

Table 9: Overall Workload by MCFR Unit

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
11	LIFESTAR	ALS Aeromedical Helicopter	72.6	114	94
	R11	Rescue	54.7	22	24
14	E14	Engine	26.7	14	32
	Q14	Quint	22.4	257	688
	R14	Rescue	45.1	672	893
16	B16	Brush truck	70.7	19	16
	E16	Engine	22.0	648	1,770
	R16	Rescue	46.5	1,532	1,976
	T16	tanker	78.4	18	14
18	E18	Engine	26.5	492	1,112
	HM18	Hazmat	47.4	91	115
	R18	Rescue	45.8	1,067	1,398
	SQ18	Hazmat	98.5	8	5
21	B21	Brush truck	118.2	67	34
	E21	Engine	23.4	910	2,329
	R21	Rescue	44.6	1,793	2,411

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Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	T21	tanker	83.8	61	44
22	B22	Brush truck	122.7	78	38
	E22	Engine	36.6	714	1,171
	R22	Rescue	46.7	958	1,231
	T22	tanker	96.8	68	42
23	E23	Engine	16.8	13	45
	Q23	Quint	21.6	684	1,897
	R23	Rescue	41.1	1,493	2,178
24	B241	Brush truck	116.7	72	37
	B242	Brush truck	134.3	56	25
	E24	Engine	30.6	386	758
	R241	Rescue	53.6	586	656
	R242	Rescue	52.9	518	588
	T24	tanker	95.3	84	53
	T28	tanker	383.2	19	3
30	B30	Brush truck	62.0	43	42
	E30	Engine	20.1	770	2,294
	R30	Rescue	41.0	1,786	2,616
32	B32	Brush truck	220.4	48	13
	E32	Engine	27.9	507	1,092
	R32	Rescue	45.3	950	1,257
	T32	tanker	97.0	40	25
33	E33	Engine	23.8	78	196
	Q33	Quint	21.4	495	1,388
	R33	Rescue	46.6	1,459	1,880
	RIB33	Dive Rescue Boat	189.9	22	7
	SPOP33	Technical Extrication Unit	68.6	55	48
	WR33	Water Rescue Truck	122.9	43	21
34	MEDIC34	non-transport ALS unit	27.1	62	137
36	B36	Brush truck	90.2	3	2
	E36	Engine	28.9	271	562
	R36	Rescue	55.2	625	679
NA	B91	Brush truck (backup)	352.7	35	6
	BAT1	Battalion Chief	31.1	321	619
	BAT2	Battalion Chief	31.0	227	439
	BAT3	Battalion Chief-floater	20.7	31	90
	E90	Engine (special events)	498.4	8	1

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Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	E91	Engine (special events)	536.2	27	3
	EMS1	EMS Supervisor	23.8	215	542
	EMS2	EMS Supervisor	25.7	458	1,069
	EMS3	EMS Supervisor	21.4	203	568
	EMS4	EMS Supervisor-floater	16.4	22	79
	EVENT1	ALS (special events)	97.4	94	58
	EVENT2	ALS (special events)	122.8	33	16
	R91	Rescue (special events)	152.5	25	10
	RECON1	Brush fire support unit	161.4	16	6
	T90	tanker (backup)	494.5	8	1
	T91	tanker (backup)	525.4	26	3

Table 10: Overall Workload by SFR Unit

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
One	B1	Brush Truck	124.1	15	7
	BAT5	Com Vehicle	22.1	301	817
	E1	Engine	20.8	434	1,249
	Q1	Ladder	23.2	251	649
	R1	Rescue	37.0	1,322	2,142
Two	E2	Engine	21.1	663	1,886
	R2	Rescue	37.8	1,392	2,207

Currently, the CAD data from 911 only captures the time a dispatcher created the call, not the time a citizen dialed 911. For calls transferred from the sheriff office, or other sources, the call received time is captured if the citizen has used a cell phone. We investigated the average and 90th percentile dispatch times by call source, and the differences are significant. This level of difference was very unlikely to happen given the same group of dispatchers were handling the calls. It does inform us that the interval from the time that a call is created until the time a unit is dispatched only accounts for a small portion of the whole dispatch process.

To study the efficiencies of the two fire departments, the major body of the report is restricted to analyze turnout time, travel time, and the sum of turnout and travel that best reflects total response time not including the dispatch interval.

This analysis utilized the first arriving units of all distinct incidents excluding mutual aid and canceled incidents. The mean (average) turnout time was 108 seconds (one minute and 48 seconds), travel

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time was 294 seconds (four minutes 54 seconds), and turnout and travel time was 402 seconds (six minutes 42 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 performance for turnout time at the 90th percentile is 165 seconds (two minutes and 45 seconds), travel time is 476 seconds (seven minutes and 46 seconds), and turnout and travel time is 597 seconds (9 minutes and 57 seconds). 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.
The response time performance also varies by jurisdiction, the average and 90th percentile response time from shortest to longest by jurisdiction in that order are: Jupiter Island, SFR, MCFR and Sewall's Point.

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, these 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 rescue and hazmat calls. Since there are only 17 rescue calls used in this analysis, the 90th percentile is essential the second longest time.

Table 11: Average and 90th Percentile Dispatch Time by Call Source

Call Source	Average	90th Percentile	Sample Size
911	0.3	0.6	5,191
Other	1.8	2.8	14,464

Table 12: Average Turnout and Travel Time of First Arriving Units by Program

Program	Turnout Time	Travel Time	Turnout and Travel	Sample Size
EMS	1.8	4.8	6.6	16,581
Fire	2.1	5.5	7.6	2,974
Rescue	1.4	4.6	6.0	17
Hazmat	2.3	5.4	7.7	83
Total	**1.8**	**4.9**	**6.7**	**19,655**

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Figure 5: Average Turnout and Travel Time by Call Category

Table 13: 90th Percentile Turnout and Travel Time of First Arriving Units by Program

Program	Turnout Time	Travel Time	Turnout and Travel	Sample Size
EMS	2.7	7.7	9.7	16,581
Fire	3.0	9.3	11.4	2,974
Rescue	2.6	9.4	10.8	17
Hazmat	3.2	8.3	10.8	83
Total	**2.8**	**7.9**	**10.0**	**19,655**

Table 14: Average Turnout and Travel Time of First Arriving Units by Jurisdiction

Jurisdiction	Turnout Time	Travel Time	Response Time	Sample Size
MCFR	2.0	5.0	8.4	15,196
SFR	1.3	4.5	7.2	4,204
Sewall's Point	1.4	7.7	10.5	139
Jupiter Island	1.2	3.9	5.9	116
Total	**1.8**	**4.9**	**8.1**	**19,655**

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

Jurisdiction	Turnout Time	Travel Time	Response Time	Sample Size
MCFR	2.9	8.2	10.4	15,196
SFR	2.0	6.8	8.3	4,204
Sewall's Point	2.2	10.8	12.2	139
Jupiter Island	2.3	6.8	8.1	116
Total	**2.8**	**7.9**	**10.0**	**19,655**

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The average and 90th percentile response time performances did not vary significantly by MPDS response determinant. The 90th percentile of turnout and travel time varied between 9.2 and 9.9 minutes.

Table 16: Average and 90th percentile Turnout and Travel Time by Response Determinant for EMS Calls

Response Determinant	Mean			90th Percentile			Sample Size
	Turnout Time	Travel Time	Response Time	Turnout Time	Travel Time	Response Time	
Alpha	1.7	5.1	6.8	2.6	8.0	9.9	5,114
Bravo	1.7	4.7	6.5	2.6	7.7	9.6	4,092
Charlie	1.7	4.6	6.3	2.6	7.2	9.2	3,772
Delta	1.9	4.6	6.5	2.8	7.5	9.8	3,399
Echo	1.9	4.5	6.3	2.8	7.6	9.5	157
Omega	1.8	5.2	7.1	2.8	7.4	9.5	43
Total	1.8	4.8	6.6	2.7	7.7	9.7	**16,577**

Fire 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 Fiscal 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: August (10.7 per day), March (10.3 per day), and July (9.7 per day). The three months with least fire calls in order were: October (6.7 per day), December (7.2 per day), and February (7.5 per day). Results are presented below in Table 17 and Figure 6.

Table 17: Total Fire Related Calls per Month

Month	Number of Calls	Calls per Day	Call Percentage
October	207	6.7	6.5
November	239	8.0	7.6
December	223	7.2	7.1
January	298	9.6	9.4
February	209	7.5	6.6
March	318	10.3	10.1
April	260	8.7	8.2
May	245	7.9	7.8
June	278	9.3	8.8
July	302	9.7	9.6
August	333	10.7	10.5
September	249	8.3	7.9
Total	**3,161**	**8.7**	**100.0**

Note: 2014 fiscal year is from October, 2013 through September, 2014.

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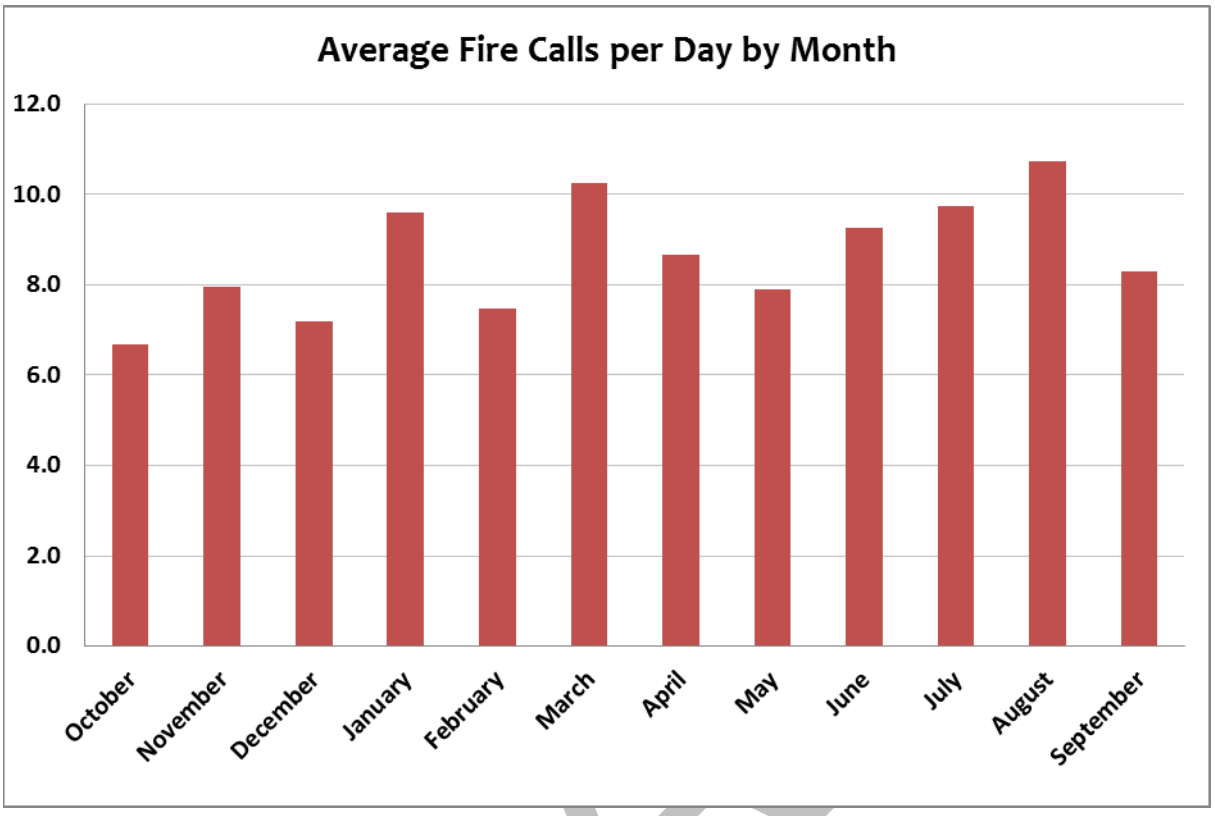
Figure 6: Average Fire Related Calls per Month of 2014



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. Sunday was the lowest for the week, averaging 7.8 per day or 12.8 of the fire related calls for the week. Friday has the highest frequency of requests for fire related services averaging 9.9 calls per day and 16.3%. Results for this analysis are presented below in Table 18 and Figure 7.

Table 18: Total Fire Related Calls by Day of Week for 2014

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	406	7.8	12.8
Monday	421	8.1	13.3
Tuesday	451	8.7	14.3
Wednesday	447	8.6	14.1
Thursday	506	9.5	16.0
Friday	515	9.9	16.3
Saturday	415	8.0	13.1
Total	**3,161**	**8.7**	**100.0**

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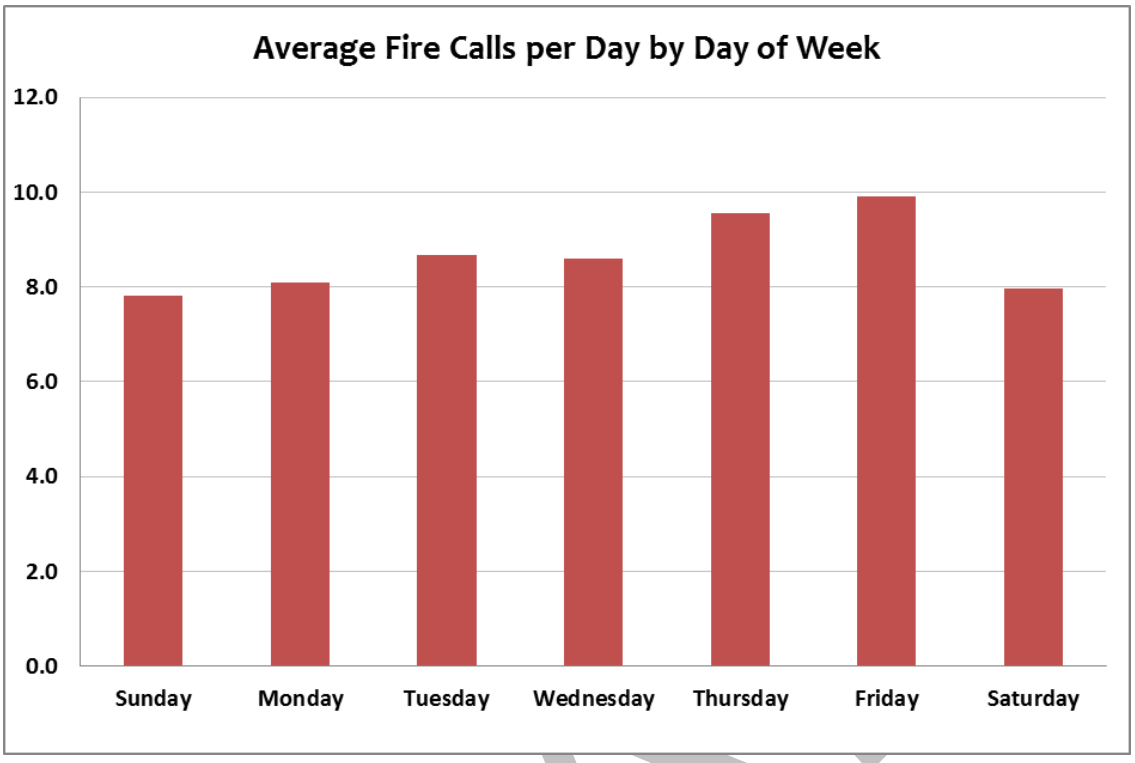
Figure 7: Average Fire Related Calls by Day of Week for 2014



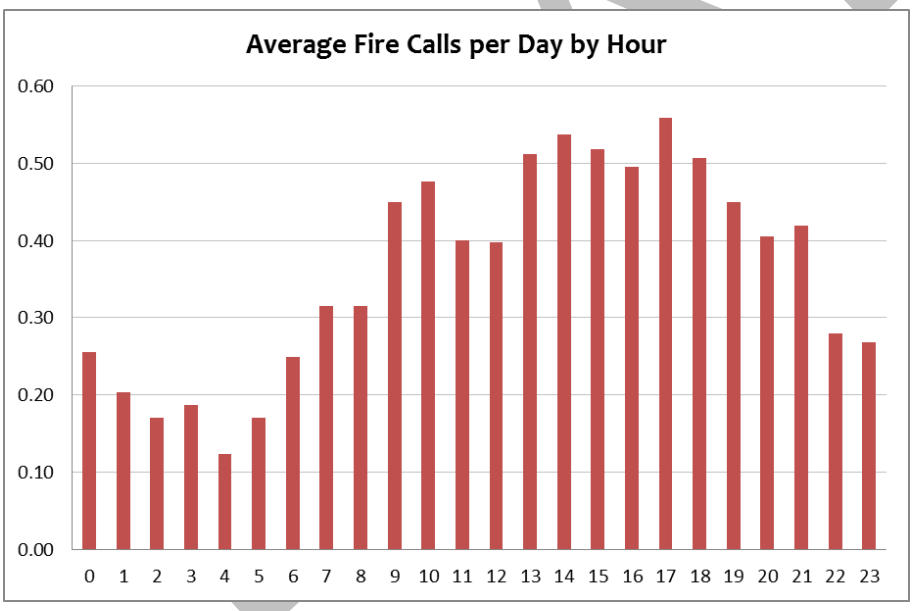
Fire related calls were evaluated by the hour of the day. Considerable variability exists in the time of day that requests for fire related services are received. The hours that include midnight to 0600 have the lowest demands. While the middle of the day has the greatest frequency of calls, specifically the 13 hours period from 0900 through 2200 are above 145 calls in a year. The average number of calls per hour in a year is 132. The data illustrates that the busiest times of the day for fire related incidents are between 1300 and 1900. 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 Table below, the busiest hour is at 1700 with 204 calls during that hour in 2014. The average number of calls per hour is a daily average for those 204 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1700 with an average hourly call volume of less than 1 at 0.56 calls per hour. Below are the results in Table 19 and Figure 8.

Table 19: Total and Average Fire Related Calls by Hour of Day for 2014

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	93	0.3	2.9
1	74	0.2	2.3
2	62	0.2	2.0
3	68	0.2	2.2
4	45	0.1	1.4
5	62	0.2	2.0
6	91	0.2	2.9

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
7	115	0.3	3.6
8	115	0.3	3.6
9	164	0.4	5.2
10	174	0.5	5.5
11	146	0.4	4.6
12	145	0.4	4.6
13	187	0.5	5.9
14	196	0.5	6.2
15	189	0.5	6.0
16	181	0.5	5.7
17	204	0.6	6.5
18	185	0.5	5.9
19	164	0.4	5.2
20	148	0.4	4.7
21	153	0.4	4.8
22	102	0.3	3.2
23	98	0.3	3.1
Total	**3,161**	**8.7**	**100.0**

Figure 8: 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 NFIRS databases. Both MCFR and SFR submitted their NFIRS records to FL state, and the NFIRS incident types reflect the nature of emergency. Public service was the most frequent community demand (averaging at 3.6 requests per day), followed by false alarm (averaging at 2.8 requests per day). Responses to structure, outside, vehicle and marine fires totaled 380 (averaging about one request per day), and outside fire is the largest category.

Fire incidents in MCFR averaged 7.4 per day, and accounted for 85 percent of the fire related incidents total. Fire incidents in SFR averaged 1.2 per day, and accounted for 13 percent of the fire related incidents total. Actual Fires include structure, outside, vehicle, and marine fires.

Table 20: Total Fire Related Calls by Jurisdiction and Category

Call Category	MCFR	SFR	Sewall's Point	Jupiter Island	Total	Calls per Day
Structure fire	66	10	1	2	79	0.2
Outside fire	198	26	1	1	226	0.6
Vehicle fire	62	7	0	0	69	0.2
Marine fire	6	0	0	0	6	0
False alarm	737	243	21	12	1,013	2.8
Good intent	176	13	1	0	190	0.5
Public service	1,237	79	5	4	1,325	3.6
Fire other	205	44	2	2	253	0.7
Fire Total	**2,687**	**422**	**31**	**21**	**3,161**	**8.7**
Actual Fire Calls per Day	**0.9**	**0.1**	**0.0**	**0.0**	**1.0**	**NA**
Fire Related Calls per Day	**6.5**	**1.0**	**0.1**	**0.0**	**7.6**	**NA**
Percent of Fire Total	**85.0%**	**13.4%**	**1.0%**	**0.7%**	**100%**	**NA**

MCFR made a total of 6,230 responses to fire related calls. The total time on task was 3,850 hours, and the average time on task was 37.3 minutes. Quint Q23 was the most utilized unit of all units in fire related calls, and it made 505 responses, and spent 227 hours on task. Of the 11 regularly staffed engines, E21 is the most utilized unit in fire related calls, followed by E30 and E46. Of the 13 regularly staffed rescue units, R21 is the most utilized unit in fire related calls, followed by R23, and R30.

SFR made a total of 852 responses to fire related calls. The total time on task was 417 hours, and the average time on task was 29.5 minutes. Engine E2 is the most utilized unit in fire related calls, and made 239 responses.

Table 21: Workload by MCFR Unit for Fire Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
11	LIFESTAR	ALS Aeromedical Helicopter	89.3	1.5	1
	R11	Rescue	18.7	1.6	5
	Total		**30.5**	**3.1**	**6**
14	E14	Engine	21.6	2.9	8
	Q14	Quint	21.1	62.9	179
	R14	Rescue	20.8	42.2	122
	Total		**21.0**	**108.0**	**309**
16	B16	Brush truck	64.2	16.0	15
	E16	Engine	22.0	94.4	258

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Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	R16	Rescue	18.5	71.3	231
	T16	tanker	76.7	15.3	12
	Total		**23.0**	**197.1**	**516**
18	E18	Engine	35.8	114.5	192
	HM18	Hazmat	51.6	37.8	44
	R18	Rescue	24.8	79.1	191
	SQ18	Hazmat	98.5	8.2	5
	Total		**33.3**	**239.6**	**432**
21	B21	Brush truck	124.5	64.3	31
	E21	Engine	33.4	234.8	423
	R21	Rescue	21.7	122.1	337
	T21	tanker	95.1	60.3	39
	Total		**34.9**	**481.5**	**830**
22	B22	Brush truck	139.8	76.9	34
	E22	Engine	49.5	183.3	222
	R22	Rescue	34.8	95.7	165
	T22	tanker	112.3	63.6	34
	Total		**55.4**	**419.5**	**455**
23	E23	Engine	14.0	0.9	4
	Q23	Quint	27.2	227.3	505
	R23	Rescue	21.3	117.2	333
	Total		**24.8**	**345.4**	**842**
24	B241	Brush truck	136.3	70.4	35
	B242	Brush truck	129.7	47.6	23
	E24	Engine	57.3	142.2	149
	R241	Rescue	66.2	85.0	80
	R242	Rescue	63.5	77.2	79
	T24	tanker	106.3	79.7	46
	T28	tanker	571.3	19.0	2
	Total		**78.4**	**521.1**	**414**
30	B30	Brush truck	64.8	40.0	37
	E30	Engine	26.4	135.3	308
	R30	Rescue	21.2	88.5	251
	Total		**26.6**	**263.8**	**596**
32	B32	Brush truck	220.4	47.8	13
	E32	Engine	34.2	137.9	242
	R32	Rescue	22.2	85.1	230
	T32	tanker	79.2	29.0	22
	Total		**35.5**	**299.8**	**507**
33	E33	Engine	21.9	8.4	23
	Q33	Quint	27.7	111.2	242
	R33	Rescue	23.8	88.2	222
	RIB33	Dive Rescue Boat	183.0	12.2	4

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Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	SPOP33	Technical Extrication Unit	157.6	42.0	16
	WR33	Water Rescue Truck	245.2	28.6	7
	Total		**34.0**	**290.6**	**514**
34	MEDIC34	ALS unit	34.8	12.2	21
36	B36	Brush truck	90.2	3.0	2
	E36	Engine	28.7	54.1	113
	R36	Rescue	36.5	69.3	115
	Total		**33.1**	**126.4**	**230**
NA	B91	Brush truck (backup)	326.2	27.2	5
	BAT1	Battalion Chief	56.9	164.1	175
	BAT2	Battalion Chief	67.1	108.5	102
	BAT3	Battalion Chief- floater	32.2	14.0	28
	E91	Engine (special events)	556.2	18.5	2
	EMS1	EMS Supervisor	35.9	31.1	52
	EMS2	EMS Supervisor	45.5	81.9	113
	EMS3	EMS Supervisor	40.4	35.0	52
	EMS4	EMS Supervisor- floater	16.4	3.3	12
	EVENT1	ALS (special events)	167.3	25.1	9
	EVENT2	ALS (special events)	170.1	5.7	2
	R91	Rescue (special events)	4.1	0.1	1
	RECON1	Brush fire support unit	191.2	9.6	3
	T91	tanker (backup)	541.4	18.0	2
	Total		**59.8**	**542.0**	**558**
MCFR Total			**37.3**	**3850.1**	**6,230**

Table 22: Workload by SFR Unit for Fire Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
One	B1	Brush Truck	124.1	14.5	7
	BAT5	Com Vehicle	34.2	65.0	114
	E1	Engine	25.9	79.1	184
	Q1	Ladder	28.7	77.0	161
	R1	Rescue	39.3	53.1	81
	Total		**31.7**	**288.6**	**547**
Two	E2	Engine	24.2	95.3	239
	R2	Rescue	29.9	32.9	66
	Total		**25.5**	**128.2**	**305**
SFR Total			**29.5**	**416.8**	**852**

We are able to collect property and content loss information from MCFR. A total of 60 structure fire, outside fire or vehicle fire calls have recorded a property loss, and the total property loss is $1.77

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million. A total of 31 structure fire, outside fire or vehicle fire calls have recorded content loss, and the total content loss is $0.65 million.

Table 23: MCFR Property and Content Loss by Call Type

	MCFR					
	Property Loss			Content Loss		
Call Type	Dollar Amount	Average Loss per Call	Number of Calls	Dollar Amount	Average Loss per Call	Number of Calls
Structure fire	$1,244,470	$54,107	23	$586,500	$34,500	17
Outside fire	$7,000	$875	8	$1,100	$367	3
Vehicle fire	$520,500	$17,948	29	$62,350	$5,668	11
Total	**$1,771,970**	**$29,533**	**60**	**$649,950**	**$20,966**	**31**

Emergency Medical Services

MCFR and SFR provide emergency Medical Services (EMS) to their respective jurisdictions. MCFR is contracted to provide EMS services to Jupiter Island and SFR is contracted to provide EMS services to Sewall's point. Requests for EMS are categorized as granular call categories using the initial CAD call description. Both agencies also provide patient transport services to local hospitals.

Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed by month of year, day of week, and hour of day. There is minor variability between months of the year with March (51.6 EMS requests per day) receiving the most requests for service and October (42.8 EMS requests per day) the least. Results are presented in tabular form as Table 24 and Figure 9 below.

Table 24: Annual Total and Average per Day of EMS Calls by Month of Year

Month	Number of Calls	Calls per Day	Call Percentage
October	1,328	42.8	7.6
November	1,364	45.5	7.8
December	1,489	48.0	8.6
January	1,546	49.9	8.9
February	1,421	50.8	8.2
March	1,600	51.6	9.2
April	1,453	48.4	8.4
May	1,455	46.9	8.4
June	1,402	46.7	8.1
July	1,446	46.6	8.3
August	1,423	45.9	8.2
September	1,457	48.6	8.4
Total	**17,384**	**47.6**	**100.0**

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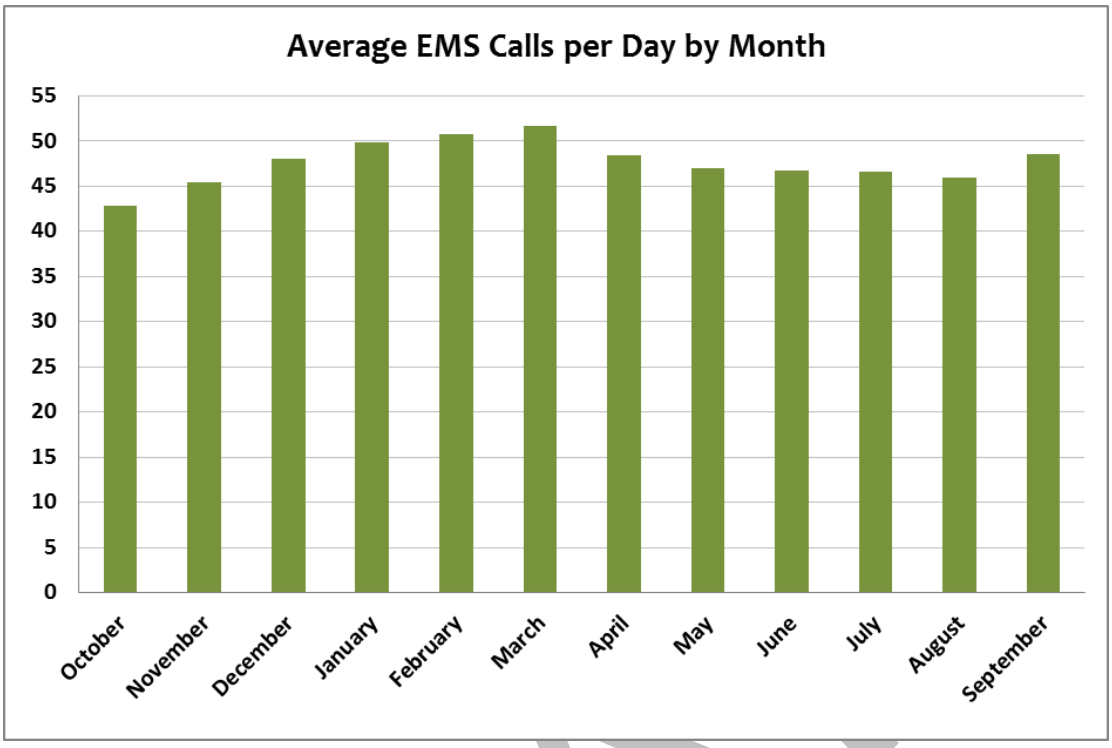
Figure 9: Average EMS Calls per Day by Month of Year

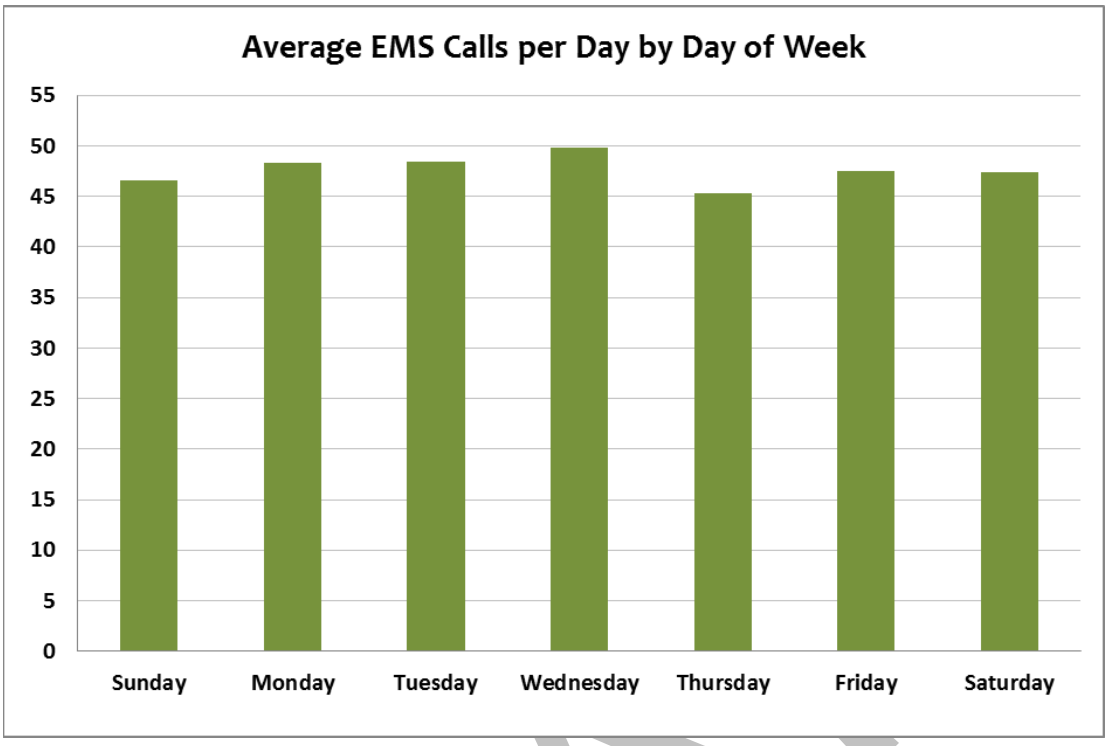


Similar analyses were conducted examining the frequency of requests for service by the day of the week. Once again, there is only minor variability in the demand for services by the day of the week. However, Wednesday receives the most requests for service and Thursday the least. Results are provided below as Table 25 and Figure 10, respectively.

Table 25: Annual Total and Average per Day of EMS Calls by Day of Week

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	2,425	46.6	13.9
Monday	2,511	48.3	14.4
Tuesday	2,516	48.4	14.5
Wednesday	2,594	49.9	14.9
Thursday	2,401	45.3	13.8
Friday	2,470	47.5	14.2
Saturday	2,467	47.4	14.2
Total	**17,384**	**47.6**	**100.0**

Figure 10: Average EMS Calls per Day by Day of Week



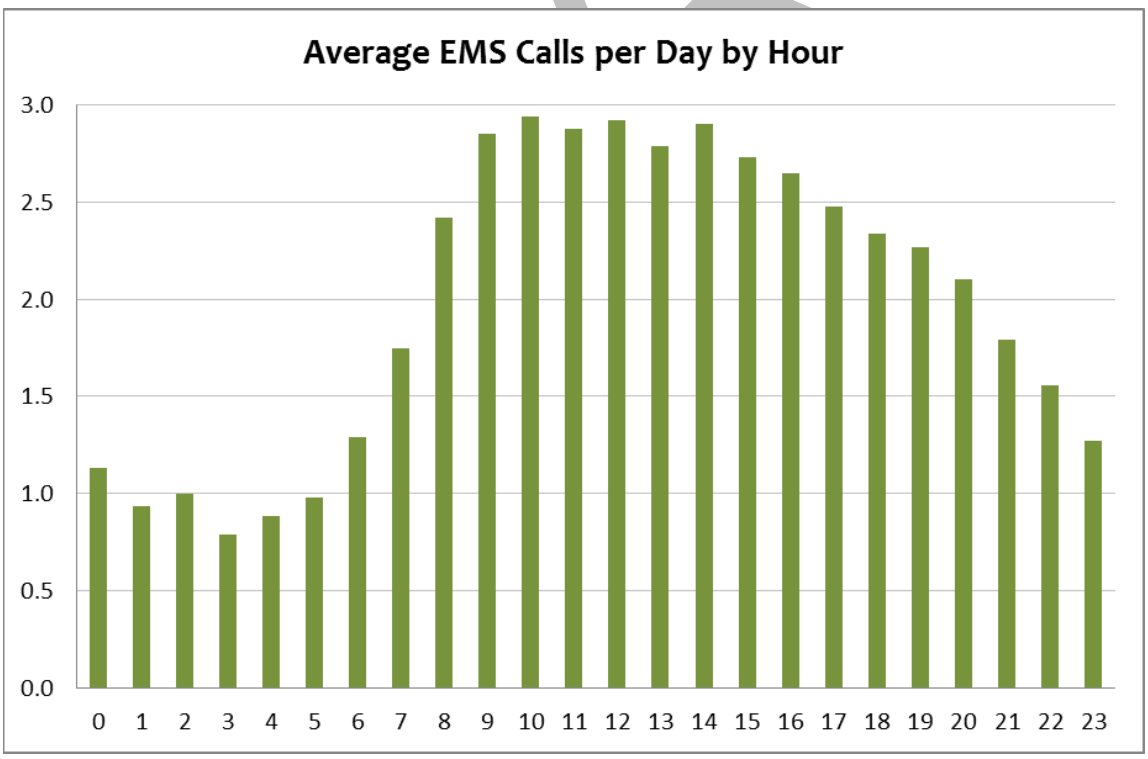
Finally, the analyses for EMS services are concluded by identifying the EMS calls by hour of day and the average hourly rate of EMS calls per hour. The demand curve for requests for EMS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls begins in the morning at 0800 and continues to increase until 1100, stabilize until 1500 and then decreases until the low of 0300. The demand peak is from 0900 until 1500, the hourly calls in the study year totaled above 1,000 calls each hour. The average hourly rate of service requests is 2.0 for any hour during the day with the peak occurring at 1000 of 2.9 calls on average during the hour, and a low at 0300 of 0.8 calls on average during that hour. Results are provided below as Table 26 and Figure 11.

Table 26: Annual Total and Average per Day of EMS Calls by Hour of Day

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
0	412	1.1	2.4
1	342	0.9	2.0
2	363	1.0	2.1
3	288	0.8	1.7
4	322	0.9	1.9
5	358	1.0	2.1
6	471	1.3	2.7
7	637	1.7	3.7
8	884	2.4	5.1

Hour of Day	Number of Calls	Calls per Hour	Call Percentage
9	1,041	2.9	6.0
10	1,074	2.9	6.2
11	1,050	2.9	6.0
12	1,065	2.9	6.1
13	1,017	2.8	5.9
14	1,059	2.9	6.1
15	996	2.7	5.7
16	966	2.6	5.6
17	905	2.5	5.2
18	852	2.3	4.9
19	828	2.3	4.8
20	768	2.1	4.4
21	654	1.8	3.8
22	569	1.6	3.3
23	463	1.3	2.7
Total	**17,384**	**47.6**	**100.0**

Figure 11: Average EMS Calls per Day by Hour of Day



For these analyses, EMS incidents are an aggregated category of the various granular EMS requests categorized based upon CAD call description. Illness and other was the most frequent community

demand (averaging 12.7 requests per day), followed by fall and injury (averaging 12.4 requests per day). Cardiac and stroke requests totaled 2,685, averaging 7.4 requests per day. EMS requests in MCFR averaged 36.2 per day, and accounted for 76 percent of the EMS total. EMS requests in SFR averaged 10.8 per day, and accounted for 23 percent of the EMS total.

Table 27: Total Fire Related Calls by Jurisdiction and Category

Call Category	MCFR	SFR	Sewall's Point	Jupiter Island	Total	Calls per Day
Cardiac and stroke	2,096	558	13	18	2,685	7.4
Seizure and unconsciousness	1,298	382	12	4	1,696	4.6
Breathing difficulty	1,460	450	9	10	1,929	5.3
Overdose and psychiatric	495	139	3	1	638	1.7
MVA	1,043	220	9	3	1,275	3.5
Fall and injury	3,311	1,150	40	34	4,535	12.4
Illness and other	3,513	1,049	28	36	4,626	12.7
EMS Total	**13,216**	**3,948**	**114**	**106**	**17,384**	**47.6**
EMS Calls per Day	**36.2**	**10.8**	**0.3**	**0.3**	**47.6**	**NA**
Percent of EMS Total	**76.0%**	**22.7%**	**0.7%**	**0.6%**	**100.0%**	**NA**

MCFR and SFR contribute considerable resources to the service area. The department sends multiple units to the 75 percent of the EMS incidents responded to by the department. On average, 2.1 units were dispatched per EMS call.

MCFR units made a total of 27,908 responses to EMS calls. The total time on task was 17,216 hours, and the average time on task was 37 minutes. Rescue R30 was the most utilized unit of all units in EMS calls, and it made 2,169 responses, and spent 1,661 hours on task. Of the 11 regularly staffed engines, E30 is the most utilized unit in EMS calls, followed by E21 and E16. A total of six rescue units made more than 1,000 responses in a year, and they are: R30, R21, R23, R16, R33, and R18. Lifestar helicopter made 73 responses to EMS calls. Please note that a total of 647 Lifestar standbys are not included in this report.

SFR units made a total of 7,738 responses to EMS calls. The total time on task was 3,862 hours, and the average time on task was 30 minutes. R2 and R1 were the most utilized units in EMS calls. R2 made 2,076 responses and R1 made 1,981 responses.

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Table 28: Workload by MCFR Unit for EMS Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
11	LIFESTAR	ALS Aeromedical Helicopter	81.9	99.6	73
	R11	Rescue	43.1	12.2	17
	Total		**74.5**	**111.8**	**90**
14	E14	Engine	29.4	11.3	23
	Q14	Quint	24.0	173.8	437
	R14	Rescue	50.8	580.9	690
	Total		**40.2**	**766.0**	**1,150**
16	B16	Brush truck	168.0	2.8	1
	E16	Engine	22.5	534.1	1,424
	R16	Rescue	52.0	1,431.2	1,651
	T16	tanker	162.8	2.7	1
	Total		**38.5**	**1,970.8**	**3,077**
18	E18	Engine	23.4	306.2	785
	HM18	Hazmat	43.1	7.9	11
	R18	Rescue	52.1	925.5	1,065
	Total		**40.0**	**1,239.6**	**1,861**
21	B21	Brush truck	72.7	2.4	2
	E21	Engine	22.0	626.1	1,706
	R21	Rescue	51.6	1,641.9	1,910
	Total		**37.7**	**2,270.4**	**3,618**
22	E22	Engine	28.3	321.2	683
	R22	Rescue	52.0	790.7	912
	T22	tanker	0.1	0.0	1
	Total		**41.8**	**1,111.9**	**1,596**
23	E23	Engine	17.5	11.4	39
	Q23	Quint	20.3	403.2	1,197
	R23	Rescue	47.1	1,331.3	1,699
	Total		**35.8**	**1,746.0**	**2,935**
24	E24	Engine	24.8	226.7	548
	R241	Rescue	62.9	472.6	529
	R242	Rescue	59.7	425.8	476
	T24	tanker	40.0	2.0	3
	Total		**47.3**	**1,127.1**	**1,556**
30	B30	Brush truck	143.9	2.4	1
	E30	Engine	20.0	593.1	1,785
	R30	Rescue	46.0	1,661.2	2,169
	Total		**34.3**	**2,256.7**	**3,955**
32	E32	Engine	22.0	253.9	693
	R32	Rescue	52.8	826.5	941
	Total		**39.7**	**1,080.3**	**1,634**
33	E33	Engine	24.6	67.1	164

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Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	Q33	Quint	20.8	370.8	1,073
	R33	Rescue	51.0	1,346.2	1,588
	RIB33	Dive Rescue Boat	298.2	9.9	2
	SPOP33	Technical Extraction Unit	28.2	12.2	26
	WR33	Water Rescue Truck	75.7	13.9	11
	Total		**38.2**	**1,820.1**	**2,864**
34	MEDIC34	ALS unit	26.4	47.0	107
36	E36	Engine	28.1	175.9	376
	R36	Rescue	63.2	500.6	475
	Total		**47.7**	**676.5**	**851**
	BAT1	Battalion Chief	21.6	130.7	368
	BAT2	Battalion Chief	22.9	97.0	275
	BAT3	Battalion Chief- floater	18.5	14.5	54
	EMS1	EMS Supervisor	22.7	171.5	455
	EMS2	EMS Supervisor	25.0	350.7	867
	EMS3	EMS Supervisor	21.1	160.6	476
	EMS4	EMS Supervisor- floater	18.1	16.9	59
	EVENT1	ALS (special events)	37.2	23.6	38
	EVENT2	ALS (special events)	11.1	2.0	11
	R91	Rescue (special events)	128.2	17.1	8
	RECON1	Brush fire support unit	131.7	6.6	3
	Total		**23.5**	**991.2**	**2,614**
MCFR Total			**37.3**	**17,215.6**	**27,908**

Table 29: Workload by SFR Unit for EMS Calls

Station	Apparatus	Apparatus Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
One	BAT5	Com Vehicle	20.2	221.9	660
	E1	Engine	20.7	344.7	1,003
	Q1	Ladder	22.7	165.8	441
	R1	Rescue	37.7	1,235.1	1,981
	Total		**29.0**	**1,967.5**	**4,085**
Two	E2	Engine	21.0	550.2	1,577
	R2	Rescue	39.0	1,344.4	2,076
	Total		**31.3**	**1,894.6**	**3,653**
SFR Total			**30.1**	**3,862.1**	**7,738**

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EMS Transport

We analyzed outcomes for the requests for EMS services. Approximately 80.4 EMS calls have patients being transported to the hospital by either MCFR or SFR. MVA incidents have the lowest transport rate at 54.1 percent. 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 an EMS transport call was 64 minutes, which is more than twice the duration of a non-transport EMS call (31 minutes).

Table 30: EMS Transports by Call Category

	Non-Transport		Transport		
Call Category	Duration	Number of Calls	Duration	Number of Calls	Transport Rate
Cardiac and stroke	33.8	349	58.7	2,336	87.0
Seizure and unconsciousness	36.6	288	56.6	1,408	83.0
Breathing difficulty	30.6	182	56.7	1,747	90.6
Overdose and psychiatric	27.0	141	53.4	497	77.9
MVA	30.8	585	69.4	690	54.1
Fall and injury	26.7	1,077	82.8	3,458	76.3
Illness and other	34.4	787	55.8	3,839	83.0
EMS Total	**31.0**	**3,409**	**63.7**	**13,975**	**80.4**

Seventy-seven percent (77%) of the EMS transport requests were in MCFR's jurisdiction, and averaged 29.5 per day. We are able to collect number of patients transported from MCFR. Based upon MCFR's NFIRS database, MCFR units transported a total of 11,253 patients in result of EMS call responses. On average, EMS transport requests averaged 8.4 per day in SFR's jurisdiction. In Sewall's Point, there were 81 EMS requests which resulted in patient transports. In Jupiter Island, there were 79 EMS requests which resulted in patient transports.

Table 31: EMS Transports by Jurisdiction

	Non-Transport		Transport		
Jurisdiction	Duration	Number of Calls	Duration	Number of Calls	Transport Rate
MCFR	34.5	2,451	68.1	10,765	81.5
SFR	21.6	898	48.3	3,050	77.3
Sewall's Point	24.9	33	57.0	81	71.1
Jupiter Island	25.9	27	66.4	79	74.5
EMS Total	**31.0**	**3,409**	**63.7**	**13,975**	**80.4**

We analyzed EMS service requests' 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 was 2.9 requests at the peak in 5 hours starting at 0900, 1000, 1100, 1200 and 1400. EMS

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transport demand peaked at 2.5 transports per hour at 1000. Requests by hour of the day are represented in Table 32 and Figure 12 below.

Table 32: Total EMS Calls and EMS Transports and Average per Day by Hour of Day

Hour	Number of EMS Transports	Number of EMS Calls	EMS Transports per Hour	EMS Calls per Hour	Transport Rate
0	324	412	0.9	1.1	78.6
1	288	342	0.8	0.9	84.2
2	286	363	0.8	1.0	78.8
3	232	288	0.6	0.8	80.6
4	271	322	0.7	0.9	84.2
5	302	358	0.8	1.0	84.4
6	392	471	1.1	1.3	83.2
7	519	637	1.4	1.7	81.5
8	747	884	2.0	2.4	84.5
9	882	1,041	2.4	2.9	84.7
10	907	1,074	2.5	2.9	84.5
11	862	1,050	2.4	2.9	82.1
12	850	1,065	2.3	2.9	79.8
13	808	1,017	2.2	2.8	79.4
14	851	1,059	2.3	2.9	80.4
15	784	996	2.1	2.7	78.7
16	738	966	2.0	2.6	76.4
17	707	905	1.9	2.5	78.1
18	670	852	1.8	2.3	78.6
19	637	828	1.7	2.3	76.9
20	595	768	1.6	2.1	77.5
21	512	654	1.4	1.8	78.3
22	442	569	1.2	1.6	77.7
23	369	463	1.0	1.3	79.7

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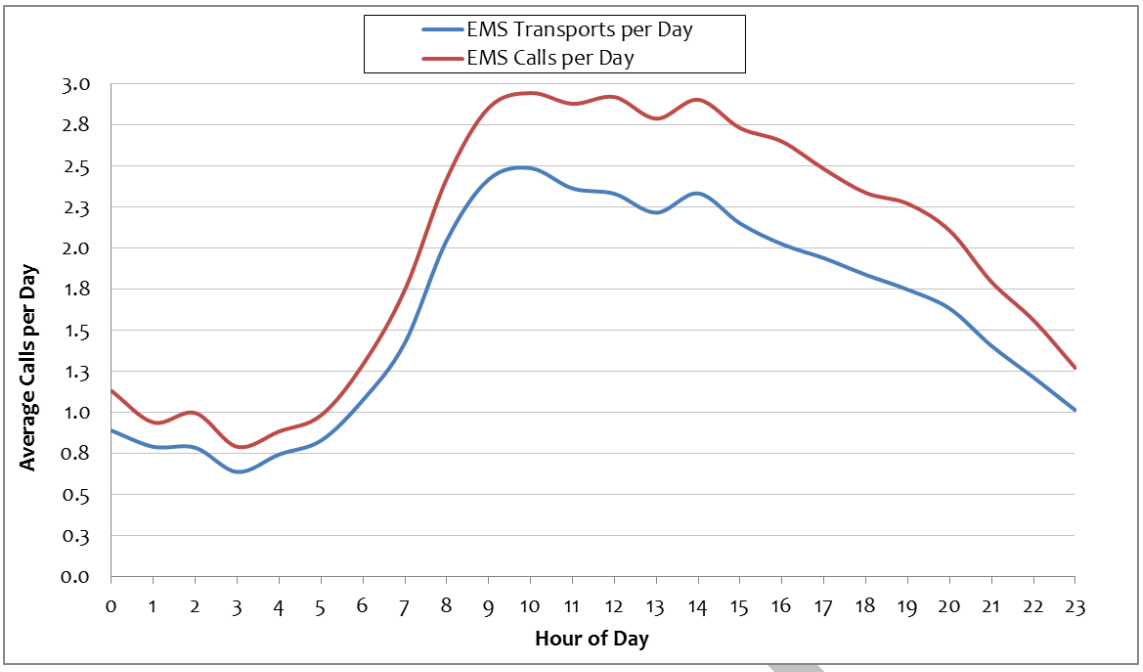
Figure 12: Average BLS/ALS Calls and BLS/ALS Transports per Day by Hour of Day



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REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of the system'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, MCFR and SFR utilize 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. An example of the cascade of events and the elements of performance utilized is provided as Table 33 below.[1]

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 911 answers the 911 call, processes the information, and subsequently dispatches EACH DEPARTMENT.

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.

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

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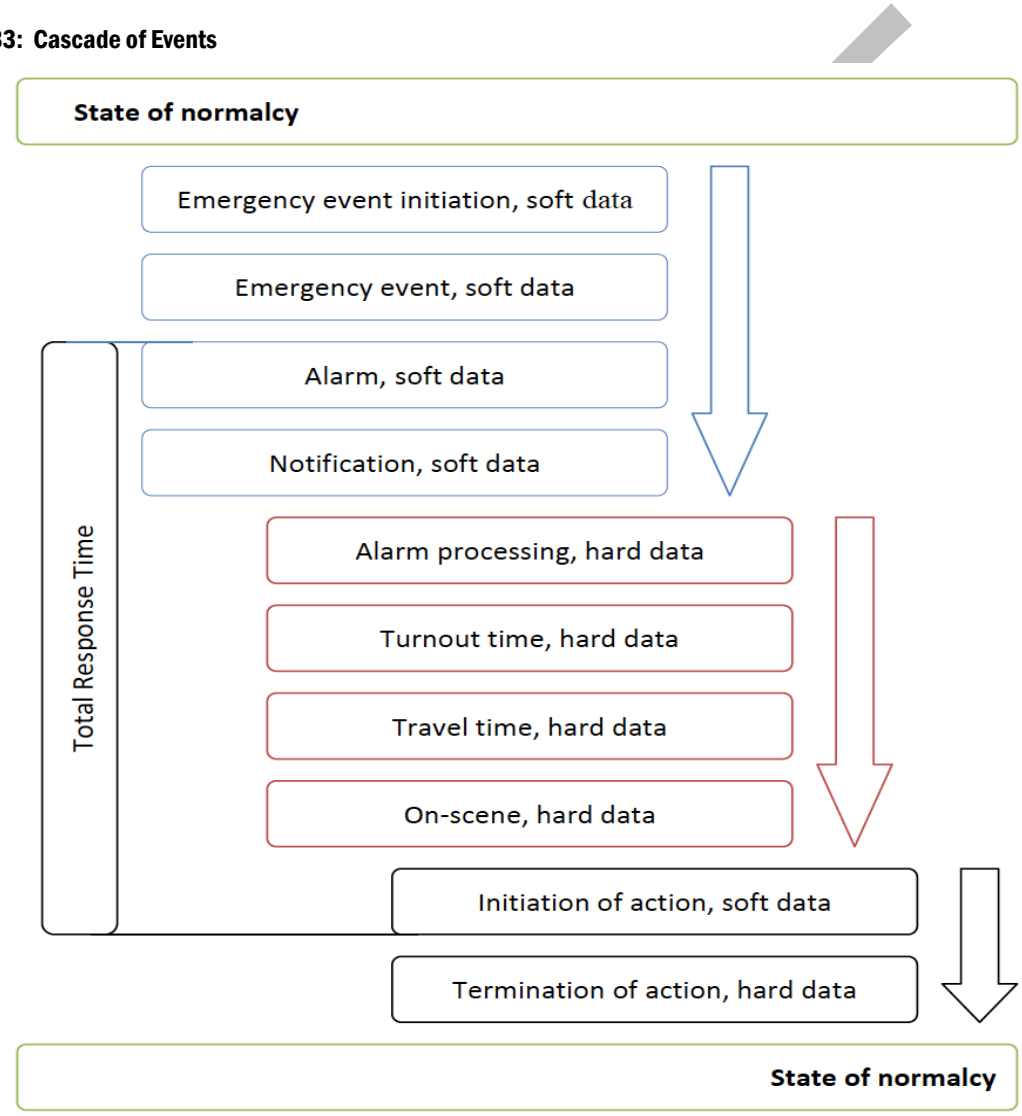
Travel Time

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 911 answering the phone request for service and the time that the units arrive on-scene.

Table 33: Cascade of Events



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 21, 30, SFD1, 16 and SFD2 were the top five demand zones, and each answer 14.1%, 13.4%, 10.3%, 9.9% and 9.5% of the total responses for services. Collectively these five demand zones accounted for 57.3% of the total workload. Station Demand Zones 34, 14 and 36 were the bottom three demand zones, and thee demand zones combined accounted for 6.3% of the total responses for services. Results are presented below as Figure 13 and Table 34.

Figure 13: Department Workload by Station Demand Zone

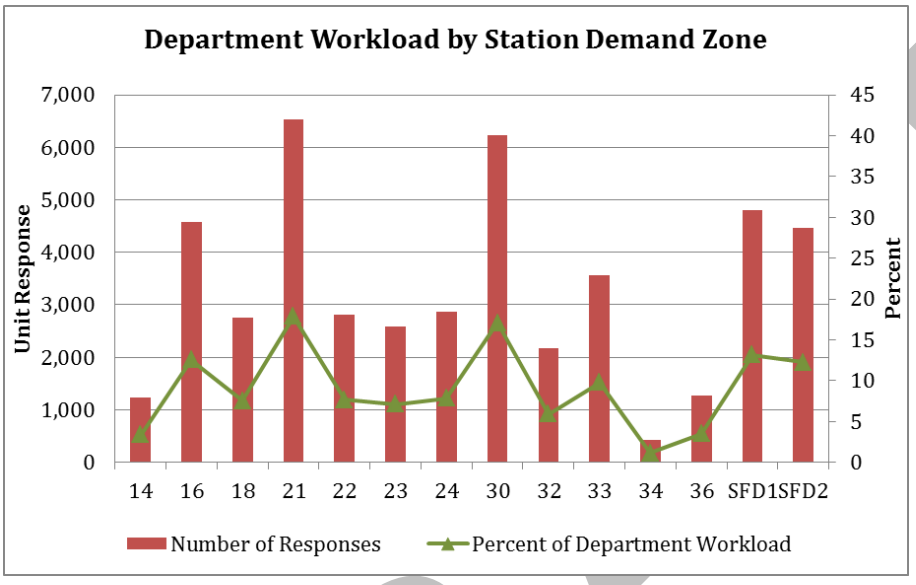


Table 34: Department Workload by Station Demand Zone

Agency	First Due Station	Number of Responses	Responses per Day	Percent of Department Workload
MCFR	14	1,225	3.4	2.6
	16	4,577	12.5	9.9
	18	2,750	7.5	5.9
	21	6,530	17.9	14.1
	22	2,803	7.7	6.0
	23	2,592	7.1	5.6
	24	2,871	7.9	6.2
	30	6,238	17.1	13.4
	32	2,166	5.9	4.7
	33	3,572	9.8	7.7
	34	418	1.1	0.9
	36	1,274	3.5	2.7
SFR	SFD1	4,797	13.1	10.3
	SFD2	4,462	12.2	9.6

Note: 128 unit responses were not included since their first due stations can't be identified.

Further analyses were completed identifying both the distribution of department workload by program. The overall distribution of department workload supports earlier findings that greater than 77% of the requests for service are EMS related. Approximately 15% of the unit responses were associated with fire related incidents. Canceled requests accounted for 6% of the total. Rescue and Hazmat programs are very small. For both EMS and fire requests, demand zones 30 and 21 ranked the top.

Figure 14: Distribution of Department Workload by Call Type

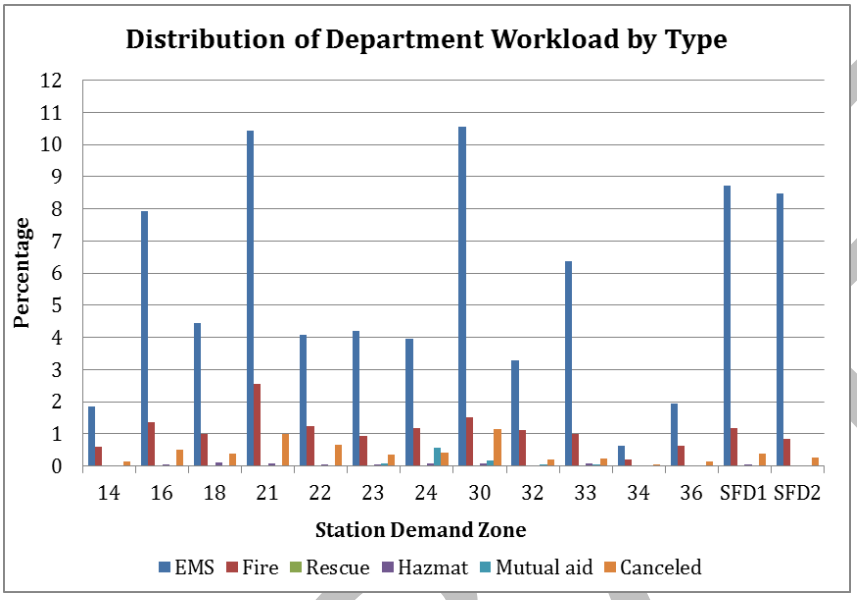


Table 35: Number of Responses by Station Demand Zone and Call Type

First Due Station	EMS	Fire	Rescue	Hazmat	Mutual aid	Canceled	Total
14	851	283	7	14	0	70	1,225
16	3,679	625	0	27	9	237	4,577
18	2,056	455	3	50	9	177	2,750
21	4,834	1,177	7	43	10	459	6,530
22	1,898	569	0	21	9	306	2,803
23	1,952	428	0	17	33	162	2,592
24	1,840	542	0	40	262	187	2,871
30	4,893	700	0	33	79	533	6,238
32	1,519	514	0	6	28	99	2,166
33	2,951	455	0	32	22	112	3,572
34	296	86	0	14	0	22	418
36	900	294	0	11	9	60	1,274
SFD1	4,043	542	11	18	5	178	4,797
SFD2	3,933	386	5	13	0	125	4,462

Note: Note: 128 unit responses were not included since their first due stations can't be identified.

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.

In MCFR, of fire suppression units (engine and quint), Engine E21 was dispatched the most with a total of 2,329 runs, followed by E30 and Q23. Nine brush trucks combined made 213 runs. Eight tankers made 185 runs. Of the 14 rescue units, R30, R21 and R23 each made more than 2,000 runs in a year.

In SFR, the two rescue units R1 and R2 are most utilized, and this is due to the fact that most requests are EMS related. R1 and R2 each made 2,142 and 2,207 runs. Of the three fire suppression units, E2, E1 and Q1 each made 1,886, 1,249 and 649 runs.

Results of the unit workload analysis are presented below as Tables 36 and 37.

Table 36: MCFR Unit Workload Analyses by Unit and Call Category

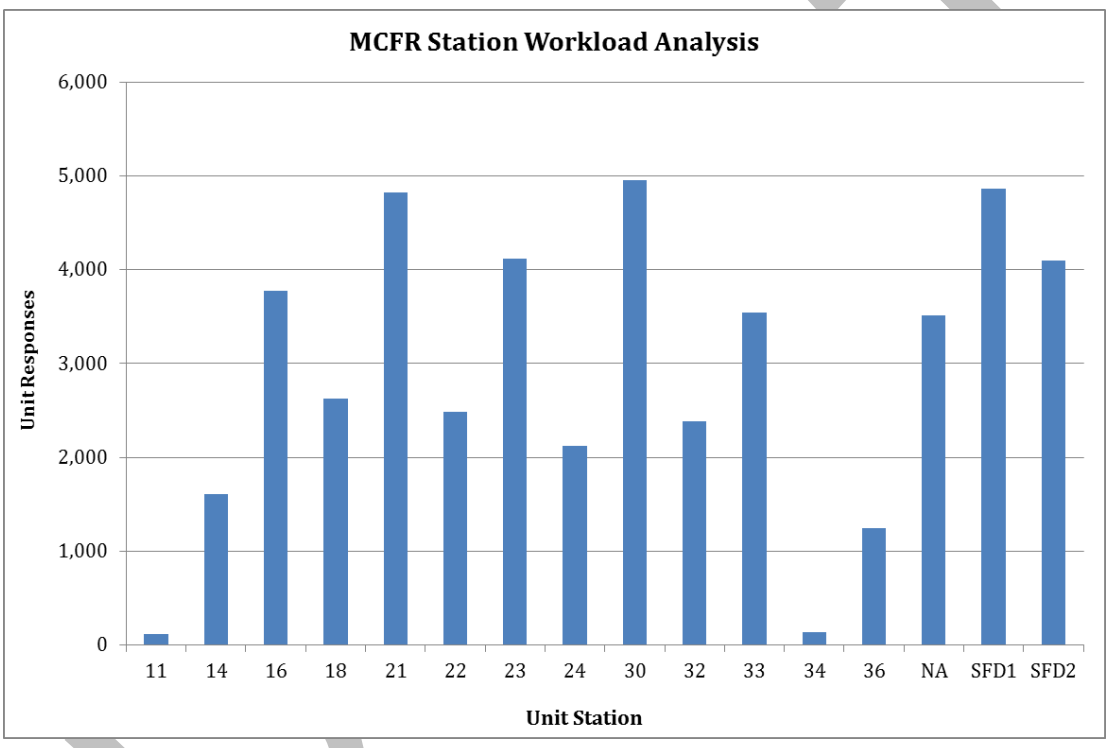
Station	Description	Unit	EMS	Fire	Rescue	Hazmat	Mutual aid	Canceled	Total
11	ALS Aeromedical Helicopter	LIFESTAR	73	1	0	0	9	11	94
11	Rescue	R11	17	5	0	0	2	0	24
14	Engine	E14	23	8	0	0	1	0	32
14	Quint	Q14	437	179	4	7	3	58	688
14	Rescue	R14	690	122	4	3	21	53	893
16	Brush truck	B16	1	15	0	0	0	0	16
16	Engine	E16	1,424	258	0	7	5	76	1,770
16	Rescue	R16	1,651	231	0	6	3	85	1,976
16	tanker	T16	1	12	0	0	0	1	14
18	Engine	E18	785	192	1	34	11	89	1,112
18	Hazmat	HM18	11	44	0	39	0	21	115
18	Hazmat	SQ18	0	5	0	0	0	0	5
18	Rescue	R18	1,065	191	0	39	8	95	1,398
21	Brush truck	B21	2	31	0	0	0	1	34
21	Engine	E21	1,706	423	3	12	9	176	2,329
21	Rescue	R21	1,910	337	3	4	2	155	2,411
21	tanker	T21	0	39	0	0	1	4	44
22	Brush truck	B22	0	34	0	0	2	2	38
22	Engine	E22	683	222	0	7	123	136	1,171
22	Rescue	R22	912	165	0	4	17	133	1,231
22	tanker	T22	1	34	0	0	4	3	42
23	Engine	E23	39	4	0	0	0	2	45
23	Quint	Q23	1,197	505	1	13	17	164	1,897
23	Rescue	R23	1,699	333	1	5	12	128	2,178
24	Brush truck	B241	0	35	0	0	1	1	37
24	Brush truck	B242	0	23	0	0	2	0	25
24	Engine	E24	548	149	0	6	3	52	758

Station	Description	Unit	EMS	Fire	Rescue	Hazmat	Mutual aid	Canceled	Total
24	Rescue	R241	529	80	0	3	7	37	656
24	Rescue	R242	476	79	0	3	5	25	588
24	tanker	T24	3	46	0	1	1	2	53
24	tanker	T28	0	2	0	0	1	0	3
30	Brush truck	B30	1	37	0	0	1	3	42
30	Engine	E30	1,785	308	0	9	17	175	2,294
30	Rescue	R30	2,169	251	0	4	14	178	2,616
32	Brush truck	B32	0	13	0	0	0	0	13
32	Engine	E32	693	242	0	4	83	70	1,092
32	Rescue	R32	941	230	0	3	26	57	1,257
32	tanker	T32	0	22	0	1	2	0	25
33	Engine	E33	164	23	0	1	1	7	196
33	Quint	Q33	1,073	242	0	7	2	64	1,388
33	Rescue	R33	1,588	222	0	4	6	60	1,880
33	Dive Rescue Boat	RIB33	2	4	0	0	0	1	7
33	Technical Extrication Unit	SPOP33	26	16	0	0	0	6	48
33	Water Rescue Truck	WR33	11	7	0	0	0	3	21
34	ALS unit	MEDIC34	107	21	0	2	0	7	137
36	Brush truck	B36	0	2	0	0	0	0	2
36	Engine	E36	376	113	0	6	45	22	562
36	Rescue	R36	475	115	0	4	54	31	679
NA	Battalion Chief	BAT1	368	175	0	17	4	55	619
NA	Battalion Chief	BAT2	275	102	0	15	10	37	439
NA	Battalion Chief	BAT3	54	28	0	3	0	5	90
NA	Brush truck (backup)	B91	0	5	0	0	1	0	6
NA	EMS Supervisor	EMS1	455	52	0	11	0	24	542
NA	EMS Supervisor	EMS2	867	113	0	12	6	71	1,069
NA	EMS Supervisor	EMS3	476	52	0	5	2	33	568
NA	EMS Supervisor	EMS4	59	12	0	2	1	5	79
NA	Engine (special events)	E90	0	0	0	0	1	0	1
NA	Engine (special events)	E91	0	2	0	0	1	0	3
NA	Rescue (special events)	R91	8	1	0	0	1	0	10
NA	ALS (special events)	EVENT1	38	9	0	0	7	4	58
NA	ALS (special events)	EVENT2	11	2	0	1	2	0	16
NA	Brush fire support unit	RECON1	3	3	0	0	0	0	6
NA	tanker (backup)	T90	0	0	0	0	1	0	1
NA	tanker (backup)	T91	0	2	0	0	1	0	3

Table 37: SFR Unit Workload Analyses by Unit and Call Category

Station	Description	Unit	EMS	Fire	Rescue	Hazmat	Mutual aid	Canceled	Total
One	Brush Truck	B1	0	7	0	0	0	0	7
One	Com Vehicle	BAT5	660	114	3	6	2	32	817
One	Engine	E1	1,003	184	4	9	2	47	1,249
One	Ladder	Q1	441	161	2	5	4	36	649
One	Rescue	R1	1,981	81	2	4	4	70	2,142
Two	Engine	E2	1,577	239	4	8	4	54	1,886
Two	Rescue	R2	2,076	66	1	3	1	60	2,207

Figure 15: Total Workloads by MCFR and SFR Station



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 2014. 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.[2] 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

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

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.[3] 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.[4] These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections.

In MCFR, the most utilized units are R21 and R30 at 20%. The top 8 most utilized units are all rescue units. The utilization of the 14 rescue units combined is 11%. The busiest fire suppression unit is E21 at nearly 10%, followed by E30 at 9% and E22 at 8%. The utilization of the 14 fire suppression units combined is 5%.In SFR, R2 and R1 were the most utilized and their UHU are at 16% and 15%. E2, E1 and Q1 each had UHU at 8%, 5% and 3%.

At the current workload utilization rates, both agencies should have a limited impact on their level of readiness or system performance.

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[3] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)
[4] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

Figure 16: Unit Hour Utilization by MCFR Rescue Unit

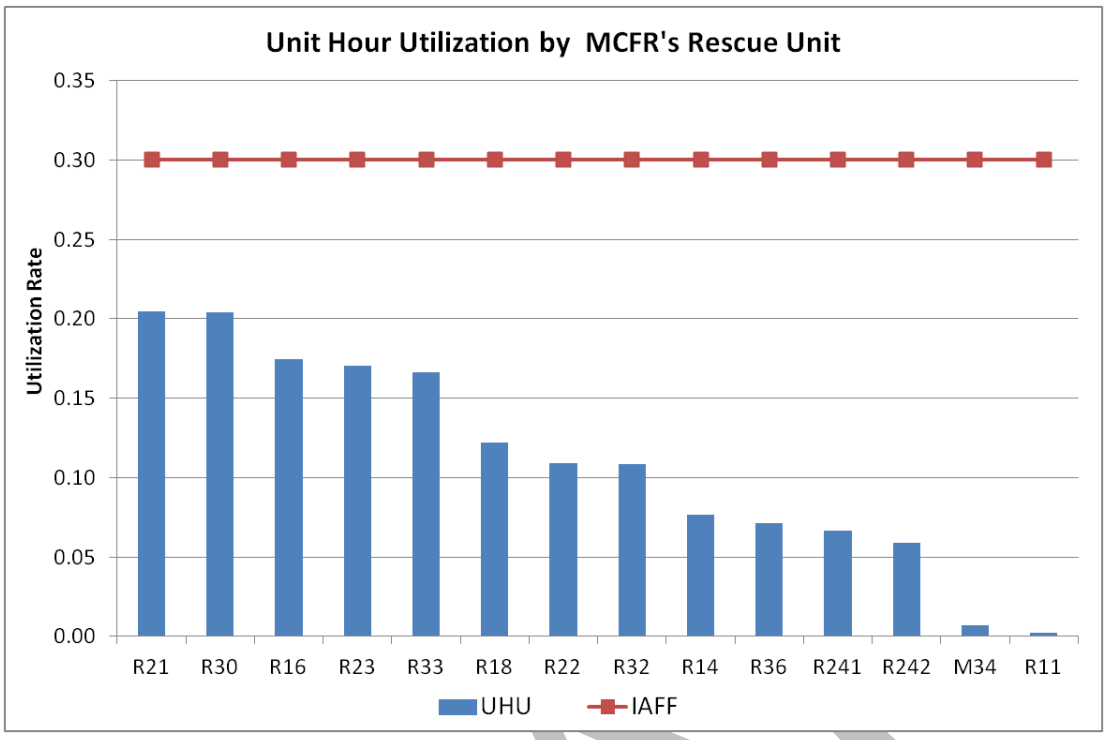


Figure 17: Unit Hour Utilization by MCFR Fire Suppression Unit

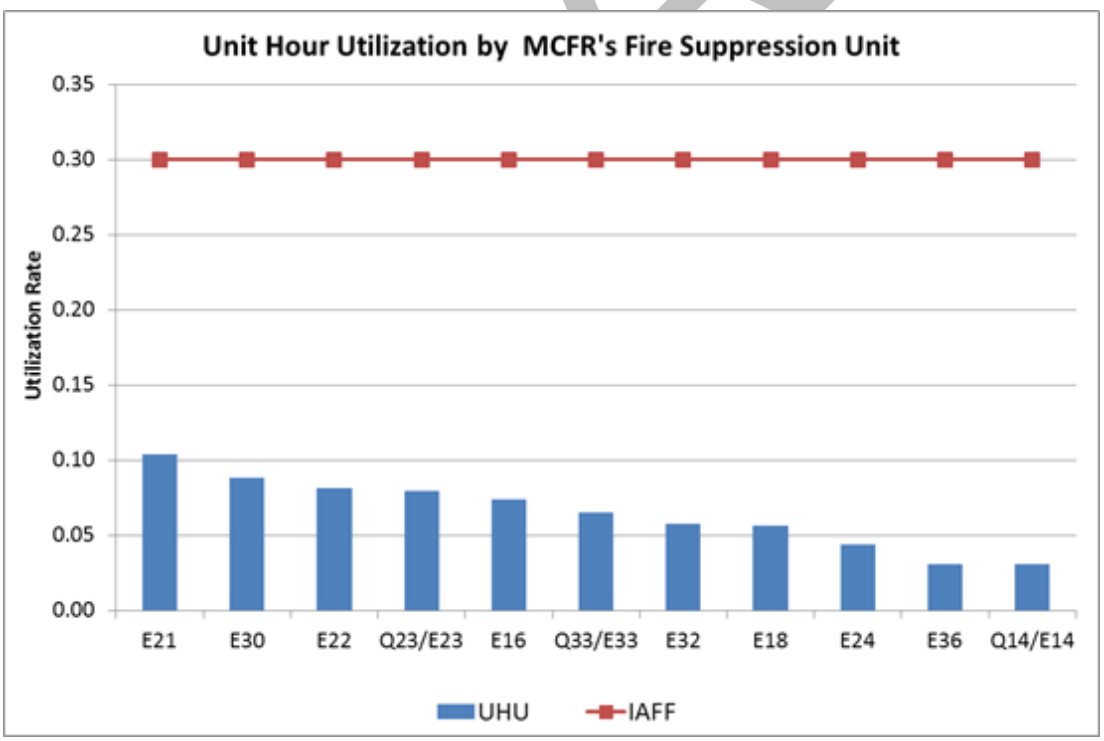
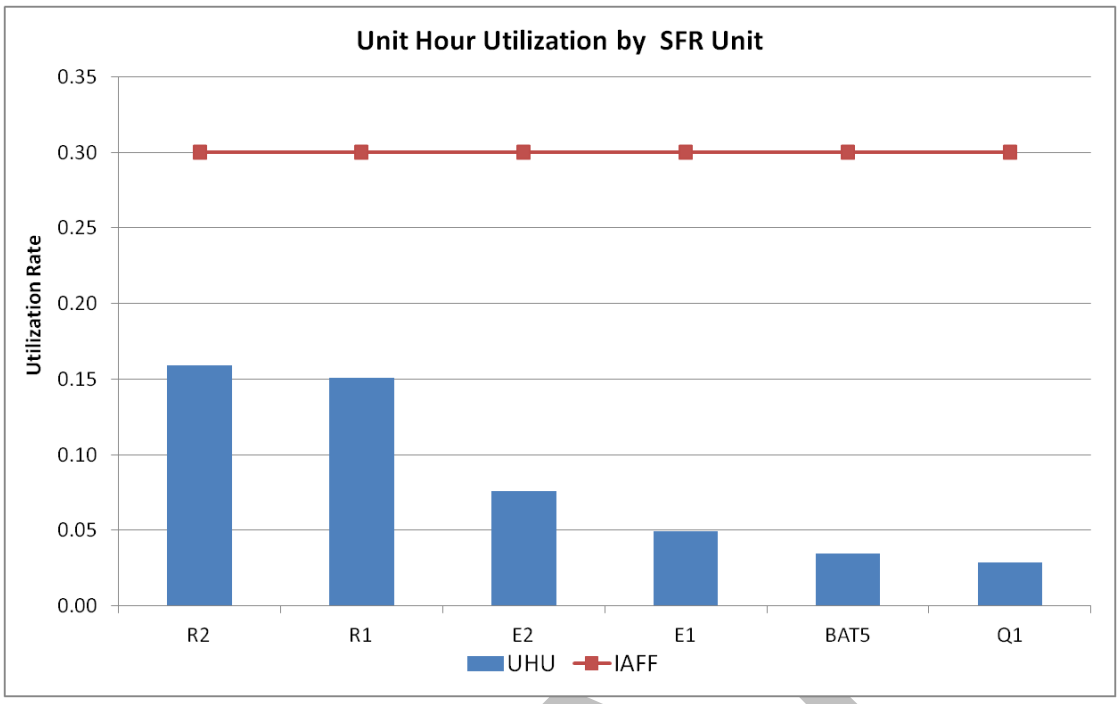


Figure 18: Unit Hour Utilization by SFR Unit



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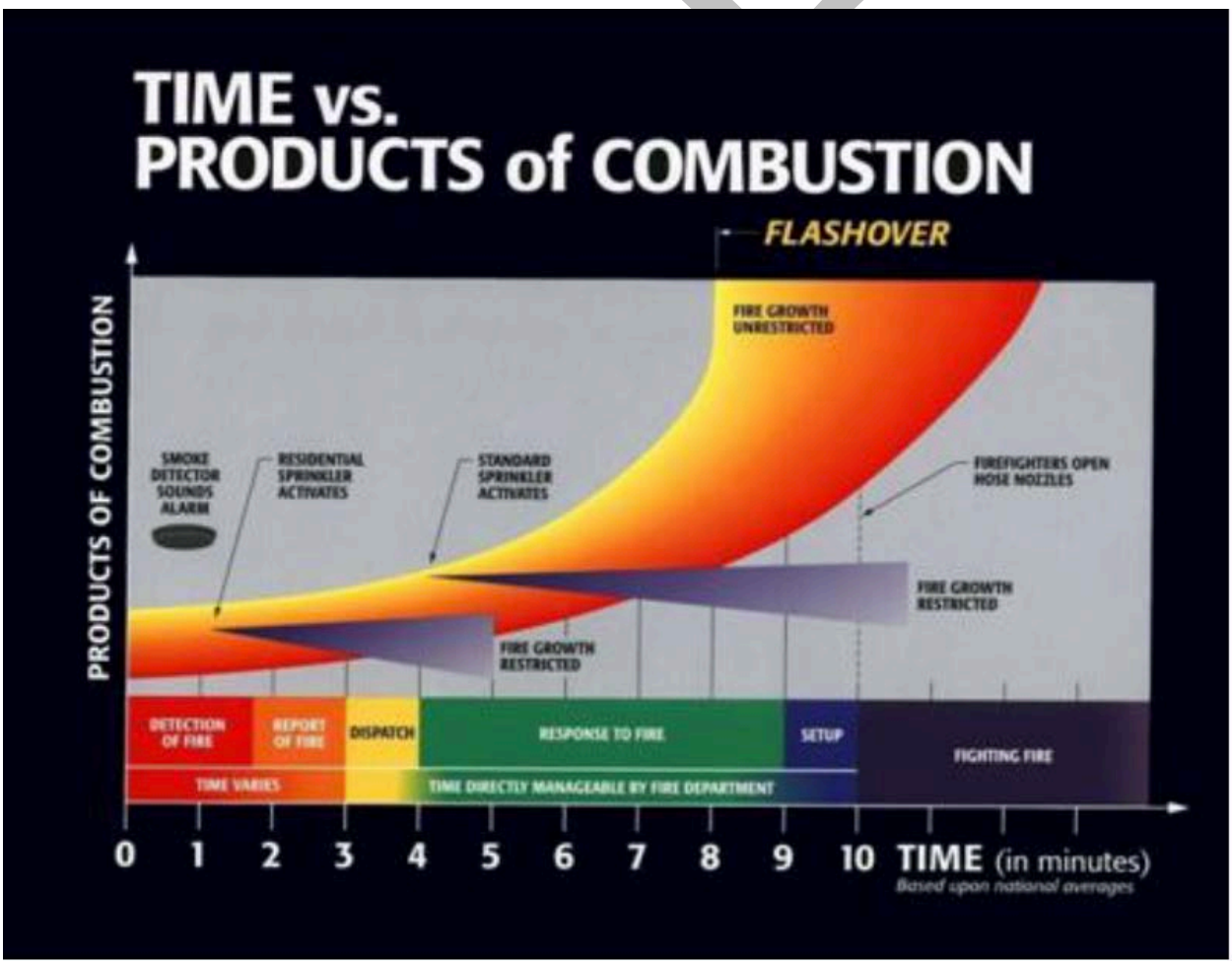
RESPONSE TIME CONTINUUM

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 19 below.[5]

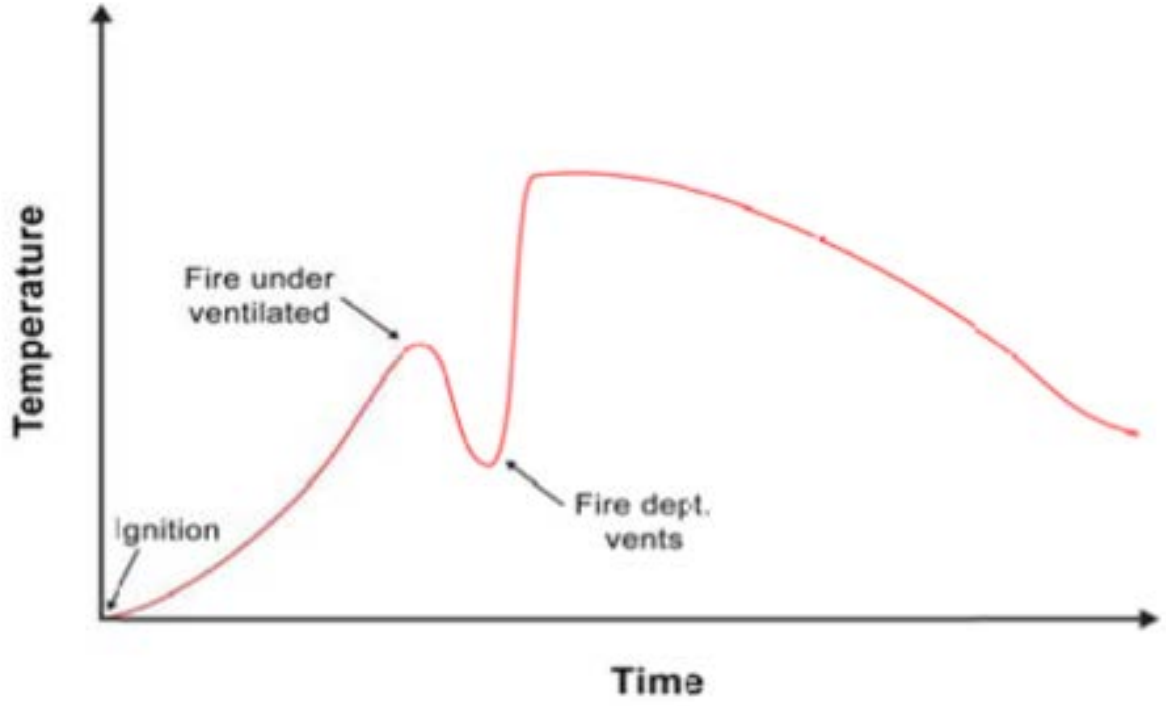
Figure 19: Example of Traditional Time Temperature Curve



[5] 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 20 below.[6]

Figure 20: 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

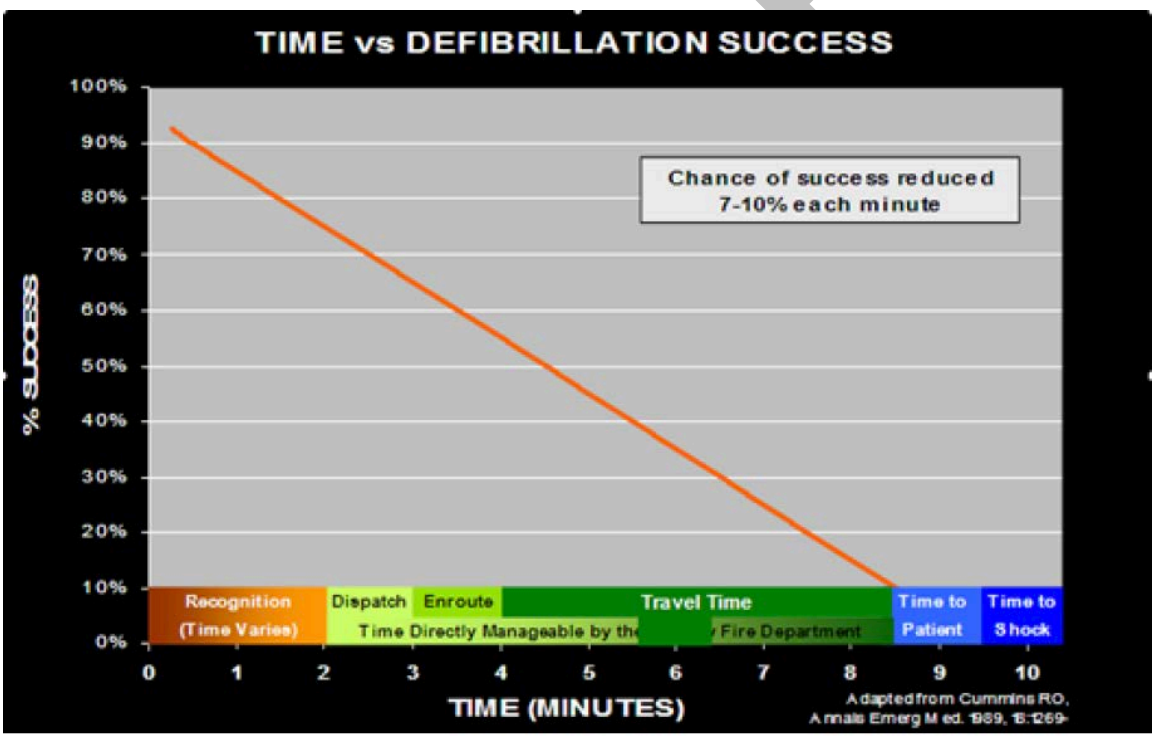
[6] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm

minutes for non-emergency responses.[7] The 12-minute upper threshold is only the upper limit of the 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.[8]

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 21 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 57[9] 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 21: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm



[7] 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.
[8] 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.
[9] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

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 below.

Description of First Arriving Unit Performance

Analyses of the response characteristics of the first arriving units were conducted. This analysis utilized all first arriving units. Overall MCFR and SFR had a mean turnout time of 108 seconds, or 1 minute and 48 seconds, and 165 seconds, or 2 minutes and 45 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 294 seconds, or 4 minutes and 54 seconds. Performance at the 90th percentile was 476 seconds, or 7 minutes and 56 seconds.

As previously discussed, since 911 calls do not capture the complete dispatch interval, the "total response time" is defined as the sum of turnout and travel times. The mean turnout plus travel time is 402 seconds, or 6 minutes and 42 seconds. Performance at the 90th percentile is 597 seconds, or 9 minutes and 57 seconds. Results of first arriving unit performance are provided in Table 38 below.

Table 38: Description of First Arriving Unit Emergency Response Performance

Measure	Average	90th Percentile
Turnout Time	1.8	2.8
Travel Time	4.9	7.9
Turnout and Travel	6.7	10.0

First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted to measure the performance of the first arriving unit in each demand zone. Response times are reported below at both the mean and 90th percentile as Tables 39 and 40, respectively.

Examination of the overall performance at the 90th percentile reveals that Stations 34, SFD2 and 23 have the quickest response times followed by Stations 32, SFD1, 18, 33, 30, 16, 14, 21, 24, 36 and 22 in order of performance. The FDZ with the longest total response times is station 22. An illustrative comparison of FDZ performance at the 90th percentile is provided as Figures 22 through 25 below.

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Table 39: Mean First Arrival Performance by First Due Station

Agency	First Due Station	Turnout Time	Travel Time	Turnout and Travel	Sample Size
MCFR	14	2.0	5.4	8.8	527
	16	2.0	4.7	8.1	2,049
	18	2.0	4.5	7.9	1,120
	21	1.9	5.5	8.9	2,692
	22	2.1	6.4	9.9	940
	23	1.9	4.0	7.4	1,073
	24	2.0	5.7	9.3	1,000
	30	1.9	4.6	8.0	2,598
	32	2.0	4.0	7.4	908
	33	1.8	4.6	7.9	1,693
	34	1.2	3.9	5.9	117
	36	2.1	6.1	9.6	588
SFR	SFD1	1.4	4.8	7.6	2,196
	SFD2	1.3	4.5	7.1	2,147
Overall		**1.8**	**4.9**	**6.7**	**19,648**

Table 40: 90th Percentile First Arrival Performance by Station FDZ

Agency	First Due Station	Turnout Time	Travel Time	Turnout and Travel	Sample Size
MCFR	14	2.9	8.3	10.3	527
	16	2.8	7.1	9.3	2,049
	18	3.0	7.0	9.4	1,120
	21	2.9	9.6	11.6	2,692
	22	3.0	10.7	12.8	940
	23	2.8	6.3	8.4	1,073
	24	3.0	13.7	15.7	1,000
	30	2.8	7.1	9.1	2,598
	32	2.9	6.7	9.1	908
	33	2.7	7.5	9.5	1,693
	34	2.3	6.8	8.1	117
	36	3.1	9.5	11.6	588
SFR	SFD1	2.0	7.4	8.8	2,196
	SFD2	1.9	6.7	8.2	2,147
Overall		**2.8**	**7.9**	**10.0**	**19,648**

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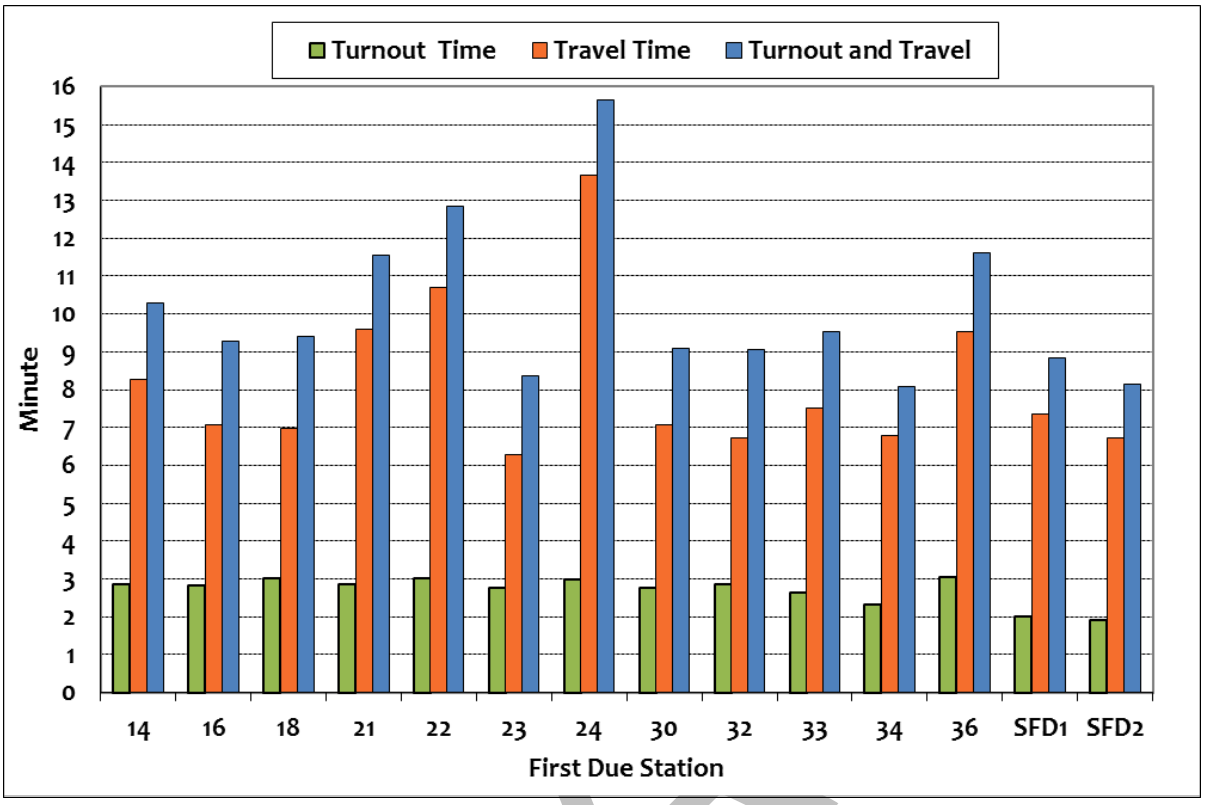
Figure 22: 90th Percentile First Arrival Performance by Station FDZ



The data were further analyzed to compare the individual station FDZ performances. With respect to turnout time, SFD1 and SFD2 have shorter turnout times than any MCFR station. Conversely, when examining the travel time performance, performances for calls in stations 24, 22, 21, and 36 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 24, 22, 21 and 36 are significantly longer than calls in the other stations.

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Figure 23: 90th Percentile Turnout Time by Station FDZ

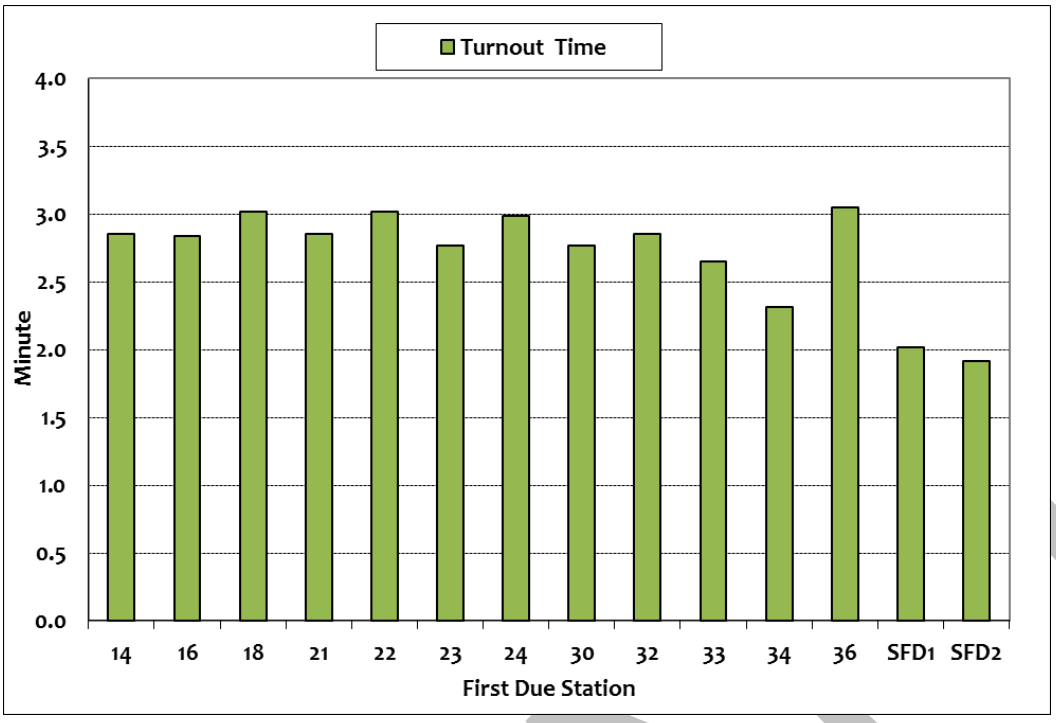


Figure 24: 90th Percentile Travel Time Performance by Station FDZ

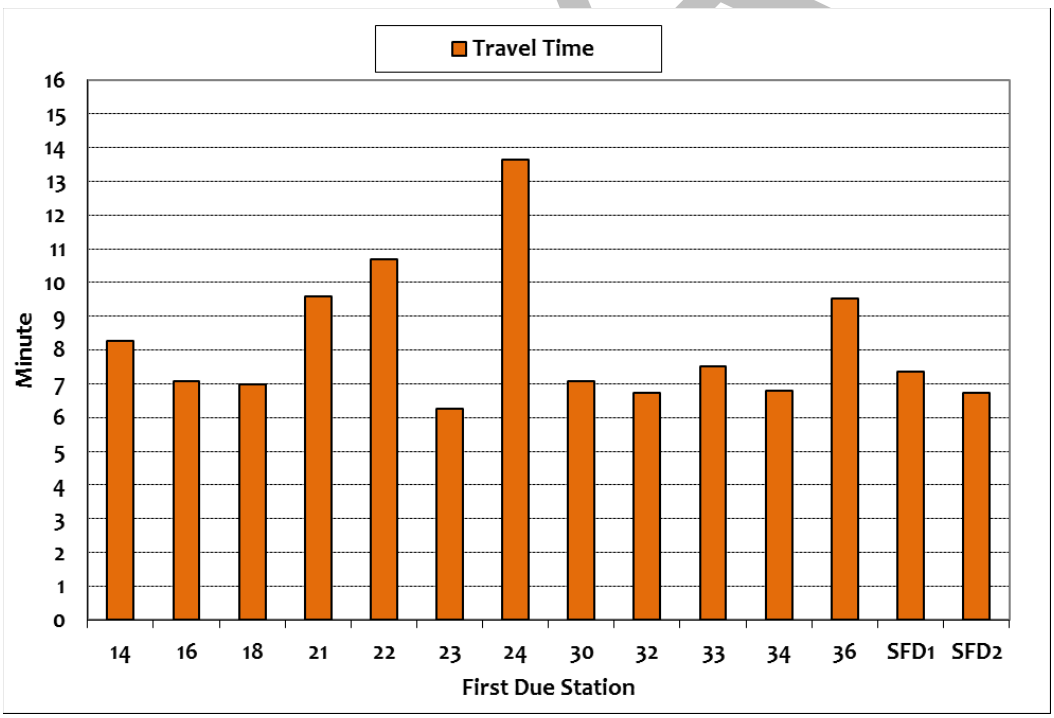
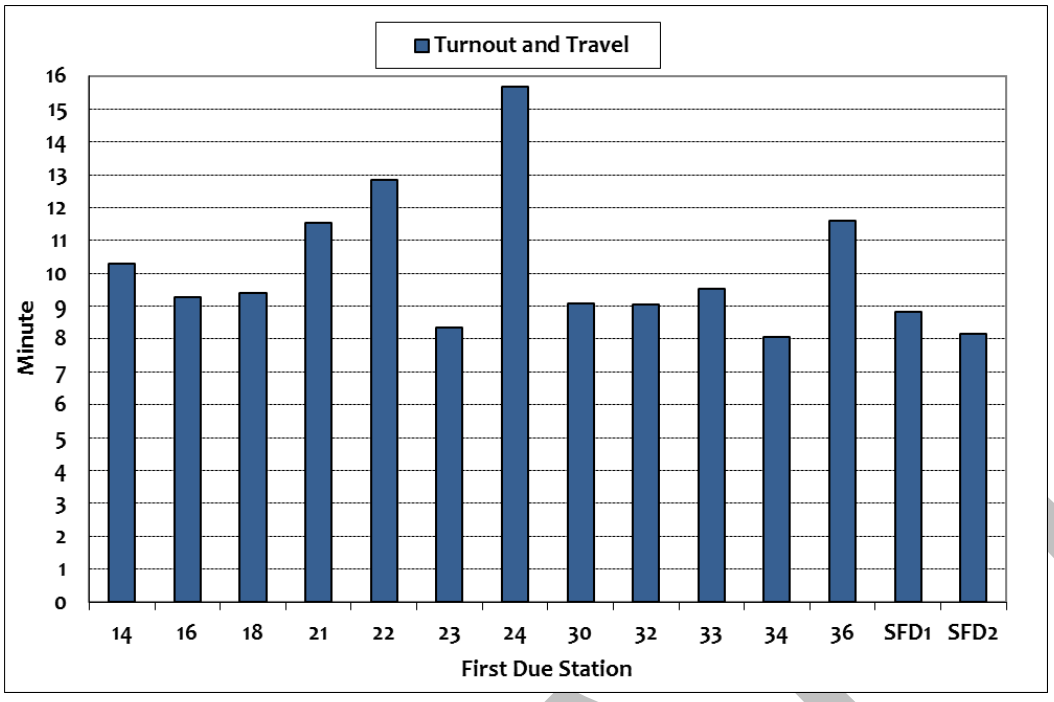


Figure 25: 90th Percentile Turnout and Travel Performance by Station FDZ



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. In general, SFR is able to meet best practices for assembling an ERF with eight (minutes). [10] [11] As with many communities, MCFR has greater difficulty assembling an ERF within NFPA's recommendations for urban fire departments.

The graphic results for each fire station demand zone are presented in the Figures 26 through 39 below.

[10] National Fire Protection Association. (2010). 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.
[11] CFAI. (2009). Fire & emergency service self-assessment manual, (8th ed.). Chantilly, Virginia: Author. (page 71)

Figure 26: Mean ERF Travel Performance for Station 14

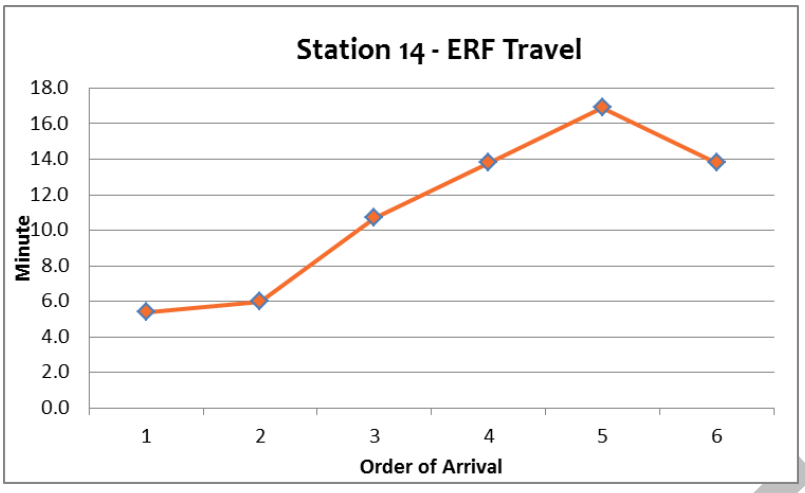


Figure 27: Mean ERF Travel Performance for Station 16

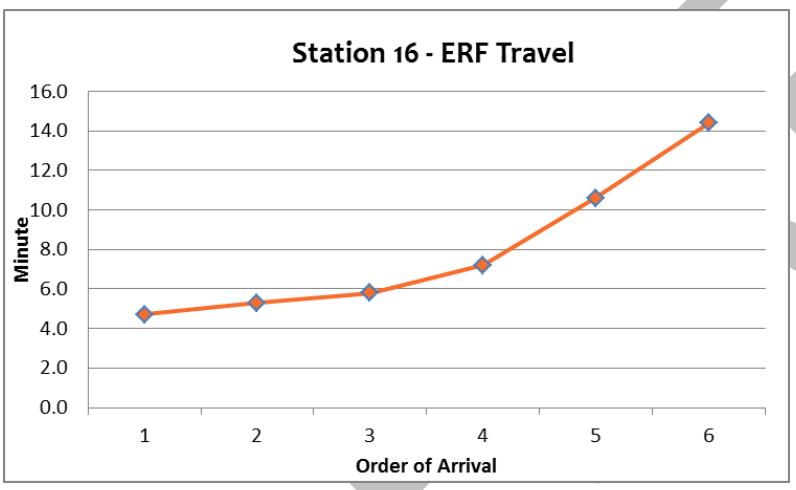


Figure 28: Mean ERF Travel Performance for Station 18

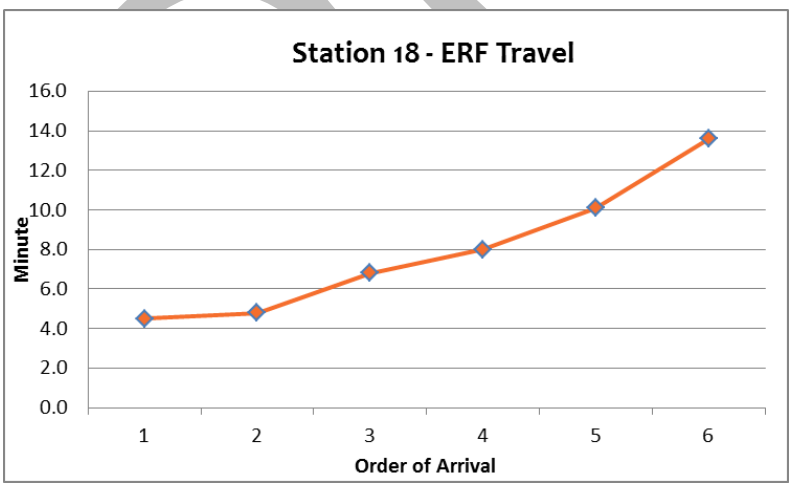


Figure 29: Mean ERF Travel Performance for Station 21

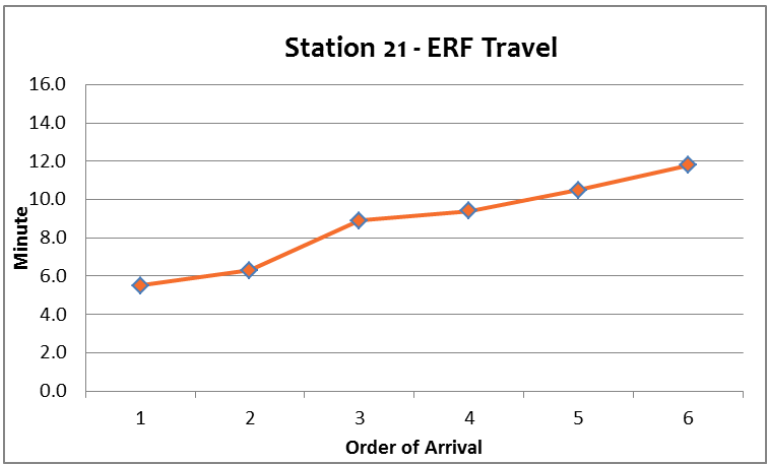


Figure 30: Mean ERF Travel Performance for Station FDZ 5

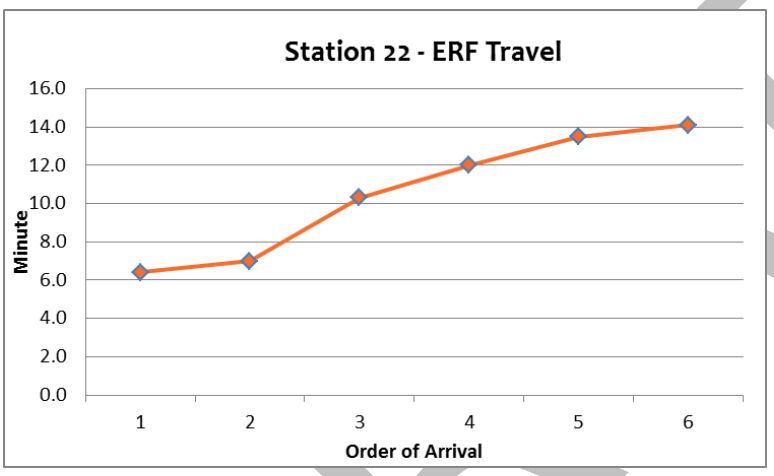


Figure 31: Mean ERF Travel Performance for Station 23

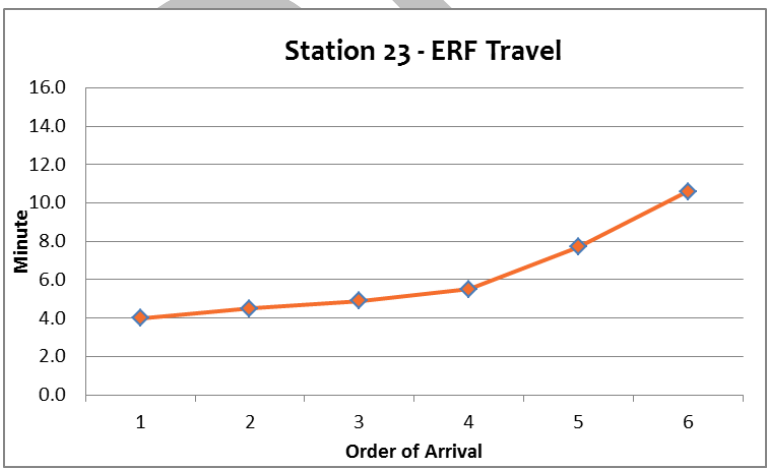


Figure 32: Mean ERF Travel Performance for Station 24

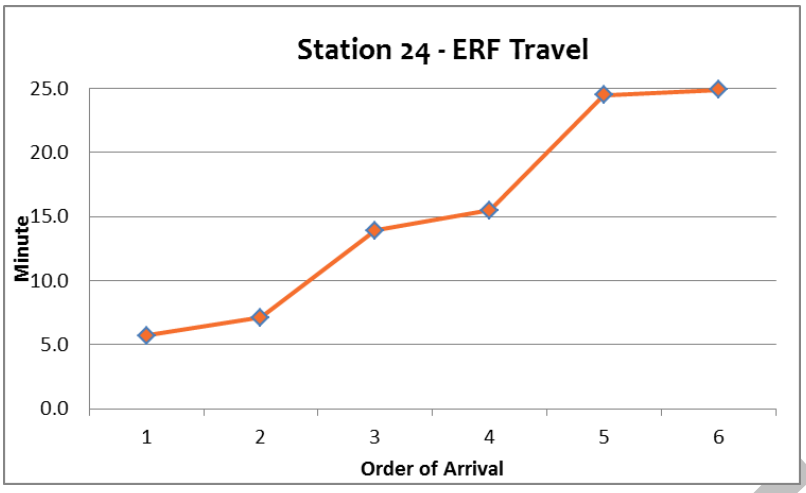


Figure 33: Mean ERF Travel Performance for Station 30

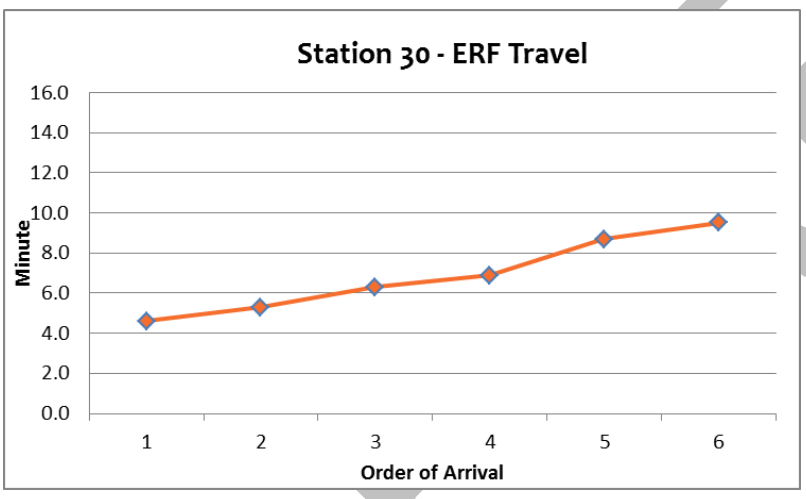


Figure 34: Mean ERF Travel Performance for Station 32

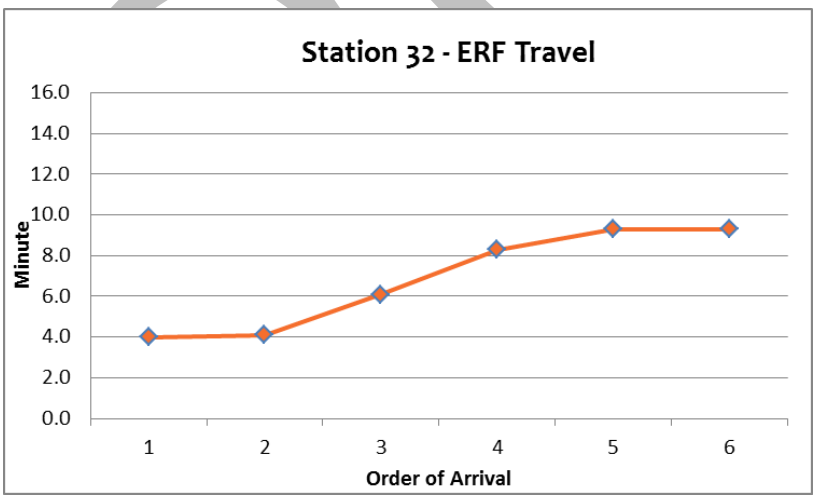


Figure 35: Mean ERF Travel Performance for Station 33

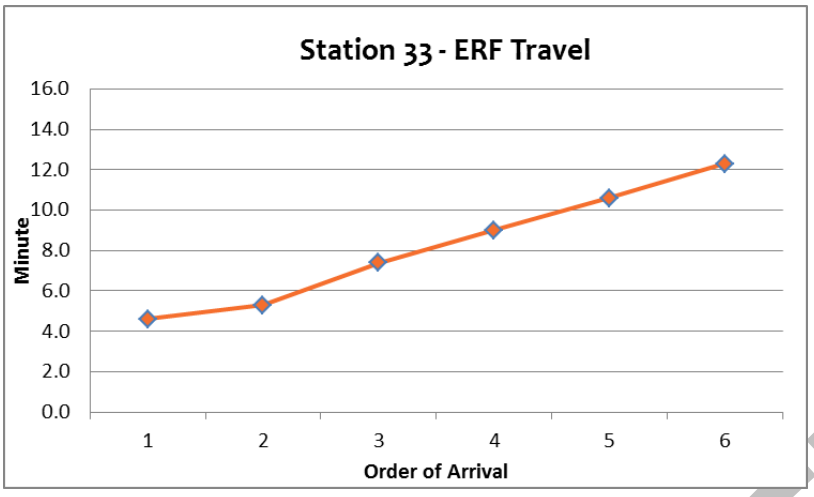


Figure 36: Mean ERF Travel Performance for Station 34

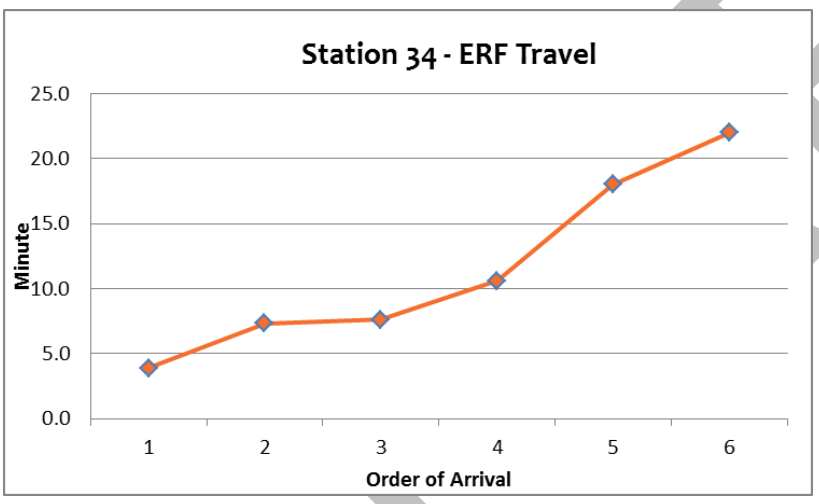


Figure 37: Mean ERF Travel Performance for Station 36

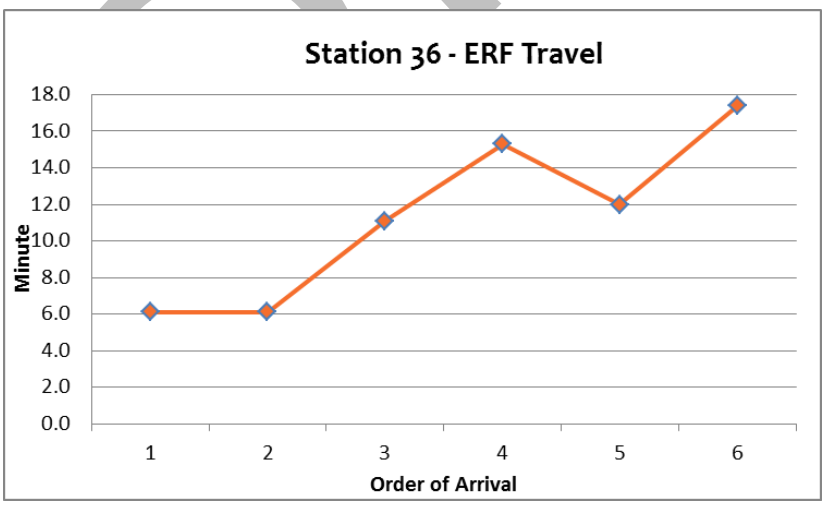


Figure 38: Mean ERF Travel Performance for Station SFD1

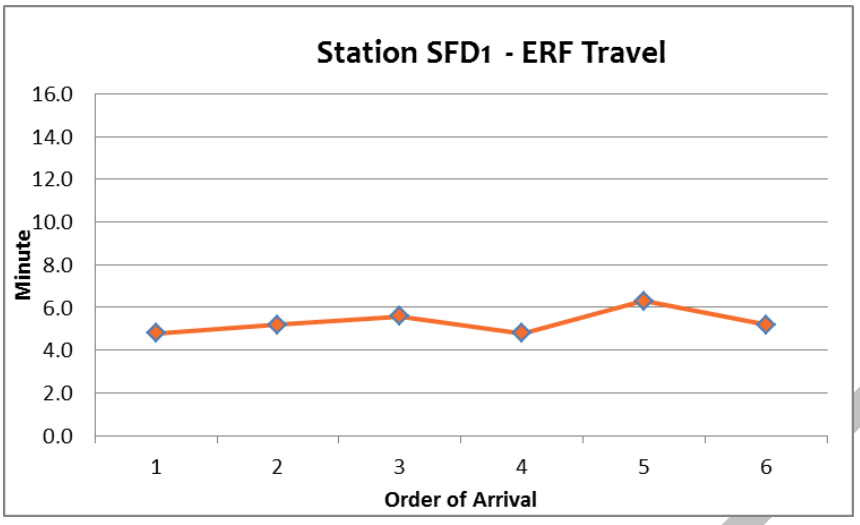
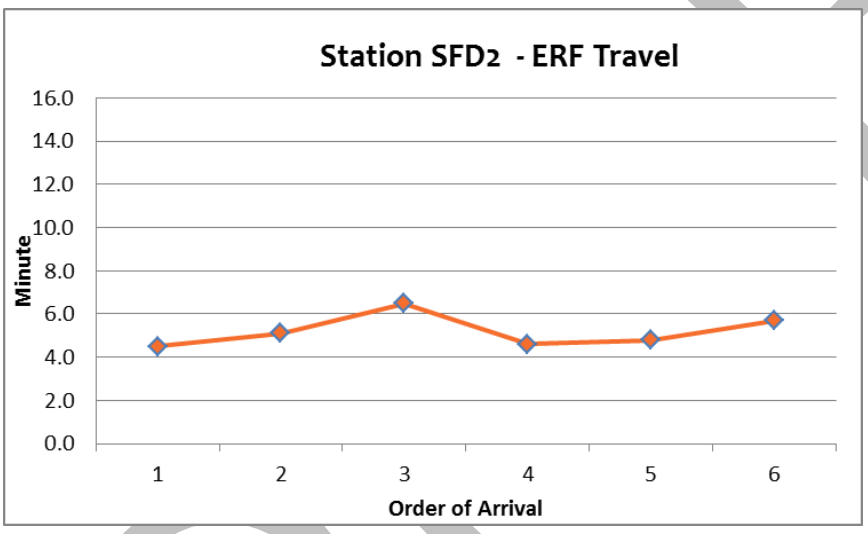


Figure 39: Mean ERF Travel Performance for Station SFD2



In addition, the data are presented in tabular form as Table 41 below. The table presents the historical travel times by the order of the arriving unit. Please note the sample size is decaying in the order of arrival. Since there are only a total of 1,386 calls with four or more units responding, the largest sample size to calculate average travel time for the 4th, 5th and 6th arriving units is 78. The 90th percentile travel time performance for ERF by station FDZ is presented in Table 42.

Table 41: Historical Average Travel Time Performance for ERF by Station FDZ

Agency	First Due Station	Order of Arrival 1	2	3	4	5	6
MCFR	14	5.4	6.0	10.7	13.8	16.9	13.8
	16	4.7	5.3	5.8	7.2	10.6	14.4
	18	4.5	4.8	6.8	8.0	10.1	13.6
	21	5.5	6.3	8.9	9.4	10.5	11.8
	22	6.4	7.0	10.3	12.0	13.5	14.1
	23	4.0	4.5	4.9	5.5	7.7	10.6
	24	5.7	7.1	13.9	15.5	24.5	24.9
	30	4.6	5.3	6.3	6.9	8.7	9.5
	32	4.0	4.1	6.1	8.3	9.3	9.3
	33	4.6	5.3	7.4	9.0	10.6	12.3
	34	3.9	7.3	7.6	10.6	18.0	22.0
	36	6.1	6.1	11.1	15.3	12.0	17.4
SFR	SFD1	4.8	5.2	5.6	4.8	6.3	5.2
	SFD2	4.5	5.1	6.5	4.6	4.8	5.7

Table 42: Historical 90th Percentile Travel Time Performance for ERF by Station FDZ

Agency	First Due Station	Order of Arrival 1	2	3	4	5	6
MCFR	14	8.3	9.9	18.0	17.7	26.5	17.1
	16	7.1	8.3	8.8	10.6	15.4	22.8
	18	7.0	8.0	11.0	12.3	16.8	32.1
	21	9.6	11.1	14.4	16.4	16.2	19.4
	22	10.7	11.8	15.8	22.8	21.9	27.4
	23	6.3	7.5	7.9	9.1	11.6	10.8
	24	13.7	16.2	26.3	31.2	47.9	35.7
	30	7.1	8.4	10.1	9.4	14.0	13.4
	32	6.7	7.0	10.9	12.5	14.7	11.8
	33	7.5	8.9	10.9	14.0	20.1	27.5
	34	6.8	11.4	12.2	15.1	46.6	46.6
	36	9.5	9.5	17.2	25.4	20.9	33.2
SFR	SFD1	7.4	7.9	8.8	7.3	7.7	6.7
	SFD2	6.7	7.5	9.4	6.6	6.9	7.9

Finally, analyses were completed to determine the number of units typically required to handle fire related incidents throughout all of Martin County, including the City of Stuart and the Stuart Fire Department. Nearly 50% of the fire related incidents are handled by a single unit and 73% of the fire related incidents are handled by two units or less. Greater than 90% of the fire related incidents are handled with four units or less. Results are presented as Table 43 below.

Table 43: Resource Commitment for Fire Related Incidents

Number of Units	Number of Fire Calls	Call Percentage	Cumulative Call Percentage
1	1,509	47.7%	47.7%
2	806	25.5%	73.2%
3	485	15.3%	88.6%
4	85	2.7%	91.3%
5	39	1.2%	92.5%
6	42	1.3%	93.8%
7	74	2.3%	96.2%
8	40	1.3%	97.4%
9	34	1.1%	98.5%
10 or more	47	1.5%	100.0%
Total	**3,161**	**100.0%**	**NA**

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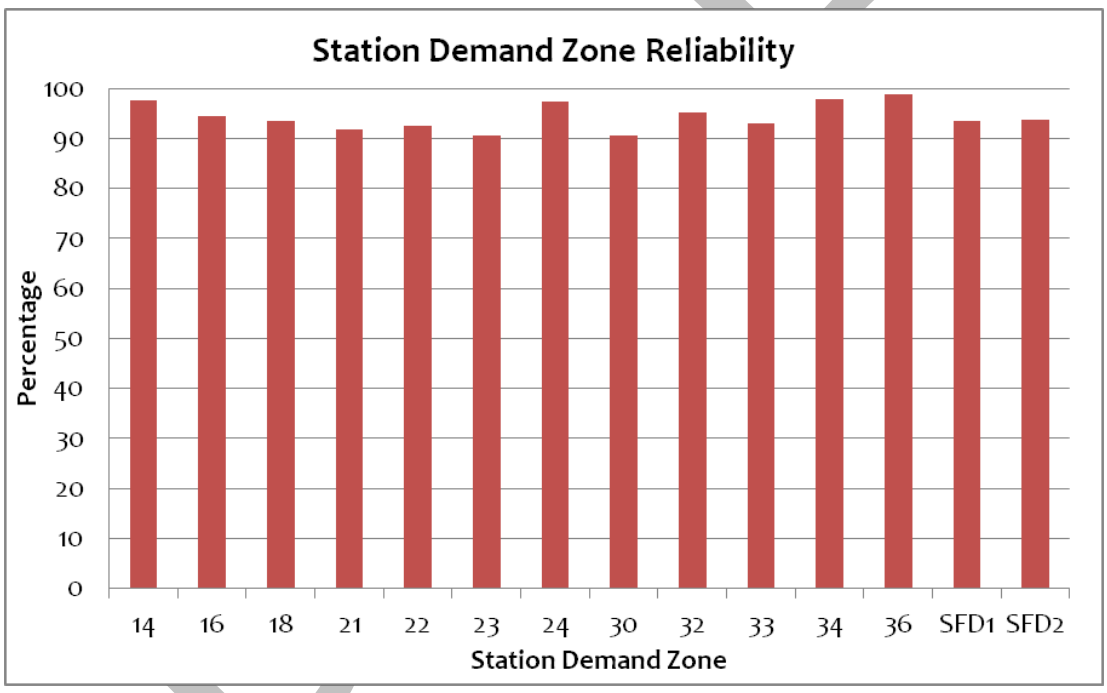
RELIABILITY FACTORS

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 Fire Station Demand Zones (FDZ), analyses reveal that all MCFR's 12 stations and SFR's 2 stations are capable of meeting their demand for services at the 90th percentile. In other words, when a request for service is received all stations are available to answer the call nine out of 10 times. Station 23 and 30 have the lowest reliability, and are 90.5 and 90.6 percent respectively. Station 36 has the highest reliability at 98.8 percent. This analysis utilized all dispatched calls within the jurisdiction and the performance included all assigned units to the specific FDZ.

Figure 40: Percentage Reliability by Station FDZ



Overlapped or Simultaneous Call Analysis

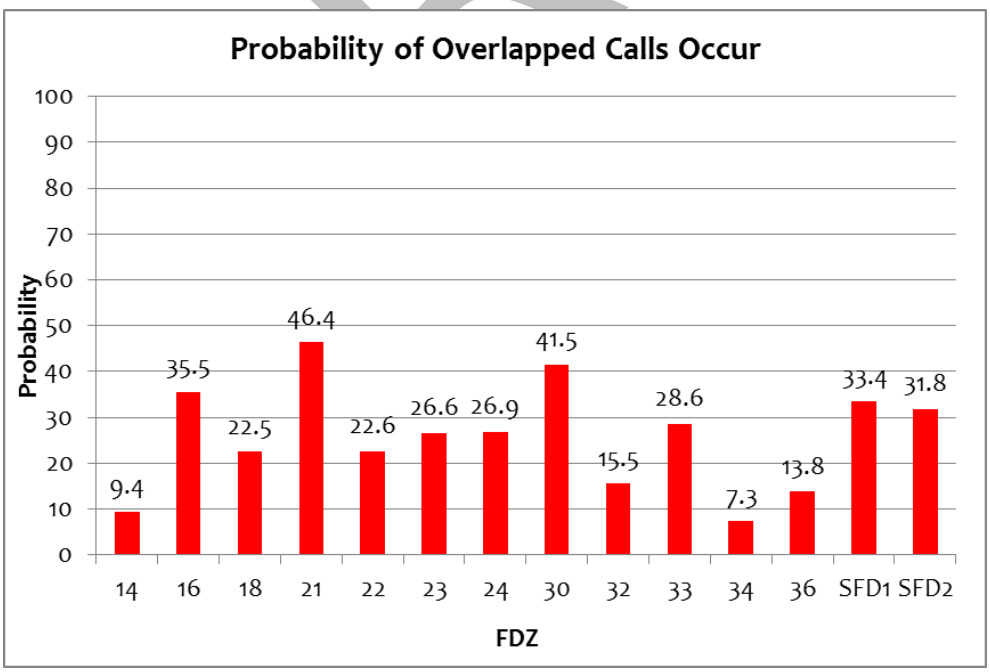
Overlapped calls are defined as the rate at which another call was received for the same first due station while there were one or more ongoing calls in the same first due station. For example, if there is one call in station 14's zone, before the call was cleared another request in station 14's zone 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. MCFR Station 21 has the highest probability of having overlapped calls at 46%, followed by MCFR station 30 at 42%. SFD1 has the probability of having overlapped calls at 33%, and SFD2 has the probability at 32%.

Table 44: Overlapped Calls by First Due Station

Agency	First Due Station	Overlapped Calls	Total Calls	Probability of Overlapped Calls Occur
MCFR	14	55	585	9.4
	16	796	2,241	35.5
	18	281	1,249	22.5
	21	1,388	2,993	46.4
	22	257	1,136	22.6
	23	323	1,216	26.6
	24	339	1,262	26.9
	30	1,213	2,921	41.5
	32	156	1,007	15.5
	33	510	1,786	28.6
	34	10	137	7.3
	36	90	654	13.8
SFR	SFD1	807	2,413	33.4
	SFD2	723	2,271	31.8

Figure 41: Probability of Overlapped Calls Occur by Station FDZ



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