

**9-1-1 AND 242-COPS
CALL TAKING STAFFING ANALYSIS
FINAL REPORT**
February 7, 2022



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INTRODUCTION

Emergency Communications Centers (ECCs) across the country are experiencing extreme challenges recruiting, hiring, training, and retaining personnel. While the reasons for these challenges vary by region (including lack of qualified applicants, applicants not willing to work shift work, COVID considerations, etc.) the impact on the ECC in virtually all cases is some degree of decrease in the levels of service the ECC is able to provide to their community and the agencies they serve.

The City of Albuquerque's ECC shares this nationwide experience, with decreased numbers of personnel available to handle the incoming emergency and non-emergency call volumes at the desired service levels. As a result, the city retained IXP Corporation to examine current call volumes and staffing models to determine if the existing staffing level targets were reasonable, and to provide insights on potential work process changes that may result in improved performance while limited staffing levels persist.

DESIRED PERFORMANCE LEVELS

The current ECC Guidelines establish the minimum performance expectations for answering inbound 9-1-1 and 242-COPS calls:

- For 9-1-1 calls, the performance target is to answer 90% of calls within 15 seconds and 95% within 20 seconds. This is consistent with National Emergency Number Association (NENA) and National Fire Prevention Association (NFPA) standards and is the prevailing performance target for ECCs across the country.
- For non-emergency calls to the 242-COPS line, the Center's current performance target is to answer 90% of calls within 180 seconds (3 minutes). Since no national standard exists for desired performance on non-emergency call answering, each jurisdiction sets their own standard based on current operating conditions, call volumes, staffing levels, and community expectations. While there is certainly a desire to improve this performance level, it is unlikely this will be possible until staffing levels improve or workflow changes are made.

UNDERLYING CALL VOLUME AND CALL DURATION DATA

Calculating and predicting call answering performance is driven by three underlying factors:

- The number of calls arriving in any given period of time for each type of call being analyzed. For this study this involves two separate groups of inbound calls: 1) the 9-1-1 calls arriving at the ECC; and 2) the 242-COPS calls arriving at the ECC. This data is captured in the 9-1-1 telephone system on an hour-by-hour basis.
- The average duration of calls for each type of call being handled. This data is also captured by the telephone system.

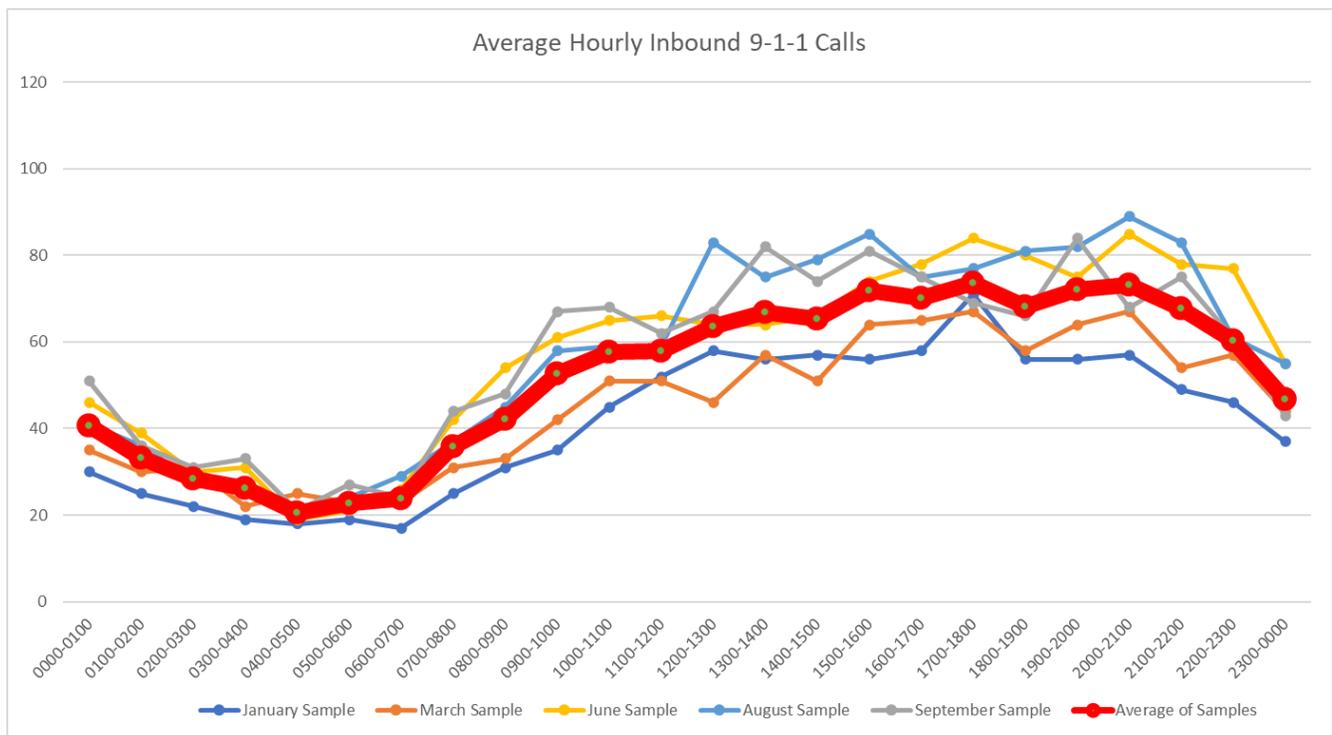
- The number of personnel available to answer the calls that are arriving. This is driven by the staffing levels and role responsibilities established for Call Taker personnel in the ECC.

Since the first two values, call volume and call duration, are largely unchangeable in the context of things the ECC can influence, it is the staffing levels that determine the resulting performance levels that can be achieved for any given volume of calls during any given hour of the day. Essentially, the number of personnel available to answer inbound calls is the determining factor when it comes to call answering performance. ECCs are constantly balancing available resources and operational practices to achieve the highest possible performance levels with the number of personnel available to do the work. As staffing levels increase, call answering performance increases.

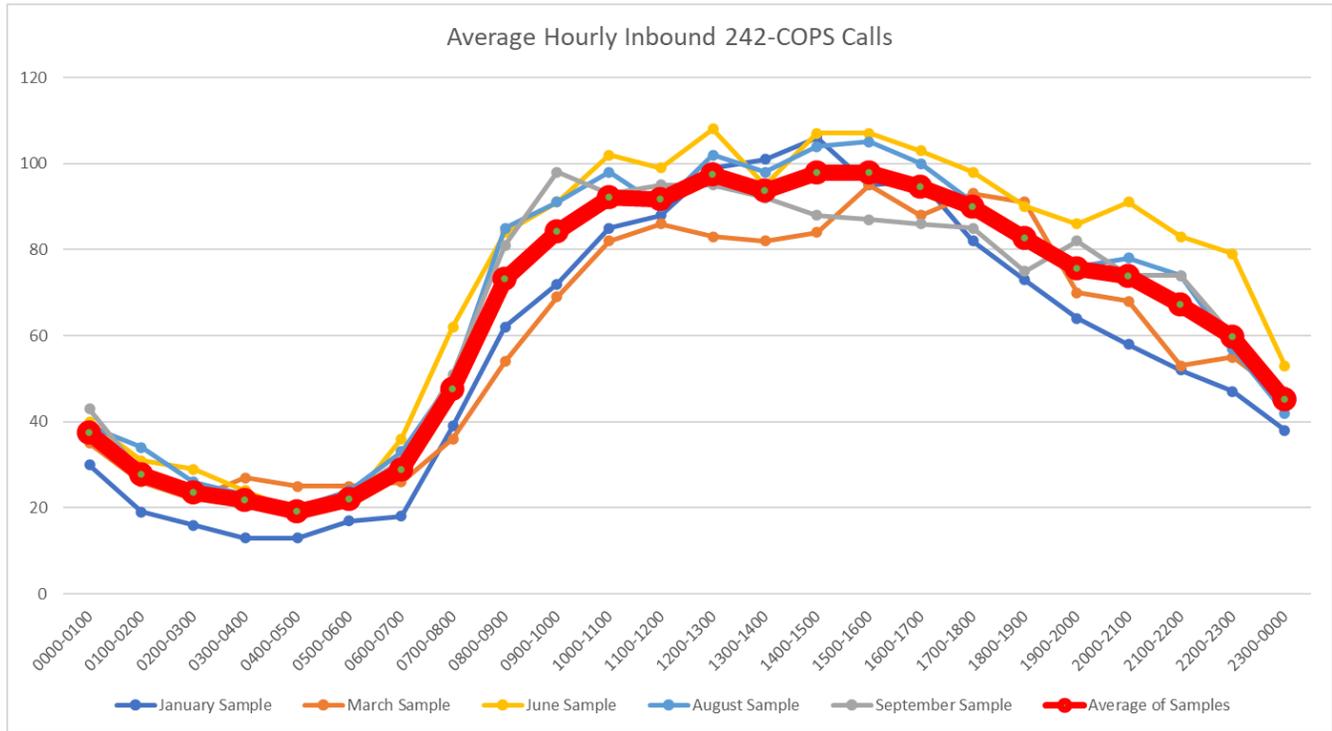
In this section of the report, we build up the current call volume and call duration data and we will then proceed to discuss staffing levels and call flows in the following sections.

Data from the VESTA telephone system was extracted for 5 sample weeks across 2021. For each hour of the daily 24-hour cycle during each sample week, the average number of inbound calls for each call type were compiled. These results were then compiled to gain an understanding of the average call volumes by hour for each call type, and are shown in the graphs and table below.

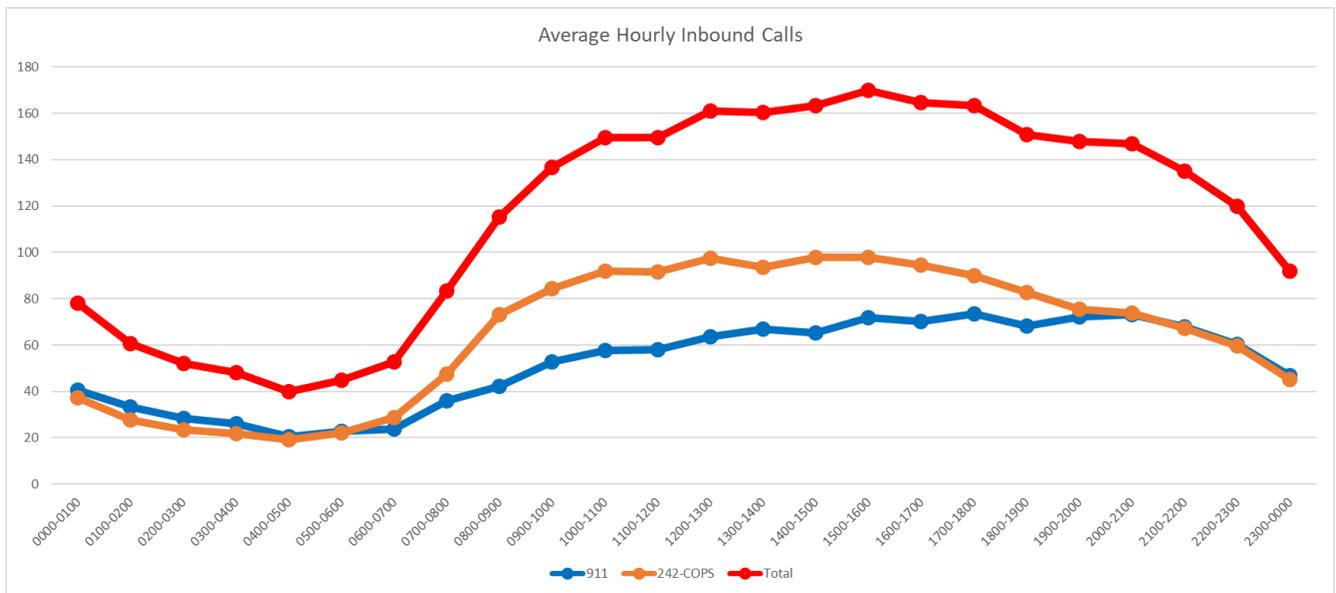
This first graph shows the hourly call volumes for 9-1-1 calls for each of the 5 sample weeks and the average of those values with the bolder red line.



This second graph shows the hourly call volumes for 242-COPS calls for each of the 5 sample weeks and the average of those values with the bolder red line.



This third graph brings both call volumes together to help understand their relative magnitude as well as the differences in when call volumes rise and fall during the normal 24-hour cycle.



Looking at this data in a tabular format is also helpful in understanding how call volumes vary across the normal 24-hour cycle. The table below uses a ‘heat map’ approach which helps visualize the busier hours in deepening shades of yellow, orange and red. Note that 9-1-1 calls represent only 45% of the total inbound call volume handled by the ECC, with calls to the 242-COPS line accounting for 55% of the average daily volume.

Hour	Averages from Sample Weeks		
	9-1-1	242-COPS	Total
0000-0100	41	37	78
0100-0200	33	28	61
0200-0300	28	24	52
0300-0400	26	22	48
0400-0500	21	19	40
0500-0600	23	22	45
0600-0700	24	29	53
0700-0800	36	48	83
0800-0900	42	73	115
0900-1000	53	84	137
1000-1100	58	92	150
1100-1200	58	92	150
1200-1300	64	97	161
1300-1400	67	94	160
1400-1500	65	98	163
1500-1600	72	98	170
1600-1700	70	95	165
1700-1800	74	90	163
1800-1900	68	83	151
1900-2000	72	76	148
2000-2100	73	74	147
2100-2200	68	67	135
2200-2300	60	60	120
2300-0000	47	45	92
Averages	52	64	116
Totals	1242	1544	2786
	45%	55%	

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With these understandings of call volumes in place, we next turn attention to the second controlling factor in determining call answering performance, the average duration of the calls being handled. The table below shows the call duration data for the 5 sample weeks used for examining call volumes. 9-1-1 call durations average 154 seconds (2 minutes 24 seconds) which is a fairly typical duration seen by IXP at ECCs similar to Albuquerque’s. Calls on the 242-COPS line are concluded slightly quicker, with an average duration of 130 seconds (2 minutes 10 seconds).

The termination of the verbal communications with the calling party is typically not the end of the call taking process. There are often additional notes and details that need to be added to the Computer Aided Dispatch (CAD) system call record before it is complete and ready for dispatching. While specific data for this ‘wrap-up’ work isn’t captured in the telephone system data, it is typical for this work to require several seconds to complete and the Call Taker to then place themselves back in the Ready status and take the next call in Queue.

For this study, we have assumed a 10-second wrap-up time, bringing the average duration of 9-1-1 calls to 164 seconds (2 minutes 44 seconds) and the average duration of 242-COPS calls to 140 seconds (2 minutes 20 seconds). If all inbound calls were viewed as a single body of work, the average call duration (including wrap up time) for the combination of 9-1-1 and 242-COPS calls would be 152 seconds (2 minutes 32 seconds).

Average Talk Times for Inbound Calls for Sample Weeks				
	Talk Times			
	9-1-1		242-COPS	
	Min:Sec	Seconds	Min:Sec	Seconds
Week of 01/04/2021 to 01/10/2021	2:33	153	2:30	150
Week of 03/22/2021 to 03/28/2021	2:38	158	2:27	147
Week of 06/21/2021 to 06/27/2021	2:36	156	1:58	118
Week of 08/09/2021 to 08/15/2021	2:26	146	2:03	123
Week of 09/06/2021 to 09/12/2021	2:39	159	1:54	114
Averages		154		130
Wrap up Time		10		10
Duration Targets for Staffing Calcs		164		140
Average Call Duration for Combined Call Volumes				152

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CALL QUEUES AND ROLES

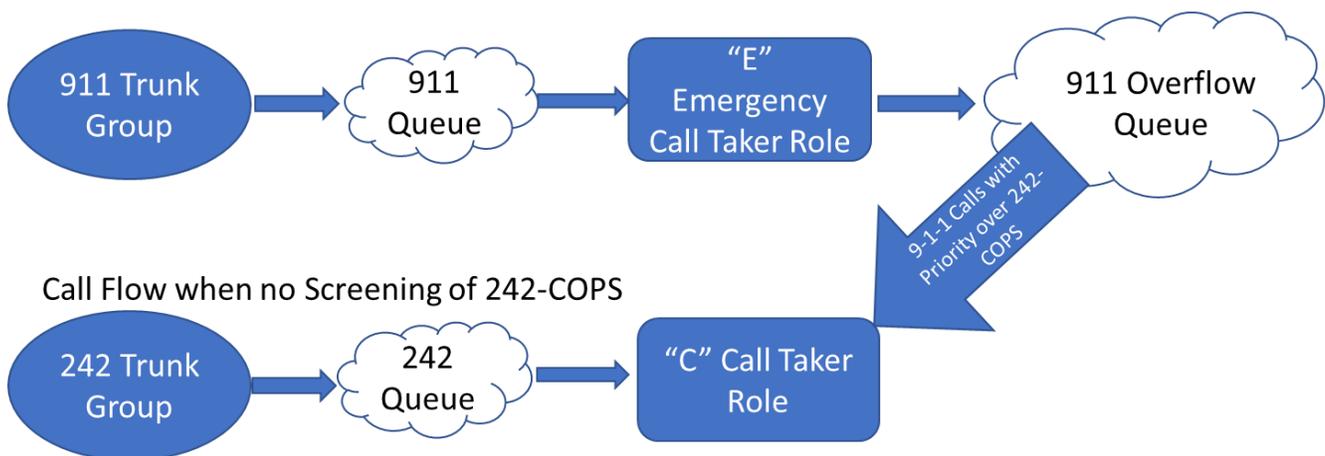
At a basic level, 9-1-1 and 242-COPS calls are managed in the phone system’s Automatic Call Distribution (ACD) system in two separate call handling queues. The ACD allocates calls, on a longest idle basis, across multiple Call Takers based on the “role” each Call Taker is filling at any given point in time. The telephone system delivers calls out of each queue based on a set of rules. For example, all 9-1-1 calls are delivered into a “9-1-1 Queue” and calls are pushed out to Call Takers that are in a Ready status and logged into the “E” Emergency Role. This is shown graphically below:



Similarly, calls to the 242-COPS line are delivered into a “242 Queue” and are pushed to “C” Role Call Takers, as shown graphically below:



The telephone system’s queuing structure can also prioritize one group of calls over another. Since calls to 9-1-1 are more often emergency in nature than calls to 242-COPS, these calls are prioritized in the system to be answered by either “E” Role or “C” Role Call Takers before they are delivered a call out of the 242-COPS Queue. This effectively increases the number of Call Takers handling 9-1-1 calls, while decreasing the number of Call Takers handling 242-COPS calls. This is accomplished through the use of a 3rd queue called the “9-1-1 Overflow Queue”. If all “E” Role Call Takers are busy on 9-1-1 calls, the call flows into a “911 Overflow Queue” and is then prioritized for ACD distribution to a “C” Role Call Taker in front of any other 242-COPS calls waiting in the 242 Queue. This is shown graphically below:



Call Flow when no Screening of 242-COPS

While this type of cascaded Emergency-over-Non-Emergency priority structure is common in busy ECCs, it can create some challenges, particularly when staffing levels are low. For example, if 9-1-1 call volumes significantly exceed the capacity of the number of “E” Role Call Takers, a significant number of calls will be distributed to “C” Role Call Takers and prevent them from answering inbound 242-COPS calls. This increases the average time to answer calls from the 242 Queue and frustrates callers calling in on these lines. Further, if 242-COPS call volumes are high at a time when 9-1-1 call volumes are low, the “E” Role Call Takers provide no relief to the 242-COPS queue since they are only assigned calls out of the 9-1-1 Queue...calls just continue to wait for an available “C” Role Call Taker.

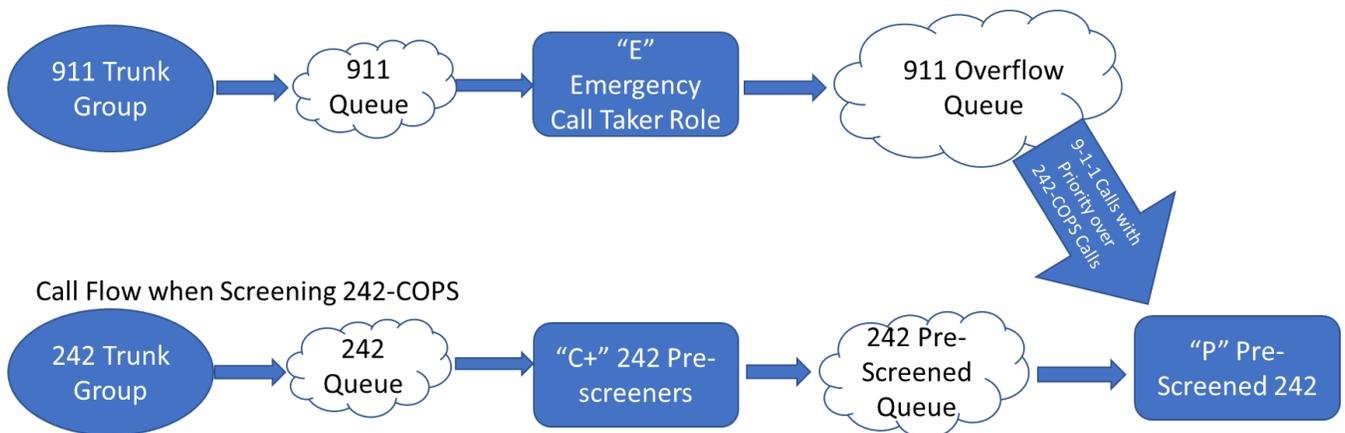
To help improve call answer times on the 242-COPS line, temporary Pre-Screeners have been added to the operational workflow for the busiest hours of the day. These Pre-Screeners are trained in a small subset of call screening protocols to allow them to transfer non-emergency or non-Police calls to other City services and not have to busy up either “E” Role or “C” Role Call Takers. However, since anecdotal information indicates that up to 40% of calls to 242-COPS do result in a dispatchable call for service, the Pre-Screeners encounter a considerable number of calls that they need to place back in a queue so they can be handled by a fully trained Call Taker.

To accomplish this Pre-Screening function, two additional Roles and one additional Queue were created. First, the “C+” Role was created for the Pre-Screeners to receive calls from the 242-COPS Queue. Then, for calls they have screened that indeed need to be handled by a trained Call Taker, a new 242-COPS Pre-Screened Queue was created and a new “P” Pre-Screened 242 Role was created to handle this queue. This is shown graphically below:

Call Flow when Screening 242-COPS

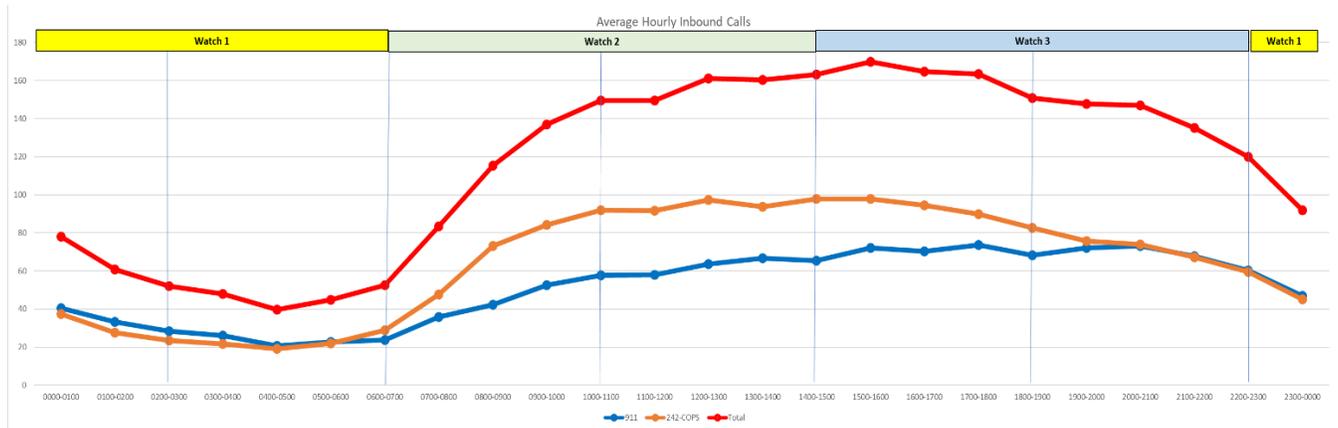


Similar to the call flows when no Pre-Screening is being done, 9-1-1 Overflow calls will be prioritized to the “P” Role Call Takers to make sure they get answered faster. So this again de-prioritizes 242-COPS calls even after the Pre-Screener has already interacted with the caller and asked them to remain on the line for the next available Call Taker. Further, This is shown graphically below:



PREDICTING CALL ANSWERING PERFORMANCE

Since call volumes vary significantly across a normal 24-hour cycle, the number of staff needed to produce the desired call answering performance also needs to vary across that cycle. The Albuquerque ECC currently operates a traditional 3-Watch model with two starting times for each 8-hour Watch. This allows them to increase and decrease their staffing levels in a predictable manner as call volumes rise and fall during the day. The relationship between call volumes and the Watch structure are shown in the graph and table below.



Hour	Averages from Sample Weeks			
	9-1-1	242-COPS	Total	
0000-0100	41	37	78	Watch 1
0100-0200	33	28	61	
0200-0300	28	24	52	
0300-0400	26	22	48	
0400-0500	21	19	40	
0500-0600	23	22	45	
0600-0700	24	29	53	
0700-0800	36	48	83	Watch 2
0800-0900	42	73	115	
0900-1000	53	84	137	
1000-1100	58	92	150	
1100-1200	58	92	150	
1200-1300	64	97	161	
1300-1400	67	94	160	
1400-1500	65	98	163	Watch 3
1500-1600	72	98	170	
1600-1700	70	95	165	
1700-1800	74	90	163	
1800-1900	68	83	151	
1900-2000	72	76	148	
2000-2100	73	74	147	
2100-2200	68	67	135	
2200-2300	60	60	120	
2300-0000	47	45	92	Watch 4
Averages	52	64	116	
Totals	1242	1544	2786	
	45%	55%		



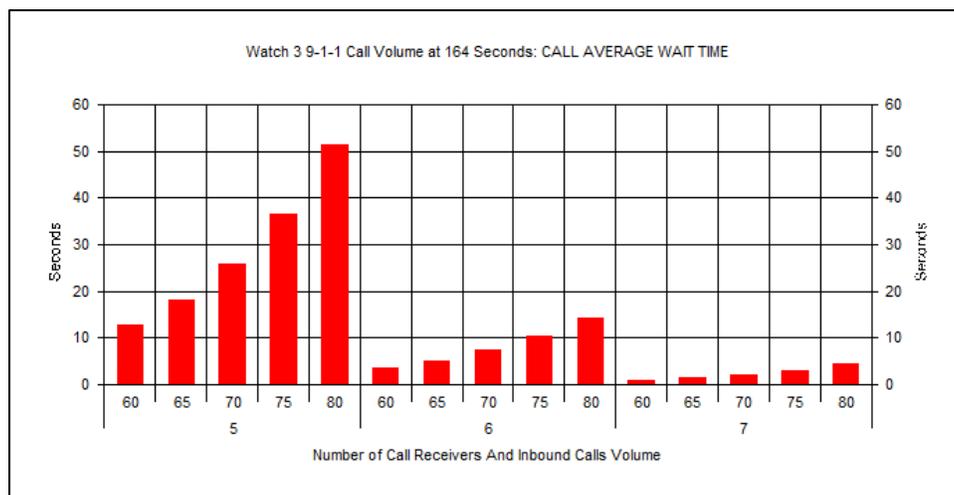
As described earlier in this report, calculating call answering performance is driven by three controlling factors: 1) the number of calls arriving in any given hour; 2) the average duration of these calls; and 3) the number of Call Takers available to handle the calls. Since prescribed performance targets are already in place (90% of 9-1-1 calls answered in 15 seconds or less and 90% of 242-COPS Calls answered in 180 seconds or less) we can calculate the number of Call Takers needed to achieve these targets since the call volumes and call durations are known values.

These queuing calculations are accomplished with mathematical queuing formulas developed by a Danish mathematician named Agner Erlang in the early 1900's. These formulas take into consider the random nature of call arrival rates along with the call volume, call duration and number of Call Takers available to handle the work. IXP has developed a modeling program that performs multiple Erlang queuing calculations across a range of call volume and call taker scenarios and displays the results in a graphical manner. This creates a set of information that can be used to determine the number of Call Takers needed in any given hour to meet the desired call answering performance. Specifically, the modeling tool provides three useful pieces of information:

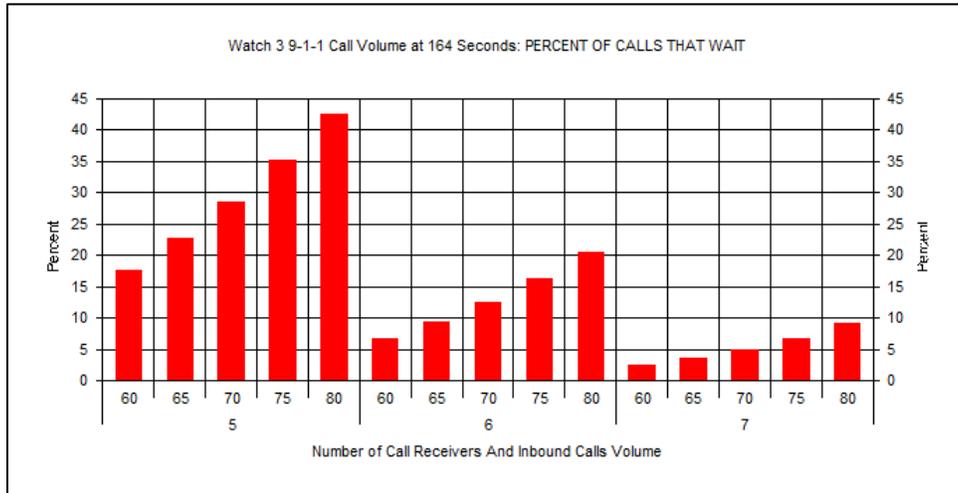
- The Average Wait Time for calls delivered to this queue
- The Percentage of Calls that will experience a wait (in other words all Call Takers in the queue are busy)
- The maximum Wait Time for callers that need to wait (for situations where all available Call Takers become busy at essentially the same point in time)

For each Watch, IXP has examined the 9-1-1 call volume in isolation, the 242-COPS call volume in isolation, and the combined call volume if all calls were handled in a single queue structure. Detailed tables for each of these scenarios is provided in the Appendix at the end of this report. Watch 3 is profiled here as an example of how to interpret and utilize the information in the Appendix.

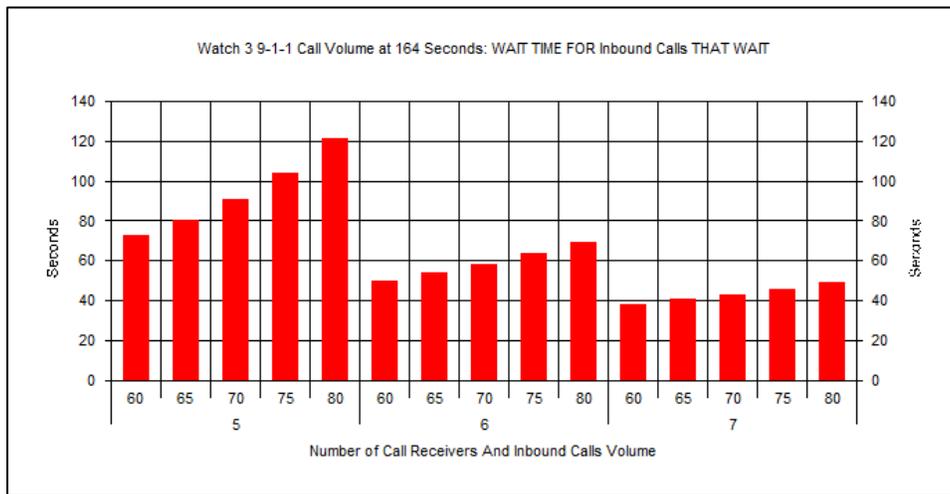
First, we will look at the 9-1-1 call volumes in isolation. The chart below shows the Average Wait Time across the range of call volumes during Watch 3, with 5, 6 or 7 Call Takers available to handle calls. With 6 Call Takers handling calls from this Queue, the Average Wait Time remains at or below the performance target of calls being answered within 15 seconds.



However, the chart below shows the Percentage of Calls That Wait for the same call volume and Call Taker assumptions. Here we see that with 6 Call Takers handling this Queue we will see greater than 10% of calls experience that Average Wait Time. Therefore, to achieve the 90% within 15 second target performance level, we need to have a 7th Call Taker handling calls out of this Queue.



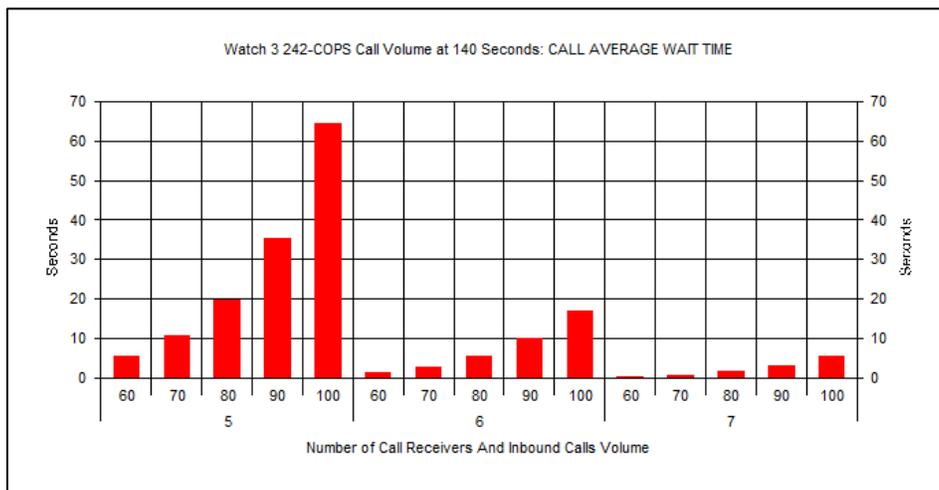
Finally, we need to understand what callers will experience if all Call Takers are busy with calls that arrive at relatively the same point in time (such as a highly visible accident with multiple callers). In this situation, with 7 Call Takers handling the Queue, the longest wait times could hit the 40 second range.



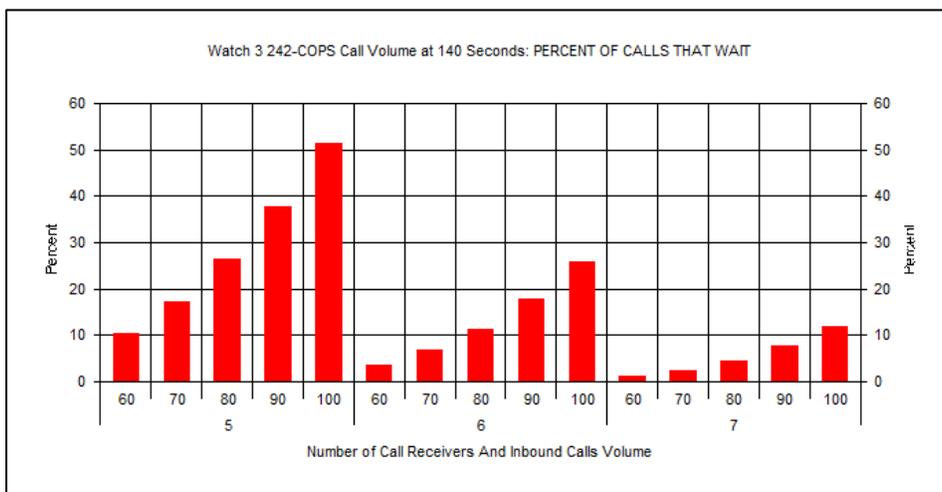
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Next, let's look at the 242-COPS call volumes in isolation. Here we have two factors helping keep the number of required Call Takers lower than for 9-1-1. First, the performance target is longer with up to 180 seconds allowed to answer 90% of the calls. Second, the call durations for these calls are shorter which allows the Queue to clear faster than the 9-1-1 Queue at 164 seconds.

With 5 Call Takers handling calls from this Queue, the Average Wait Time is well below the 180 second target.

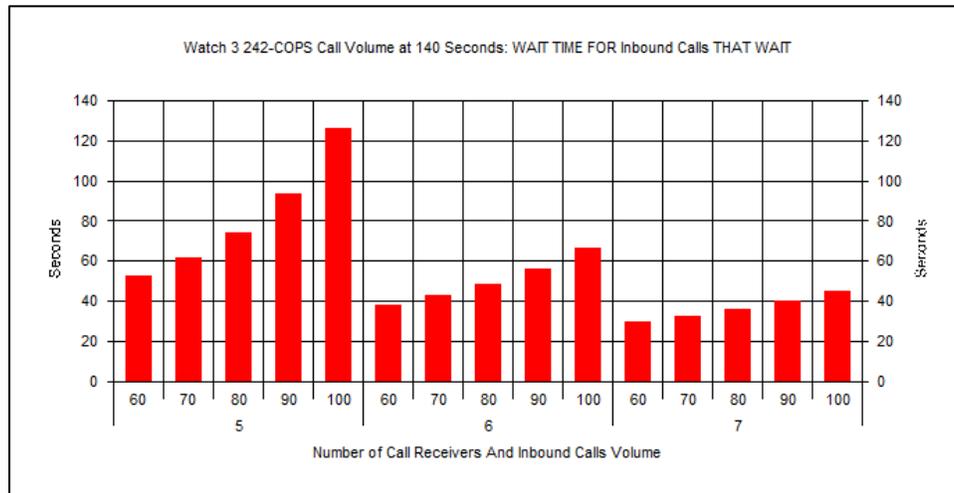


However, at this staffing level you hit the desired 90% level at the low end of the call volume range. Therefore, a 6th Call Taker is needed to get to the target in the middle of the call volume range, and 7th is needed to achieve this level at the high end of the call volume range.



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Finally, we need to look at the longest wait times for that worst-case scenario of multiple calls arriving at approximately the same time. Here we see that even at the 5 Call Taker level, the longest waits are below the 180 second maximum. So even though up to half the callers are experience long wait times, they are still under the maximum time established by policy.



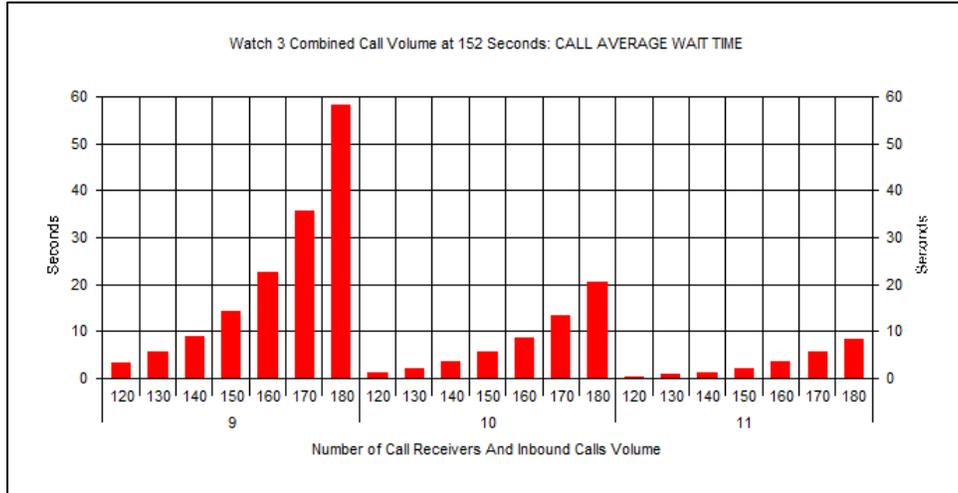
Bringing this all together in the context of current Queue and Role structures and current staffing levels is the final step in the process. The current Minimum Staffing Level for the busiest hours of Watch 3 is 15 Call Taker personnel. Assuming that at least 3 of these personnel will be up on break at any given time, that means that there would be 12 Call Takers available and taking calls.

If the goal is to try and keep most all of the 9-1-1 calls being handled by “E” Role Call Takers, you would assign 7 Call Takers to that role. At this staffing level during the busiest hours of the Watch, approximately 10% of the time all 7 will be busy on call and the call would roll into the 9-1-1 Overflow Queue and be prioritized for the next available “C” Role Call Taker. The remaining 5 Call Takers would be assigned as “C” Role Call Takers handling the 242-COPS Queue and the 9-1-1 Overflow Queue.

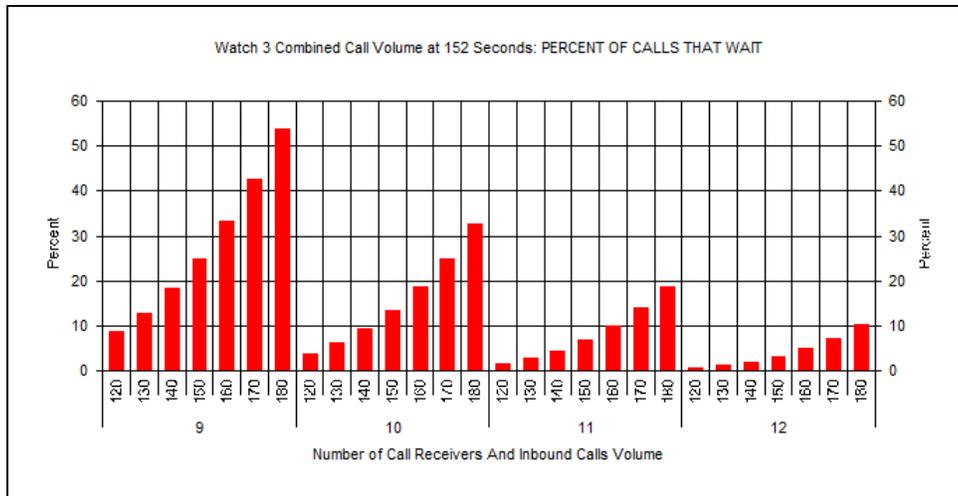
Walking through this same sequential thought process for the other two watches leads IXP to conclude that the Minimum Staffing Levels already established for the Center are very reasonable and should allow you to deliver the desired levels of service. The problem is that current staffing levels do not allow these minimum staffing levels to be met. For example, in the sample weeks used for this analysis, Watch 3 was typically only staffed by 13-14 Call Takers on duty which means something like 11 or maybe 12 actually logged in and handling calls at any given point in time. Since 9-1-1 calls are given priority over 242-COPS calls, the call answer times for 242-COPS calls suffers the most.

IXP therefore examined an alternative scenario for consideration, handling all inbound calls in a single Queue, and a single pool of Call Takers. This scenario is described below.

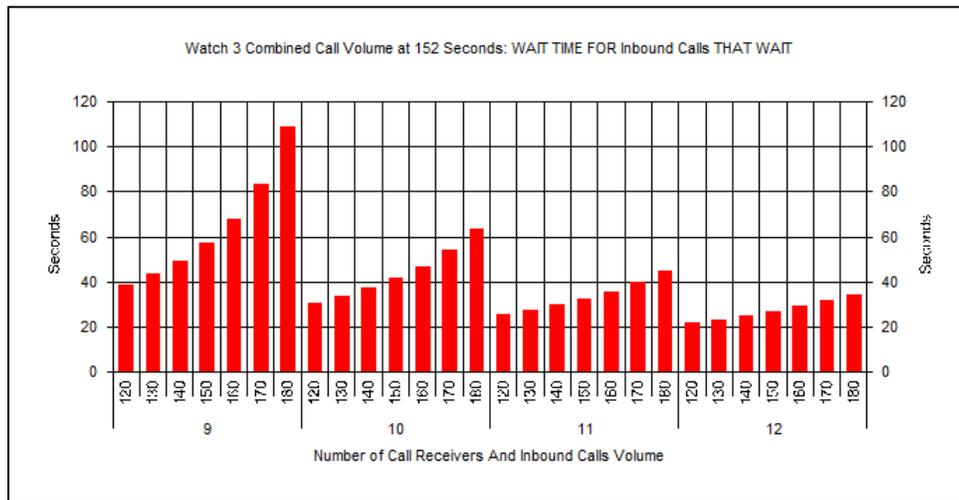
In a single Queue model, Watch 3 handles between 120 and 180 calls per hour. Average Wait Time modeling for this range indicates that with 11 Call Takers handling this full volume of calls the Average Wait Time would be slightly under 10 seconds.



For the majority of hours during the Watch the Percentage of Calls that Wait would remain within the 15% target for 9-1-1 calls. If a 12th position were indeed staffed that would fall to 10%.



Finally, the longest wait times would likely be in the 30-40 second range, which is about the same situation experienced with 9-1-1 calls in their own Queue with 7 Call Takers as described above.



Therefore, at current staffing levels, it appears that operating with a single Queue structure will allow the Center to maintain 9-1-1 call answering performance targets while also significantly improving 242-COPS call answering performance. This can be accomplished without the need for the Pre-Screening process which is bringing its own set of operational complications to the Center and frustrations to the community at large when they call seeking non-emergency services from the Police Department.

CLOSING OBSERVATIONS

From everything IXP was able to observe, the Albuquerque ECC is conducting their business consistent with industry-wide best practices. The established Minimum Staffing Levels seem to be adequate to meet the desired performance targets for both 9-1-1 and 242-COPS call answering. The current problem is that agency-wide staffing levels prevent the Center from staffing at their desired Minimum Staffing Levels. This has placed increasing pressure on 242-COPS call answering performance.

While every possible effort should continue to be expended to recruit, hire, and train new Call Taker personnel, it will take some time to get to a point where agency-wide staffing levels allow the Center to staff at established Minimum Staffing Levels. Therefore, it may be worth considering running a controlled trial period with all calls being handled by a single pool of Call Takers. It appears that controlled trials of this nature could be conducted without needing to make any changes to existing Queues or Roles. While this would need to be confirmed with your telephone system service provider, it appears that if all Call Takers were to log in as “C” Role Call Takers, the 9-1-1 calls would flow directly to the 9-1-1 Overflow Queue and then be handled by this larger pools of fully trained Call Takers. Similarly, all 242-COPS calls would also flow to this pool of Call Takers.

This approach could accomplish several useful outcomes:

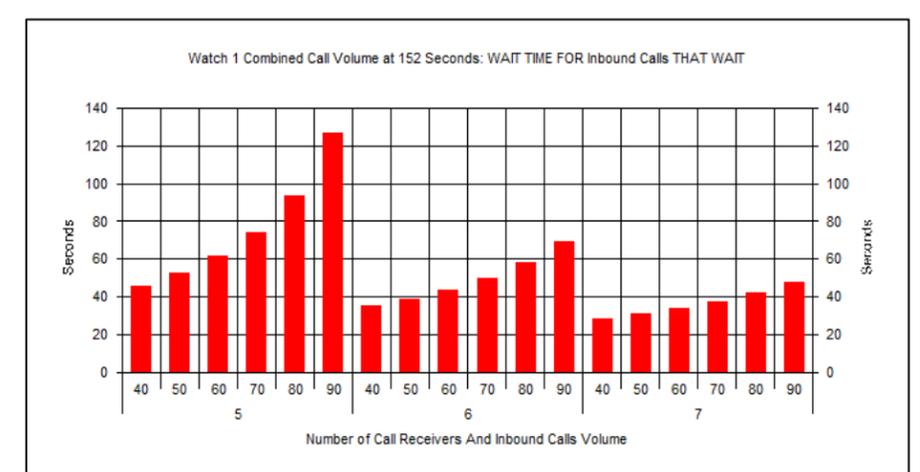
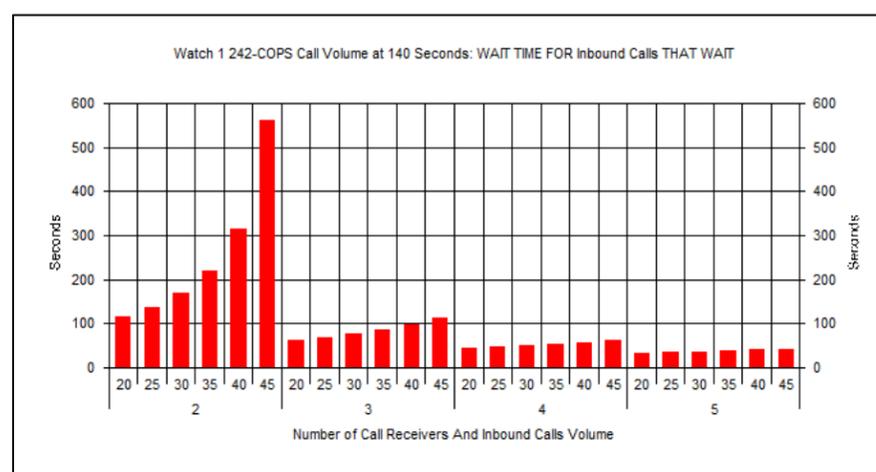
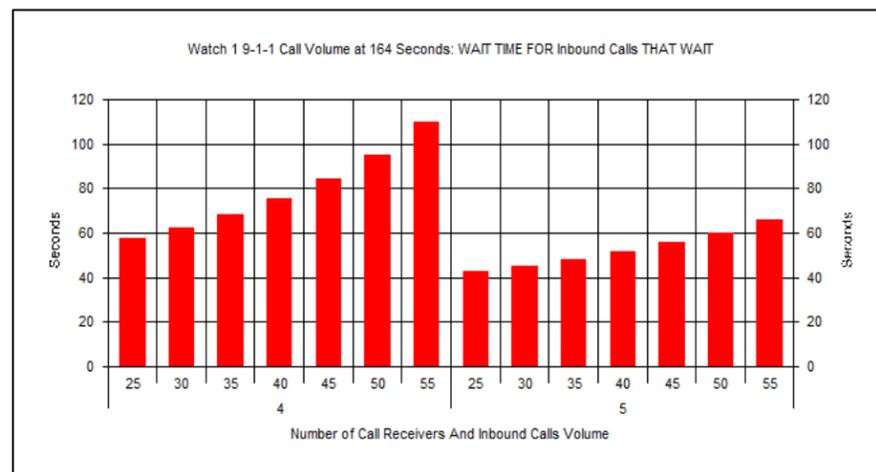
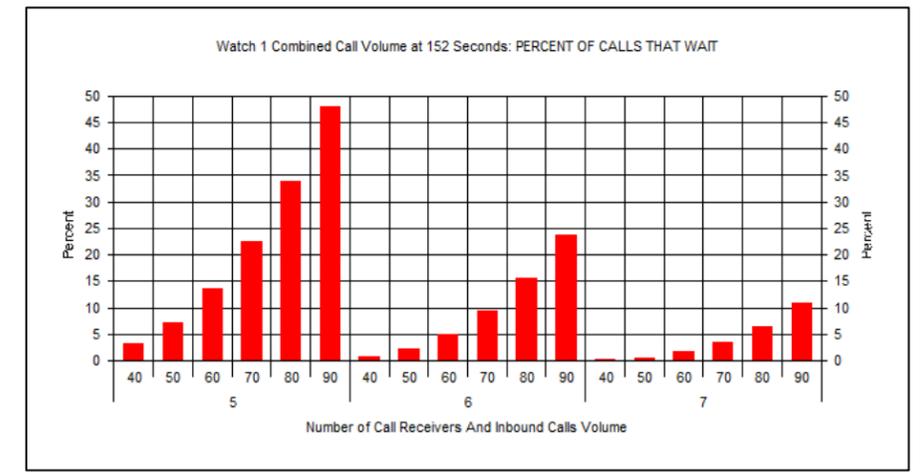
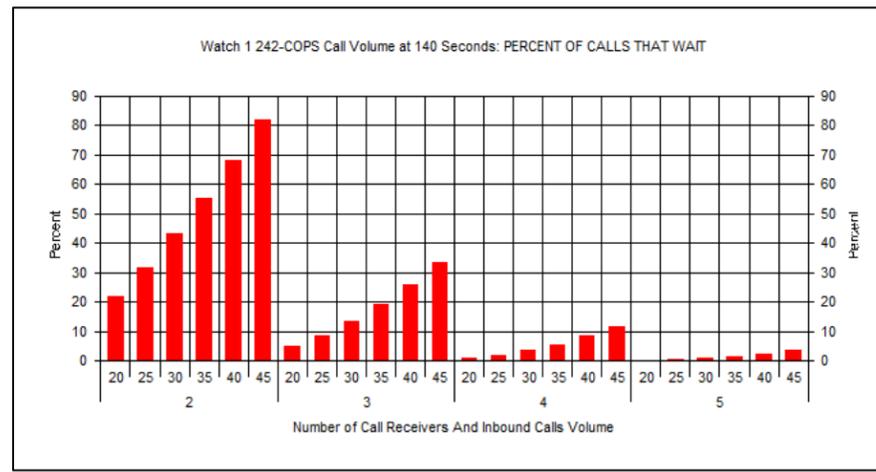
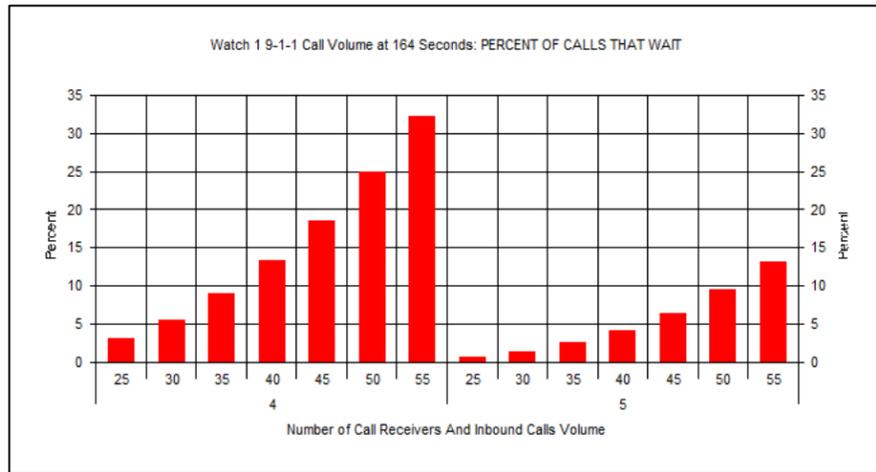
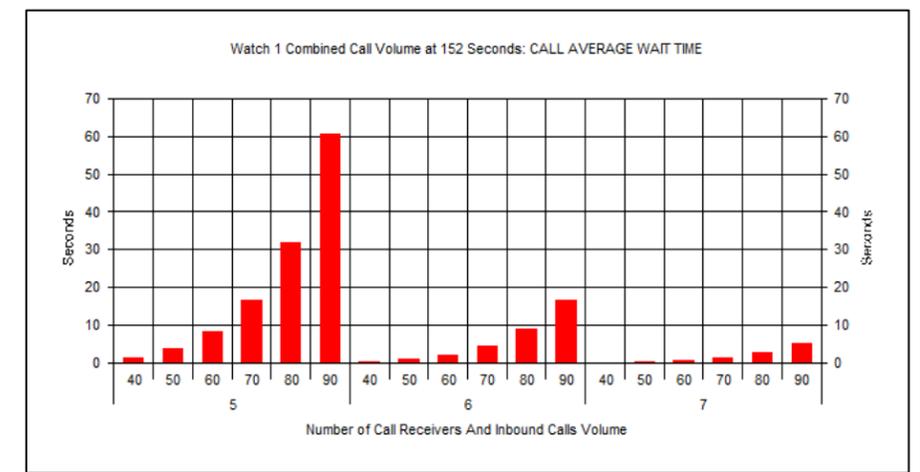
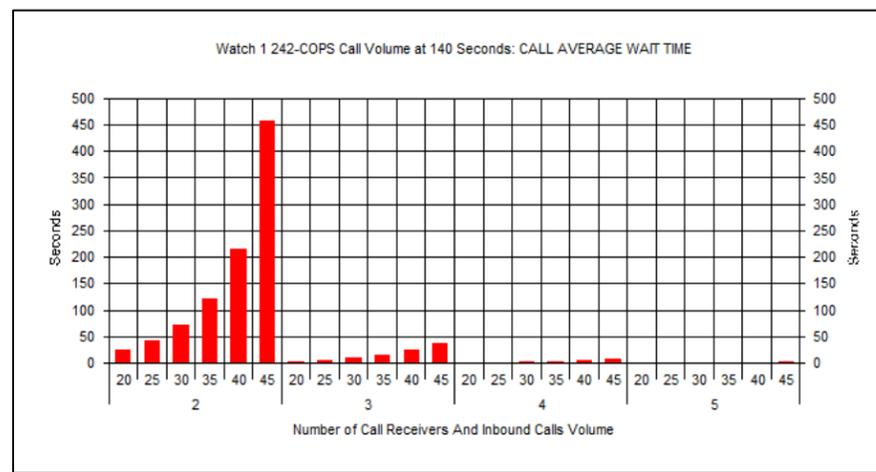
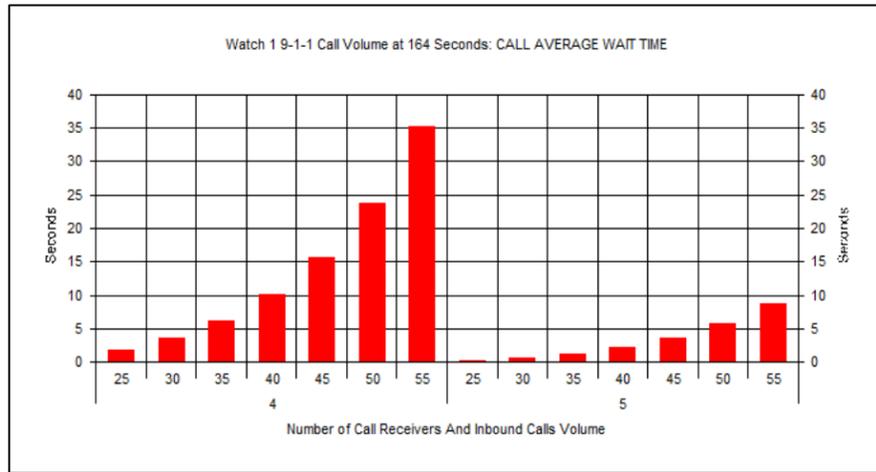
- First, the call answering times for 9-1-1 calls would not suffer since they are prioritized over 242-COPS calls.
- Second, the average answer time for 242-COPS calls should come down significantly.
- Third, with no Pre-Screening of 242-COPS calls, you eliminate the situation where a person's call gets answered, and then put on hold until a fully trained Call Taker can process the call.

IXP would recommend performing structured trial periods during portions of each of the three Watches so that performance during the trial period can be compared to performance during current operations. If the trial begins to go poorly and 9-1-1 call answering begins to suffer, you could quickly exit the trial by having some of the Call Takers re-log into the system as "E" Role Call Takers and operations would be back to their normal configuration.

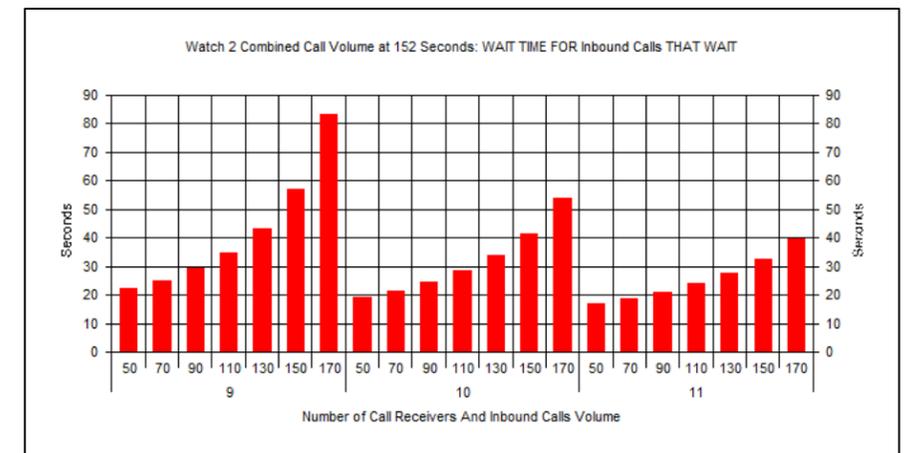
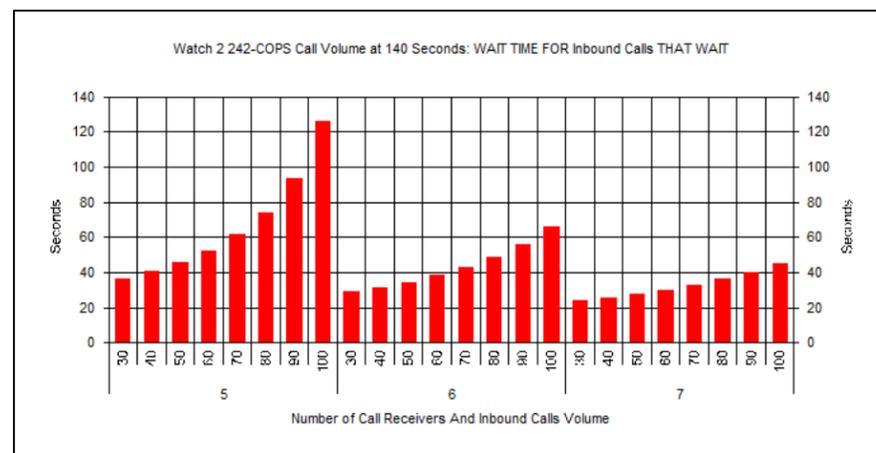
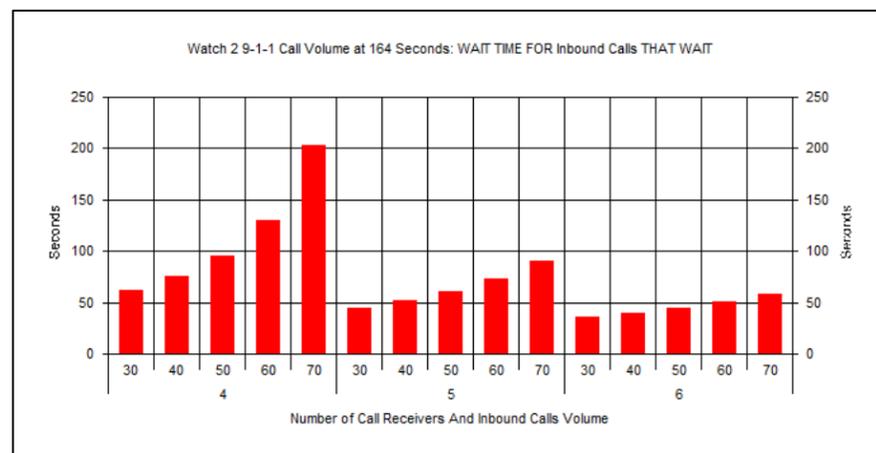
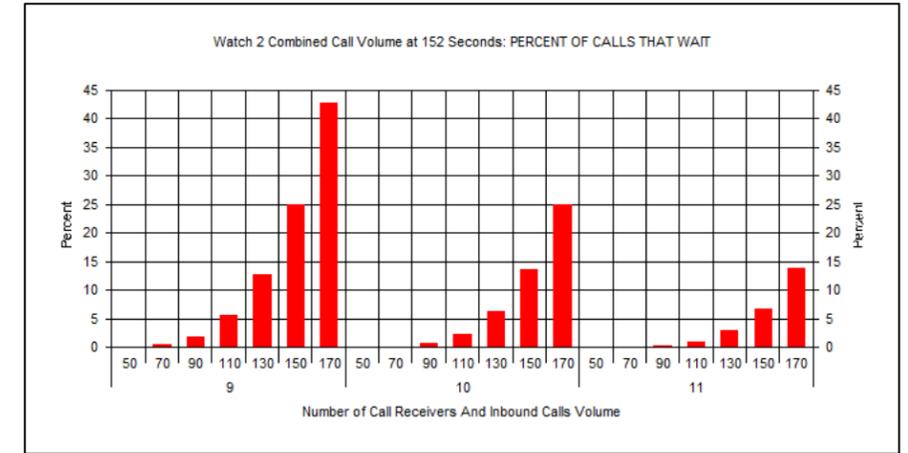
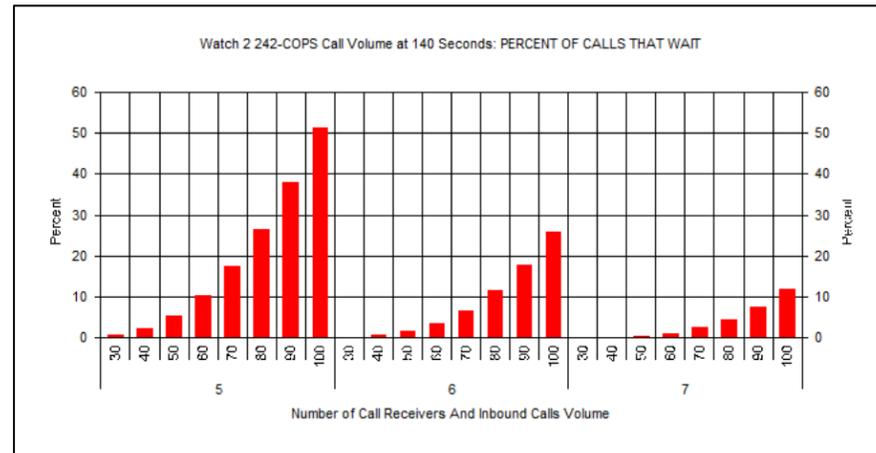
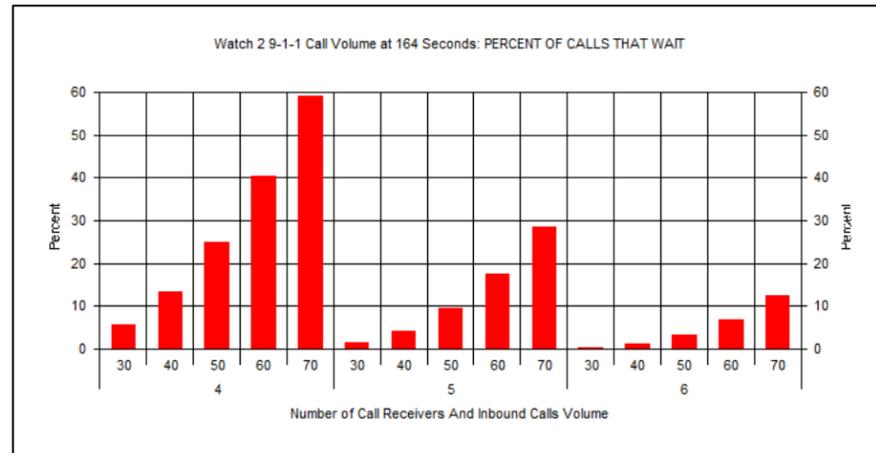
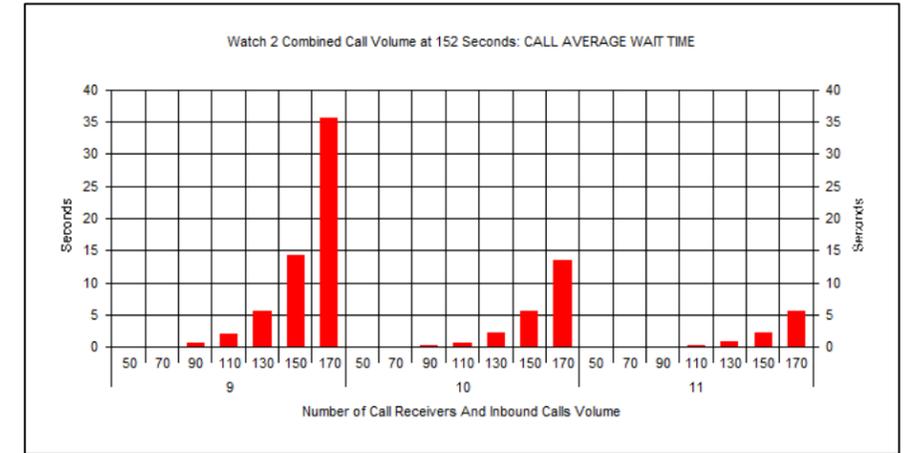
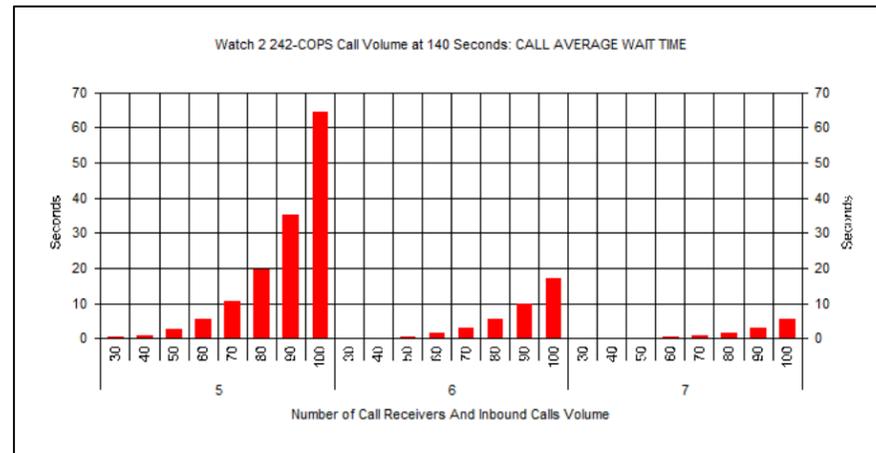
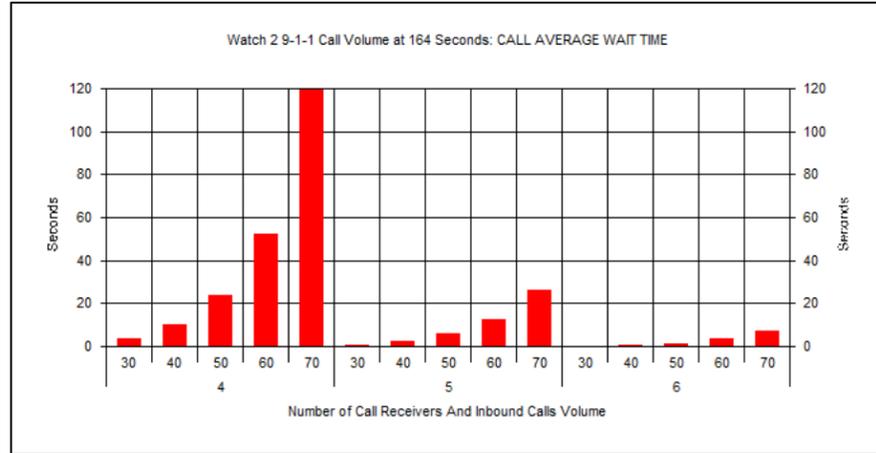
APPENDIX

The following pages provide the detailed staffing model graphs for each of the Watches and each of the three Queue-structure scenarios. These pages are formatted as 11X17 Landscape pages to aid in being able to use a single page to understand each scenario for each Watch.

Watch 1 Models



Watch 2 Models



Watch 3 Models

