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PSAP STAFFING GUIDELINES REPORT
AS COMMISSIONED BY
NENA SWAT OPERATIONS TEAM

9-1-1 SME
Consulting

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1.0   EXECUTIVE SUMMARY

L. Robert Kimball & Associates, Inc. and 9-1-1 SME Consulting have performed a PSAP Staffing Survey and Analysis Study for the National Emergency Number Association (NENA) SWAT Team Operations Group. The objectives of the study were to develop staffing and budget models from data collected from existing PSAPs with which those approximately 432 counties in the United States without Enhanced 9-1-1 can project staffing and associated budgetary needs to implement Enhanced 9-1-1 service. This report presents the findings of the study and the guidelines for optimizing the use of the data.

The premise on which the study was developed was that no one method for determining staffing needs would suffice given the number of influencing factors, both local and industry imposed. Thus, by combining two techniques, a rational approach and an empirical approach, there is a check on each to increase the robustness of the recommendations created.

The Scope of Work for the study included six primary tasks. These were:

1.   Define PSAP profiles
2.   Review NENA-developed databases
     a.   DOT Project
     b.   PSAP Registry
3.   Define specific PSAPs to be surveyed
4.   Collect data
5.   Determine staffing requirements based on call volume
6.   Analyze the collected data and create staffing and budget models

In a SWAT Operations Group meeting held April 5, 2003, the survey tool and study objectives were refined and approved.

It was evident early in the study that the desired number of completed surveys and the required profile-specific PSAPs would be slow in being returned or not forthcoming at all. Numerous attempts were made to gather the data from the necessary PSAPs. Additionally, little data relevant to this study could be gleaned from the existing NENA-developed databases.

The result of the limited number of completed surveys caused a modification of desired goals in that the influence of specific factors on call processing could not be validated to the degree intended by the study. These factors included customer premises equipment (CPE) technology level, the presence of four lane highways within 9-1-1 service areas, and the number of wireless subscribers.

Summary

This study was designed to collect information on PSAP Staffing for those jurisdictions with populations up to 140,000 and to analyze it to determine the level of staffing required by the major factors that may affect how many persons should be employed in what tasks. Key to the study was determining the extent to which each factor may affect the number of personnel required.

The study specifically collected information and reports on the following factors:
1.   Population
2.   Four-lane Highway Mileage
3.   Number of Wireless Subscribers
4.   Population Density
5.   Level of CPE expected to be installed

It was thought that all of the above would affect the PSAP staffing based on their effect on how they would influence 9-1-1 and 7-/10-digit emergency call volume. Thus, call volume was collected to compare to each of the above factors to validate the factor as an influencer of call volume and thus of PSAP staffing requirements.

To provide the best recommendation, the PSAP categories were divided into three population sizes as determined by PSAP Staffing characteristics defined by the NENA SWAT Team:

1.   0 – 19,000 population
2.   19,000 to 100,000 population
3.   100,000 to 140,000 population

Additionally, since a factor that might influence PSAP staffing would be the level of CPE automation, seven CPE levels were defined (See PSAP Data Sources below for details.), so that there were a total of 21 categories of operation (Three by population times seven by CPE level.). We sought three examples of each category, for a <u>target number of 63 completed PSAP surveys</u>.

The information was gathered by requesting PSAP managers to complete an electronic copy of a PSAP Staffing Study that was both emailed to prospective PSAPs and made available on the NENA web site for downloading. More than 500 surveys were sent to targeted PSAPs and extensive advertising and promotion were done via NENA, Dispatch Monthly News Hound and the National Academies of Emergency Dispatchers talk list.

Additional information about the PSAPs and jurisdictions were obtained by other means. The NENA/DOT Survey and phone calls to PSAPs provided CPE information. Microsoft Streets & Trips® provided four-lane highway miles. The U.S. Census Bureau provided verification of questionable populations and square miles within jurisdictions. A man-hours survey was sent to PSAP Manager who had provided PSAP staffing survey inputs to document the number of hours a year a telecommunicator works for PSAPs of these three sizes.

Although 70 qualified PSAP surveys were received, they did not provide information on each category, so that the PSAP staffing requirements as affected by the level of CPE could not be determined. However, the data did provide sufficient information for other conclusions.

There were two different philosophical approaches used in this analysis to better support the resulting guidance.

1.   <u>Rational Approach</u>. This method is based on applying theory to source data. Here, the staffing levels are determined upon call volume, call duration time and queuing theory. The results were close to the actual staffing for those PSAPs that reported all the information.

<u>Result</u>: If call volume can be determined, then the number of call-takers required can be determined with good accuracy.

2. <u>Empirical Approach</u>. This method is based on observation of similar cases. By noting staffing requirements in jurisdictions that have similar characteristics to one's own jurisdiction, one may assume that similar staffing will be required.

<u>Result</u>: Where all inputs were used, the ranges of staff requirements varied so significantly that the only factor that showed good correlation to staffing was the jurisdiction's population. Even there, some factors (for example, the approximately 20 hotels and 20 large office buildings in Agency A1, created a 9-1-1 volume far in excess of what its residential population of 4,224 persons would indicate.) showed that for these office- and hotel-dense areas, that the day-time population must be used – the correlation with day-time population (versus residential) was good in the three examples in this study.

However, none of the other factors (highway mileage, wireless subscribers, population density) could be seen as having an effect. For example, among the PSAPs reporting, there were pairs that were within a few percentage points of call volume per capita yet one had high highway mileage, the other had low. An attempt to do cross-correlation (i.e., show how multiple affecting factors influenced the call volume) yielded no cross-correlation among these three factors.

Thus, the major conclusions of this report are:

1. To predict call volume, additional potentially influencing factors must be considered.

2. True cross-correlation calculations require more examples. If additional work in this area were to be done, good data from at least 150 PSAPs would be required. In this study, owing to not all data being available from all 70 PSAPs, the correlation work was done on 20 to 70 PSAPs. Additionally, of the surveys received, we need a greater percentage of answers in the key areas. For this survey, the following table shows the percent of respondents (of the 70 qualified surveys) that had provided information in each key category.

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Category	# Respondents	Percent
Square Miles*	70	100%
Population*	70	100%
Highway Mileage**	70	100%
Operations Personnel	68	97%
Wireline 9-1-1 Calls	67	96%
DBA or GIS Personnel	65	93%
Dispatched calls	59	84%
Operations Budget	58	83%
Wireless 9-1-1 Calls	57	81%
Call durations	53	76%
Customer Premises Equip Level	51	73%
DBA or GIS Budget	33	47%
Wireless Subscribers	20	29%

*Number of Respondents was not 70, but 9-1-1 SME Consulting research closed gap.
**Highway mileage all done by 9-1-1 SME Consulting.*

Table 1-Percent of Data Requested

3. The data that was obtained was sufficient for general PSAP staffing recommendations based on population and modified slightly for mapping & addressing and call taking attitude factors for each of the three PSAP sizes.

In sum, this report provides two good bases for establishing the number of call-takers at a PSAP, a method to provide support staff, an example of overall budget planning by PSAP size and statistics to provide benchmarks for call taking and costs.

Guidelines

Therefore, this study has produced PSAP staffing guidelines based on averages from the reliable data obtained from each PSAP size category. The recommendations are provided in this document in the **RESULTS** section:

1. Call-taker staffing based on call volumes, call durations and queuing theory.
2. Call-taker and support personnel staffing based on sample PSAPs in three jurisdiction sizes.
3. Operations and support budget based on sample PSAPs in three jurisdiction sizes.

Thus, the primary goal of this project to provide guidance to the PSAP manager in making staffing decisions has been met with the production of the "PSAP Staffing Guidelines," which are both provided below in the body of this document and as a stand-alone Excel document that is proposed for listing on the NENA web site. This "PSAP Staffing Guidelines" guides the PSAP manager to enter call volumes, call durations and information about the jurisdiction to provide recommended staffing.

Up to now, PSAP managers had to rely on call center data for planning staffing even though

9-1-1 has some unique characteristics. They also had to do their own research and try to fit their data into the formulas.

Now with the PSAP Staffing Guidelines, the PSAP manager has an easy-to-use and fairly solid basis for planning operations and support staff customized for the unique aspects of 9-1-1. This also provides a basis for reviewing current PSAP staffing as a check to ensure PSAP manning is sufficient to meet the emergency response needs of the community.

PSAP Statistics

Additionally, several PSAP statistics were calculated for the three PSAP sizes. These included:

1. Cost per call received
2. Cost per dispatch
3. Budget for Operations Staff
4. Budget for Administrative and Technical Staff
5. Number of Calls and Dispatches per Operating Staff
6. Comparison of Call Duration based on level of CPE

Next Steps

Yet, the work here actually highlights that further work is needed and defines that work.

Issues

1. The data was not sufficient to get better than a good correlation based on population. PSAP managers know that there are numerous factors that influence call volume, yet the data from this study was not sufficient to determine them. NENA Western Region Vice President Bill McMurray provided the following comment on the Interim Report in his letter of May 31, 2003:

   "I recognize that there is a value in a standardized formula in determining appropriate funding, but as you have found, it cannot be based on the simplistic value average busiest hour, or even population. Rather I believe there are a variety of factors of varying weight that ought to be considered.

   "I call this concept, 'PSAP Profile', or better stated for the purposes the kind of report you are preparing, a 'Community Profile'."

   Bill goes on to list the following factors that he recommends be considered in any PSAP Staffing Guideline:

   a. Community Demographics (rural, suburban, urban, metropolitan, etc.)
   b. Discipline Configuration (dispatch just police, or police and fire, or, etc.)
   c. Population Directly Served
   d. Population Indirectly Served
   e. Seasonal High-Visitor Counts

From the conversations and data obtained in researching for this report, the following factors are recommended:

a. Crime rate
b. Attitude towards calling the PSAP (whether via 9-1-1 or 7-/10-digit number) and the PSAP's acceptance of these calls. For example, a county where it is acceptable for a child to call the PSAP to learn if school has been closed on account of snow will have significantly higher call volume than PSAPs that will respond only to emergency calls. In another example, a PSAP that also serves as call-taker for municipal utilities will have a higher call volume than one that doesn't take these calls, all other factors remaining equal.
c. Demographics of the surrounding jurisdictions. The aspects of these will spill over into the target PSAP to some degree.
d. Does the CPE allow the call-taker to take the next call immediately after hanging up from a call? Some CPE require a few seconds for the integrated CAD to generate files at the conclusion of the call before another call can be answered.

Additionally, in a meeting 9-1-1 SME Consulting had with the 9-1-1 Director of Steuben County, NY (previously the number three person in the Rochester, NY, PSAP), it was learned that weather has a major effect on call volume. We propose to include this.

Thus, there are other factors that should be considered.

2. A key data set is wireless 9-1-1 call volume. With only 20 PSAPs being able to provide this, the information was of no value in determining correlations. The problem was two-fold: (a) Most PSAPs did not have the information, (b) A few of the PSAPs that had the information stated that they could not provide it owing to the Non-Disclosure Agreements they'd signed. Thus, it appears that if the impact of this call volume is to be understood, we should get it from the wireless carriers themselves through a direct approach to them. Working this issue from the top down (i.e., via wireless carrier reps that are already working with NENA) may produce the information we need.

3. There is a need for PSAP Staffing Standards for PSAPs that serve more than 140,000 people, have Automatic Call Distribution and have separate call-takers and dispatchers. Documentation of this need comes from emails posted on NENA's list server and the APCO Project (40) Report that recommends that standard methodologies be used to determine staffing levels, but has no actual recommendation as to a methodology.

The results of this project provide an excellent basis for filling in the gaps to create the definitive PSAP Staffing Standard that would also meet the needs of larger PSAPs and those with Automatic Call Distribution.

What we have:

1. Inputs from 76 PSAPs, although data was incomplete with several and six PSAPs were outside our target groups (i.e., were either too large or were airports).
2. Established relationships between the L. Robert Kimball – 9-1-1 SME Consulting team and the PSAP managers who have participated.
3. An understanding of the issues that goes beyond what has been previously published for PSAPs.

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What we need:

1. Additional completed surveys, to include larger PSAPs.
2. Additional information about the PSAPs, which is listed along with the recommended sources in the following Table 2.

Data Required	Source	
	PSAP	**Other**
Crime Rate		FBI Statistics
Attitude towards callers	X	
Emergency Response Agencies Served	X	
Demographics of Jurisdiction		US Census Bureau
Demographics of Surrounding Jurisdictions		US Census Bureau
Modifier for Seasonal Population Variances	X	
Weather Patterns	X	Weather Bureau
Wireless 9-1-1 Call Volume		Wireless Carriers
Additional CPE Level understanding	X	

Table 2-Data Required

3. Obtaining the "Wireless 9-1-1 Call Volume" will require a new approach. Since it is so difficult to obtain this from the PSAP managers, the wireless carriers should be contacted directly by NENA to provide the data. An NDA is acceptable with the actual numbers not shown in a report, just the needed correlation factor.

Conclusion

Thus, L. Robert Kimball & Associates and 9-1-1 SME Consulting consider that they have met the requirements of the survey to the extent data and available time permitted. In addition to the Guidelines provided below, we offer NENA the option of continuing the effort to develop the complete PSAP Staffing Guide.

Feedback on this report is welcomed. Send comments and critiques to:

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2.0 OBTAINING PSAP DATA

2.1 SELECTING PSAP DATA CATAGORIES

The project plan was to obtain data in three categories of PSAP sizes based on the populations of the jurisdictions served. The sizes were derived from an early SWAT Technical Team study that delineated PSAPs based on staff structure. The SWAT Team sizes do continue to include larger PSAPs, but those are outside the scope of this study.

1. <u>Small PSAPs</u> – Often have the PSAP manager working as a telecommunicator. (Or you could look at it the other way around – They assigned one of the telecommunicators to do PSAP management functions.). Usually only one call-taker/dispatcher on duty most of time. Population: 0 to 19,000.

2. <u>Medium PSAPs</u> – Have a dedicated PSAP manager who does all the support work. Minimal call volume times will have one call-taker/dispatcher on duty, but have significant periods where two persons are on duty. Population: 19,001 to 100,000.

3. <u>Large PSAPs</u> – Have a dedicated PSAP manager and one or two full-time support personnel such as an administrative assistant/assistant manager, database manager and/or training supervisor. Normally have two to three call-takers/dispatchers on duty. May have one call-taker and two dedicated dispatchers, one for police, other for fire and EMS. Population: 100,001 to 140,000.

We all know that PSAP staffing varies widely, so a staffing recommendation must take into account the key factors that influence the staffing requirements. One factor is the level to which automated CPE can assist the telecommunicator. Thus, we planned to assess PSAPs based on the following seven levels of automation:

- Manual call processing
- Computer-based telephony, no Map display
- Computer-based telephony and Map display only
- Computer-based telephony, Map display and CAD
- Primary PSAP serving Secondary PSAPs with ALI display only (e.g., monitor or printer)
- Primary PSAP serving Secondary PSAPs with computer-based telephony and Map display only
- Primary PSAP serving Secondary PSAPs with computer-based telephony, Map display and CAD

Table 3 below shows the several sources of data for this survey. While it would be convenient and efficient for the survey team to receive all the data it needed via the primary instrument, the "PSAP Staffing Survey," that would not be likely and might well, by the additional length of the survey, discourage PSAP managers from filling it out, thereby reducing the number of surveys received. Therefore, some of the data was collected by either a short secondary survey to just those PSAP managers who had replied (the Man-hours Survey), by follow-up phone call, or standard reference (Microsoft Streets & Trips®). Additionally, where the population and/or square miles area of the jurisdiction did not appear to be correct, the U.S. Census Bureau's web site was used to obtain the information (http://www.census.gov/main/www/cen2000.html).

Sources of Data Used in this Report

Legend
P – Primary method of obtaining data
S – Secondary or backup method

Information Sought	Source				
	PSAP Survey	**Phone Call**	**Man-hours Survey**	**Microsoft Streets & Trips®**	**U.S. Census Bureau**
Agency name and address	P	S			
Contact name title, e-mail and phone numbers	P	S			
Jurisdiction(s) served (Note only one Primary PSAP per survey)	P	S			
9-1-1 service level (i.e., Basic, Enhanced, Phase I, Phase II)	P				
Square miles in jurisdiction	P				S
Population of jurisdiction	P	S			S
Day-time population served	P	S			
Number in incoming trunks	P				
Number of wireless subscribers	P				
Primary PSAP names, call and dispatch responsibilities	P				
Secondary PSAP names, jurisdictions and dispatch responsibilities	P				
How call statistics were determined	P	S			
9-1-1 call volume by wireline and wireless	P	S			
7-/10-digit emergency services number call volume	P	S			
Dispatches by police, fire and EMS per Primary and Secondary PSAP	P	S			
Call duration times	P	S			
Staff budgeted (number of persons per task)	P	S			
Man-hours work per year per telecommunicator			P		
Budget for Operations and Support Personnel	P	S			
CPE level (e.g., map display?)		P			
Highways in jurisdiction and their mileage.				P	

Table 3-Source of Data

The PSAP Staffing Survey is provided as **Appendix A**.
The Man-hours Survey is provided as **Appendix B**.

2.2 DETERMINING NUMBER OF SURVEYS REQUIRED

With each of the three PSAP sizes (small = 0 – 19,000, medium = 19K –100K, large = 100K-140K) being assessed for each of the above seven levels of automation we have a matrix of 21 PSAP size and automation categories.

In research, validity improves with the increase in the number of examples. However, cost also increases. With 21 categories, that would demand a large number of examples. Yet, since all surveys could be used to answer some questions, it was not felt that we needed, for example, 20 PSAP surveys for each category. We (NENA SWAT Operations Team, L. Robert Kimball & Associates and 9-1-1 SME Consulting) set the balance of validity vs. cost to be three examples of each category for a total of 63 PSAPs.

The effort to obtain sufficient PSAP responses started with a request to NENA Regional Vice Presidents for their PSAP recommendations. When the PSAP contacts were received, PSAP Staffing Surveys were sent to them via e-mail. However, this did not produce the desired number of responses, so publicity and promotions were initiated throughout the collection period. The subsequent efforts to obtain sufficient PSAP responses were:
1. Request to President of NASNA (National Association of State Nine-One-One Administrators) for their help.
2. Posted survey on NENA web site for more than a month.
3. Posted on NENA talk list, twice.
4. Posted on NAED (National Academies of Emergency Dispatchers) talk list, four times.
5. E-mail request sent twice to Dispatch Monthly magazine's News Hound list.
6. E-mail request sent to "All NENA Members."

As of our last day of collecting data prior to working on this report (May 30, 2003), the following numbers of PSAPs by category had provided their data. The definition of each CPE Category is by the equipment in the PSAP and is indicated in the below **Table 4** by an X in the heading. Please note that the DOT/NENA database was used to determine the below categories.

CPE Category		1	2	3	Not used	4	5	6	7	
Secondary PSAP							X	X	X	
Computer-Based Telephony*			X	X	X	X	X	X	X	
Map Display				X		X		X	X	**No**
CAD					X	X			X	**CPE**
PSAP Population	**Number**									**Info**
0 to 19K	**19**	0	6	6	0	0				7
19K - 100K	**40**	0	7	18	1	8				6
100K 0- 140K	**11**	0	1	5	1	4				0
>140K	4									4
Airport	2									2
Total . . .	76	0	14	29	2	12	0	0	0	19
Qualified	**70**									

*If not checked, then only manual (electro-mechanical) CPE is installed.

Table 4 -CPE Level by PSAP Size

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On the data availability and usefulness:

1. PSAP Staffing Surveys – The 76 PSAP Staffing Surveys exceeded our target number of 63, but only 70 fit our target categories and we did not reach the goal of 21 PSAPs in the small and large PSAP categories. This affected the ability of the data assessment to provide validity to conclusions within these PSAP sizes. However, since there are sufficient PSAPs for the medium sizes, the conclusions drawn there have good validity. The overall number of 70 valid PSAP Staffing Surveys enables conclusions to be drawn in PSAP staffing issues that use the entire data set with excellent validity. The majority of the surveys returned had missing data or numbers placed in the wrong location (e.g., dollar amounts in the table requesting number of persons assigned) requiring the survey to returned with a request for the additional info or clarification. Many surveys were followed up with phone calls to further improve on understanding the data.

2. Follow-up phone calls – In order to keep the PSAP Staffing Surveys from being dauntingly large to where PSAP managers would be discouraged from attempting to fill it out, some key data was requested via second survey or telephone call to the PSAP manager. As many PSAPs as could be contacted were asked to define their CPE, whether they have map display capability and Computer-Aided Dispatch.

3. Man-hours Survey – A critical data element in estimating PSAP Staffing is knowing how many hours of work a telecommunicator can be expected to provide in a year. Research on some previous studies indicated 1,575 to 1,877 hours. Therefore a second survey was sent to just the PSAPs that had provided a PSAP Staffing Survey to ask how many hours each year was the average telecommunicator off for holidays, personal days, training, sick, etc. Thirty-three PSAPs reported, providing a good basis for this document. Results of this survey are provided in the Rational Approach section. See **Appendix B** for the Man-hours Survey.

4. Highway mileage – The ease with which the "measure distance" tool can be used in Microsoft Street & Trips® to obtain highway mileage made the use of this software program the most efficient way to obtain the data. Also, the mileage could be captured as four-line divided limited-access highways and as standard highways to see if the individual or combined mileages were factors.

5. U.S. Census Bureau – Most surveys were submitted with what appeared to be accurate population and square mile area information. However, when one PSAP listed its area as 150,000 square miles and other PSAP managers provided round numbers, the U.S. Census Bureau was checked and the numbers for the populations estimated for 2001 was used. (The PSAP with the 150,000 square miles served five counties, but the total area of the five counties was 11,487 square miles.)

With the data collected, the following sections report the assessment of the data, conclusions and PSAP Staffing Recommendations.

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3.0 RESULTS

3.1 PSAP STAFFING GUIDELINES

PSAP Staffing Guidelines for Primary PSAPs serving populations of fewer than 140,000

This provides operational and support-staffing recommendations based on either known call volume or upon parameters of the jurisdiction. The two will produce slightly different results primarily because the method that is based on jurisdiction parameters does not take into account all parameters that influence call volume. If there is a choice, use the call volume basis as that, by virtue of resulting from the sum effects of all the influencing parameters, will be more realistic.

Both methods are based on formulas in the Excel spreadsheet version (separate document) that will take data you enter. Thus some data gathering for each method is required.

A separate worksheet is used for each:
1. Call Volume – Staff recommendations based on call volume.
2. PSAP Compare – Staff recommendations based on PSAPs with similar characteristics.

Finally, a third worksheet, "Budget", is provided to show what PSAPs of similar size are budgeting for their Operations.

3.2 STAFFING BASED ON CALL VOLUME

Call volumes should be based on the Average Bouncing Busy Hour (ABBH) as measured during a minimum of a 14-day period during the busiest time of the year for 9-1-1 calls. The formulas are not set up for a PSAP that uses automatic call distribution.

Preferred Sources of Call Volumes (in descending order)

1. Offered calls from the 9-1-1 control office (AKA 9-1-1 selective router, 9-1-1 tandem). This is a count of calls attempted to be routed to the PSAP or call centers currently accepting 9-1-1 calls that will be a part of the new PSAP's call volume. This may also be tracked for 7-/10-digit emergency calls if the serving central office can track these.

2. Accepted calls arriving at PSAP or call centers currently accepting 9-1-1 and/or 7-/10-digit calls. This does not count the lost calls that occurred when all call-takers were busy.

Calculating ABBH and "Normal Hour" call volumes (applies to Offered and Accepted Calls)

1. Select either the "Offered Calls" or "Accepted Calls" method and follow the steps below.

2. Collect Data:

   a. Plot hourly call volume over a minimum of 14 days during the busiest time of the year for the following categories of calls:
      (1) 9-1-1 calls (Those coming in over dedicated 9-1-1 circuits.)

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(2)   7-/10-digit emergency number calls (Those coming in over the Public Switched Telephone Network to 7-/10-digit emergency numbers or admin lines that are answered by the call-taker.)

(3)   Pre-Arrival Instruction Dispatch (These are actually dispatches but have to be counted as they extend the call duration significantly. The "call duration" used is an estimate of how much time the PAI and staying on the line with the caller will take. Thus, this can only be in the "Accepted" category.) If PAI is not used, leave this line blank.

b.   If the PSAP will provide Pre-Arrival Instruction (PAI), also track the number of calls dispatched. This will be noted separately from the call volume.

3.   Sum the 9-1-1 and 7-/10-digit calls in each hour to get a total of all calls received during each hour of the monitoring period.

4.   Take the average of the busiest hour of each day for the sum of these calls. This becomes the "Average Bouncing Busy Hour" or ABBH.

5.   Determine the characteristics of the "Busy Hour Shift." Look at the hourly call volumes before and after the ABBH to select an eight-hour period that has the most calls (The period must include the ABBH.). This will be the "Busy Hour Shift." Note these hours.

6.   Take the highest hourly call volume of the remaining hours of the day. This is the "Normal Hour" upon which manning for a "Normal Hour Shift" will be based.

7.   Put the "ABBH" and "Normal Hour" call volumes into the column in the below table that reflects the method you chose ("Offered Calls" or "Accepted Calls"). The different columns calculate the using different queuing theories, although they produce nearly the same result. It is expected that the ABBH and Normal Hour call volumes will be decimals (e.g., 4.3, 2.5), which are entered below as examples.

8.   For the ABBH and "Normal Hour", look at the PAI dispatches (again, this applies only if PAI is used) and note the number of dispatches for each hour. Enter them in the table below.

Determining Call Duration

The call duration must also be determined for each category of calls. The duration is the time in seconds from first ring to dispatch and call termination as this captures the telecommunicator's time. If you do not have call durations, use the following numbers (Call duration must be in seconds.):
 - 9-1-1 and 7-/10-digit calls = 95 seconds
 - PAI dispatch = 400 seconds

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Enter data in the yellow highlighted cells in the Data Entry Table below.

Data Entry Table

Enter call volume in "Offered" or "Accepted for each line, not both.

	ABBH Call Volume		Normal Hour Call Volume		Call Duration
Call Volume Category	Offered	Accepted	Offered	Accepted	
9-1-1 Calls	4.3	0	0	2.4	95
7-/10-digit emergency #	0	3.6	0	3.1	95
PAI dispatches*	N/A	0	N/A	0	400

*Leave blank if Pre-Arrival Instructions are not provided. The "9-1-1 calls" will cover this. NOTE: The PAI dispatches aspect was later decided to be an unnecessary complication for the final PSAP Staffing Guideline Worksheet and so is omitted from it. This PAI aspect remains here for those who would like to use it.

The above calls equate to approximately 55,188 calls per year. Calculated via multiplying (1/3rd times sum of ABBH call volumes plus 2/3rds sum of Normal call volumes) x 24 hours x 365 days.

Determine Hours of Work Per Year to be Obtained from Each Call-taker

Enter number of days off per category in table below (highlighted cells).

Days in year	365
Less Days Off:	
Weekends (i.e., 2 days per 52 weeks)	104
Paid Holidays Off	10
Vacation	5
Personal Days off	3
Training	5
Conference	2
Sick	5
Total Days off per Year	134

Days available to work	231
If work eight hours per day	x 8
Hours available to work	1848
Manning Ratio* (Hours in Year/Hours Available)	4.74

*Manning Ratio - How many persons must be hired to keep one position manned 24 x 7. It is calculated by dividing the number of hours in a year (8,760) by the number of hours a call-taker is available to work at a position (for PSAPs reporting in this study, that is 1,848).

Table 5-PSAP Data Entry Tables

PSAP STAFFING GUIDELINES REPORT
AS COMMISSIONED BY
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Calculations for Staff based on above inputs and P.01 Grade of Service

Call Volume Category		Erlangs			
		Busy Hour Shift		Normal Hour Shift	
		Offered	Accepted	Offered	Accepted
9-1-1 calls		0.113	0.000	0.000	0.063
7-/10-digit emergency #		0.000	0.095	0.000	0.082
PAI dispatches*		N/A	0.000	N/A	0.000
Total Erlangs		0.113	0.095	0.000	0.145
Total Erlangs per Shift . . .			0.208		0.145
Call-takers required per shift . . .			3		2
Number of shifts per day . . .			1		2
Total Call-takers on watch in typical day					7
Manning Ratio . . .					4.74
Total Call-takers required to man 24 x 7					**33.2**

Table 6-Calculations for Staff Based on Inputs

The **Total Call-takers required to man 24 x 7** above is the result based on the example inputs on the previous page. To calculate your inputs, the document **PSAP Staffing Guidelines** (Appendix D, an Excel spreadsheet) is provided.

In **Table 7** below, for a given number of Erlangs (rows 1, 2 or 3), the following number of call-takers (row 4) are required. In this document, Extended Erlang B is used for Offered Call Volume and Poisson is used for Accepted Call Volume. Erlang B is not used in PSAP queuing owing to the absence of the allowance for redialing (which happens with 9-1-1 calls) and is shown just for comparison.

Lookup Table for Required Telecommunicators
For a Given Number of Erlangs (rows 1, 2 or 3), the number of servers required are shown below (row 4).

Extended Erlang B	0.000	0.011	0.152	0.452	0.863	1.350	1.893	2.480
Erlang B	0.000	0.011	0.153	0.456	0.870	1.361	1.910	2.510
Poisson	0.000	0.010	0.150	0.450	0.850	1.300	1.800	2.350
Servers	1	2	3	4	5	6	7	8

Table 7-Lookup table (Erlangs to Required Call-takers)

Reasoning for choice of Extended Erlang B:
This queuing theory was specifically created to account for call volumes where if the caller was blocked, then at least 85% of the time the caller immediately redials. This is the situation of a person seeking emergency help.

Why Erlang B was not selected:
This mathematically represents the situation where if a caller is blocked, the caller will wait some time before redialing.

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<u>Why Poisson was not selected</u>:
Poisson has been criticized in use in telecommunications because it mathematically assumes that if a call attempt is not successful that the time until it is accepted is counted as "calling time." Of course in reality, there is no communication during that period, so the method is not realistic.

<u>Why all three are shown</u>:
Just to highlight the point that there is not much difference among them at these levels of call volumes.

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3.3 STAFFING BASED ON COMPARISON WITH SIMILAR PSAPS

During the spring of 2003, 70 PSAPs were sampled to determine their call volume, staffing and what factor may have influenced their staffing requirements. In this section you will be asked a few questions about your jurisdiction which will lead to your filling out data tables and coming to a staffing recommendation. The recommendations are based on the staffing of the surveyed PSAP that had similar characteristics.

First, determine your jurisdiction's population.

 - If less than 19,000, you will plan with the "Small PSAP" size.

 - If between 19,000 and 100,000, you will plan with the "Medium PSAP" size.

 - If between 100,000 and 140,000, you will plan with the "Large PSAP" size.

If your PSAP will just handle 9-1-1 and 7-/10-digit emergency calls only, then the Operations Staff need not be modified. However, if your PSAP will be routinely handling non-emergency calls, such as answering for municipal utilities or providing information on municipal services similar to 3-1-1 calls, then there must be an adjustment to the call-taker requirement.

The Data Base Administrator's (DBA) workload depends significantly on the mapping and addressing activity in the jurisdiction and must be adjusted from the base number given.

a. If the jurisdiction has addressed and mapped the area, and the jurisdiction is stable (i.e., no new subdivision and little growth), then the man-hours requirement is minimal. Recommend 0.1 to 0.3 depending on the size of the jurisdiction.

b. If the jurisdiction is growing with much new development and/or a highly mobile population so that address updates are frequent, the work for the DBA is greater. Recommend 0.2 to 0.6 additional personnel.

c. If the jurisdiction is in the addressing and mapping mode, even though contractors are doing that work, there is a significant burden on the jurisdiction to validate addresses for 9-1-1 use. Recommend one to three DBAs, depending on the size of the jurisdiction.

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See the following table for numbers to enter into the appropriate PSAP Staffing table that follows:

		Additional Personnel Requirement		
	Task	Small PSAP	Medium PSAP	Large PSAP
MAPPING AND ADDRESSING				
Stable community, few changes*	DBA	0	0	0
Dynamic, many changes	DBA	0.4	0.8	1
New mapping and addressing in progress.	DBA	1.5	3	4
CALLS ACCEPTED				
9-1-1 and 7-/10-digit emergency calls only	Call-taker	0	0	0
Municipal Utilities	Call-taker	1	1	2
Jurisdiction official**	Call-taker	2	4	6

*There are zeros in this row as the number required for a particularly PSAP (0.1, 0.2, 0.3) are
considered the minimum for that PSAP size and thus are built into Tables 9, 10, and 11 below.
**Jurisdiction official - Take call to answer questions on municipal services as in case of 3-1-1.

Table 8-Adjustment Numbers for Personnel Requirements

Enter any adjustments from the above table into the PSAP Staffing matrix below for your size PSAP.
The "Total" row in each PSAP Staffing table will automatically add up any adjustments for a staffing
recommendation.

Small PSAP Staffing (population less than 19,000)

PSAP Size	CT/ Disp	Ops Supervisor	Total Ops	DBA	Technical	Training	Public Education	Admin	Total Support	Total Staff
< 19,000	7	1	8	0.1	0.2	0.2	0.05	0.45	1	9
DBA Adjust										
Calls Adjust										
Total	7	1	8	0.1	0.2	0.2	0.05	0.45	1	18.00
Decision										

Table 9-Staffing Recommendations for a Small PSAP

Medium PSAP Staffing (population between 19,000 and 100,000)

PSAP Size	CT/ Disp	Ops Supervisor	Total Ops	DBA	Technical	Training	Public Education	Admin	Total Support	Total Staff
19K - 100K	12	2	14	0.2	0.25	0.25	0.1	1.2	2.6	16.0
DBA Adjust										
Calls Adjust										
Total	12	2	14	0.2	0.25	0.25	0.1	1.2	2.6	32.6
Decision										

Table 10-Staffing Recommendations for a Medium PSAP

Large PSAP Staffing (Population 100,000 to 140,000)

PSAP Size	CT/ Disp	Ops Supervisor	Total Ops	DBA	Technical	Training	Public Education	Admin	Total Support	Total Staff
100K - 140K	19	4	23	0.3	0.4	0.3	0.1	1.5	3.2	25.6
DBA Adjust										
Calls Adjust										
Total	19	4	23	0.3	0.4	0.3	0.1	1.5	3.2	51.8
Decision										

Table 11-Staffing Recommendations for a Large PSAP

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3.4 GUIDELINE FOR BUDGET

The PSAPs in the study were categorized into three sizes based on NENA SWAT Team determinations:

1. <u>Small PSAPs</u> - Often have the PSAP manager working as a telecommunicator. Usually only one telecommunicator on duty most of time; does call taking and dispatching. Serves populations up to 19,000.
2. <u>Medium PSAPs</u> - Have a dedicated PSAP manager who does all the support work. Minimal call volume times will have one telecommunicator on duty, but will have significant periods when there are two persons on duty. Serves populations from 19,000 to 100,000.
3. <u>Large PSAPs</u> - Have a dedicated PSAP manager and one or two full-time support personnel, such as administrative assistant/assistant manager, database administrator and/or training supervisor. Will have two or three telecommunicators on duty, depending on call volume. Serves populations of 100,00 to 140,000.

There are many factors that can influence the Operational Expenses of a PSAP: wage rates in local area benefits packages, paid time off, decision to hire full-time only or to augment with part-time employees and the PSAP manager's desires to have or not have certain levels of support. As a result, simplified Guidelines can only show the statistics of PSAPs similar to the PSAP being designed.

These statistics follow:

PSAP Size	Costs		
	Least	**Average**	**Highest**
Small	$143,370	$251,500	$415,966
Medium	$49,050	$562,302	$2,300,646
Large	$625,293	$1,395,988	$2,687,900

Table 12-PSAP Budget Ranges by PSAP Size

Please note that some PSAPs reported their costs with statements such as "City provides Internal Telecommunications (or data base administrator) support that is not in our budget." Thus, the Least and Average Costs are low (The Highest Cost PSAPs appeared to report all their costs.)