Call Handling and Incident Processing in Emergency Communications Centers: A Research Report

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

For this report, APCO International collaborated with the Center for Social Science Research (CSSR) at George Mason University to study call processing and incident handling times at Emergency Communications Centers (ECCs) in the United States. The aim of the study was to gather data on how long ECCs take to process different incident types, and what factors might affect call processing times. The findings in this report are based on primary data collected through a survey instrument administered to ECC employees. The survey draws on a sample of 772 employees working at ECCs from across the country. Over three-quarters of the respondents are Directors, Supervisors, or Communications Managers at ECCs.

Despite the broad differences between ECCs of different sizes and from different regions, a number of patterns emerged in this study that hold relevance for the nation's ECCs. Selected findings from the survey are summarized below.

ECC CHARACTERISTICS:

- Most sampled ECCs are small (66.9%) followed by medium (28.8%) and large (4.3 %). Small ECCs are those consisting of one to 15 employees, medium ECCs are those consisting of 16 to 75 employees, and large ECCs are those with 76 or more employees.[1]
- The total number of agencies served averages 12 for small ECCs, 21 for medium ECCs, and 22 for large ECCs.
    - For law enforcement agencies served, small ECCs average 3, medium ECCs average 6, and large ECCs average 7.
    - For fire agencies served, small ECCs average 6, medium ECCs average 10, and large ECCs average 8.
    - For EMS agencies served, small ECCs average 2, medium ECCs average 4, and large ECCs average 5.
- The number of consoles varies significantly by ECC size, with large ECCs averaging 34 compared to 8 for medium and 3 for small ECCs.
- The number of consoles dedicated to radio dispatch averages 13 for large ECCs, 5 for medium ECCs, and 2 for small ECCs.
- A majority of ECCs of all sizes serve geographic areas greater than 400 square miles.
- The number of 9-1-1 calls received in a year varies significantly by ECC size, with large ECCs averaging 524,456 calls, medium ECCs averaging 61,884 calls, and small ECCs averaging 13,626 calls.
    - For non-emergency calls, these averages are 471,740 for large ECCs, 122,377 for medium ECCs, and 39,033 for small ECCs.
- Only 38 percent of all ECCs surveyed currently receive Text to 9-1-1.

[1] Based on CALEA definitions for small, medium and large ECCs (www.calea.org).

    - Large ECCs averaged the most Text to 9-1-1 sessions in the past year at 2,687, followed by an average of 132 for medium ECCs, and 89 for small ECCs.[2]
- While a majority of all ECCs surveyed use Emergency Medical Services (EMS) dispatch protocols (68.5%), only a minority of all ECCs use Fire dispatch protocols (40.6%) or Law Enforcement dispatch protocols (36.6%).
- The abandoned call rate is 3.9 percent for small ECCs, 2.2 percent for medium ECCs, and 4.0 percent for large ECCs.
- The hang up call rate is 4.7 percent for small ECCs, 2.8 percent for medium ECCs, and 5.2 percent for large ECCs.
- A majority of all ECCs surveyed use either E9-1-1 or a Next Generation/Internet Protocol (IP) based service for wireline calls.
- 97 percent of all ECCs surveyed use 9-1-1 With Wireless Phase II for wireless 9-1-1 calls.
- Over 75 percent of all ECCs have a master clock, and large majorities of all ECCs synchronize their recorder, Computer Aided Dispatch (CAD), radio, and Customer Premise Equipment (CPE) systems to their master clock.

CALL PROCESSING AND INCIDENT HANDLING TIMES:

- The average call answer time for all sampled ECCs is 9.1 seconds, and the median is seven seconds.[3]
- Overall, the average processing time for law enforcement, fire, or EMS calls does not vary significantly by ECC size.
    - For law enforcement call answer to incident entry, the average time is 38.4 seconds.
    - For law enforcement incident entry to call dispatch, the average time is 59.7 seconds.
    - For fire call answer to incident entry, the average time is 35 seconds.
    - For fire incident entry to call dispatch, the average time is 47.2 seconds.
    - For EMS call answer to incident entry, the average time is 36.4 seconds.
    - For EMS incident entry to call dispatch, the average time is 47.8 seconds.

- The average processing time for incidents requiring language translation, the use of a TDD/TTY device or Telecommunications Relay Service (TRS), or incidents that require determining the location of the incidents due to insufficient information, do not differ significantly across ECC sizes.
    - For incidents requiring language translation, the average call answer to incident entry time is 70.9 seconds.
    - For incidents requiring language translation, the average incident entry to call dispatch time is 81.3 seconds.

[2] A Text to 9-1-1 session is defined as the time from when a Text to 9-1-1 call was received by the ECC to the time when the communication ended.

[3] These estimates were calculated after removing a small amount of very large outliers; see Section II for details on our methodology.

    - For incidents requiring the use of a TDD/TTY or TRS device, the average call answer to incident entry time is 48.4 seconds.
    - For incidents requiring the use of a TDD/TTY or TRS device, the average incident entry to call dispatch time is 62.1 seconds.
    - For incidents with difficult location determination, the average call answer to incident entry time is 70 seconds.
    - For incidents with difficult location determination, the average incident entry to call dispatch time is 74.6 seconds.
- The average processing time for Text to 9-1-1 sessions is 166.3 seconds and does not vary significantly by ECC size.

RESPONDENT OPINIONS ABOUT CALL PROCESSING TIMES AND STANDARDS:

- Respondents identified a number of call-specific factors that affect or delay call processing times, including: challenging callers; language barriers; and difficult location determination.
- Respondents identified several non-call factors that affect or delay call processing times, including: staffing levels; staff experience; and weather.
- Respondents from small ECCs are the most likely to report that their ECC processing time benchmarks are consistently met.

PROVIDING DATA ON INCIDENT PROCESSING TIMES:

Our primary findings on call handling and incident processing times in ECCs are summarized below. When interpreting the results, "X-bar" ($\bar{X}$) represents the sample mean, and lower-case "m" represents the sample median. Due to outliers in the data, we provide summary statistics for the whole sample as well as the sample with outliers removed (see Section IV below):

Call Answer Times:

- **Without outliers: $\bar{X}$** = 9.1 seconds, **m** = 7.0 seconds.
- **Full sample: $\bar{X}$** =15.8, **m** = 8.0 seconds.

Law Enforcement Calls:

- **Without outliers, call answer to incident entry: $\bar{X}$** = 38.4 seconds, **m** = 30 seconds.
- **Full sample, call answer to incident entry**: **$\bar{X}$** = 55.5 seconds, **m** = 40.0 seconds.
- **Without outliers, incident entry to call dispatch: $\bar{X}$** = 59.7 seconds, **m** = 60.0 seconds.
- **Full sample, incident entry to call dispatch: $\bar{X}$** = 97.9 seconds, **m** = 60.0 seconds.

Fire Calls:

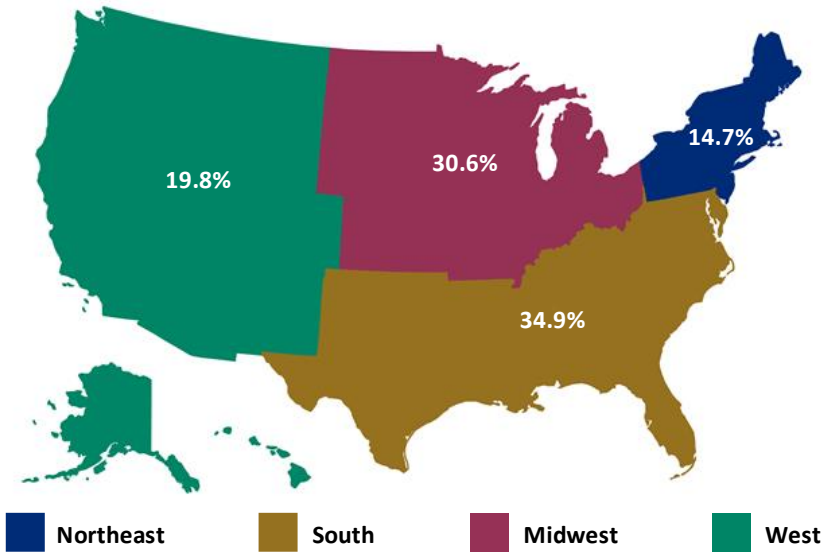
- **Without outliers, call answer to incident entry: $\bar{X}$** = 35 seconds, **m** = 30.0 seconds.
- **Full sample, call answer to incident entry**: **$\bar{X}$** = 47.3 seconds, **m** = 30.0 seconds.
- **Without outliers, incident entry to call dispatch: $\bar{X}$** = 47.2 seconds, **m** = 45.0 seconds.
- **Full sample, incident entry to call dispatch: $\bar{X}$** = 64.8 seconds, **m** = 59.5 seconds.

EMS Calls:

- **Without outliers, call answer to incident entry: $\bar{X}$** = 36.4 seconds, **m** = 30.0 seconds.
- **Full sample, call answer to incident entry**: **$\bar{X}$** = 56.6 seconds, **m** = 30.0 seconds.
- **Without outliers, incident entry to call dispatch: $\bar{X}$** = 47.8 seconds, **m** = 45.0 seconds.
- **Full sample, incident entry to call dispatch: $\bar{X}$** = 75.9 seconds, **m** = 56.0 seconds.

SECTION I: DESCRIBING THE SAMPLE OF EMERGENCY COMMUNICATIONS CENTERS

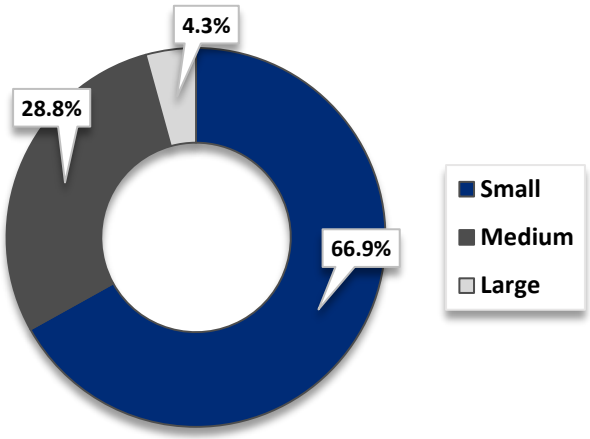
Figure 1: Distribution of ECCs By Region



Our sample of ECCs is representative of the entire country, as Figure 1 shows. By region, 14.7 percent of the 772 sampled ECCs are from the Northeast, 30.6 percent are from the Midwest, 34.9 percent are from the South, and 19.8 percent are from the West.[4]

We categorize our sampled ECCs by size in accordance with the standards established by the Commission on Accreditation for Law Enforcement Agencies, Inc. (CALEA)[5]. According to CALEA, small ECCs are those consisting of one to 15 employees, medium ECCs are those consisting of 16 to 75 employees, and large ECCs are those consisting of 76 or more employees. As shown in Figure 2, 66.9 percent of sampled ECCs are small, 28.8 percent are medium, and 4.3 percent are large. Virtually all surveyed ECCs are Primary ECCs (97.1%), with just under three percent of respondents reporting that they represent a secondary ECC.

Figure 2: ECC Size



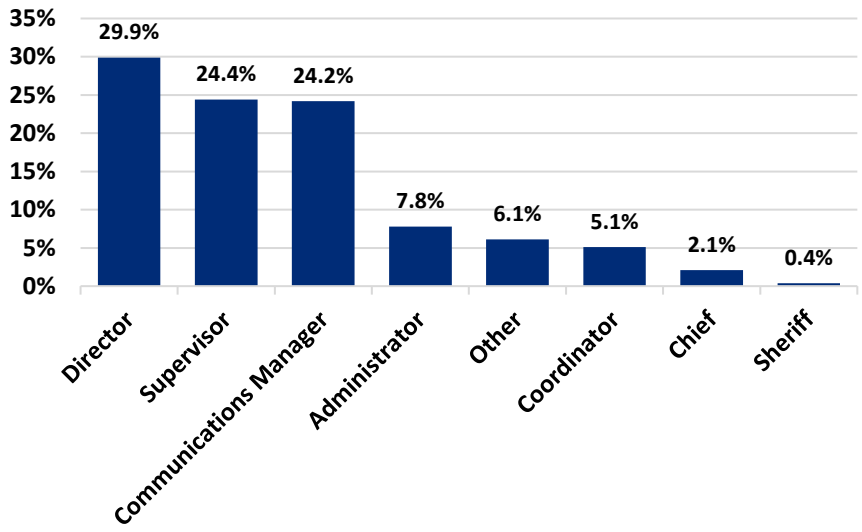
As shown in Figure 3, the largest proportion of surveyed employees indicate that they are the Directors of their ECCs (29.9%). Supervisors account for 24.4 percent of all respondents followed closely by Communications Managers (24.2%). The remaining respondents indicated they

[4] These data are representative of the overall population of ECCs from the APCO sampling frame, where 14.9 percent are located in the Northeast, 37.2 percent are located in the South, 30.5 percent are located In the Midwest, and 17.5 percent are located in the West.

[5] www.calea.org

were Administrators (7.8%), Coordinators (5.1%), Chiefs (2.1%), Sheriffs (0.4%) or some other role (6.1%).

Figure 3: Employee Title at ECC



As described in Table 1, there are significant differences between ECCs of different sizes and the population size and geographic areas that they serve. While a majority of ECCs of all sizes serve areas of 400 square miles or more, large ECCs are the most likely to service regional areas greater than 400 square miles (75.8%) compared to medium (65.3%) and small (53.8%) ECCs. Conversely, small ECCs are the most likely to service areas of 150 square miles or less (38.6%) relative to medium (23.1%) and large (15.2%) ECCs.

Table 1: ECC Service Areas

SIZE OF AREA			
Square Miles	**Small ECCs**	**Medium ECCs**	**Large ECCs**
0 – 150	38.6% (192)	23.1% (50)	15.2% (5)
151 – 400	7.6% (38)	11.6% (25)	9.1% (3)
Greater than 400	53.8% (268)	65.3% (141)	75.7% (25)
Total:	100% (498)	100% (216)	100% (33)
SIZE OF POPULATION			
# of People**	**SMALL ECCs**	**MEDIUM ECCs**	**LARGE ECCs**
0 – 50,000	82.9% (423)	22.4% (49)	3.0% (1)
50,001 – 250,000	16.7% (85)	66.2% (145)	12.1% (4)
250,000 – 500,000	0% (0)	8.2% (18)	33.3% (11)
Greater than 500,000	0.4% (2)	3.2% (7)	51.5% (17)
TOTAL:	100% (510)	100% (219)	100% (33)

**p<.01

Most small ECCs (82.9%) serve populations of 50,000 or less, while over half of large ECCs serve

populations greater than 500,000 (51.5%).[6] Medium centers are the most likely to serve populations of 50,001 to 250,000 (66.2%), although close to a quarter serve populations of 50,000 or less (22.4%) and 11.4 percent serve populations in excess of 250,000.

ECCs of different sizes vary significantly from one another on a variety of characteristics, as Table 2 shows. The total number of agencies served by ECCs reaches as high as 150 agencies. Small ECCs average 12 agencies, medium ECCs average 21, and large ECCs average 22.

Table 2: Average Characteristics By ECC Size

	Small ECCs	Medium ECCs	Large ECCs	F (Welch)
Total Number of Agencies Served	12	21	22	15.1**
Number of Law Enforcement Agencies Served	3	6	7	17.6**
Number of Fire Agencies Served	6	10	8	14.5**
Number of EMS Agencies Served	2	4	5	8.8**
Number of Consoles	3	8	34	124.6**
Total Consoles Dedicated to Radio Dispatch	2	5	13	68.8**
Number of 9-1-1 Calls	13,626	61,884	524,456	78.7**
Total Non-Emergency Calls	39,033	122,377	471,740	67.1**
Total Text to 9-1-1 Sessions[7]	89	132	2,687	1.5
Number of TDD/TTY Calls	16	233	261	2.6
Total Calls Transferred to Another Agency	2,163	8,247	51,226	15.1**
Number of Outgoing Calls	16,436	58,388	262,538	26.9**
Abandoned Call Rate	3.9%	2.2%	4.0%	6.5**
Hang Up Call Rate	4.7%	2.8%	5.2%	1.9

**p<.01

[6] Sample sizes sometimes vary in the analysis due to some survey respondents not answering all of the questions.
[7] The face value differences are deceiving. Although standard ANOVA finds significant differences, the Levene's statistic is also significant, meaning normality assumptions are violated. The Welch F is not significant and a post hoc Games-Howell test shows that, when accounting unequal variance, no between groups differences exist.

Broken down by discipline, there are variations in the number of agencies served by ECCs:

- Overall, ECCs serve an average of four law enforcement agencies. Small ECCs average three law enforcement agencies, medium ECCs average six, and large ECCs average seven. Virtually all ECCs provide law enforcement functions, including 99 percent of small, 98.6 percent of medium, and 100 percent of large ECCs.

- ECCs serve an average of seven fire agencies. Small ECCs average six fire agencies, medium ECCs average ten, and large ECCs average eight. Emergency fire services are provided by 91.3 percent of ECCs sampled.

- The average number of EMS agencies served by ECCs is three. Small ECCs average two EMS agencies, medium ECCs average four, and large ECCs average five. 87.3 percent of ECCs service EMS functions. There are no statistically significant differences between ECC size and the likelihood of offering EMS services.

The number of consoles per ECC ranges from a reported low of one to a high of 100. For all ECCs, the average is six. ECC size has a significant effect on the number of consoles, with small ECCs averaging three, medium ECCs averaging eight, and large ECCs averaging 34. The number of consoles primarily dedicated to radio dispatch ranges from zero to 50.[8] Large centers are significantly more likely to dedicate consoles to radio dispatch, averaging 13 such consoles compared to an average of eight in medium and two in small ECCs.

The average annual number of 9-1-1 calls is 52,458. Large ECCs receive a significantly greater number of 9-1-1 calls, averaging 524,456 9-1-1 calls compared to 61,884 9-1-1 calls for medium ECCs and 13,626 9-1-1 calls for small ECCs. The average annual number of non-emergency calls is 86,546. Once more, large centers receive significantly more non-emergency calls, averaging 471,740 such calls compared to 122,377 for medium ECCs and 39,033 for small ECCs.

There are no statistically significant differences between ECCs of different sizes and the number of Text to 9-1-1 sessions. Overall, ECCs average 189 Text to 9-1-1 calls in a year. Small ECCs average 89 sessions, medium ECCs average 132, and large ECCs average 2,687. Although these differences are not statistically significant, medium ECCs are significantly more likely to report being equipped to receive Text to 9-1-1 calls (50.2%) than both small (32.6%) and large (33.3%) ECCs.

The overall average number of TDD/TTY calls is 83. Large ECCs average the most TDD/TTY calls at 261 and medium ECCs are close behind with an average of 233. Although small ECCs average only 16 TDD/TTY calls per year, none of these differences are statistically significant.

[8] The ECC reporting 50 consoles primarily dedicated to radio dispatch is a large agency with 100 or more total consoles.

For all ECCs, the average number of calls transferred to another agency is 6,029, although this number differs significantly by ECC size. Large ECCs average the most transfers at 51,226, medium ECCs average significantly less with 8,247 transfers, and small ECCs average just 2,163 transfers.

Overall, the average annual outgoing call activity for ECCs is 40,089 calls. Large centers average the greatest number of outgoing calls at 262,538, while medium centers average 58,388 calls and small ECCs average 16,436 calls.

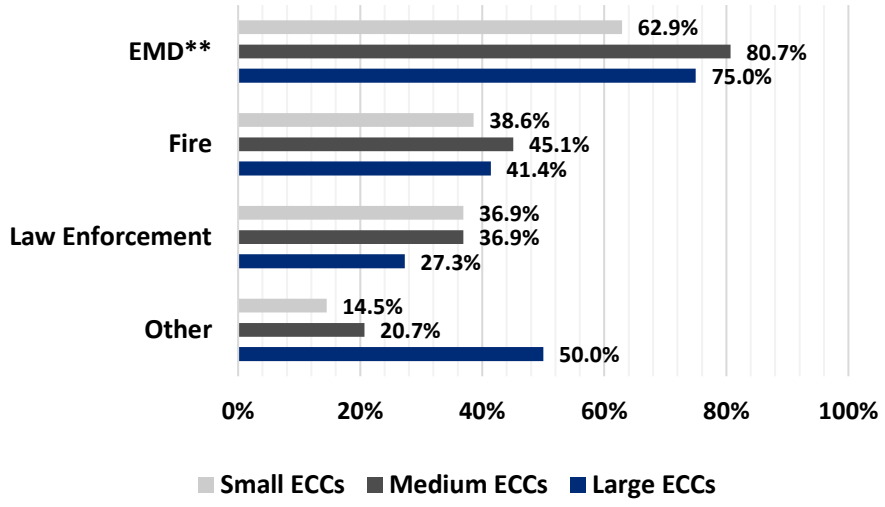
For all ECCs, the average abandoned call rate is 3.4 percent. In large ECCs, the abandoned call rate is highest at 4.0 percent, followed by 3.9 percent in small ECCs, and 2.2 percent in medium ECCs.[9]

The average hang up call rate is 4.3 percent for all ECCs. Although large centers average a higher hang up rate of 5.2 percent compared to rates of 2.9 percent in medium ECCs and 4.8 percent in small ECCs, these differences are not statistically significant.

Emergency Communications Center Dispatch Protocols

Respondents were asked a number of questions about their ECCs' operational protocols and technology systems. Overall, ECCs do not generally use dispatch protocols outside of EMD. While 68.5 percent of ECCs report using EMD dispatch protocols, just 38.6 percent report using law enforcement dispatch protocols and only 40.6 percent reporting using fire dispatch protocols.

Figure 4: ECC Use OF Dispatch Protocols



**p<.01

As Figure 4 shows, dispatch protocol use does not statistically significantly vary by ECC size except for the use of EMD dispatch protocols. 75.0 percent of large ECCs, 80.7 percent of medium ECCs, and 62.9 percent of small ECCs report using EMD dispatch protocols. Another interesting finding

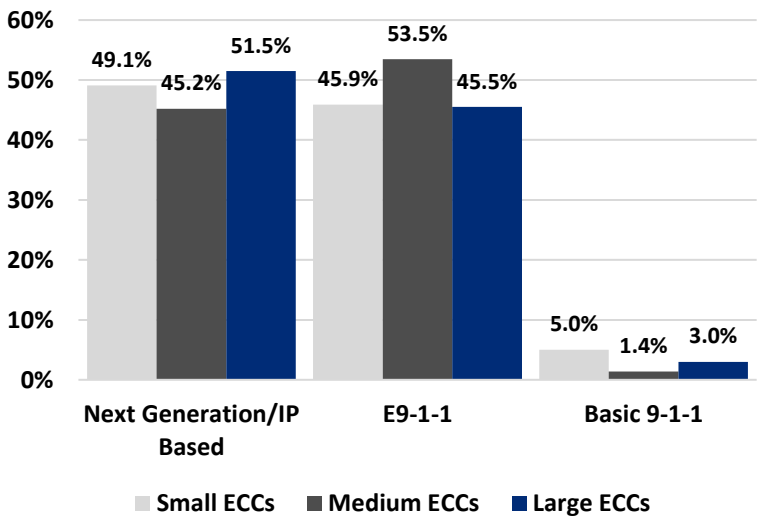
[9] Small and large ECCs do not significantly differ from one another with respect to abandoned call rates, although medium centers significantly differ from both small and large ECCs.

from Figure 4 is that large ECCs are the most likely to report using dispatch protocols for "other" incidents (50%) compared to small (14.5%) and medium (20.7%) ECCs. Due to the small sample of respondents indicating that their ECCs report use other dispatch protocols, however, we cannot say that these findings are statistically significant.[10]

Most ECCs are using either an E9-1-1 or some level of Next Generation/IP based call handling components for wireline 9-1-1 calls. This is true for all ECCs irrespective of size. As Figure 5 shows, 49.1 percent of small ECCs use a Next Generation/IP based system, 45.9 percent use E9-1-1, and only 5.0 percent use Basic 9-1-1. Similarly, 42.5 percent of medium centers use a Next Generation/IP based system, over half use E9-1-1 (53.5%), and just 1.4 percent use Basic 9-1-1. A majority of large ECCs are equipped with Next Generation/IP systems (51.5%), 45.5 percent are using E9-1-1, and just 3 percent are using Basic 9-1-1.

In a similar vein, respondents were also asked to indicate the highest level of service their ECC receives for wireless 9-1-1 calls. Virtually all ECCs, regardless of size, are equipped with 9-1-1 Wireless Phase II. This is the case for 97 percent of large ECCs, 94 percent of medium ECCs, and 91.7 percent of small ECCs.

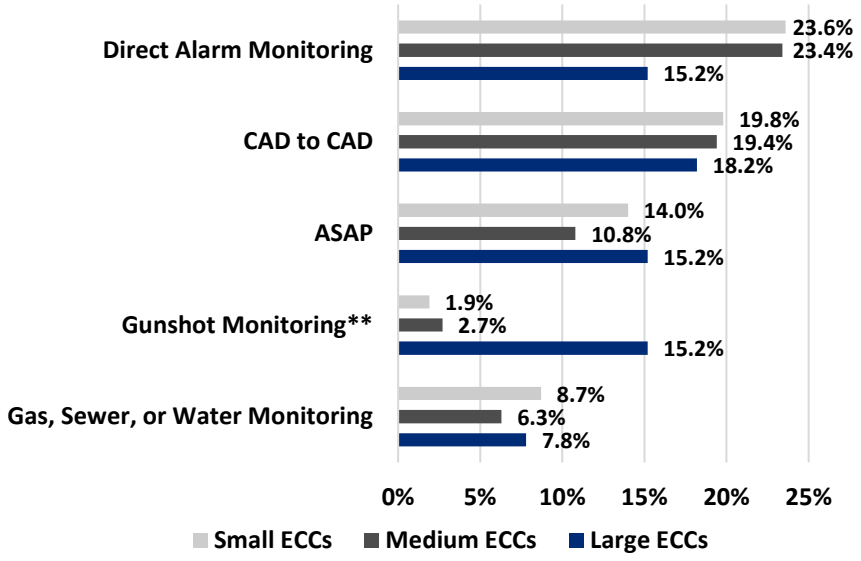
Figure 5: Wireline 9-1-1 Level OF Service



Respondents were asked if their ECC accepts incidents via non-traditional or automated means, such as CAD to CAD or Automated Secure Alarm Protocol (ASAP). Overall, 46.4 percent of respondents indicate their ECCs accept incidents through non-traditional means. For the subsample of ECCs that accept incidents through non-traditional means, there are generally no statistically significant differences between ECCs of different sizes and the types of special incident handling they are equipped for, as Figure 6 shows. Direct alarm monitoring is slightly more likely to be present in small ECCs (23.4%) than medium (23.4%) and large (15.2%) ECCs, but no statistical association is observed. CAD to CAD systems are about equally distributed across small (19.8%), medium (19.4%) and large (18.2%) ECCs. Similarly,

[10] Respondents described a diverse array of "other" dispatch protocols, including: Public Works; Animal Control; Rough Terrain Rescue; Campus Security; DPW; Search and Rescue; BIA; County Emergency Services; DNR; Utilities; Marshal; Probation; Wreckers; Animal Welfare; Highways and Roads; Mountain Rescue Teams; City Maintenance; Missing and Exploited Children Protocol; Gasp Pipeline; Swift Water Rescue; Streets Department; EMA; and Hospital Security.

Figure 6: Special Incident Handling

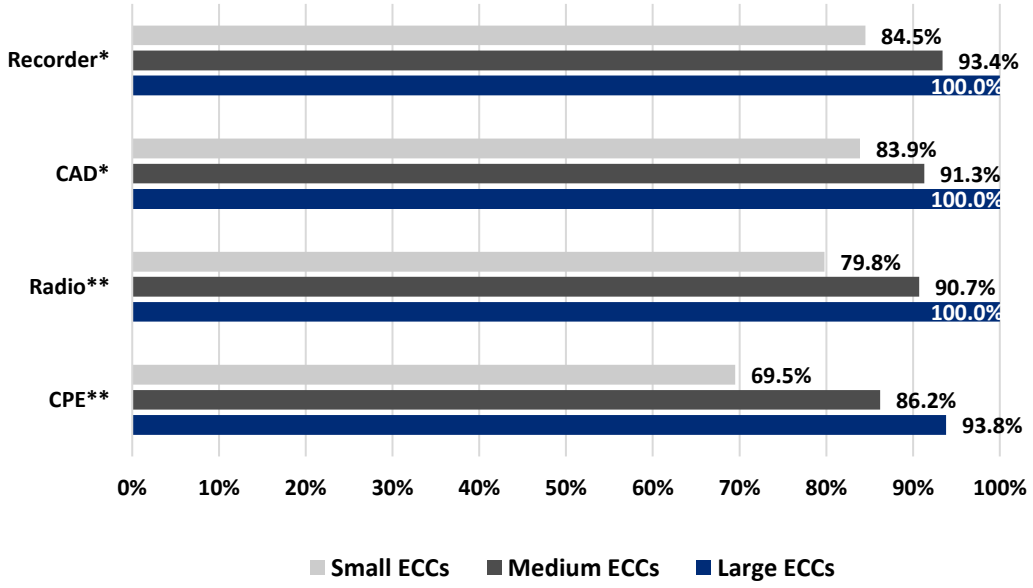


**p<.01

ASAP capabilities are relatively evenly dispersed among small (14.0%), medium (10.8%), and large (15.2%) ECCs.

The only statistically significant difference between ECCs and types of special incident handling involves gunshot monitoring systems. While 15.2 percent of large ECCs utilize a gunshot monitoring system, only 2.7 percent of medium and 1.9 percent of small ECCs are equipped with this technology. Interestingly, small ECCs were more likely (8.7%) than medium (6.3%) and large (7.8%) ECCs to monitor gas, sewer, and water incidents, although these differences are not significant.

Figure 7: Systems Synchronized With Master Clock



**p<.01
*p<.05

While over 75 percent of all ECCs report having a master clock, this varies by size, as large ECCs are significantly more likely to report having a master clock (91.3%) compared to medium (84.9%) and small (70.0%) ECCs. Of those ECCs that do have master clocks, many report synchronizing their master clocks with a number of their systems.

Small ECCs are the least likely to synchronize their master clocks with their recorder systems (84.5%), CAD systems (83.9%), radio systems (79.8%), and CPE systems (69.5%) compared to medium and large ECCs. Indeed, medium ECCs with master clocks synchronize their clocks with their recorder systems in 93.4 percent of cases, with their CAD systems in 91.3 percent of cases, with their radio systems in 90.7 percent systems, and with their CPE systems in 86.2 percent of cases. Large ECCs are the most likely synchronize their master clocks with their recorder (100.0%), CAD (100.0%), radio (100.0%), and CPE (93.8%) systems.

Although the synchronization of systems with master clocks varies significantly by ECC size, it should be noted that all ECCs—small, medium, and large—equipped with master clocks synchronize them with their systems in an overwhelming majority of cases. Nevertheless, due to the observed linear pattern of increasing ECC size and increased master clock synchronization, larger ECCs do appear to have attributes that are conducive to such synchronization. However, determining the mechanism driving this relationship requires data that exceeds the scope of this investigation.

SECTION II: INCIDENT HANDLING IN ECCS

This section looks at ECC call processing times for calendar year (CY) 2017 across the three primary disciplines: law enforcement, fire, and EMS. Three specific situations that may require a longer processing time are also considered: (1.) language translation; (2.) use of a TDD/TTY device or audio/video relay services; and (3.) location determination when a caller provides insufficient information. The call processing time includes three stages of a call: (1.) call receipt to call answer; (2.) call answer to incident entry; and (3.) incident entry to call dispatch.

For the purpose of this study, the following definitions are used:[11]

- **Call Receipt to Call Answer:** Time from when a call arrives at Customer Premise Equipment (CPE) to call answer.
- **Call Answer to Incident Entry:** Time from when call is answered at the ECC to initiation of incident entry.
- **Incident Entry to Dispatch**: Time from initiation of incident entry to when call is dispatched to assigned units. This may be identified as: verbal dispatch of the call, completion of assignment in CAD, silent dispatch to Mobile Data Terminal (MDT), or Initiation of tones.

For those instances where respondents indicated that their ECCs receive Text to 9-1-1 calls, they were asked to record the average processing times for these text sessions as well, where a single session refers to the entire period of communication via Text to 9-1-1.

Call Processing and Incident Handling Times

Preliminary analyses of the call processing time data revealed the data to be highly skewed. This skewedness was caused by the fact that overall, ECCs process calls rather quickly with only a moderate amount of variance, meaning that call processing times tended to cluster towards the lower end of the distribution (see the plots in Section IV).

A small minority of ECCs, however, have extremely long processing times. When conducting aggregate statistical analyses, these large but rare values tended to inflate estimates above their expected values. This means that while most ECCs have lower call processing times, the very few ECCs that have long call processing times weigh heavily on the average estimates for all ECCs. These extreme values are called outliers. Put simply, they are data points that are far away from the other data points, and this distance can interfere with numerical interpretation. Just as a few individuals with very high incomes lead to a mean income that exceeds the median income(i.e., the income earned by the first fifty percent of all earners). A few ECCs with

[11] The same definitions were used in the incident handling process survey delivered by the CSSR and APCO (see Appendix C).

extremely high call processing times lead to a mean processing time that is much higher than the call processing times of the majority of ECCs.

Based on this fact, a decision was made to restrict the analyses in Table 3 and Table 4 below to ECCs falling at or below the 90th percentile for each measure considered. A percentile refers to a value in a distribution below which a certain proportion of the data falls. For example, if 30 seconds is the 90th percentile for the time it takes an ECC to answer a call upon receipt; this can be interpreted as 90 percent of ECCs answer calls in less than 30 seconds. Alternatively, this could be interpreted as ECCs that take 30 seconds to answer a call upon receipt constitute only 10 percent of all ECCs, specifically the top 10 percent of ECCs (i.e., the 10 percent of ECCs that take the longest). Presumably, these ECCs are qualitatively different from the majority of ECCs and assessing the practices and standards for such ECCs calls for a different framework than the typical ECC. Accordingly, the following analyses are conducted on the bottom 90 percent of data for each measure—that is, all data up to and including the 90th percentile.

The average call processing times for law enforcement, fire, and EMS calls in small, medium, and large ECCs are reported in Table 3. All times are reported in seconds.

Table 3: ECC Call Processing Times (in seconds)

	Total ECC Average	Small ECC Average	Medium ECC Average	Large ECC Average	F
Call Answer Time	9.1 (n=302)	9.5 (n=213)	7.9 (n=78)	9.7 (n=11)	1.7†
LAW ENFORCEMENT CALLS					
Call Answer to Incident Entry	38.4 (n=254)	36.7 (n=184)	42.2 (n=63)	47.6 (n=7)	1.4
Incident Entry to Dispatch	59.7 (n=270)	54.1 (n=199)	74.6 (n=63)	82.4 (n=8)	5.3*†
FIRE CALLS					
Call Answer to Incident Entry	35.0 (n=238)	34.2 (n=175)	37.6 (n=57)	33.5 (n=6)	0.42
Incident Entry to Dispatch	47.2 (n=251)	45.6 (n=182)	50.7 (n=63)	61.3 (n=6)	1.2
EMS CALLS					
Call Answer to Incident Entry	36.4 (n=225)	35.3 (n=163)	40.1 (n=56)	33.5 (n=6)	0.8
Incident Entry to Dispatch	47.8 (n=239)	47.0 (n=175)	48.1 (n=57)	67.9 (n=7)	1.2

*p<.05; †Welch F

As the first column of estimates shows, the average call answer time for all ECCs is 9.1 seconds.

Although not listed in the table, the median is seven seconds, very close to the mean of 9.1 seconds, indicating that the removal of outliers beyond the 90th percentile reduced the bias of the sample.[12] Small ECCs take an average of 9.5 seconds to answer calls, medium ECCs average 7.9 seconds, and large ECCs average 9.7 seconds. However, these differences are not statistically significant, indicating that the size of an ECC does not affect call answer times.

Moving on to the disciplinary specific estimates in Table 3, we see that for law enforcement calls, the average time it takes ECCs of all sizes to enter law enforcement incidents upon answering a call is 38.4 seconds (the median is 30 seconds).[13] The average time for small ECCs is 36.7 seconds, the average for medium ECCs is 42.2 seconds, and the average for large ECCs is 47.6 seconds. Again, these differences are not statistically significant, suggesting that ECC size does not affect the time it takes to enter law enforcements incidents upon receiving them.

Continuing on to law enforcement incident entry to dispatch times, Table 3 shows that for all ECCs, the average for this metric is 59.7 seconds (the median is 60 seconds).[14] Small ECCs average 54.1 seconds between incident entry to the dispatch of law enforcement calls, while medium ECCs average 74.6 seconds and large ECCs average 82.4 seconds. For this measure, the difference between small ECCs and medium ECCs is statistically significant, indicating that small ECCs dispatch law enforcement calls more quickly than medium ECCs upon incident entry. However, large ECCs do not differ significantly from either small or medium ECCs. This is likely caused by the small sample of large ECCs in the dataset.

Moving on to the fire call data in Table 3, we see that for all ECCs, the average time it takes to enter fire calls upon receipt is 35 seconds (the median is 30 seconds).[15] For small ECCs, the average time it takes to enter fire calls upon receipt is 34.2 seconds, medium ECCs average 37.6 seconds, and large ECCs average 33.5 seconds. For this measure, ECC size does not significantly affect the processing time.

Continuing to fire incident entry to dispatch, Table 3 shows that it takes all ECCs an average of 47.2 seconds to dispatch fire calls upon entering them (the median is 45 seconds).[16] Small ECCs average 45.6 seconds, medium ECCs average 50.7 seconds, and large ECCs average 61.3 seconds. Again, ECC size does not statistically significantly affect the processing times of this measure.

The last discipline reported in Table 3 is EMS. The average EMS call answer to incident entry processing time for all ECCs is 36.4 seconds (the median is 30 seconds).[17] For small ECCs, this

[12] With outliers, the average rises to 15.6 seconds with a median of eight seconds.
[13] With outliers, the average rises to 55.6 seconds with a median of 40 seconds.
[14] With outliers, the average rises to 97.9 seconds with a median of 60 seconds.
[15] With outliers, the average rises to 47.3 seconds with a median of 30 seconds.
[16] With outliers, the average rises to 64.8 seconds with a median of 59.5 seconds.
[17] With outliers, the average rises to 56.4 seconds with a median of 30 seconds.

average is 35.3 seconds, for medium ECCs the average is 40.1 seconds, and for large ECCs the average is 33.5 seconds. For EMS incident entry to dispatch times, the average for all ECCs is 47.8 seconds (the median is 45 seconds).[18] Small ECCs average 47.0 seconds, medium ECCs average 48.1 seconds, and large ECCs average 67.9 seconds. For both of the EMS measures, there are no statistically significant differences between ECCs of different sizes, suggesting that the size of an ECC does not affect the processing times for EMS calls.

Table 4 reports the incident processing data for the three incident types: incidents requiring language translations, incidents requiring use of a TDD/TTY device or TRS, and incidents requiring the determination of incident locations due to insufficient information.

Beginning with incidents requiring language translation, Table 4 shows that ECCs of all sizes average 70.9 seconds from call answer to incident entry (the median is 60 seconds). Small ECCs are the quickest, averaging 66.4 seconds compared to 77.4 seconds for medium ECCs and 123.3 seconds for large ECCs. The comparison of means also reveals a statistically significant difference between small ECCs and large ECCs, although no statistically significant differences exist between small and medium ECCs or medium and large ECCs.

Table 4: ECC Call Processing Time By Incident Type (Time in Seconds)

LANGUAGE TRANSLATION	Total ECC Average	Small ECC Average	Medium ECC Average	Large ECC Average	F
Call Answer to Incident Entry	70.9 (n=153)	66.4 (n=115)	77.4 (n=32)	123.3 (n=6)	3.5*
Incident Entry to Dispatch	81.3 (n=154)	78.9 (n=116)	82.9 (n=33)	126.0 (n=5)	2.3
TDD/TTY DEVICE, TRS					
Call Answer to Incident Entry	48.4 (n=117)	43.8 (n=90)	64.0 (n=24)	63.3 (n=3)	1.6
Incident Entry to Dispatch	62.1 (n=120)	62.3 (n=95)	60.2 (n=23)	75.0 (n=2)	0.1
DIFFICULT LOCATION DETERMINATION					
Call Answer to Incident Entry	70.0 (n=161)	68.7 (n=127)	74.1 (n=30)	82.5 (n=4)	0.2
Incident Entry to Dispatch	74.6 (n=156)	73.0 (n=121)	78.1 (n=32)	100.0 (n=3)	0.4

*p<.05

The average processing time for calls requiring language translation from incident entry to call dispatch is 81.3 seconds for all ECCs (the median is 60 seconds). Small ECCs average 78.9

[18] With outliers, the average rises to 75.2 seconds with a median of 56 seconds.

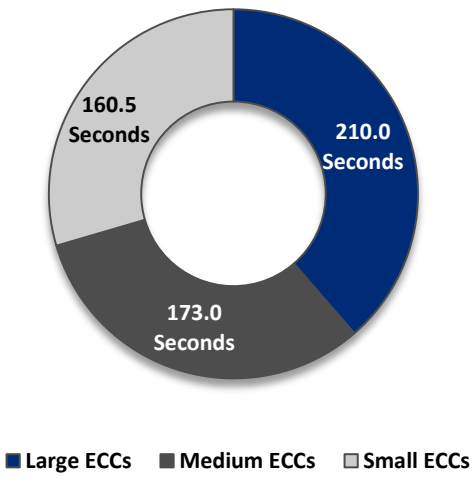
seconds, medium ECCs average 82.9 seconds, and large ECCs average 126.0 seconds. None of these differences, however, are statistically significant.

For calls requiring a TDD/TTY device or TRS, ECCs of all sizes average 48.4 seconds for call answer to incident entry (the median is 30 seconds), and 62.1 seconds for incident entry to call dispatch (the median is 60 seconds). For incident entry upon answering a TDD/TTY or TRS call, small ECCs are quickest (48.4 seconds) followed by large (63.3 seconds) and medium (64.0 seconds) ECCs. Medium ECCs are quickest to dispatch calls requiring TDD/TTY or TRS upon incident entry (60.2 seconds) compared to small (62.3 seconds) and large (75.0 seconds) ECCs. Once more, however, none of these differences are statistically significant, meaning that no evidence exists to conclude that the size of an ECC influences its call processing times for calls requiring TDD/TTY or TRS.

Finally, for incidents requiring location determination due to insufficient information, ECCs of all sizes average 70.0 seconds for call answer to incident entry (the median is 60 seconds), and 74.6 seconds for incident entry to dispatch (the median is 60 seconds). Small ECCs are quickest at entering incidents requiring location determination upon answering calls (68.7 seconds) followed by medium (74.1 seconds) and large (82.5 seconds) ECCs. Similarly, small ECCs are, on average, faster (73.0 seconds) than medium ECCs (78.1 seconds) and large ECCs (100.0 seconds) at dispatching incidents requiring location determination upon entry. However, consistent with previous findings, none of these results are statistically significant, meaning that we lack sufficient evidence to conclude that ECC size influences the processing times of incidents requiring location determination.

Figure 8 considers the processing times of Text to 9-1-1 sessions. As it shows, there are no statistically significant differences between ECCs of different sizes and their Text to 9-1-1 processing times. The overall processing time of Text to 9-1-1 sessions is 166.3 seconds for all ECCs. Small ECCs are slightly above this average at 160.5 seconds, while medium and large ECCs are below average at 173.0 and 210.0 seconds, respectively. It should be noted, however, that due to the mechanics of Text to 9-1-1, processing times for these for some of these incidents may be longer.

FIGURE 8: ECC TEXT TO 9-1-1 PROCESSING TIMES



In sum, there is little evidence to suggest that ECCs of different sizes have different incident processing times for the disciplines and incident types analyzed here. Although these estimates were produced with limited data, and although the data was skewed, restricting analysis to the

90th percentile of each metric should provide a more accurate representation of ECC processing times by dropping extreme outliers.

A follow-up study on call processing and incident handling times in ECCs is likely to result in a larger sample of valid responses as more ECCs begin tracking their incident processing times. Nevertheless, the estimates provided in this report should serve as plausible preliminary calculations about incident processing and handling times in ECCs.

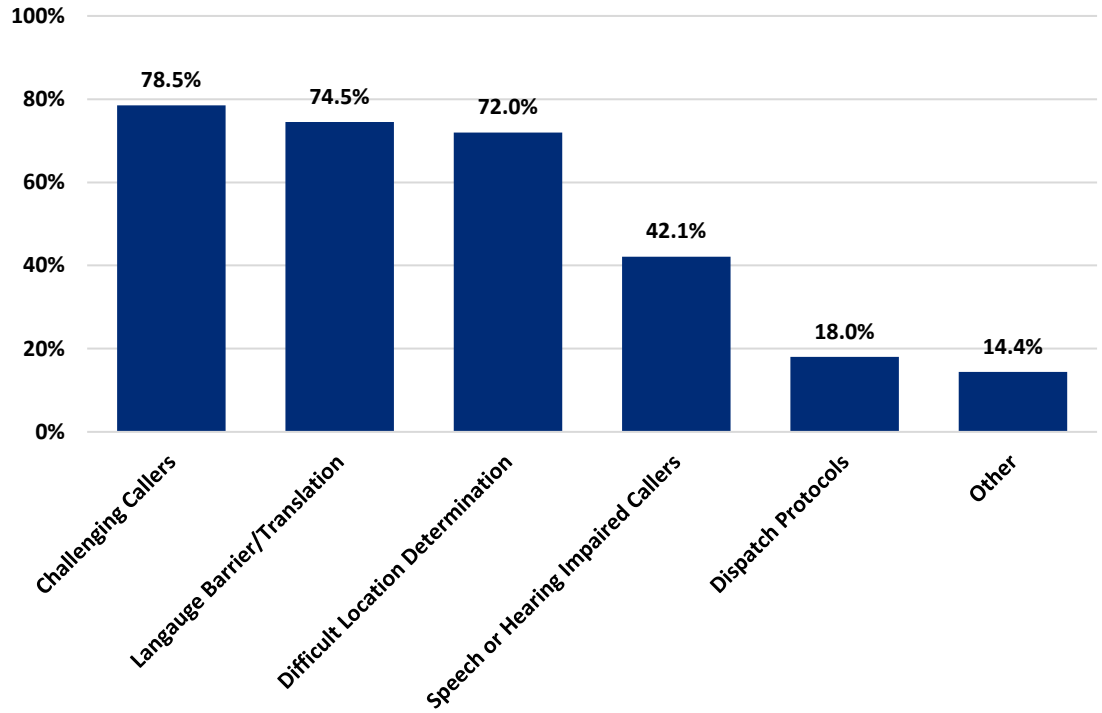
SECTION III: RESPONDENTS' OPINIONS ABOUT CALL PROCESSING TIMES AND STANDARDS

This section looks at respondents' opinions about incident processing times and standards. This includes examining important factors that may delay or affect incident processing time for ECCs, as well as asking respondents to evaluate how often their ECCs meet their expectations or benchmarks for law enforcement, fire, and EMS incident processing targets.

Factors Affecting Incident Processing Times

First, respondents were asked specifically about the types of calls that might delay processing times at their ECCs. As Figure 9 shows, 78.5 percent of all ECCs report that dealing with challenging callers—such as children, the elderly, callers under duress, intoxicated callers, etc.—tends to delay their processing times. Calls requiring translation or calls that require language translation delay processing times in nearly three quarters of all ECCs.

Figure 9: Call-Related Factors Affecting Processing Times

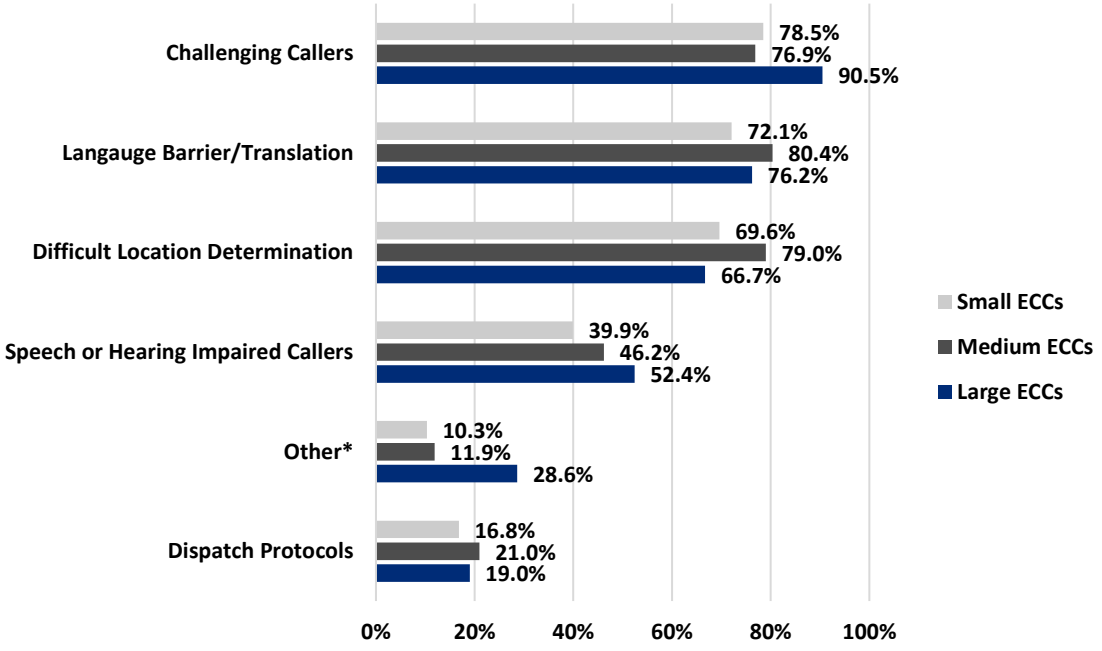


Calls requiring difficult location determination delay processing times in 72.0 percent of ECCs. Calls from speaking or hearing impaired callers only delays processing times in a minority of ECCs (42.1%). Dispatch protocols do not seem to be a great impediment to ECC call processing

times, as only 18 percent of ECCs report that they slow processing times. Finally, 14.4 percent of respondents report that other factors delay processing times in their ECCs.[19] Some of the examples they list include multiple calls of the same incident, non-emergency calls, poor cellular reception, and having to respond to emergency calls in rural areas.

As is shown in Figure 10, in general, there are no significant differences between ECCs of different sizes and the factors affecting processing times; that is, calls of the same type create challenges for ECCs of all sizes. The lone exception is the other category, where large ECCs are significantly more likely (28.6%) to report that "other" factors affect their processing times than medium (11.9%) and small (10.3%) ECCs. This suggests that large ECCs are dealing with far more call diversity than small and medium ECCs, leading to unique challenges affecting processing times in large ECCs.

Figure 10: Call-Related Factors Affecting Processing Times in ECCs



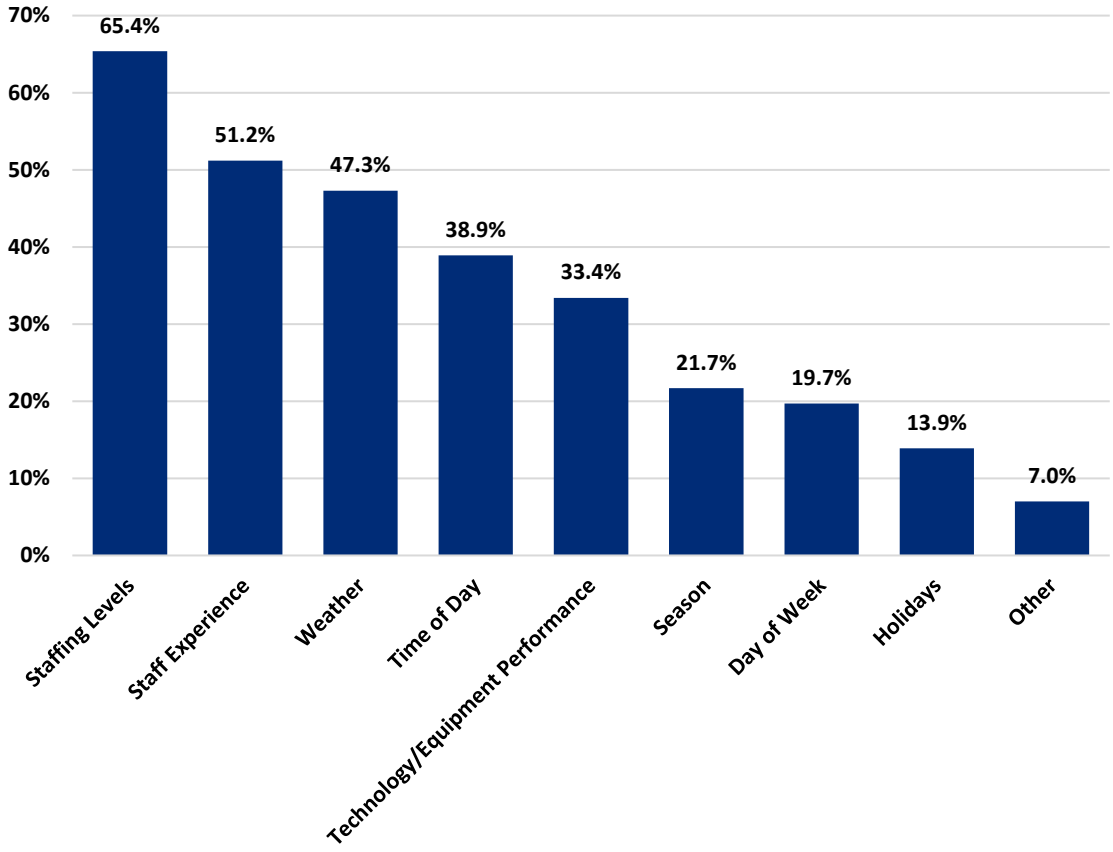
*p<.05

Additionally, respondents were asked about factors external to calls that might affect processing times in their ECCs. These findings are reported in Figure 11. It is immediately clear that the most significant external factor affecting call processing times is staffing levels, a challenge occurring in 65.4 percent of ECCs. Similarly, the experience level of ECC staff affects processing times in 51.2 percent of ECCs. Weather conditions affect processing times in nearly

[19] These "other" factors include: call volume; improperly transferred calls; old equipment; transferring and/or relaying call information; delays in Phase II data; audio quality; misuse of 9-1-1; multiple reports of the same incident; mentally ill callers; use of Text to 9-1-1; jurisdictional issues; and bad cellular reception.

half of ECCs (47.3%), as does the time of day (38.9%). For just over a third of ECCs, technology and equipment performance influences processing times—a sizeable minority.

Figure 11: Overall Non-Call Related Factors Affecting Processing Times

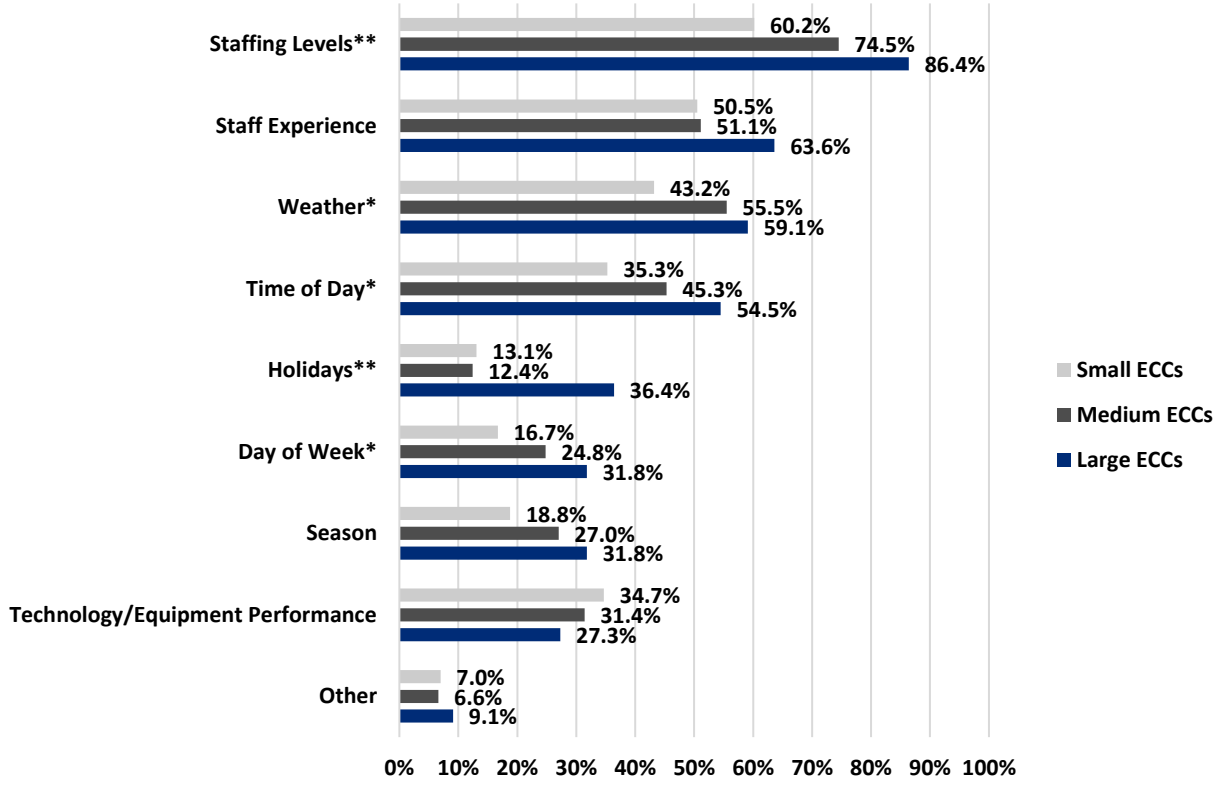


Season of the year (21.7%), day of week (19.7%), and holidays (13.9%) do not appear to be significant factors affecting call processing times in ECCs, and just 7.0 percent of ECCs report that other factors influence processing times. Some of these other factors include special town or city events, staff unwillingness to use the CAD system instead of pen and paper, and Family Medical Leave Act (FMLA) vacancies.

As shown in Figure 12, there are significant differences between ECCs of different sizes and the external factors affecting processing times. Large ECCs are significantly more likely (86.4%) to report staffing levels affecting processing times than medium (74.5%) and small (60.2%) ECCs, although it should be noted that sizeable majorities of all ECCs report this to be a challenge. Majorities of all ECC sizes report that staff experience affects processing times, and none of the differences between small, medium, and large ECCs are significant, indicating that staff experience is a universal challenge for ECCs.

A marginal statistical association exists for weather events, with large ECCs being slightly more likely (59.1%) than medium (55.5%) and small (43.2%) ECCs to report that weather affects processing times. Calendar effects –such as holidays or special local events—and time of day effects are also more pronounced in large ECCs. 54.5 percent of large ECCs report that time of day affects processing times compared to 45.3 percent of medium ECCs and 35.3 percent of small ECCs. Similarly, large ECCs are significantly more likely to report that holidays affect processing times (36.4%) compared to medium (12.4%) and small (13.1%) ECCs, as well as day of the week. Seasonal effects do not vary significantly by ECC size.

Figure 12: Non-Call Related Factors Affecting Prcoessing Times by ECC Size



**p<.01, *p<.05

There are no significant differences between ECCs of different sizes and the likelihood of technological or equipment performance affecting processing times. Finally, although large ECCs are slightly more likely to report that other factors affect processing times (9.1%) compared to medium (6.6%) and small (7.0%) ECCs, these differences are not statistically significant.

Respondents' Opinions on Call Processing Times

In addition to identifying factors that might affect call processing times, respondents were asked to evaluate how often average call processing times in their ECCs meet their expectations for three disciplines—law enforcement, fire, and EMS—as well as an optional "other" category. Answers were scored on a five-point Likert scale with the following values: (1) Never; (2) Rarely; (3) Sometimes; (4) Often; and (5) Always.

To compute a respondent's score on the scale, the values for their answers were summed and divided by four (i.e., the number of scale items/questions), resulting in a standardized composite score ranging from one to five. Overall, respondents scored an average of 3.3 out of 5 with a standard deviation of 0.55. The median was close to the mean at 3.0.

As Table 5 shows, respondents' opinions on how often their ECCs meet their benchmarks for average processing times varies significantly by ECC size. Respondents from small ECCs average a score of 3.3 compared to 3.1 for respondents from medium ECCs and 2.9 for respondents from large ECCs. However, all of the statistical significance is accounted for by differences between small and medium ECCs, as no statistical association distinguishes large ECCs from either small or medium ECCs.

Table 5: Overall ECC Processing Time Benchmark Scale Scores

	Small ECCs	Medium ECCs	Large ECCs	F
Processing Time Scale Score	3.3 (n=269)	3.1 (n=107)	2.9 (n=11)	8.1**
**p<.01				

In Table 6, the scale scores are broken down my discipline. For law enforcement call processing, small ECCs are significantly more likely to report meeting their processing benchmarks for this discipline with a score of 4.4 compared to scores of 4.2 for medium and 3.8 for large ECCs. Large ECCs do not significantly differ from medium ECCs on this measure.

Table 6: ECC Processing Time Benchmark Scale Scores By Discipline

Avg. by Discipline	Small ECCs	Medium ECCs	Large ECCs	F
Law enforcement	4.4	4.2	3.8	10.9**
Fire	4.4	4.2	3.9	5.6**
EMS	4.3	4.1	4.1	3.1*
**p<.01, *p<.05				

This pattern is repeated for fire call processing, as small ECCs are significantly more likely (4.4 scale score) than medium ECCs (4.2 scale score) to report meeting their processing time benchmarks for this measure. Large ECCs, although averaging the lowest score (3.9), do not significantly differ from either small or medium ECCs in this area.

Finally, for EMS call processing, a statistical association exists with small ECCs being slightly more likely (4.3 scale score) than medium ECCs (4.1) to report meeting their processing benchmarks for this discipline, although neither small nor medium ECCs have any significant differences with large ECCs (4.1) in this area.

Further disaggregating respondents' opinions helps clarify these relationships, as is shown in Table 7. Beginning with law enforcement call processing times, small ECCs are significantly more likely to report always meeting their benchmarks (45.5%) compared to medium (29.6%) and large (21.1%) ECCs. Similarly, large ECCs are more than five times more likely than medium ECCs and over 26 times more likely than small ECCs to report rarely or never meeting their benchmarks.[20]

Table 7: Opinions On ECC Processing Times By ECC Size

Law Enforcement**	**Small ECCs**	**Medium ECCs**	**Large ECCs**
Always	45.5%	29.6%	21.1%
Often	51.0%	61.6%	63.2%
Sometimes	2.9%	5.6%	0.0%
Rarely/Never	0.6%	3.2%	15.7%
Total:	100%	100%	100%
Fire**	**Small ECCs**	**Medium ECCs**	**Large ECCs**
Always	45.1%	30.3%	25.0%
Often	49.3%	58.8%	41.7%
Sometimes	4.2%	8.4%	33.3%
Rarely/Never	1.4%	2.5%	0.0%
Total:	100%	100%	100%
EMS*	**Small ECCs**	**Medium ECCs**	**Large ECCs**
Always	43.0%	27.5%	33.3%
Often	51.8%	62.4%	50.0%
Sometimes	3.3%	7.3%	16.7%
Rarely/Never	1.9%	2.8%	0.0%
Total:	**100%**	**100%**	**100%**

**p<.01, *p<.05

A similar pattern is seen with fire call processing, with 45.1 percent of small ECCs reporting they always meet their benchmarks compared to 30.3 percent of medium ECCs and a quarter of large ECCs. Large ECCs are the most likely to report sometimes meeting their fire benchmarks (33.3%), and small ECCs are the least likely to report rarely or never meeting their fire benchmarks (1.4%). These differences are statistically significant, indicating that large ECCs

[20] For these Chi Square tests, the categories "Rarely" and "Never" were combined due to small N counts in each leading to an excess of expected cell counts of less than zero.

have the most difficult time meeting their fire processing time benchmarks, small ECCs have the easiest time, and medium ECCs occupy a middle ground between both.

With EMS calls, the differences between ECCs narrow, although small ECCs are still significantly more likely to report always meeting their benchmarks (43.0%) compared to medium (27.5%) and large (33.3%) ECCs. Even so, half of large ECCs and 62.4 percent of medium ECCs report often meeting their EMS processing time benchmarks compared to 51.8 percent of small ECCs. Although large ECCs remain significantly more likely to report that they only sometimes meet their EMS processing benchmarks (16.7%) compared to medium (7.3%) and small (3.3%) ECCs, no large ECCs report rarely or never meeting these benchmarks, although 2.8 percent of medium and 1.9 percent of small, ECCs do.

Overall, small ECCs are the most likely to meet their call processing time benchmarks. Medium ECCs trail behind small ECCs only slightly, while large ECCs follow behind in third place. Although large ECCs are more likely to report missing their call processing time benchmarks, these differences are not extreme, and save for fire call processing times, a strong majority of large ECCs (over 80 percent) report often or always meeting their call processing times.

SECTION IV: A CLOSER LOOK AT ECC CALL PROCESSING AND INCIDENT HANDLING

Developing a set of standards for incident handling and processing times for the three primary call types—law enforcement calls, fire calls, and EMS calls—is a priority for APCO. These standards will function both as a target for ECCs to strive for, as well as a set of stable expectations for incident handling and processing times for these types of calls. The close look we take at our survey data regarding ECC call processing and incident handling in this section should provide APCO's working group with important information that will aid them in developing such standards.

As we showed in Section II above, there are generally no statistically significant differences between ECCs of different sizes and their call processing and incident handling times on any of the metrics of interest. Given these data, we do not have sufficient evidence to conclude that the size of an ECC alone hinders or facilitates processing times. Therefore, the analyses contained herein rely on an aggregated approach that looks at processing times in the respected disciplines across all ECCs.

These analyses are driven by a thorough investigation of the distribution of processing time data by percentiles. Recall from Section II that a percentile refers to a value in a distribution below which a certain proportion of the data lie. So, for example, if 30 seconds is the 90th percentile for the time it takes ECCs to answer calls upon receipt, we can say that ECCs taking 30 seconds to answer calls take longer than 90 percent of all other ECCs. Alternatively, we can say that these ECCs represent only ten percent of all ECCs, specifically the top ten percent of ECCs (i.e., the ten percent of ECCs that take the longest). As we explained in Section II above, due to outliers, the analysis contained herein is restricted to the bottom 90 percent of our sample.

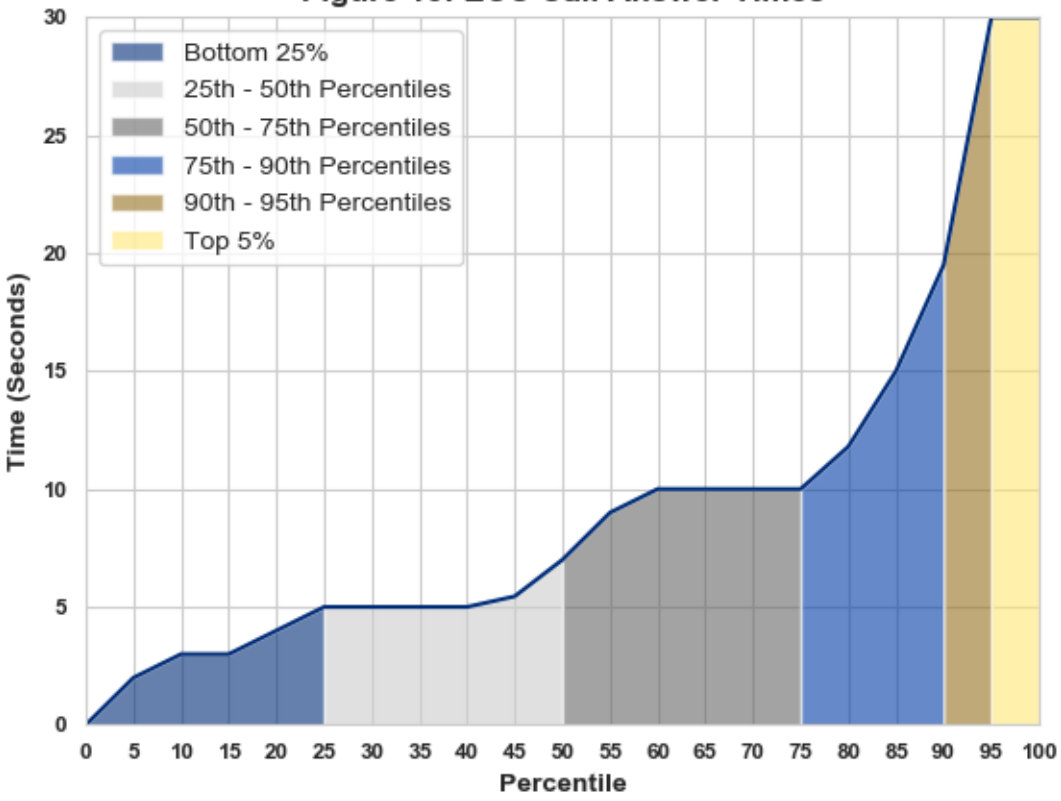
Call Receipt to Call Answer

Figure 13 below represents the distribution of call answer times in ECCs. The x-axis represents the percentile, while the y-axis represents the time in seconds. Each of the shaded regions on the plot represents the range of values falling at and below the 25th percentile, in-between the 25th and 50th percentiles, in-between the 50th and 75th percentiles, in-between the 75th and 95th percentiles, in-between the 90th and 95th percentiles, and the top 5 percent.

Examining Figure 13, we see that the max ECC call answer time in the sample is 30 seconds. However, this value drops precipitously as we move down the distribution. For example, at the 90th percentile, ECCs take 19.5 seconds to answer calls upon receipt, while at the 75th percentile, ECCs take just 10 seconds. This means that three-quarters of ECCs answer calls in under 10 seconds. Midway through the distribution at the 50th percentile, ECCs take only seven

seconds to answer calls upon receiving them, while the ECCs in the bottom 25 percent of the distribution take just five seconds or less. For those ECCs in the bottom five percent of the distribution, only two seconds or less passes before a call is answered.

Figure 13: ECC Call Answer Times



It is important to recognize the skewed shape of the distribution. From the 75th percentile onwards, there is a steep upwards climb in ECC call answer times. ECCs that take longer than nine seconds to answer calls are in the minority, and ECCs that take much longer than nine seconds are among the slowest ECCs in the sample. In order to fall into the bottom half of the distribution, an ECC would need to take less than seven seconds to answer calls.

Law Enforcement Calls

Shifting our attention to law enforcement incidents, Figure 14 plots the distributions of call answer to incident entry times in our sample of ECCs. On the high end, ECCs take a maximum of 94 seconds to enter law enforcement incidents upon answering a call. However, this time falls by over 34 seconds just by shifting our attention to the 85th percentile, a conspicuous point in the data set beyond which a steep climb in incident handling times is observed.

As Figure 14 further shows, between the 65th and 85th percentiles, there is considerable clustering around 60 seconds. This clustering comes after a steep climb from the 50th to 65th

percentiles, or an increase from 30 seconds to 60 seconds. At the 25th percentile, ECCs take 12 seconds to enter law enforcement incidents upon answering a call, while those in the bottom five percent take under five seconds. In order to fall in the bottom half of the distribution, ECCs would need to decrease their law enforcement incident entry times to 30 seconds or less.

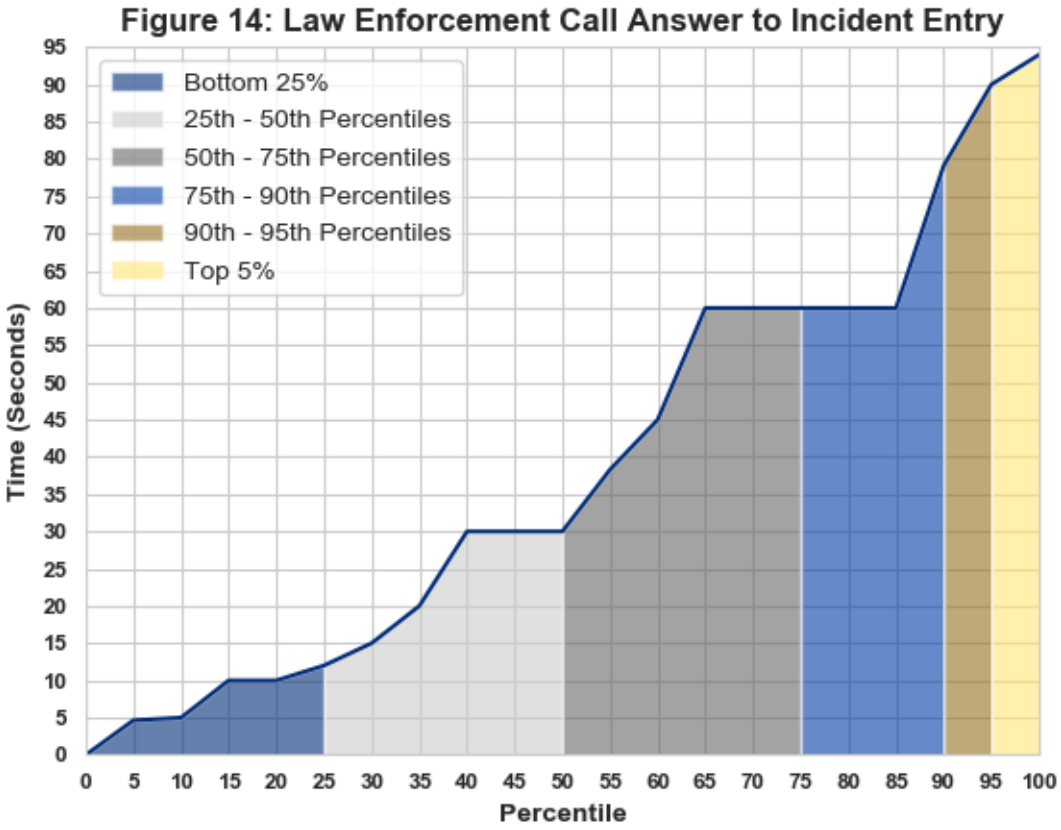
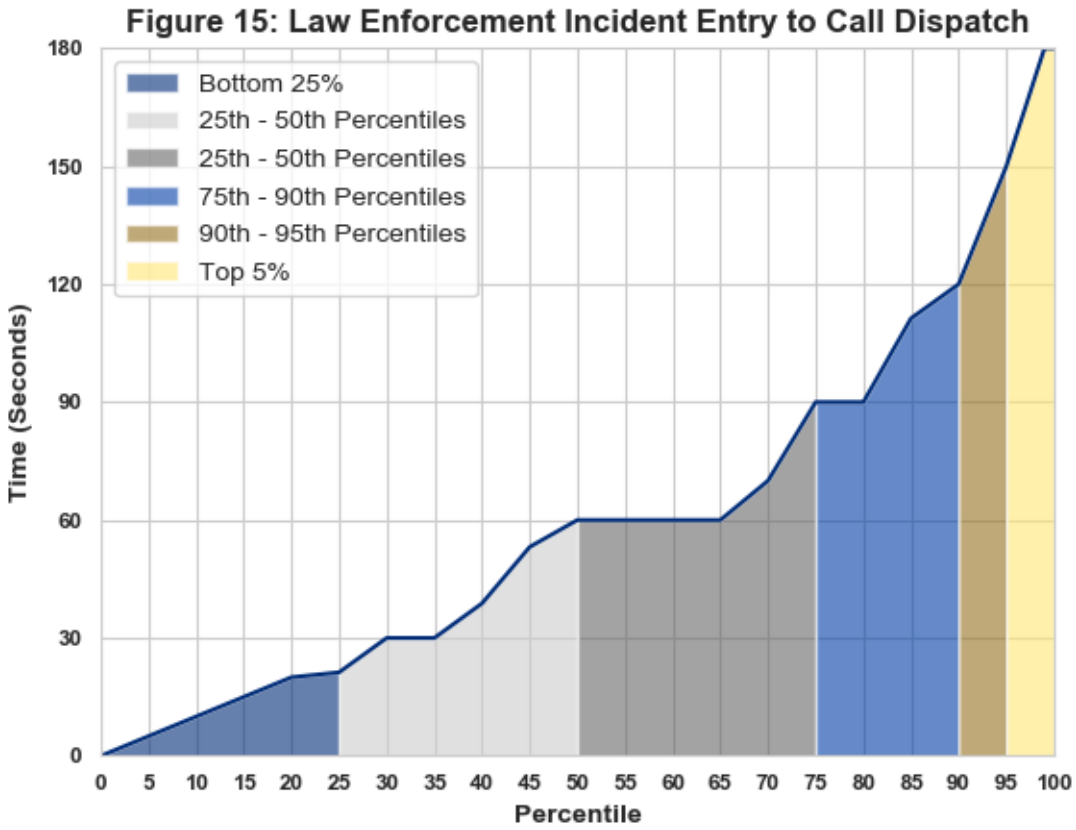


Figure 15 plots ECC law enforcement incident entry to call dispatch times. At the high end, ECCs take a maximum of 180 seconds to dispatch law enforcement calls after incident entry. This drops by 30 seconds at the 95th percentile to 150 seconds, and again at the 90th percentile to 120 seconds.

At the 75th percentile, ECCs take 90 seconds to dispatch law enforcement calls upon incident entry, and at the 50th percentile, this drops to 60 seconds. Indeed, there is conspicuous clustering around the 60 second mark from the 50th to 75th percentiles. Below the 50th percentiles, there is a noticeable drop-off in incident handling times as the line indicates.

At the 25th percentile, ECCs take only 21.3 seconds to dispatch law enforcement calls upon incident entry, and this time is only ten seconds for ECCs in the 10th percentile, and five seconds for ECCs in the bottom five percent.

In order for an ECC to fall into the bottom half of the distribution, they would need to take less than 60 seconds to dispatch law enforcement calls upon incident entry.



Fire Calls

Moving to ECC fire call standards, Figure 16 plots the call answer to incident entry times for fire calls in ECCs. At the high end, ECCs take a maximum of 90 seconds to enter fire incidents upon answering a call. However, this drops to 76.8 seconds at the 95th percentile, and 60 seconds at the 75th percentile. As the plot shows, from the 75th percentile to the 90th percentile, there is considerable clustering around 60 seconds. Similar clustering is observed from the 45th to 60th percentiles around the 30 second mark, and the median incident entry time for fire calls is 30 seconds.

On the low end of the distribution, ECCs in the bottom 25 percent take 10 seconds or less to enter fire incidents upon answering a call. ECCs in the bottom ten percent of the distribution take just five seconds to enter fire incidents upon answering a call, while ECCs in the bottom five percent require under five seconds. In order for an ECC to fall into the lower half of the distribution, a fire incident entry time of under 30 seconds is necessary.

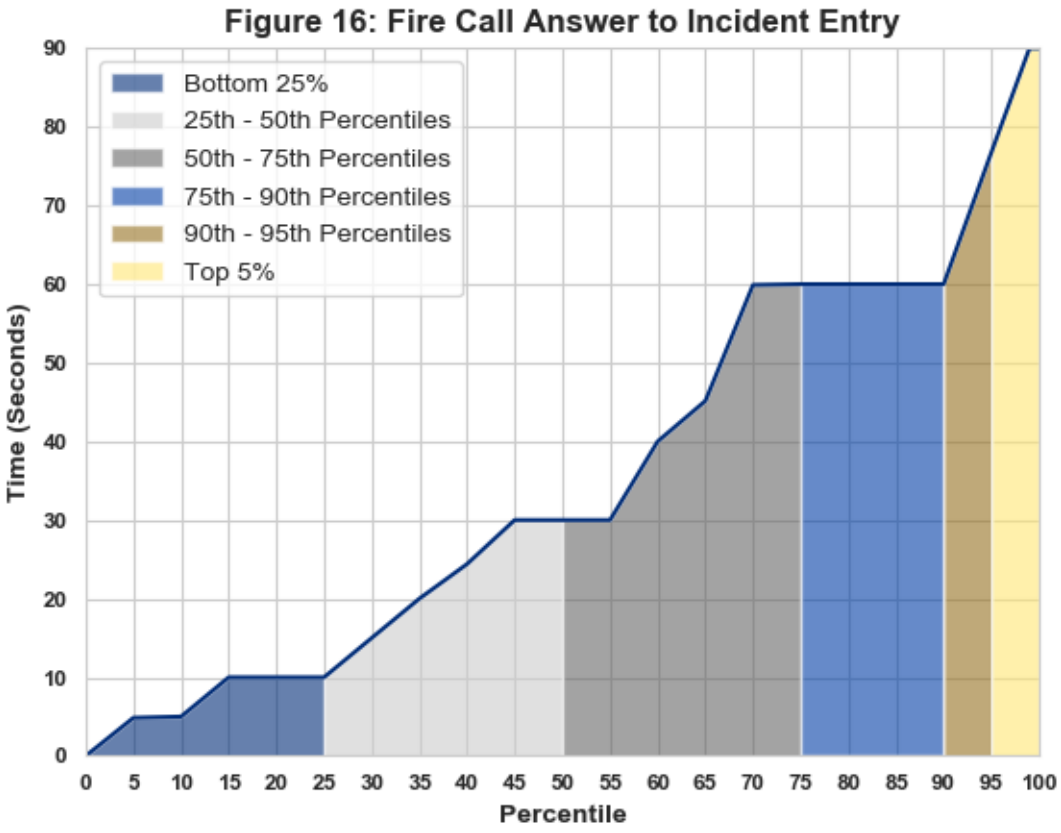
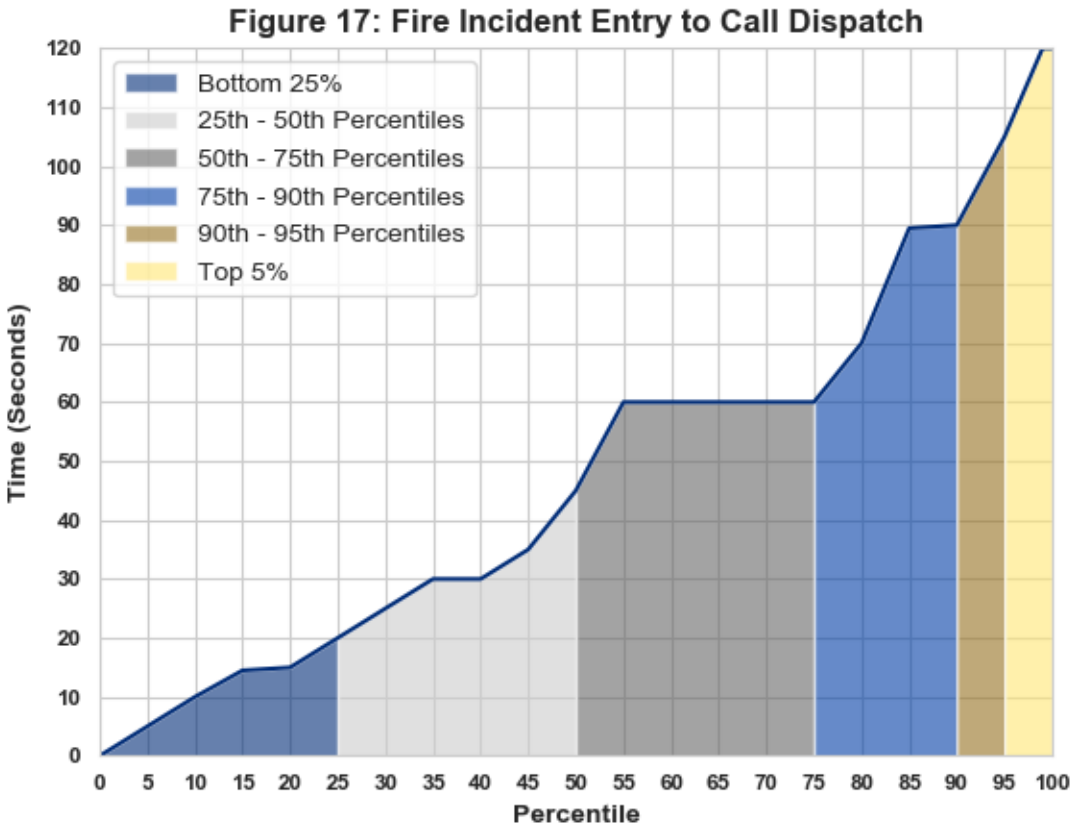


Figure 17 plots the distribution of incident entry to call dispatch times for fire calls in ECCs. The distribution observed here is very similar to that observed in Figure 16, although the absolute time values are different.

At the maximum, ECCs require 120 seconds to dispatch fire calls upon entering an incident. This falls by 15 seconds at the 95th percentile to 105 seconds, and further still to 60 seconds at the 75th percentile. Again, we see considerable clustering around the 60 second mark in the plot, specifically from the 55th to 75th percentiles.

Below the 55th percentile, however, there is a sharp drop-off in fire call dispatch times. The median fire dispatch time is 45 seconds, while ECCs in the bottom 25 percent of the distribution require just 20 seconds to dispatch fire calls. In the top ten percent, ECCs take just ten seconds or less to dispatch fire calls, and ECCs in the bottom five percent take just five seconds or less.

In order for an ECC to fall into the bottom half of the distribution, a fire call dispatching time of less than 45 seconds from incident entry is required.



EMS Calls

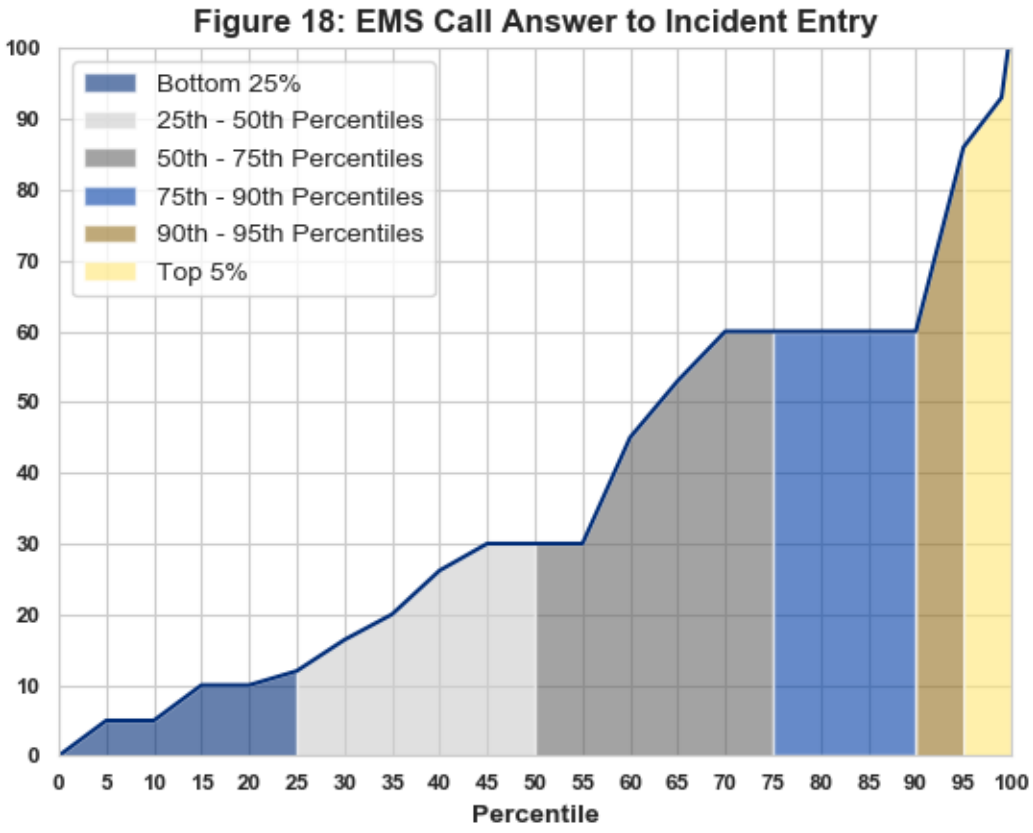
Finally, we consider EMS call processing and incident handling in ECCs. Figure 18 plots the distribution of call answer to incident entry time for EMS calls in ECCs.

The maximum value for EMS call answer to incident entry in our sample of ECCs is 103 seconds.[21] This drops by a sizeable amount to 86 seconds at the 95th percentile, and again to 60 seconds at the 65th percentile. Again, we see considerable clustering around the 60 second mark for ECCs falling in between the 70th and 90th percentiles.

At the 50th percentile, or the median, ECCs take 30 seconds to enter EMS incidents upon answering a call. This number is more than halved at the 25th percentile, falling to 12 seconds, and again at the 10th percentile where it drops to five seconds or less.

In order for an ECC to fall in the bottom half of the distribution, it would need to enter EMS incidents within 30 seconds or less of answering an EMS call.

[21] For visual clarity, the y-axis in Figure 18 is capped at 100 seconds.



Lastly, Figure 19 plots EMS incident entry to call dispatch times in ECCs. The plot in Figure 19 bears similarities to Figure 18, although there is a bit less clustering towards the high end of the distribution.

As Figure 19 shows, ECCs require a maximum of 120 seconds to dispatch EMS calls upon incident entry. There is a modest reduction to 110.2 seconds at the 95th percentile, and steeper decline to 90 seconds at the 90th percentile.

At the 75th percentile, ECCs take 60 seconds to dispatch EMS calls upon incident entry. There is also apparent clustering around the 60 second mark for ECCs falling between the 60th and 75th percentiles, as Figure 19 shows.

At the median, ECCs take 45 seconds to dispatch EMS calls upon incident entry, while ECCs in the bottom 25 percentile take 20 seconds or less. In the very low end of the distribution, ECCs in the bottom ten percent take just ten seconds to dispatch EMS calls upon incident entry, while ECCs in the bottom five percent take five seconds or less.

In order for an ECC to fall into the bottom half of the distribution, it would need to dispatch EMS calls in less than 45 seconds after entering an EMS incident.

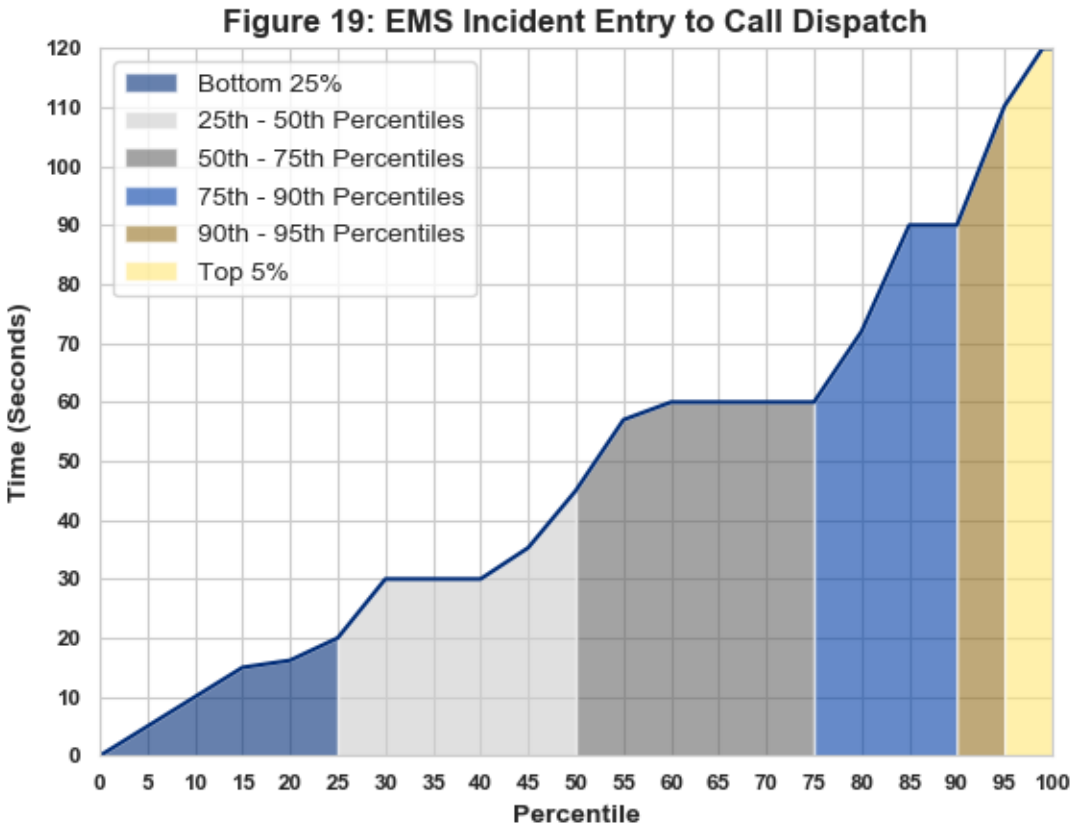
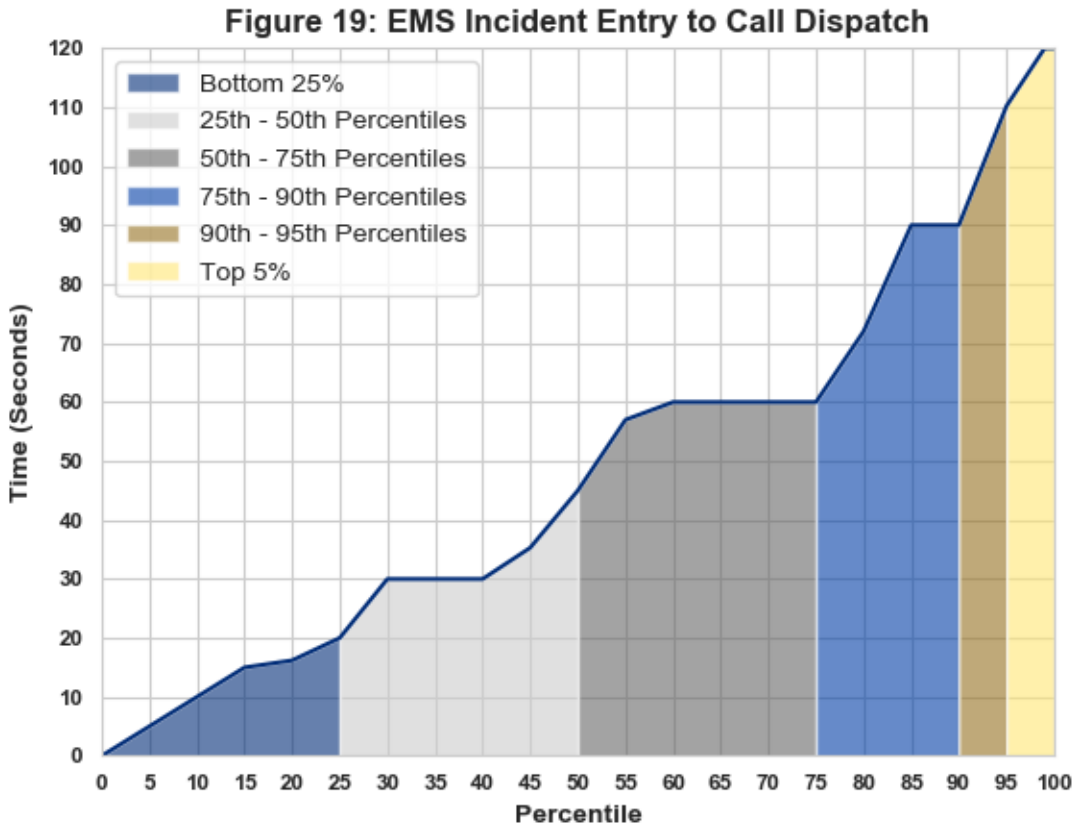


Figure 19: EMS Incident Entry to Call Dispatch
Bottom 25%
25th - 50th Percentiles
50th - 75th Percentiles
75th - 90th Percentiles
90th - 95th Percentiles
Top 5%
Time (Seconds)
Percentile
0
10
20
30
40
50
60
70
80
90
100
110
120
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100



In order to fall into the bottom half of the distribution, ECCs would have to reduce their processing times on this metric to under 60 seconds.

SECTION V: CONCLUSIONS

In this study, APCO and the CSSR set out to determine call processing and incident handling times in ECCs that could then be used by the working group to develop standards for ECCs to work towards when dealing with specific call types. Three metrics were measured: (1) call receipt to call answer time; (2) call answer to incident entry time; and (3) incident entry to call dispatch time. Six incident types were investigated: (1) law enforcement calls; (2) fire calls; (3) EMS calls; (4) calls requiring language translation; (5) calls requiring difficult location determination; and (6) calls requiring the use of a TDD/TTY or TRS device. Three primary call types were emphasized and closely analyzed in Section IV: (1) law enforcement calls; (2) fire calls; (3) and EMS calls.

There are some important caveats to the analyses contained herein. First, the sample of ECCs included in these estimates are small. This is primarily an issue of missing data, as many respondents were unable to provide the relevant call processing information. Follow-up research could help address this issue of missing data.

Second, many survey respondents indicated that their ECCs either do not track, or do not have access to, this sort of call processing and incident handling data. For example, on some of the paper surveys, respondents included annotations speaking to the unavailability of these data, writing such things as “unknown,” “unk.,” or “N/A” for all of the call processing time questions. Many other respondents wrote that call processing data is “not captured,” that “there is no way to estimate,” or simply left these answers blank or crossed-out.

Other survey respondents indicated that they are just now beginning to systematically track these call processing metrics. Thus, while they did not have data available at the time they took the survey, they will in the future. Therefore, a follow-up survey about ECC call processing and incident handling times is recommended.

Based on the analyses contained in this report, we recommend the following proposed future research agenda for APCO:

1. **Further study of call processing time recordkeeping:** It could be beneficial for APCO to develop a short, quick, descriptive survey that seeks to gather information on how widespread the practice is of recording call processing times within ECCs. We have reason to believe that it is not a widespread practice, and a brief survey of this sort could help identify those ECCs that do record their call processing times.

2. **Building on the previous recommendation, develop a follow-up call processing survey based on a purposive sample of ECCs to improve data quality:** With adequate information, we could build a purposive sample of ECCs that are known to track their call processing time data and thereby collect more accurate and complete

information. Although not necessarily representative of the overall ECC population, such a purposive sample would help to overcome the problem of missing data in this study.

3. **Further inquiry into those ECCs at the extreme end of the call processing time distributions:** The size of an ECC and other characteristics captured by this survey are not reliable predictors of call processing times in ECCs. Therefore, further analysis is needed about those ECCs at the extreme ends of the distribution to determine what mechanisms are driving them to take so much time to process all incident types at every stage in the call process.

APPENDIX A: METHODOLOGICAL INFORMATION

Survey Design

Process: For this study, a survey instrument was created and administered to ECC employees. The survey questionnaire was developed by CSSR in collaboration with APCO International based upon criteria of interest to APCO with respect to incident handling and call processing times in ECCs. The survey was designed such that it could be completed as a web-based survey, a mail survey, or a phone survey. APCO provided a sampling frame representative of the entire population of U.S. ECCs, which included addresses, phone numbers, and email addresses of the relevant ECCs. The email addresses provided by the APCO sampling frame were used to email a digital copy of the survey to all those ECCs with a corresponding email address.

This multi-mode approach was designed to maximize participation and response rates, and to minimize overall project cost. A copy of the survey is attached in Appendix C.

The topic areas for this survey include:

- Characteristics of ECCs:
    - Type of 9-1-1 services;
    - Geographic and population area;
    - Information on total agencies served;
    - The types of functions provided;
    - Call volume data;
    - Technological equipment;
    - Respondent information (e.g., role in ECC)

- Processing time data:
    - Multiple call types (9-1-1 and other calls);
    - Call receipt to call answer times;
    - Call answer to incident entry times;
    - Incident entry to call dispatch times.

- Factors delaying and affecting processing times:
    - Call factors (e.g., difficult callers, difficult location determination, language barriers);
    - External factors (e.g., staffing levels, staff experience, weather events).

Sample Selection and Response Rate

The administration of this survey occurred in five stages. First, an initial email invite was sent to the ECC email addresses provided by APCO. Second, the CSSR mailed paper copies of the survey to ECCs that either (1.) did not have a listed email address, or (2.) had not completed the online

survey. Third, in an attempt to contact individuals who did not respond to the initial email invite or paper survey, the CSSR's survey lab reached out to unresponsive ECCs through phone calls with friendly reminders to participate in the survey. Phone interviewers also took participants through the survey over the phone if they requested to complete the survey at the moment of the call. Fourth, another round of paper copies of the survey were sent to ECCs who had still not responded to the survey. Fifth, a final effort was made to reach ECCs that still had not completed the survey by phone to administer the survey during the course of the call.

Web-based survey: An email invite was sent to 4,633 ECCs from across the country to participate in the study based on the APCO sampling frame. The email briefly explained the survey and provided a unique link generated by Qualtrics directing respondents to complete the survey electronically. Two reminder emails were sent to ECCs encouraging them to participate. Of the final sample of 772 ECCs, 577 (74.7%) respondents participated via the web-based survey.

Paper copy: On the occasion that ECC emails were not available, or ECCs had not taken the web-based survey, a paper copy of the survey was mailed. A business class pre-paid return envelope containing the ECC's unique identification number was enclosed in the mailing. 99 respondents in the sample (12.8%) were recruited via the paper survey.

Phone survey: On the occasion that ECCs did not respondent to either the web-based or paper copy surveys, they were contacted by the CSSR's survey lab to take the survey by phone. 96 respondents in the sample (12.4%) were recruited via the phone survey.

Target Sample: At the beginning of the study, 360 ECCs were randomly selected for intensive follow-up. 14 of these ECCs were removed from the sample as they had consolidated with other ECCs between the time the list was created and the survey went into the field, resulting in a final target sample of 346 ECCs. Two weeks after the initial email invite, those ECCs in the targeted sample who had not yet responded were contacted by phone. During the call, they were encouraged to participate in the online survey. The CSSR survey lab staff provided the ECC employee with their ECC's registration number and the survey URL. ECC employees were also offered the opportunity to complete the survey over the phone at the time of the call. In total, 241 of the 346 ECCs in the target sample completed the survey for a response rate of 69.9 percent – and excellent showing.

Follow Ups: Several follow up methods were used in this survey. Email reminders were sent periodically to encourage unresponsive ECCs to participate. For unresponsive ECCs that had received both email and paper surveys, they were contacted by phone and reminded of the survey. Phone interviewers also offered to conduct the survey over the phone at the point of contact.

Response Rate, Margin of Error, and Confidence Interval: Out of a population size of 4,633 ECCs (based on the APCO sampling frame), we received a final sample size of 772 ECCs. This results in a response rate of 16.7 percent – a sizeable proportion given the size of the sampling frame and

the efforts made to contact the entire population of U.S. ECCs. The margin of error for this study is ± 3.2 percent at a confidence level of 95 percent.

Given the random sampling procedures adopted in this study, and given that we were able to sample a sizeable proportion of ECCs from a sampling frame representative of the entire population of ECCs, we can say with confidence that these data are representative of the overall population of ECCs in the United States.

Notes on Statistical Significance

When we refer to statistically significant relationships or statistically significant tests, we mean that the observed relationship is likely to occur in the larger population. A numerical indicator called a p-value determines statistical significance. In social science research, a p-value of less than .05 is considered statistically significant. A p-value of less than .05 indicates that there is less than a five percent chance that the observed relationship in the sample is due to chance.

In many instances, the p-values we observe in this study are less than .01. This means that there is a less than one percent chance that the observed relationship in the sample is due to chance.

APPENDIX B: GLOSSARY

Abandoned calls – See Call Abandonment.

Annual Call Volume (ACV) – The total number of calls processed by an ECC in a year. It is often reported as incoming calls only, but a more accurate measure includes all call activity: incoming, internal transfers, and outgoing calls. Duplicate calls for a single incident, such as multiple wireless calls for the same car accident, should also be considered for inclusion in total call volume since they require a response and consume calltaker time.

ANOVA – A statistical test of the difference in means (averages) between three or more groups.

Average Speed of Answer (average answer time) – A common quality measure in ECCs; it is the time it takes a dispatcher to pick up from first ring in the ECC.

Bivariate – A type of statistical analysis that looks at the relationship between two variables.

Busy Time – The time when a calltaker is talking on the telephone or the dispatcher is actually talking on the radio. It is the time recorded by most software programs and does not include any additional time associated with a particular call or incident.

Call Abandonment – An incoming call that is abandoned when the caller hangs up before the call is answered. The number of abandons and the abandon rate are good quality indicators and generally related to speed of answer.

Call Answer to Incident Entry – The time from when call is answered at the ECC to initiation of incident entry.

Call Completion Time – The non–telephone time spent processing a call. It includes all additional time related to a call; time spent entering data into the CAD system, handling the call internally, transferring calls, dispatching a unit to the scene, address verification, etc.

Call Receipt to Call Answer – The time from when a call arrives at Customer Premise Equipment (CPE) to call answer.

Call Volume – A common term for the number of calls. Usually used with a time delineated qualifier such as annual call volume, or hourly call volume. Call volume is not about the length of calls or the nature of the calls. It is simply the number of calls and it is used to determine workload. ECCs where each employee handles telephone and radio activity, may want to add the number of incidents dispatched to the number of telephone calls to obtain a more accurate indication of workload (number of CAD entries or incidents dispatched is considered a more realistic indicator than number of push–to–talk events).

Calltaker – A PST who processes incoming calls through the analyzing, prioritizing, and disseminating of information to aid in the safety of the public and responders. See Position below.

ECC size – Small ECCs (1 – 15 employees); Medium ECCs (16 – 75 employees); Large ECCs (76 or more employees). See CALEA definition below.

Chi Square (X^2) – A test of the existence of a relationship between two categorical variables. When chi-square is statistically significant ($p < .05$) there is a relationship between the variables.

Client Agencies – Those agencies which are served by the ECC. These include fire, police, EMS, public utilities, etc.

The Commission on Accreditation for Law Enforcement Agencies, Inc., (CALEA) – The purpose (e.g., determination of ECC classification size) of CALEA's Accreditation Programs is to improve the delivery of public safety service by: maintaining a body of standards developed by public safety practitioners that covers a wide range of up-to-date public safety initiatives; establishing and administering an accreditation process; and recognizing professional excellence.

Computer-Aided Dispatch (CAD) – Computer software that provides dispatch related services such as records management, mobile data, 9–1–1, links to National Crime Information Center (NCIC) and state databases, and interfaces to jail, property, personnel records, etc.

Confidence Interval – Because statistical estimates generated from sample data are not likely to be exactly equal to the value of the larger population we are interested in, a confidence interval is constructed to delimit the upper and lower range of values that likely contain the actual population value. This range is affected mostly by the size of the sample from which the estimate is generated.

Console – The physical space where a dispatcher works, also called a workstation or post.

Correlation Coefficient — A statistical measure of the strength of the relationship between two numerical variables. The closer to 1 (or -1), the stronger the relationship is, or the more power one variable would have in predicting the value of the other.

Coverage Position – A job category in which the number of employees is determined by the need to provide service regardless of the workload. The "coverage" may refer to a particular task, a specific workstation, post, or console that must be staffed or "covered" for a given length of time, usually continuous service 24/7/365. This position type is most closely equated to minimum staffing. This position is discussed more in-depth in the first APCO Project RETAINS study. See the Effective Practices Guide for more details.

Cronbach's alpha – A statistic that measures how well a set of variables or items, taken together, measure a single underlying concept. The closure the measure is to 1, the greater the reliability of the set of items.

Public Safety Dispatcher (Dispatcher) – A PST who provides dispatch services by analyzing, prioritizing, and processing calls while maintaining radio contact with responders to ensure safe, efficient, and effective responses to calls for emergency medical, fire, and law enforcement services, in accordance with local, state, tribal, or national standards. See also Position.

Emergency Communications Center (ECC) – A facility equipped and staffed to receive emergency and non-emergency public safety calls for service via telephone and other communication devices. Emergency calls for service are answered, assessed, classified, and prioritized.

Employee Availability – A measure of the actual number of hours employees are available to handle a task. It is calculated by subtracting the total hours an employee is on leave or in training from the total work hours (i.e. the number of hours in a year for a "full time" employee).

Full Time Equivalent (FTE) – The number of full time staff it takes to cover a position for one shift. If an ECC schedules two half–time employees to cover one position, the two employees make up one full time equivalent, or one FTE. Each half–time employee would be .5 FTE.

Huber-White "sandwich" estimator — A specialized regression procedure that accounts for the dependence of errors across individuals in a dataset without assuming a pattern of error variance. This kind of technique reduces the bias presented by having multiple individuals who share certain characteristics within the sample.

Incident – An emergency event requiring a response from Police, Fire, EMS or combination thereof.
Incoming Call Volume – The total number of incoming wireless and wire-line calls received in a given time period.

Incident Entry to Call Dispatch – The time from initiation of incident entry to when call is dispatched to assigned units. This may be identified as: verbal dispatch of the call, completion of assignment in CAD, silent dispatch to Mobile Data Terminal (MDT), or Initiation of tones.

Median (m) – The middle value of a distribution.

Multivariate model — A way of analyzing data so that we compute the independent effects of several predictor or independent variables on one outcome or dependent variable.

Pearson's R — A measure of the strength of a relationship between two numerical variables.

Performance Targets – Quality indicators that serve as a proxy for ECC performance. Common indicators are the percentage of calls that are answered within ten seconds, the percentage of calls answered within three rings, the call abandonment rate, the average speed of answer (ASA), blocked calls (busy signals), etc.

Public Safety Answering Point (PSAP) – See Emergency Communications Center (ECC).

Public Safety Telecommunicator (PST) – The individual employed by a public safety agency as the first of the first responders whose primary responsibility is to receive, process, transmit, and/or dispatch emergency and non-emergency calls for service for law enforcement, fire, emergency medical, and other public safety services via telephone, radio, and other communication devices.

Secondary Emergency Communications Center (ECC) – A facility to which 9-1-1 calls for service are transferred from a primary ECC (see Primary ECC).

Telecommunications Relay Service (TRS) – A technology that allows hearing and speech disabled individuals to place and accept phone calls.

Telecommunicator – See Public Safety Telecommunicator (PST).

Text to 9-1-1 Session – The entire period of a communication via Text to 9-1-1.

Total Call Volume (TCV) – is used to estimate staffing needs for volume– influenced positions. Call volume is simply the number of calls; it is not about the length or nature of the calls. All calls should be counted, incoming, lateral or transfer calls, and outgoing calls contribute to the total number of calls handled. As long as a call requires time, it should be included in the total. Note that Total Call volume can be for any time period, and it can be for any position, as long as the data is available in that format.

Welch F – A statistic used when normality assumptions for an ANOVA are violated as indicated by a Levene's statistic. Due to the small proportion of large ECCs in our sample, the distributions of certain variables are often skewed, but true differences between ECCs of different sizes do exist. To correct for this skewness, we use a Welch *F* to ensure the veracity of the ANOVA results when significant relations are found but a Levene's test indicates asymmetric distributions in variance.

X-bar ($\bar{X}$) – Mathematical notation for the arithmetic mean of a sample.

APPENDIX C: INCIDENT PROCESSING SURVEY

BEGIN SURVEY:

This questionnaire is part of a study by George Mason University on behalf of APCO International. Your ECC has been randomly selected to participate in a survey about incident processing at public safety answering points. As manager or director of your ECC, we ask that you take a few minutes to answer some questions as part of this study.

Participation is voluntary and you may choose not to answer any questions. All responses will be kept confidential and only reported in the aggregate. Your individual responses will not be seen by others at your ECC or APCO International. Your name will not be identified in any publication. There are no penalties if you decide not to participate.

Thank you very much for completing the survey. Your participation will aid APCO International in determining policies and procedures that improve ECC operations. Please refer any questions to:

APCO International Incident Processing Survey
Center for Social Science Research
George Mason University
4400 University Drive, MSN 1H5
Fairfax, VA 22030
Email: cssr@gmu.edu

We will begin this survey by asking about your ECC. These questions will collect basic information such as state, size, coverage area and other characteristics.

What is the name of your ECC?

_____

In which state is your ECC located?

▼ AK ... WY

What is the size of your ECC?

- ❍ Small (1-15 Full-Time Equivalent Positions)
- ❍ Medium (16-75 Full-Time Equivalent Positions)
- ❍ Large (76 or more Full-Time Equivalent Positions)

Is your center a <u>primary</u> ECC to receive emergency calls in your jurisdiction or a <u>secondary</u> ECC that received calls directed from another agency?

- ❍ Primary
- ❍ Secondary

What is the area served by your ECC?

- ❍ State
- ❍ Region
- ❍ County or parish
- ❍ City, town or borough
- ❍ Special jurisdiction, such as an airport, island, harbor, park land, or campus. *(Please specify.)* _____

How many square miles are in your ECC's service area?

▼ 0 to 10 ... 801 or more

What is the population of your ECC's service area?

▼ 0-10,000 ... 5,000,001 or more

The next series of questions will ask about the functions of your ECC.

Please select which emergency functions your ECC provides:

	Yes	No
Law Enforcement	❍	❍
Fire	❍	❍
EMS	❍	❍
Other *(Please specify.)*	❍	❍

How many agencies does your ECC provide dispatch services for?

	# of agencies
Law Enforcement Agencies	▼ 0 ... 50 or more
Fire Agencies	▼ 0 ... 50 or more
EMS Agencies	▼ 0 ... 50 or more
Other *(Please specify.)*	▼ 0 ... 50 or more
Other *(Please specify.)*	▼ 0 ... 50 or more
Other *(Please specify.)*	▼ 0 ... 50 or more

Please select whether or not your ECC uses dispatch protocols (e.g., EMD) for the following agencies. *(Consider each agency type separately.)*

	Yes	No
Law Enforcement	❍	❍
Fire	❍	❍
EMS	❍	❍
Other *(Please specify.)*	❍	❍

The next series of questions will ask about the equipment in your ECC.

What is the current level of service your ECC receives for wireline 9-1-1 calls?

- ❍ Basic 9-1-1
- ❍ Enhanced 9-1-1 (E 9-1-1)
- ❍ Some level of Next Generation (IP based) call handling components

What is the highest level of service your ECC receives for wireless 9-1-1 calls?

- ❍ 9-1-1 with wireless Phase 0
- ❍ 9-1-1 with wireless Phase I (with a tower location)
- ❍ 9-1-1 with wireless Phase II (with a latitudinal and longitudinal location)

Does your ECC accept incidents via non-traditional or automated means?
(Check all that apply.)

- ❑ Direct Alarm Monitoring
- ❑ Automated Secure Alarm Protocol (ASAP to ECC)
- ❑ CAD to CAD
- ❑ Gunshot Monitoring System
- ❑ Gas, Sewer or Water Monitoring System
- ❑ Other *(Please specify.)* _____

Does your ECC currently receive Text to 9-1-1?

- ❍ Yes
- ❍ No

Display This Question:
If **Does your ECC currently receive Text to 9-1-1?** = Yes

What Text to 9-1-1 solution is being used?

- ❍ Text to TTY/TDD
- ❍ Web Based Program
- ❍ Other *(Please specify.)* _____

How many consoles are in your ECC?

▼ 1 ... 100 or more

Of your ECC's total, how many consoles are primarily dedicated to radio dispatch?

▼ 0 ... 100 or more

The next series of questions will ask about the volume of calls your ECC handles. When a specific answer is not available, please provide the best estimate.

What was the total call volume in calendar year (CY) 2017 for the following call types?
*(Please **do not** use commas or other punctuation. Ex., 10000)*

- ❍ # of 9-1-1 calls _____
- ❍ # of non-emergency calls _____
- ❍ # of outgoing calls _____
- ❍ # of abandoned calls (Caller disconnected prior to answer in the ECC.) _____
- ❍ # of hang up calls (Answered by ECC. Caller disconnected.) _____
- ❍ # of TDD/TTY calls _____
- ❍ # transferred to another agency _____

The next section of this survey will collect information about your ECC's average call processing time for calendar year (CY) 2017. For the purposes of this survey, the following definitions will be used:

Call Receipt to Call Answer= Time from when call arrives at Customer Premise Equipment (CPE) to call answer;

Call Answer to Incident Entry= Time from when call is answered at the ECC to initiation of incident entry;

Incident Entry to Call Dispatch= Time from initiation of incident entry to when call is dispatched to assigned units. This may be identified as:

- Verbal dispatch of the call
- Completion of assignment in Computer Aided Dispatch (CAD)
- Silent dispatch to Mobile Data Terminal (MDT)
- Initiation of tones

For (CY) 2017, what is the average processing time in minutes and seconds for a call in your ECC across the following three disciplines?
*(Please **do not** use commas or other punctuation. Ex. 10000)*

	Law Enforcement Call		Fire Call		EMS Call	
	Minutes	Seconds	Minutes	Seconds	Minutes	Seconds
Call receipt to call answer						
Call answer to incident entry						
Incident entry to call dispatch						

What is the average processing time in minutes and seconds for a call in your ECC across the following three incident types?
*(Please **do not** use commas or other punctuation. Ex. 10000)*

	Incidents requiring language translation		Incidents requiring the use of a TTY/TDD device or audio/video relay services		Incidents that require determining the location of the incidents due to insufficient information	
	Minutes	Seconds	Minutes	Seconds	Minutes	Seconds
Call receipt to call answer						
Call answer to incident entry						
Incident entry to call dispatch						

Display This Question:
If **Does your ECC currently receive Text to 9-1-1?** = Yes

What is the total number of Text to 9-1-1 sessions in calendar year (CY) 2017? Please count the whole conversation as one session, not the number of individual text messages.
*(Please **do not** use commas or other punctuation. Ex. 10000)*

- ❍ **# of text sessions** _____

Display This Question:
If **Does your ECC currently receive Text to 9-1-1?** = Yes

What is the average processing time for a Text to 9-1-1 session in calendar year (CY) 2017?
*(Please **do not** use decimals, commas or other punctuation. Ex. 10000)*

	Minutes	Seconds
Average processing time in seconds		

Does the agency have a master clock?

- ❍ Yes
- ❍ No

Display This Question:
If **Does the agency have a master clock?** = Yes

Is the master clock synced with the each of the following systems:

	Yes	No
CAD	❍	❍
CPE	❍	❍
Radio	❍	❍
Recorder	❍	❍
Other *(Please specify.)*	❍	❍

The next portion of this survey will ask for <u>your opinion</u> about call processing at your ECC.

Which of the following extenuating circumstances do you believe may delay processing time at your ECC?

(Select all that apply.)

- ❑ Language barrier/ Translation service required
- ❑ Difficult location determination
- ❑ Utilization of dispatch protocols (e.g., EMD)
- ❑ Challenging callers (e.g., elderly, children, intoxicated, under duress, emotional caller, etc.)
- ❑ Speech/Hearing impaired (Video Relay Service, TTY/TDD)
- ❑ Other *(Please specify.)* _____

Which of the following items affect the <u>average call processing time</u> at your ECC?

(Select all that apply.)

- ❑ Staffing levels
- ❑ Staff experience
- ❑ Time of day
- ❑ Day(s) of the week
- ❑ Season of the year
- ❑ Holiday(s)
- ❑ Weather
- ❑ Technology (Equipment performance)
- ❑ Other *(Please specify.)* _____

At your ECC, how often does the <u>average call processing time</u> meet your agency's benchmarks for the following disciplines?

	Always	Often	Sometimes	Rarely	Never
Law Enforcement	❍	❍	❍	❍	❍
Fire	❍	❍	❍	❍	❍
EMS	❍	❍	❍	❍	❍
Other *(Please specify)*	❍	❍	❍	❍	❍

We would like to identify who is responding for each ECC.

What is your role at your ECC?

- ❍ Director
- ❍ Supervisor
- ❍ Communications Manager
- ❍ Coordinator
- ❍ Chief
- ❍ Sheriff
- ❍ Administrator
- ❍ Other *(please specify)*: _____

END OF SURVEY.

APPENDIX D: RAW CALL PROCESSING AND INCIDENT HANDLING DATA

Table 8: Call Receipt to Call Answer, Raw Data			
Time (Seconds)	**Frequency**	**Valid Percent**	**Cumulative Percent**
0	2	0.6	0.6
1	4	1.2	1.8
2	13	4	5.8
3	31	9.5	15.4
3.33	2	0.6	16
4	21	6.5	22.5
5	61	18.8	41.2
5.33	1	0.3	41.5
5.67	1	0.3	41.8
6	13	4	45.8
7	11	3.4	49.2
8	5	1.5	50.8
9	7	2.2	52.9
10	65	20	72.9
11	4	1.2	74.2
12	4	1.2	75.4
15	26	8	83.4
20	9	2.8	86.2
24	1	0.3	86.5
25	2	0.6	87.1
30	18	5.5	92.6
35	1	0.3	92.9
37	1	0.3	93.2
40	2	0.6	93.8
50	1	0.3	94.2
59	1	0.3	94.5
60	8	2.5	96.9
67	1	0.3	97.2
70	2	0.6	97.8
75	1	0.3	98.2
90	2	0.6	98.8
120	2	0.6	99.4

450	1	0.3	99.7
820	1	0.3	100
Valid Total	**325**	**100%**	
Missing Data	**447**		
Sample Total	**772**		

Table 9: Law Enforcement Call Answer to Incident Entry, Raw Data			
Time (Seconds)	**Frequency**	**Valid Percent**	**Cumulative Percent**
0	2	0.7	0.7
1	2	0.7	1.4
2	5	1.8	3.2
3	3	1.1	4.2
4	1	0.4	4.6
5	17	6	10.6
7	1	0.4	11
8	2	0.7	11.7
9	1	0.4	12
10	28	9.9	21.9
12	5	1.8	23.7
14	3	1.1	24.7
15	7	2.5	27.2
16	1	0.4	27.6
18	1	0.4	27.9
20	16	5.7	33.6
22	1	0.4	33.9
25	3	1.1	35
30	37	13.1	48.1
33	1	0.4	48.4
34	1	0.4	48.8
35	1	0.4	49.1
38	1	0.4	49.5
40	3	1.1	50.5
42	1	0.4	50.9
45	10	3.5	54.4
49	1	0.4	54.8
50	2	0.7	55.5
54	1	0.4	55.8

55	1	0.4	56.2
59	4	1.4	57.6
60	55	19.4	77
61	1	0.4	77.4
63	2	0.7	78.1
68	1	0.4	78.4
74	2	0.7	79.2
75	2	0.7	79.9
76	1	0.4	80.2
77	1	0.4	80.6
80	1	0.4	80.9
82	1	0.4	81.3
85	1	0.4	81.6
86	2	0.7	82.3
87	1	0.4	82.7
88	1	0.4	83
89	1	0.4	83.4
90	16	5.7	89
92	1	0.4	89.4
94	1	0.4	89.8
97	1	0.4	90.1
120	16	5.7	95.8
133	1	0.4	96.1
135	1	0.4	96.5
146	1	0.4	96.8
150	1	0.4	97.2
180	2	0.7	97.9
190	1	0.4	98.2
200	1	0.4	98.6
212	1	0.4	98.9
300	2	0.7	99.6
1800	1	0.4	100
Valid Total	**283**	**100%**	
Missing Data	**489**		
Sample Total	**772**		

Table 10: Law Enforcement Incident Entry to Call Dispatch, Raw Data			
Time (Seconds)	Frequency	Valid Percent	Cumulative Percent
0	2	0.7	0.7
1	2	0.7	1.3
2	2	0.7	2
3	1	0.3	2.3
4	2	0.7	3
5	11	3.7	6.7
7	1	0.3	7
9	1	0.3	7.4
10	12	4	11.4
12	3	1	12.4
15	16	5.4	17.8
20	15	5	22.8
25	2	0.7	23.5
26	1	0.3	23.8
30	34	11.4	35.2
35	2	0.7	35.9
37	1	0.3	36.2
40	4	1.3	37.6
45	7	2.3	39.9
50	2	0.7	40.6
53	1	0.3	40.9
56	1	0.3	41.3
57	1	0.3	41.6
58	1	0.3	41.9
59	1	0.3	42.3
60	55	18.5	60.7
63	3	1	61.7
65	2	0.7	62.4
70	4	1.3	63.8
73	1	0.3	64.1
75	3	1	65.1
80	2	0.7	65.8
84	1	0.3	66.1
90	22	7.4	73.5
91	1	0.3	73.8
92	1	0.3	74.2

94	1	0.3	74.5
95	2	0.7	75.2
100	1	0.3	75.5
105	1	0.3	75.8
106	1	0.3	76.2
109	1	0.3	76.5
110	1	0.3	76.8
112	1	0.3	77.2
118	1	0.3	77.5
120	17	5.7	83.2
132	1	0.3	83.6
135	2	0.7	84.2
137	1	0.3	84.6
150	5	1.7	86.2
165	1	0.3	86.6
166	1	0.3	86.9
168	1	0.3	87.2
179	1	0.3	87.6
180	9	3	90.6
196	1	0.3	90.9
210	1	0.3	91.3
216	1	0.3	91.6
240	1	0.3	91.9
245	1	0.3	92.3
251	1	0.3	92.6
255	1	0.3	93
259	1	0.3	93.3
265	1	0.3	93.6
275	1	0.3	94
300	3	1	95
301	1	0.3	95.3
309	1	0.3	95.6
323	1	0.3	96
351	1	0.3	96.3
359	1	0.3	96.6
360	1	0.3	97
416	1	0.3	97.3
570	1	0.3	97.7
600	1	0.3	98

650	1	0.3	98.3
708	1	0.3	98.7
791	1	0.3	99
837	1	0.3	99.3
1490	1	0.3	99.7
1680	1	0.3	100
Valid Total	**298**	**100%**	
Missing Data	**474**		
Sample Total	**772**		

Table 11: Fire Call Answer to Incident Entry, Raw Data

Time (Seconds)	Frequency	Valid Percent	Cumulative Percent
0	2	0.8	0.8
1	2	0.8	1.5
2	5	1.9	3.4
3	2	0.8	4.2
4	1	0.4	4.6
5	16	6.1	10.6
6	1	0.4	11
7	2	0.8	11.8
8	1	0.4	12.2
9	1	0.4	12.5
10	29	11	23.6
12	6	2.3	25.9
14	3	1.1	27
15	6	2.3	29.3
16	1	0.4	29.7
18	1	0.4	30
20	15	5.7	35.7
22	1	0.4	36.1
25	3	1.1	37.3
27	1	0.4	37.6
28	1	0.4	38
30	38	14.4	52.5
33	1	0.4	52.9
35	1	0.4	53.2
38	1	0.4	53.6

40	4	1.5	55.1
42	1	0.4	55.5
44	1	0.4	55.9
45	8	3	58.9
48	1	0.4	59.3
50	3	1.1	60.5
53	1	0.4	60.8
55	1	0.4	61.2
57	1	0.4	61.6
59	4	1.5	63.1
60	51	19.4	82.5
64	1	0.4	82.9
65	1	0.4	83.3
67	2	0.8	84
74	1	0.4	84.4
75	3	1.1	85.6
76	1	0.4	85.9
81	1	0.4	86.3
85	1	0.4	86.7
87	1	0.4	87.1
89	1	0.4	87.5
90	8	3	90.5
91	2	0.8	91.3
94	1	0.4	91.6
120	15	5.7	97.3
150	1	0.4	97.7
180	2	0.8	98.5
300	2	0.8	99.2
330	1	0.4	99.6
600	1	0.4	100
Valid Total	**263**	**100%**	
Missing Data	**509**		
Sample Total	**772**		

Table 12: Fire Incident Entry to Call Dispatch, Raw Data			
Time (Seconds)	Frequency	Valid Percent	Cumulative Percent
0	3	1.1	1.1
1	4	1.5	2.6
2	2	0.7	3.3
3	1	0.4	3.7
4	1	0.4	4
5	10	3.7	7.7
7	1	0.4	8.1
10	12	4.4	12.5
12	3	1.1	13.6
14	1	0.4	14
15	16	5.9	19.9
16	2	0.7	20.6
17	1	0.4	21
20	16	5.9	26.8
25	3	1.1	27.9
26	1	0.4	28.3
28	1	0.4	28.7
30	31	11.4	40.1
32	1	0.4	40.4
33	1	0.4	40.8
35	3	1.1	41.9
38	1	0.4	42.3
40	4	1.5	43.8
41	1	0.4	44.1
45	7	2.6	46.7
50	2	0.7	47.4
51	1	0.4	47.8
52	1	0.4	48.2
53	1	0.4	48.5
55	2	0.7	49.3
57	1	0.4	49.6
59	1	0.4	50
60	58	21.3	71.3
62	1	0.4	71.7
63	1	0.4	72.1
65	1	0.4	72.4
66	1	0.4	72.8

68	1	0.4	73.2
70	2	0.7	73.9
75	4	1.5	75.4
79	1	0.4	75.7
80	1	0.4	76.1
83	2	0.7	76.8
84	1	0.4	77.2
85	2	0.7	77.9
89	1	0.4	78.3
90	19	7	85.3
91	1	0.4	85.7
94	1	0.4	86
100	1	0.4	86.4
102	1	0.4	86.8
105	3	1.1	87.9
109	1	0.4	88.2
112	1	0.4	88.6
116	1	0.4	89
120	9	3.3	92.3
148	1	0.4	92.6
150	4	1.5	94.1
170	1	0.4	94.5
173	1	0.4	94.9
179	1	0.4	95.2
180	7	2.6	97.8
203	1	0.4	98.2
210	1	0.4	98.5
300	2	0.7	99.3
390	1	0.4	99.6
1830	1	0.4	100
Valid Total	**272**	**100%**	
Missing Data	**500**		
Sample Total	**772**		

Table 13: EMS Call Answer to Incident Entry, Raw Data			
Time (Seconds)	Frequency	Valid Percent	Cumulative Percent
0	2	0.8	0.8
1	1	0.4	1.2
2	5	2	3.2
3	2	0.8	4
4	1	0.4	4.4
5	17	6.8	11.2
6	1	0.4	11.6
7	2	0.8	12.4
10	22	8.8	21.2
12	5	2	23.2
13	1	0.4	23.6
14	2	0.8	24.4
15	6	2.4	26.8
16	1	0.4	27.2
18	1	0.4	27.6
20	16	6.4	34
22	1	0.4	34.4
24	1	0.4	34.8
25	3	1.2	36
27	1	0.4	36.4
30	35	14	50.4
33	1	0.4	50.8
35	1	0.4	51.2
38	1	0.4	51.6
40	4	1.6	53.2
42	1	0.4	53.6
45	8	3.2	56.8
48	1	0.4	57.2
50	3	1.2	58.4
55	1	0.4	58.8
57	1	0.4	59.2
59	5	2	61.2
60	50	20	81.2
61	1	0.4	81.6
64	1	0.4	82
67	1	0.4	82.4
70	1	0.4	82.8

74	1	0.4	83.2
75	2	0.8	84
76	1	0.4	84.4
85	1	0.4	84.8
86	2	0.8	85.6
90	8	3.2	88.8
94	1	0.4	89.2
96	1	0.4	89.6
103	1	0.4	90
108	2	0.8	90.8
120	13	5.2	96
140	1	0.4	96.4
150	1	0.4	96.8
180	3	1.2	98
300	2	0.8	98.8
330	1	0.4	99.2
600	1	0.4	99.6
1830	1	0.4	100
Valid Total	**250**	**100**	
Missing Data	**522**		
Sample Total	**772**		

Table 14: EMS Incident Entry to Call Dispatch, Raw Data

Time (Seconds)	Frequency	Valid Percent	Cumulative Percent
0	3	1.2	1.2
1	1	0.4	1.6
2	2	0.8	2.3
3	1	0.4	2.7
4	1	0.4	3.1
5	7	2.7	5.8
7	1	0.4	6.2
10	13	5	11.2
12	3	1.2	12.4
15	16	6.2	18.6
17	1	0.4	19
20	16	6.2	25.2
21	1	0.4	25.6

22	1	0.4	26
24	1	0.4	26.4
25	2	0.8	27.1
26	1	0.4	27.5
30	32	12.4	39.9
32	1	0.4	40.3
35	4	1.6	41.9
38	1	0.4	42.2
39	1	0.4	42.6
40	4	1.6	44.2
45	8	3.1	47.3
50	3	1.2	48.4
53	1	0.4	48.8
54	1	0.4	49.2
55	1	0.4	49.6
56	2	0.8	50.4
57	2	0.8	51.2
58	2	0.8	51.9
59	1	0.4	52.3
60	51	19.8	72.1
63	1	0.4	72.5
65	1	0.4	72.9
68	1	0.4	73.3
70	2	0.8	74
75	3	1.2	75.2
80	1	0.4	75.6
81	1	0.4	76
85	2	0.8	76.7
90	23	8.9	85.7
91	1	0.4	86
94	1	0.4	86.4
99	1	0.4	86.8
105	2	0.8	87.6
110	1	0.4	88
112	1	0.4	88.4
116	1	0.4	88.8
119	1	0.4	89.1
120	9	3.5	92.6
127	1	0.4	93

128	1	0.4	93.4
150	3	1.2	94.6
153	1	0.4	95
179	1	0.4	95.3
180	5	1.9	97.3
194	1	0.4	97.7
210	1	0.4	98.1
215	1	0.4	98.4
283	1	0.4	98.8
300	1	0.4	99.2
1200	1	0.4	99.6
3630	1	0.4	100
Valid Total	**258**	**100%**	
Missing Data	**514**		
Sample Total	**772**		