Staffing and Retention in Public Safety Communication Centers

August, 2005

Staffing Workbook

cAPCO Project RETAINS
Responsive Efforts to Assure Integral Needs in Staffing

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Mary Jean Taylor, Ph.D.
Veronica Gardner, M.S.
Phil Clark, B.S.

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University of Denver Research Institute

APCO Project RETAINS

Dear Public Safety Communications Colleagues:

We are pleased to bring you this Effective Practices Guide for public safety communications center professionals. This document is the culmination of years of research and a collaborative effort between the APCO Project RETAINS Committee, the University of Denver Research Institute, and public safety communications professionals from across the country.

This guide was developed in response to inquiries from public safety communications managers who requested a resource to help them address their staffing and retention concerns. They wanted ideas and strategies that could help them reduce the problems and issues associated with finding and keeping staff in communications centers.

Advisors in the development of this document included public safety professionals beyond Project RETAINS Committee members and the DRI team. All agreed that the focus of this Guide would be effective practices. It offers many resources, lessons learned, and success stories from the field to assist you. There are over 6,000 public safety communication centers around the country, they are as diverse as the communities they serve. We hope the blending of this research-based information with your knowledge and expertise will help you improve staffing and retention in your center.

We also invite you to look in on the APCO website under "projects" to get additional information on the subject of staffing and retention in public safety communications centers and access the electronic *Staffing and Retention Tool Kit*. The *Tool Kit* automates the processes of calculating your staffing needs, monitoring your center's retention rate over time, and conducting research on employee satisfaction in our center.

We hope you find this document useful, and look forward to your feedback.

Tom Tolman
Principle Investigator
University of Denver Research Institute

Steve Souder
Chair APCO Project RETAINS

Acknowledgements

This Effective Practices Guide and the research behind it could not have been completed without the generous assistance and involvement of the following organizations and many very capable people, in addition to those listed below, who care deeply about assuring public safety.

This Research was made possible by the following organizations:

The Association of Public-Safety Communications Officials, International (APCO) provided direction and support

The University of Denver Research Institute (DRI) provided research support

The National Institute of Justice (NIJ) and Bureau of Justice Assistance (BJA) provided funding

Intrado, Inc. provided public safety communication center contact information

The Project RETAINS Team (2003/2004)

Project Chair:	Steve Souder
APCO Staff Liaison:	William Cade
APCO 9-1-1 Services Manager:	Loredana Elsberry
APCO Board Liaison:	Diana Borash (2003 - 2004)
APCO Board Liaison/Group Leader:	Chris Fischer (2004 - 2006)
Management Committee Liaison:	Pat Hall

Project Committee (2003/2004):

Julie Righter	Jeff Haislet	Randy Kerr
David Saffel	Jimmy Jones	Tami deRuiter
Mike Fischel	Chris Shadwell	Brent Finster
Karen Allen	Mark Bucholz	

Project Committee: (2004/2005)

Julie Righter	Jeff Haislet	Randy Kerr
David Saffel	Jimmy Jones	Tami deRuiter
Mike Fischel	Chris Shadwell	Brent Finster
Mark Bucholz	Gregory Ballentine	Paul Dixon
Kimberly Burdick	Patrick Kelly	Shannon Sewell
Angela Bowen	Robert Venables	Jeffrey Strunk
Marsha Jones	Debra Peterson	Bonnie Maney

Project Committee (2005/2006):

Julie Righter	Jeff Haislet	Randy Kerr
Jimmy Jones	Tami deRuiter	Mike Fischel
Mark Bucholz	Paul Dixon	Karen Allen
Michael Tillman	Michael Crockett	James Young
Audrey Rychalsky	Gregory Ballentine	Shannon Sewell
Cindy Dietz	David Magnenat	Francis Moore

The University of Denver Research Institute

The University of Denver Research Institute Team

Management Team:

- Tom Tolman, Principle Investigator
- David Funk, Public Safety Communications Advisor
- Gene McGahey, Public Safety Communications Advisor

Research Team:

- Mary Taylor, PhD, Senior Researcher
- Veronica Gardner, MS, Statistical Analyst
- Phil Clark, Data Manager, TEQ Services, Inc.
- Barbara McCombs, PhD, Research Associate
- Kathy Green, PhD, Statistics Consultant
- Laura Meyer, MS, Qualitative Analyst

Local Area Advisors

- Jim Bradley, Lakewood Police Department, CO
- Ed Bingham, Denver Division of Public Safety, CO
- Betty DeShazer, Adams County Combined Center AdCom 9-1-1), CO
- Cory Friend, Douglas County Sheriff's Office, CO
- Cindy Cline, Jefferson County Communications Center, CO
- James Monson, Arvada Communications Center, CO

Funding support for this project was provided by the Bureau of Justice Assistance (BJA) and the National Institute of Justice (NIJ), components of the Department of Justice (DOJ).

Project RETAINS research work was conducted under DOJ/National Institute of Justice Award No. 2003-MU-MU-K013 to APCO International and subcontracted to the University of Denver Research Institute in two phases.

The effective practices and formulas contained in this document are a product of the research conducted by the staff at the University of Denver Research Institute on behalf of APCO Project RETAINS. They should be used only as general guidance or "helps" and applied judiciously to specific situations, with proper consideration of any unique factors in your communication center. No guarantee is expressed or implied by offering these guidelines or tools.

APCO Project RETAINS
EFFECTIVE PRACTICES GUIDE

STAFFING WORKBOOK

Background

In 1999, APCO convened a Staffing Crisis Task Force to study the issue of staffing in public safety communications centers. The APCO Executive Council and Board of Officers eventually elevated the Task Force to Project status (Project 40 in the APCO Project series) and named it Project RETAINS (Responsive Efforts to Assure Integral Needs in Staffing).

Two national surveys were conducted by staff at the University of Denver Research Institute (DRI) on behalf of Project RETAINS. Study I surveyed managers and employees in a random sample of public safety communications centers, whereas Study II surveyed only managers and focused on learning about the staffing and retention situation in large centers with 76 or more employees. The national average retention rate for public safety communications centers in Study I was 83 percent. In other words, on average, centers retained 83 percent of their employees in the previous year and experienced 17 percent turnover. The average size of the centers in Study I was 18 employees. The larger centers in Study II had an average retention rate of 85 percent.

These studies revealed that the strongest and best predictor of a high retention rate was having all authorized positions filled. The fact that only a third of the managers reported having enough staff to “comfortably handle the workload” confirmed what members had been telling APCO, that there was a staffing problem in many public safety communications centers. We were particularly interested in centers which reported that understaffing was a *serious* problem or that they were *chronically understaffed*. Managers of centers with more than 75 employees were twice as likely to indicate they were understaffed and all of them reported vacancies. Although the overall average retention rates were higher in large centers, turnover is inevitable and it is an ongoing concern for managers in organizations that employ a large number of people.

About 40 percent of the large center managers indicated they hired to accommodate routine turnover or unexpected employee absences. The practice is referred to as “over hiring” and it is discouraged by many government entities, but these centers were more likely to report that they were fully staffed and they had higher retention rates. These were centers where employees were comfortably handling the workload, without unnecessary stress or excessive overtime.

Introducing the Staffing Workbook

This workbook is based on Project RETAINS research and a review of the staffing formulas and calculations used by communications centers. The formulas presented here do not use Erlang calculations. They use the basic mathematical processes of addition, subtraction, division, and multiplication (and their respective symbols +, -, ÷, x). Step-by-step directions and examples of the calcuations are provided. The process for estimating the number of employees needed to handle the work is deliberately transparent and the rationale behind it is explained in depth. The intent is to provide formulas, language and ideas that will make it easier for public safety communications managers to understand and explain the staffing needs in their center.

The formulas are designed to offer maximum flexibility. The decision about which formula to use depends on the structure of the work in your center, whether the call taking and dispatch tasks are combined at one console, or separated and assigned to staff at separate consoles. After working through the process of estimating staffing levels for each position in the center, you can compare the center's current staffing level with the estimated need determined by using the formulas.

New terms are introduced in this section while other commonly used terms have been modified specifically for this purpose. An extensive and detailed glossary is included at the end of this document to help clarify the meaning of any terms that may be unfamiliar. When in doubt, it is a good idea to make sure that your understanding of a familiar term is consistent with the way it is being used in the text.

Is the workload increasing?

Most managers reported an increase in the workload over the past few years, but many indicated that the staffing levels in their centers had remained about the same. They reported increases in total call volume, the number of emergency calls, wireless calls, and dispatch. So the question was whether these centers were using employee time more efficiently or eroding the safety margin that permits them to handle unanticipated surges in call activity. If centers were operating closer and closer to their maximum call handling ability, and their current staffing levels were compromising the center's ability to respond to normal call activity, what might happen in the event of a disaster?

The addition of a single employee can make a huge difference in employee stress and the quality of service provided to the public. Large center managers reported an average of nine vacancies, and one manager reported 36 vacancies. When asked to estimate the number of additional staff they needed so that call takers and dispatchers could comfortably handle the workload, these managers said they needed about twice as many *as the number of vacancies*, an average of 17 additional staff. One center indicated a need for 84 additional employees.

Every body makes a difference

In a busy center, the number of agents available to handle the workload can make a substantial difference in response time. To get a sense of the difference a single employee can make in a small, medium and large center, look at Table 1. For purposes of comparison, the ASA (Average Speed of Answer) or caller wait time is the same for each center, so the calls per half-hour and the number of calls that can be handled varies from one center to another.

Note the difference in answering times when just one agent is subtracted from the total in each scenario. Wait time almost triples, increasing from 30 seconds to 83 seconds in a small center when the number of call takers drops from 10 to 9. The increase in wait time is not as big in a large center when the number of employees drops from 50 to 49, but 20 seconds is a substantial difference in an emergency situation. These figures demonstrate the difference in wait time experienced by callers when even one employee is unavailable to respond to an incoming call.

Table 1: Power of One on Average Speed of Answer*

57 calls/half hour		163 calls/half hour		346 calls/half hour	
# of Agents	ASA	# of Agents	ASA	# of Agents	ASA
10	30 sec.	25	30 sec.	50	30 sec.
9	83 sec.	24	58 sec.	49	50 sec.

There is a point of diminishing returns in terms of operational efficiency and impact on costs vs. benefits. If service levels are good (i.e. calls are being answered quickly), the addition of one person doesn't make much difference.

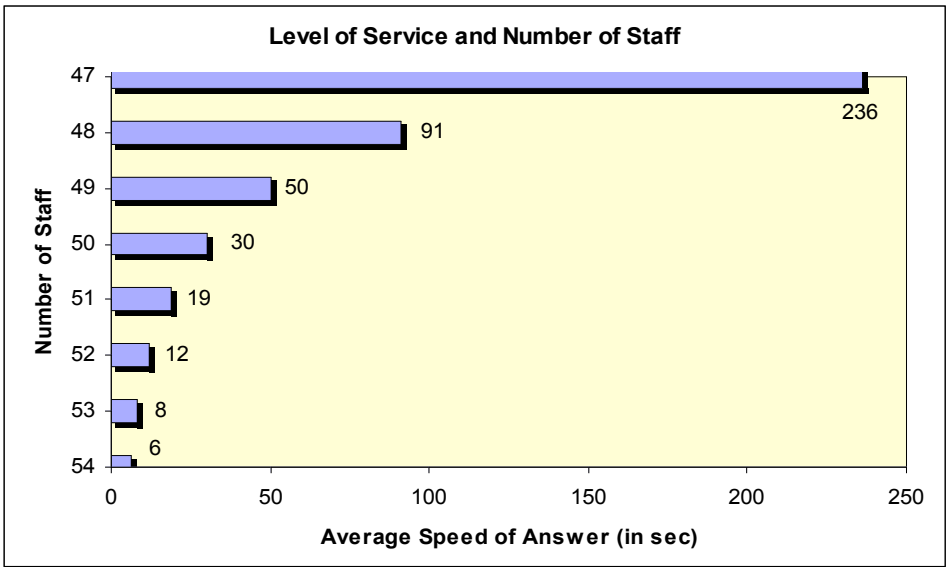
Table 2: Level of Service and Number of Staff (346 calls per half hour)*

Number of Staff	Average Speed of Answer (sec)
54	6
53	8
52	12
51	19
50	30
49	50
48	91
47	236

The figures in Table 2 are for a large center, handling 346 calls per half-hour. The wait time (ASA) doesn't change much if there are 54 rather than 52 agents handling calls; ASA decreases from 12 to six seconds, a difference of just six seconds. But if service levels are already slow, the loss of one or two individuals dramatically increases the time it takes for a call to be answered. The wait time increases almost five-fold when the number of agents drops from 49 to 47; from under a minute to almost four minutes. Few callers will tolerate being put on hold for four minutes if they are in a crisis situation. The data in

Table 2 are presented graphically in Exhibit 1, further illustrating the dramatic difference in a callers experience with the addition or subtraction of just one employee in a situation where a center is understaffed. [1]

Exhibit 1: Level of Service and Number of Staff



The graph shows that the addition of even one person can dramatically improve the response time in a center that is seriously understaffed.

The service goal most commonly mentioned for public safety communications centers is to answer 90 percent of calls within 10 seconds. Some 9-1-1 centers strive to answer every call by the third ring. Clearly such response goals require an adequate level of agent availability to handle the possibility of a sudden influx of calls. Even though most 9-1-1 centers use a recording to tell callers not to hang up, callers assume a human being will answer the phone and not an answering machine. If they are experiencing a crisis, the last thing a caller wants to hear is a recording telling them they are being put on hold. Call abandonment rates are a good indicator of whether or not existing staffing levels are comfortably handling the incoming call volume.

Staffing calculations are part of the problem

How do public safety communications centers determine the number of staff they need? Over half of large center managers (56 percent) indicated they used a *formula* to determine the number of call takers and dispatchers they needed. Of those that used a formula 27 percent used call volume in their calculations, and 8 percent figured average calls per hour. Fifteen percent of large center managers used an Erlang C calculation to

[1] These illustrations were adapted from Reynolds, P. 2002. The Power of One in Call Center Staffing. The Call Center School, Nashville, TN.]

estimate their staffing needs. One in five used a shift relief factor, and 40 percent indicted they calculated employees' available work time. Twenty percent conducted a work analysis to determine their staffing needs.

Erlang formulas are considered the standard for any process that requires an application of queuing theory, such as the nonlinear arrival times of incoming calls in a call center. The Erlang formulas use a statistical solution that addresses the randomness of call arrival times, but the formulas seem complex and often intimidate people who don't have a science or engineering background. Erlang formulas are commonly used by commercial call centers to determine staffing and scheduling needs. Some large commercial centers use *hourly* calculations to increase precision in matching employees to the expected call volume and to maximize profitability.

The question is why so few public safety communications centers use a systematic, formula-based process for determining their staffing needs – especially given the fact that lives rather than dollars are on the line. Our data suggest many public safety communications center managers probably have not had any formal instruction in the process of determining staffing needs. The requests that come in to APCO seem to confirm this hypothesis.

In addition, many managers (66 percent) indicated government spending limits and budgetary considerations were the most important considerations in determining the number of staff in their center; necessary decisions were made based on dollars rather than needs.

In too many centers, the process for determining the number of staff needed to do the job appears to be fundamentally flawed, providing inaccurate guidance, and leading directly to employee burnout and high turnover rates! That is why Section II is devoted to a process for estimating appropriate staffing levels. In addition, the process is automated so all calculations can be completed online using the tools in the *Staffing and Retention Tool Kit* on the APCO website.

Understanding the numbers

We convened a panel of practitioners to help us identify the issues and understand the processes that were being used to determine staffing levels. It was clear from our surveys and conversations with managers that they were being asked to provide numbers and explain the rationale behind requests for additional staff, but the industry-specific resources that were available to them were difficult to interpret and they were finding it a challenge to explain and justify their requests. The people in charge of the budgets wanted specifics, not generalities, and they expected succinct explanations of the issues involved and a well-developed rationale behind requests for additional staff. They expected the same when managers attempted to defend current staffing levels from budget cuts.

Managers must be able to explain the process in lay language, and they must have a deep understanding of the work and the issues that impact their staffing needs. So we set out to design a process that didn't require an understanding of Erlang or queuing theory - a process that could be used, understood and explained by managers in communications centers of every size and configuration.

The calculations build on and refine the procedures that are already used in the field. To use the formulas managers must pull together the pertinent data, but the end result is a solid estimate of the number of employees needed to handle the workload. The expectation is that managers will use these formulas to help them estimate the number of employees needed to do the work of the center. We say "estimate" because we firmly believe the final determination of an appropriate staffing level must be based on attainment of quality indicators. In addition, we believe managers must be held accountable for efficient and effective use of public resources. That means they need to be monitoring the average cost per call and/or cost per dispatch.

A word about efficiency: optimal efficiency in a public safety communications center requires excess capacity. A center where employees are busy all of the time cannot respond to the unexpected. As a result, we have included a discussion of agent occupancy rate, essentially a measure of the time that agents are not busy but they are available to handle the unexpected. Agent occupancy rates vary widely based on the size of a center and the nature of the calls it processes, but all centers must be mindful of staffing at a level that does not compromise public safety. (See Agent Occupancy Rate in the Glossary).

If current authorized staffing levels are inadequate, it is usually the manager who must build a case for increasing the number. If your employees are comfortably handling the workload and meeting quality goals with the current authorized staffing level, that is reason to celebrate - and to use the formulas to help the community anticipate future communications center employment needs.

Comfortably handling the workload

The number of calls an employee handles each year varies widely from one center to another, based on the nature of the calls, how the center processes them (e.g., routing them through to an appropriate service provider or direct dispatch), and center size. The best indicators of employee ability to *comfortably* handle the workload are average speed of answer, call abandonment rates, agent occupancy rates, overtime and other quality criteria.

Calculate your staffing needs. If the employees in your center average more than eight hours of overtime every month you need to analyze your staffing numbers. Use the process in this document or the staffing tool in the *Staffing and Retention Tool Kit* to

estimate the number of employees your center actually needs to handle the workload. If your call volume has grown in the past five years, a volume-influenced formula may give you a better handle on staffing needs than the shift relief factor or coverage formula you have been using. Try both formulas.

Know your numbers. Use your telephone records. Query your telephone or CAD database to obtain the historical data you need. Section II provides some guidance on *which* numbers you need to know to estimate staffing needs. If you don't have telephone records that provide the number and length of calls, devise a process that allows you to obtain those critical numbers. You can obtain the necessary numbers using paper and pencil and an inexpensive stopwatch – and the cooperation of call takers and dispatchers. Set up a data collection process and use it. The time invested will be rewarded by greater certainty if you have to request authority to hire additional staff. You cannot provide high quality services for your client agencies or your community if you don't have an appropriate and adequate number of employees, and you cannot estimate the number of employees you need if you don't know the numbers that can help describe the workload.

Do your homework. Decision makers don't really care which formula you use. They want to know that you have a good understanding of activity levels and the capability of your staff to handle them. They don't want to be blamed for putting citizens' lives in peril, but they aren't going to write a blank check. Don't wait for a disaster. Give them a reason to trust your analysis and give you the hiring authority you need.

Don't do it alone. Pull together the people who can help make the initiative a success, and get the staff involved. Involve people from the personnel and/or Human Resources (HR) office. Ask HR for personnel records to help determine worker availability. Be sure everyone is "on the same page" and understands the process and the rationale behind the calculations. If the call taking and dispatch staff are simply too overwhelmed to do the data collection, consider using retirees who are familiar with the work of the center. If you have a staff member who loves numbers, or is particularly good with analytical tasks, provide oversight and delegate. It is your responsibility, but that doesn't mean you are the one who has to do it.

Request the authority to hire an appropriate number of employees. Build a case for adequate staffing based on historical records, a sound rationale, accurate calculations and center performance on quality indicators

Monitor the adequacy of authorized staffing levels. Continually monitor quality indicators such as the use of overtime, and the ability to answer calls directly and within your targeted speed of answer goals (e.g., within three rings, or 90 percent of calls answered within 10 seconds). If carefully calculated estimates don't result in meeting

your service quality goals, figure out why and build a case for staffing based on your findings.

Make recruiting a priority. Initiate a recruiting drive focused on filling all authorized positions. Staffing to authorized levels is a big deal so make the recruiting process a big deal. Get employees involved, work with the city or county personnel office and make sure they take your request seriously. Educate them (in their language) and enlist their support. They can't help you if they don't know why they should, and they won't give you more resources just because you ask for them.

Staff to authorized levels. Staffing to authorized levels is the best thing a manager can do to improve retention rates. Being fully staffed and having all authorized positions filled is the most effective strategy you can use to increase your retention rate. Centers that are not fully staffed have more difficulty keeping employees and use more overtime to fill the gaps in the schedule; productivity goes down as new employees are being prepared to fill the vacant positions, and the quality of service is compromised. The best strategy for positive media coverage is to provide high quality service. Every authorized position should be filled as quickly as possible.

Keep the center fully staffed. The safety of personnel in the field and the well-being of citizens depend on your ability to assure adequate staffing levels and keep all authorized positions filled. Positions that go unfilled for a period of time are viewed as expendable, especially when budgets are tight ("If you aren't staffing to authorized levels, then you obviously don't really need that many staff"). Even if the currently authorized FTEs do not meet your needs, hire to authorized levels before asking for additional staffing. Build a case for appropriate staffing levels using detailed estimates and center performance on quality indicators.

Hire so employees can comfortably handle the workload. Staffing that doesn't include room for a sudden influx of calls leaves the center vulnerable. The trends reported by many managers were toward increasing call volume (partially due to more wireless calls), and increasing dispatch activity. Build a case to hire proactively so the communications center isn't always playing "catch up."

Keep the staff you have. Use effective management practices to provide direction and support for employees. If salaries are not competitive, or not aligned with other public safety personnel, do something about it. Collect relevant data and use solid evidence to prepare your request. Don't give up if decision-makers don't give you what you request the first time you ask. Keep asking; that's how you send the message that this is an important issue for you and for the safety of the community.

Hire to accommodate predictable turnover. Do a historical study of the turnover and retention rates in your center. Include turnover as a factor when determining hiring needs and build a case for hiring to accommodate predictable separations.

Consistently staff necessary positions. Assure that all necessary positions are staffed. Don't put the center or client agencies in a situation that makes them legally vulnerable or undermines public confidence in the services provided. Consistently and adequately staffing necessary positions sends a powerful message to employees, field personnel and client agencies about the importance of the work and dedication to providing high quality services to the community.

Assuring Adequate Staffing

The importance of staffing at an appropriate level cannot be over stated. These formulas are designed to help you estimate the number of staff you need, not the number you currently have. The only thing that might be more important than knowing how many staff you actually need to handle the workload is to make sure you *fill all of the positions that are currently authorized*. Centers that are fully staffed to authorized levels enjoy higher retention rates and higher employee satisfaction. The first priority for a manager who wants to solve a staffing and retention problem is to fill all authorized positions.

Then it is important to figure out how many employees are actually needed to comfortably handle the workload.

Determining Staffing Needs

There will always be questions about the number of employees needed to cover the phones or handle the call volume. The title of Bill Weaver's 1999 article, one that largely influenced our thinking about staffing estimation, frames the basic question well: *Communications Center Staffing: When is Enough, Enough?*

The process of estimating staffing needs is full of opportunities to *under*estimate the true need, to *under*estimate the amount of time it actually takes to process calls, and to *over*estimate the amount of time that employees are available to handle calls. Managers want and need guidelines for estimating the number of employees needed to do the job properly.

But what is "the job?" The most basic answer for public safety communications centers is "answering the telephone and dispatching personnel." Behind that simple answer is the world of complexity and diversity that characterizes public safety communications centers.

Estimating staffing needs is a combination of art and science. Section I discussed some of the "art" related to managing for staffing, retention and employee satisfaction. This section delves into a little of the "science." We suggest a six-step process for estimating staffing levels. These steps are discussed in detail in this section.

Step 1: Identify the type of position you wish to analyze.

Step 2: Determine employee availability.

Step 3: Determine your turnover rate.

Step 4: Select the appropriate formula and analyze all positions.

Step 5: Compare the number of staff you have with the number you need.

Step 6: Do a reality check.

"Estimate" of Staffing Need

We use the word "estimate" throughout this discussion as a constant reminder that any staffing formula represents only the beginning of determining actual staffing needs. Quality indicators (such as percent of calls answered within 10 seconds, call abandonment rates, or average speed of answer) ultimately determine whether there are "enough" employees to provide high quality services to the agencies and communities you serve.

There is no formula that can give you a magic number. That is an illusion. Using only *one* formula to address the diversity that exists in public safety communications centers is totally inappropriate, if not dangerous. The number of staff you need depends on the size of the center, the number of client agencies, the nature of services provided, and

the way in which the work is assigned. A thorough analysis of the nature of the work assignments should accompany the calculations provided here.

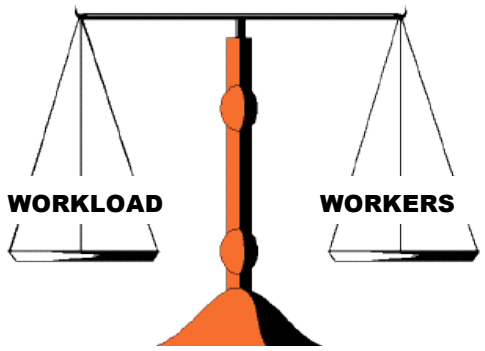
Staffing is NOT the Same as Scheduling

It is important to clarify the difference between staffing and scheduling. The two concepts are so similar that the line between them isn't always obvious. *Staffing* concerns the number of employees needed to do the job, whereas *scheduling* is concerned with assigning those employees to specific time blocks to match the need. The formulas and calculations included in this section are designed to determine the number of employees needed to either cover a console or handle the call volume.

Decisions about providing relief for meals and break times, when to start the day shift, whether to use 8-, 10-, or 12-hour shifts, how to structure days-on/days-off patterns, or whether to use rotations are *scheduling* decisions. "How many people do I need to handle the workload this year?" is a *staffing* question.

The Basic Formula

Every staffing formula is an equation that balances the work that needs to be done with the number of workers available to do it. Of course it isn't quite that simple. Imagine a set of scales. Now imagine the *workload* on the left and *workers* on the right. To balance the scales (i.e. the two sides of the equation), the weight in the two sides must be equal. If they are not equal, the challenge is to figure out why.



There are two ways to balance the pans, and although the most common approach is to add weight to the side that raises, that isn't necessarily the right approach. It could be that there is too much "weight" on the other side. Careful analysis of both pans can help clarify the options, and help determine the best response - to remove weight from the pan on the left (reduce the work), or add weight to the pan on the right (increase the number of workers).

Redistributing the workload

In one center we visited the workload was redistributed when officers began doing NCIC checks from their mobile/in-vehicle laptop computers. The work didn't go away; it simply was handled differently. Redistribution is not an easy sell, but it is a reasonable and cost-effective solution in some situations.

Let's look at the individual components of our equations, the measures that determine the "weight" in each of the pans. Recall we have two sides to the equation, a measure that describes worker availability on one side, and a

measure that describes the workload on the other. It is always easier if both measures are in the same unit, and we have chosen the hour as the unit of measurement. We will look first at the process for determining employee availability in hours because both formulas require this number.

Step 1: Identify the type of position you wish to analyze

The first step is to make a list of all the positions in your center. The term “position” refers to a specific job such as call-taker or dispatcher which consists of a specific task such as taking calls or dispatching.

To avoid some of the inevitable confusion around the word “position”, in this section we use “console” when referring to a physical location, and “position” when referring to an organizational task or job that is done by an employee. As an example, when an employee works as a dispatcher (the organizational task, job or *position*), they are working at a physical location within the communications center (a dispatch *console*). It is considered a dispatch “position” whether an individual employee is cross-trained or not. That same employee may work a call taker position at some other time (i.e. a different location within the center). You are estimating the number of employees needed to do the work of specific *positions* within your center.

At least three different kinds of positions may be present in communications centers: function positions, coverage positions, and volume-influenced positions. Deciding whether a position (i.e. a job) qualifies as a "function", "coverage", or "volume-influenced” position is the first step in the process. This can be confusing, especially if employees in your center are cross-trained. For example, if employees are cross-trained but assigned to a call taking *or* dispatch position on any given shift, you want to calculate the number of employees needed to handle the duties for each position.

Some centers have only coverage positions; others have all three types of positions, and some are in transition. Increases in call volume may mean that a center that has traditionally used a coverage position calculation now needs to use a volume-influenced position calculation. We encourage you to explore both formulas, but the structure of the work assignments within your center and the availability of statistical information about call volume and call processing times will determine which formula is most appropriate for your center.

Function positions. Some staffing decisions are based completely on “function.” For example, in most centers there is only one manager to fill the management function. Some centers may have three full time trainers and a full time training director to handle the training task, but the number of employees in these positions is not determined by the workload or the number of hours the center is open, so no formula is involved. However, they are essential to making the communications center a functional unit so

they should be included when summarizing actual and estimated staffing levels for the three types of positions.

Coverage positions. Some staffing decisions are determined by simple "coverage" needs; that is, the number of positions that require an employee to be in a chair at the console to cover the incoming calls and/or the radio, or the number of supervisors needed to meet requirements for a supervisor in the center at all times. For some centers it is sufficient to calculate the number of people needed to provide minimum coverage 24/7/365. For others, physical limitations, such as the number of radio channels, or the number of consoles in the center limit the number of employees that can be accommodated. Radio/Dispatch positions typically require a coverage calculation in centers where call taking and dispatch are separated.

Volume-influenced positions. For other centers, the number of employees needed is influenced by the volume of incoming calls and/or radio activity. "Volume-influenced" positions generally handle the incoming calls (call-takers in centers that separate the functions or call taker/dispatchers in centers that combine the duties in one console). Determining the number of employees needed for these positions requires a calculation based on volume.

Volume (i.e. number of calls) changes from hour to hour, from day to day and from one week to the next. Volume-influenced staffing needs can be estimated for an hour at a time or a year at a time. A tool for analyzing average weekly activity or a typical week from different seasons or quarters is available in the *Staffing and Retention Tool Kit*.

Is radio dispatcher a coverage or volume-influenced position?

We came to the conclusion that the use of a time measure such as minutes of radio time for radio/dispatch activity is not a realistic approach to calculating the number of dispatchers needed. Push-to-talk numbers or actual radio time is intermittent and intermingled (i.e. short bursts of activity on several unrelated incidents make it difficult to calculate an average processing time, which is an essential ingredient of the calculation for volume-influenced positions).

Staffing for radio dispatch positions is often based on a different kind of measure: the number of available channels, frequency availability, the number of consoles in the center, the number of field units that can safely be monitored by a single dispatcher, contracts with client agencies, etc. The number of staff possible is constrained by these factors. Most centers have refined their minimum dispatch staffing needs over the years using the time honored method of trial and error, but a coverage calculation is a good place to begin.

Step 2: Determine employee availability

The work year for full time employees is typically figured as 52 weeks at 40 hours per week or 2,080 work hours per year. These "full time" numbers are not adjusted to account for holidays, vacation time, sick leave, etc. Employee availability is usually calculated by subtracting the time an employee is unavailable from the number of days or work hours in a year. When employees are on vacation, on sick leave, in training, or assigned to other duties, they are not available to handle incoming calls or dispatch. Any time they are out of the building or out of the room, they are unavailable. Whenever someone else has to do the work, that amount of time has to be included in the determination of unavailable time.

We decided to use an employee availability measure that is based on *hours* rather than *shifts*. An hourly measure can be used by centers that use the traditional 8 hour shift, but it also accommodates the diversity of shifts being used by different centers, and offers greater flexibility for centers experimenting with multiple shift lengths. Many centers are experimenting with different shift lengths, using combinations of 8-, 10-, and 12-hour shifts to provide extra coverage during busy periods.

Liebert and Miller[2] provide a detailed explanation of the concept of calculating staffing needs (for jails) based on hours rather than shifts. Their use of Net Annual Work Hours makes sense and applies to communications centers, but we modified the meaning of the acronym slightly, to Net Available Work Hours (NAWH), to emphasize that the calculation determines available time rather than the unavailable time, and that the concept is not restricted to *annual* calculations.

An example for calculating NAWH is provided in Table II-1. Determine the actual *averages* for each position by creating a list of actual hours in each category for each employee. Sum those hours, then divide by the number of employees, and enter the averages in the worksheet. If calculating averages is not possible, another option is to use *allocations* such as two weeks vacation per year (2 weeks = 80 hours), or 10 days of sick leave (80 hours). However, using allocations does not account for differences in vacation time for employees with higher seniority and may underestimate the hours of available time. We recommend using averages based on historical personnel records rather than allocation figures for greater accuracy, but either will work. Keep in mind that different positions (i.e. job categories) may have a slightly different NAWH and may require separate NAWH calculations for each position (each position not each employee).

[2] Liebert and Miller, (2003) Staffing Analysis Workbook for Jails: Second Edition. U.S. Department of Justice, National Institute of Corrections. Available at http:/nicic.org/Library/016827

Table II-1: Sample Calculation of Net Available Work Hours (NAWH)		
Position: Call taker/Dispatcher (Telecommunicator)		
A	2,080	Total hours for one full time employee
B	144	Average vacation and holiday leave (total hours)
C	37	Average sick leave (total hours)
D	0	Average personal leave (total hours)
E	0	Average training leave (total hours)
F	0	Average military, FMLA leave, etc. (total hours)
G	219	Average lunch and break (total hours)
H	0	Average other activities (meetings, light duty, special assignments, etc.)
I	400	Total unavailable time = Total B through H (144 + 37 + 219 = 400)
J	1,680	Net Available Work Hours (NAWH) = A – I (2080 – 400 = 1,680)
1,680 = Net Available Work Hours per employee (NAWH from J above)		

The example is based on one full time employee (using 2080 hours as the number of "full time" employee work hours per year). The number of work hours in an employee year may vary, so be sure to find out the correct number of work hours for your center. Note that in the example, the total work time of 2,080 hours "shrinks" by 19.2 percent to 1,680 hours during which employees are actually available to process calls (this is why commercial call centers refer to this as a "shrinkage adjustment"). *Over*estimating the available time will result in an *under*estimate of staffing needs and likely make overtime a necessity. A blank worksheet for calculating NAWH is available at the end of this section.

Calculate the number you need, not the number you have.

When estimating the number of staff you need, include time for breaks, training, predictable absenteeism (e.g. military duty, FMLA, disability), etc. Planning for time to take a break away from the console may seem trivial, but our research indicates that centers where employees have scheduled time away from the console have higher retention rates. Some centers account for lunch and breaks when calculating available time; others do not, they cover lunch and breaks informally with officers coming in from the road. We recommend planning for breaks when estimating your staffing needs - even if time off for lunch and breaks isn't currently included when calculating employee availability. Excluding lunch and break times from the calculation of employee availability means you will be underestimating the real need.

Include time for employees to attend training sessions, classes, or professional conferences. If you leave these items out of the calculations you are leaving these activities to chance and they most likely will not happen. The point is to use the calculations to estimate what you *need*, not what you already *have*.

Step 3: Determine your turnover rate

If you keep track of retention and turnover rates from year to year, you know whether the turnover rate in your center is *predictable* or *variable*. For example, if your center's turnover rate is close to the national average of 17 percent year after year, you can predict an average annual turnover of 17 percent, and plan ahead. If turnover varies from one year to the next (e.g., a flurry of retirements or FMLA requests) adjust your FTE calculation based on expected turnover. Another possibility is to hire additional staff based on the *lowest* turnover rate in recent years. If your center experiences regular turnover, a turnover adjustment is an essential component in your staffing estimate.

To determine average turnover rate, fill in the numbers in Table II-2. This simple calculation for turnover is the total number of people who left the center during a given year divided by the total number of staff (the highest number employed at one time during that same year). Turnover = Staff who left ÷ Total employees. Note that this calculation is based on actual employees, not authorized positions. An extra worksheet for calculating average turnover rate is available in the Resources section (worksheet B). If including part time employees in your calculation of turnover, be sure to adjust the numbers to reflect full time equivalents (i.e. two half-time employees are equivalent to one full time employee, and one half-time employee should be included as .5 FTE). You can take it a step further and separate the numbers for probationary and experienced employees to see if there are a disproportionate number of people leaving from either group (see steps B and C in Table II-2).

Table II-2: Calculating Average Turnover Rate						
Category	Year					Average
	20__	20__	20__	20__	20__	
A Total number of employees at the highest staffing level for that year						
B Number of new hires that failed to complete the probationary period						
C Number of experienced employees who left for any reason*						
D Turnover Rate (Turnover = B + C ÷ A)						
E Retention Rate (Retention = 1 – Turnover) x 100						

*Include all experienced employees who left for voluntary or involuntary reasons (e.g. turnover initiated by the employee, rotation, retirement, death, management action, etc.)

Step 4: Select the appropriate formula and analyze all positions.

In a small center, a single calculation may be all that is needed to estimate staffing levels. In larger centers, this will be an iterative process, working through the calculations for each separate position, and then adding it all up in a summary report that compares current staffing levels with the estimates of the number of employees needed to either cover a position or respond to a given workload.

The process takes time and patience but it is worth the effort if it helps you determine the appropriate number of employees needed to comfortably handle the workload. Knowing the number of employees you need is an important step toward obtaining them.

Coverage Positions

Estimate the number of staff for coverage positions.

Coverage positions are jobs or posts that must be "covered" regardless of the number of incoming calls or dispatch activity. The coverage may refer to a particular task or a specific work station that must be staffed or covered for a given length of time, usually continuous service 24/7/365. Centers that can handle the workload with minimal staffing on all shifts should use a coverage calculation.

Identify coverage positions.

Jobs such as law enforcement dispatch, fire-rescue dispatch, emergency medical dispatcher, and shift supervisor, are typical coverage positions. If a center staffs a fire-rescue dispatch console and a law enforcement dispatch console around the clock, regardless of the amount of call activity, those are two different "coverage" positions. It does not matter whether it is covered by someone who works exclusively as a call taker or dispatcher, or someone who is cross-trained.

Different staffing levels

If your center has different coverage needs on different shifts, calculate each shift separately. If three employees typically cover dispatch on days, but only one employee is needed for the night shift, calculate them separately. In this case, the calculation might be for Dispatcher-Day (3 positions), Dispatcher-Swing (3 positions), and Dispatcher-Graves (1 position). This may be the easiest way to use the formula if your center uses overlapping 10-hour shifts; treat each shift as a separate position and calculate the number of employees needed to "cover" that position (i.e. shift)

The formula for coverage positions

Staffing for coverage positions is based on balancing the number of hours each position must be covered and worker availability. Coverage need is the number of positions that must be covered multiplied by the number of hours per day, the number of days per week and the number of weeks per year. Worker availability has already been calculated using the Net Available Work Hours worksheet, so we plug in our NAWH for this position. Then we divide the hours needing coverage by NAWH to get a base estimate. This base estimate is multiplied by the turnover adjustment to obtain a more realistic estimate of the number of full time equivalent employees (FTEs) needed to cover that position. Note: All of the formulas yield an estimate of FTEs, the most common unit of measurement for staffing. The basic formula for coverage positions is: FTE = Hours needing coverage ÷ Employee Availability x Turnover Adjustment. Table II-3 illustrates a sample calculation of FTEs for a Call Taker/Dispatcher or coverage position.

TIP: *If a new recruit is being mentored by an experienced employee (i.e. both are working a single position together) count the two of them as one FTE.*

Estimates usually result in a fraction of an FTE. The decision of whether to round up or down does not need to follow traditional math rounding rules. If your calculation results in an FTE of 2.3, you can decide whether to round up or down, but you will have to justify it in budget requests. Think of it this way – if it takes 2.3 people to lift a heavy object, two people will not be able to lift it no matter how hard they try. Applying that to the communication center, it means there will be times when service quality goals cannot be met. That's one reason why managers are encouraged to staff for peak call volume

rather than average call volume on any given shift. These estimates usually result in a fraction of an FTE. Rounding down is the equivalent of building failure into the system during the design process. Those extra FTE needs can be covered by overtime, but recognize that you are building overtime into the process. Historical records of overtime expenditures and turnover can reveal the extent to which *planning short* is impacting center performance on service quality goals.

Table II-4 illustrates a variety of different scenarios. If coverage needs vary with the season (e.g., hurricane season, wildfire season, tourist season), shorten the number of weeks per year or increase the number of positions. For example, if three additional dispatch positions are covered around the clock for the summer season (.5 FTE = 52 ÷ 2 = 26 weeks), you can do one estimate for the year long positions and a separate estimate for the summer positions (sample examples 5 and 6), or you can calculate for 4.5 positions (see table II-4, example 7), since 26 weeks = .5 FTE x 3 = 1.5 part time positions, plus the 3 full-time positions). Adjust the weeks and NAWH for summer positions if no vacation time is allocated.

Different shift lengths

If your center uses multiple shift lengths (e.g., a combination of 8-hour, and 10-hour or 12-hour shifts), treat the different length shifts as different positions. For example, if the center uses a basic eight hour shift structure that is supplemented by two overlapping ten hour shifts for the busiest periods of the day, use the worksheets to calculate coverage for Dispatcher-8 and Dispatcher-10 separately and add up the results of the two calculations to obtain the overall estimate for the number of Dispatchers needed.

If coverage for a given console varies by shift, you can treat it as a separate position or add an appropriate fraction (using decimals) to indicate the total number of FTEs needed. For example, if your center can handle incoming calls with one call taker console most of the time but you add a 10-hour position to cover the busy afternoon and evening period, you can estimate coverage for one 24-hour console (see table II-4, example 1) and a second console that is covered for only 10 hours (see table II-4, example 2), or you can calculate the number of staff needed based on 1.42 positions, since a daily 10 hour shift is 10 ÷ 24 or 41.7 percent of a full day (see table II-4, example 3). Note that these two strategies are illustrated in Table II-4, and that both calculations estimate a need for 8.5 full time employees (8.5 FTE).

You can also see that the total number of hours in the calculation varies with the number of positions to be covered (see table II-4, examples 4 and 5). Two additional positions that need to be covered 24/7/365 require an additional 12 FTEs (30.0 – 18.0 = 12.0 FTEs).

To calculate coverage for multiple positions such as 9-1-1 call taker, fire-rescue dispatcher, law enforcement dispatcher, or emergency medical dispatcher, use a worksheet for each position. Remember, a position refers to an organizational task or job

which is located at a specific physical location or console in the center. A blank worksheet for estimating FTEs for coverage positions is available at the end of this section

Table II-3: Sample Calculation of FTEs for Coverage Positions	
Note: Coverage positions must be covered regardless of call volume or level of activity.	
Position: Call taker/Dispatcher (Telecommunicator)	
Hours needing coverage:	
A. 5	Total number of consoles that need to be covered for this position
B. 24	Number of hours per day that need to be covered
C. 7	Number of days per week that need to be covered
D. 52	Number of weeks per year that need to be covered
E. 43,680	Total Hours needing coverage = A x B x C x D (5 x 24 x 7 x 52 = 43,680)
Employee Availability:	
F. 1,680	Net Available Work Hours - enter average NAWH from worksheet
Staff Needed:	
G. 26.0	Full Time Equivalent base estimate (FTE) = E ÷ F (FTE = 43,680 ÷ 1,680 = 26.0)
H. .15	Turnover Rate - from retention worksheet, convert to decimal (15% = .15)
I. 30.0	Full Time Equivalent required to accommodate turnover, prior to any adjustments based on quality indicators: FTE = G x (1+ H) (FTE = 26.0 x 1.15 = 30.0)
30.0 = Estimated Staffing Need (in FTEs from Step I above)	
FTE = Hours needing coverage ÷ Employee Availability x Turnover Adjustment	

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Table II-4: Comparison of Alternative Calculations for Coverage Positions

	Coverage Needs					Availability	Staff needed		
	A	B	C	D	E	F	G	H	I
Steps in Calculation:	Enter	Enter	Enter	Enter	=AxBxCxD	Enter	= E ÷ F	Enter	=G(1+H)
Position	Consoles	Hrs/Day	Days/Wk	Wks/Yr	Total Hrs	NAWH	FTE	Turnover	FTE+
1) Call Taker (8 hour)	1	24	7	52	8,736	1,680	5.2	0.15	6.0
2) Call Taker (10 hour)	1	10	7	52	3,640	1,680	2.2	0.15	2.5
3) Call Taker (3 x 8 + 10)	1.42	24	7	52	12,405	1,680	7.4	0.15	8.5
4) Call Taker/Dispatcher	5	24	7	52	43,680	1,680	26.0	0.15	30.0
5) Fire-Rescue Dispatcher	3	24	7	52	26,208	1,680	15.6	0.15	17.9
6) Summer Fire Dispatcher	3	24	7	26	13,104	1,000	13.1	0.15	15.1
7) Fire (Summer added)	4.5	24	7	52	39,312	1,340	29.3	0.15	33.7

Volume-Influenced Positions

Estimate the number of staff for volume-influenced positions

The number of employees required to *staff* volume-influenced positions is determined by measures of the overall activity level in the center, and the number of individuals *scheduled* to handle the workload on any given shift is determined by the workload for that shift. There are additional steps in the calculation of staffing for volume-influenced positions because there are more factors to consider. We still have a formula with work on one side and workers on the other, but the work is defined based on the *amount* of work rather than the number of hours that positions or consoles need to be covered. The basic formula for volume-influenced positions is FTE = Workload ÷ Employee Availability x Turnover Adjustment.

Identify volume-influenced positions.

Call taker is often a volume-influenced position in larger centers. The combined call taker/dispatcher position may be a volume-influenced position if staffing levels are increased to handle increased phone activity during the afternoon or evening shift, or if the number of call taker/dispatchers is increased to handle consistent and predictable increases (e.g. weekends). Situations in which staffing is increased to handle a special event such as a sports event or the 4th of July are typically handled with overtime and might be considered "volume-influenced scheduling" but not volume-influenced staffing.

Calculating the number of employees needed for volume-influenced positions begins with converting workload from number of calls into hours. This is accomplished by multiplying total call volume by the average time it takes to process each call. If different positions handle different types of calls, and you can separate out the call volume data and determine average processing times for different positions (e.g., law enforcement, fire-rescue, EMS, NCIC), you can calculate them separately.

Count all calls.

Most centers use Computer Aided Dispatch (CAD) to track emergency calls, but if you have automated call reporting software that allows you to track statistics on all incoming and outgoing telephone calls your estimate will be more realistic. CAD entries tend to underestimate actual call activity. Detailed phone records will help you estimate the number of staff needed more accurately if you know which numbers you need. You will need measures of total call volume and the average time it takes to process calls.

While *incoming* call volume is an indicator of the workload, used alone, it underestimates the actual workload because outgoing calls and internal or transfer calls also take time. Consider all call activity when analyzing the workload. If you are using call volume to estimate the number of staff needed, make sure to count duplicate calls that report the

same incident. Do this even if the calls are short and don't get entered into the CAD system. If a call requires time to answer, it must be counted.

Determine hourly processing capability.

If your telephone software indicates *how many* calls you process, it most likely can tell you *how long* each call lasts (call duration), and it should be able to generate averages.

Many centers combine the call taking and dispatch functions, so we use the term "average processing time" (APT) in our formula rather than "average call duration." Average processing time is a combination of actual telephone busy time and after-call wrap-up time. APT includes time spent entering CAD data, dispatching units, transferring calls, address verification, checking NCIC, etc., as well as actual busy time on the telephone or radio.

The key word is "average" processing time. You want to estimate the actual number of employees that are needed, so it is not appropriate to use the average for the fastest dispatcher in the center and assume everyone else could work that fast if they set their mind to it. An average includes everyone, from the slowest to the fastest. After all, there are times when doing something fast is not the same as doing it properly, and different people do their best work at different speeds. Table II-5 provides an example of the process used to convert APT into hourly processing capability. A blank worksheet for calculating hourly processing capability for coverage positions is available at the end of this section.

Table II-5: Sample Calculation of Hourly Processing Capability	
A. 1.0 minutes	Average telephone busy time (call duration in minutes, using decimals), from phone records
B. 1.5 minutes	Average call completion time (in minutes, this includes time for data entry, address verification, etc.)
C. 2.5 minutes	Average Processing Time (APT) = A + B
D. 24 calls hourly	Average Hourly Processing Capability (HPC) = 60 ÷ C

In the example, the average telephone time for all employees is one minute, and the average wrap-up time is 1.5 minutes, the average processing time (APT) is 2.5 minutes per call. Divide the 60 minutes of an hour by 2.5 to obtain the number of calls that can be processed in an hour, which is 24 calls (HPC = 24 calls per hour). Remember, this is different than call duration, which is telephone time only. Your software can provide detailed information about telephone time, but you will have to use other means to determine wrap-up time.

APT tells us how long it takes to process each call, but we want to know how many calls can be processed each *hour*. We divide the 60 minutes of an hour by the APT to obtain an hourly measure, the Hourly Processing Capability (HPC = 60 minutes ÷ APT). This is the average number of calls that *could* be handled by agents *if* they were busy every minute of the hour. The more accurate your calculation of APT and HPC, the closer your staffing estimate will be to your actual staffing needs.

Total Call Volume (TCV) is divided by average Hourly Processing Capability to convert the number of calls into worker hours, the measure of the Workload (W = TCV ÷ HPC). It seems logical simply to put the Workload estimate on one side of our equation, and put the NAWH in the other, and calculate the number of FTEs by dividing NAWH into the Workload. However, there are additional issues that we did not consider when estimating staffing for coverage positions. The number you would get from dividing workload by NAWH is the number of employees needed to work every minute of every hour they are available. If you were to staff at the level estimated with this calculation, you would be expecting employees to function at maximum processing capability at all times. That is analogous to planning to drive across country at full speed every minute you are in the car; not slowing down for towns or gas stations. You are either driving full speed or at a complete stop! This is neither reasonable nor possible.

TIP: *An indirect approach to HPC*

If you don't have the data for calculating APT and HPC directly, you may be able to calculate HPC indirectly. One manager reported an increase in the abandonment rate whenever the center received more than 200 calls per hour during periods when the center was staffed with 12 call takers/dispatchers. That means 12 employees could handle a maximum of 200 calls per hour, so employees had an average hourly processing capability of 16.7 calls per hour (i.e. 200 ÷ 12 = 16.7).

Adjust for a reasonable agent occupancy rate.

There is another factor related to time that is beyond our calculation of employee availability based on NAWH and one which you have no control over. It is the rate at which calls come into the center. Agent occupancy rate (AO) is the component in the formula that adjusts for all those minutes when employees are in their chair and ready to answer calls, but *there are no calls*. For example, if there are 4 people working an 8-hour shift (i.e. 4 x 8 = 32 potential work hours) and the actual workload is 26 hours of busy time (telephone/radio), agent occupancy is 26 ÷ 32 or 81.25 percent. As you can see, "agent occupancy" is an indicator of actual work (26 hours) vs. potential work (32 hours) accomplished. This example was for a shift, but the calculation can be done on an hourly basis to determine agent occupancy for each hour of the day or week. An hourly analysis makes sense if the center has very high call volumes,

Agent Occupancy rate

$$AO = \frac{\text{Actual Work Hours}}{\text{Potential Hours}}$$

significant daily or hourly variation, and/or uses a combination of overlapping shift lengths. For most centers it is sufficient to use a target value in the formula, or calculate agent occupancy rates for each shift and determine an overall average.

In the example above, employees are occupied 81.25 percent of the time but not busy 18.75 percent of the time simply because the phone isn't ringing even though they are available. Whether viewed as "ready" time or "available" time, it is a variable that needs to be considered when estimating actual staffing needs.

This is the factor that concerned us when we learned that most call centers were experiencing increases in call volume, but that staffing levels had remained "about the same" in many of those same centers. One possibility was that the additional calls were being absorbed by available staff time (i.e. the center had low agent occupancy rates and employees could easily accommodate the increase in call volume), but the other possibility was that agent occupancy rates were getting too high (i.e. the center was operating dangerously close to its maximum call handling capability). If all call takers are operating at peak productivity levels at all times, any non-routine event will immediately throw a center into overload. In other words, if all agents are already operating at peak efficiency the center cannot respond to an emergency! Imagine a rubber band stretched to the limit – if any additional tension is put on it, it breaks.

Commercial call centers report that an average agent occupancy rate of 85-90 percent is optimal, but probably only achievable in very large centers that have a steady stream of incoming calls. Pushing employees beyond that level for extended periods of time tends to result in increased turnover and undesirable call handling behaviors.[3] Think of the quiet times in the middle of the night or a quiet Sunday afternoon. Someone needs to be at the console even though they may not be busy much of the time; unfortunately, those unused minutes can't be scraped together and given to the people on the swing shift so you have to adjust for them in your estimate. An adjustment for agent occupancy rate is the safety factor, the "cushion" that allows centers to absorb the shock of unanticipated surges in activity, such as a train wreck, a tornado, or a multi-car pile-up on the Interstate.

Consequently, the volume-influenced estimate presented here includes an agent occupancy adjustment. Ideally you will use actual numbers, but those numbers will vary on a daily and hourly basis, and will be different for each shift. The alternative is to use a target agent occupancy rate based on either a best guess or a random sample from different shifts on different days of the week.

[3] Reynolds, P. (2002) Understanding Agent Occupancy. The Call Center School, Nashville, TN. Available at www.thecallcenterschool.com

A large center may want to use a target agent occupancy rate of 80 percent, whereas a more realistic figure for a smaller center is probably between 60-70 percent. Higher rates are not achievable in smaller centers simply because they lack a steady stream of calls.

If agent occupancy is too low, employees have too much "empty" time on their hands and they tend to get bored. If the occupancy rate is too high, such as over 90 percent on a regular basis, turnover rates and undesirable behavior increase. You can determine an appropriate agent occupancy rate for your center indirectly by monitoring these quality indicators.

Adjust for turnover.

If you haven't already done so, follow the steps in Table II-2 to determine your center's turnover rate. Anticipating turnover, and hiring proactively is often referred to as over-hiring, but that term makes it sound like you have excess staff, when in reality you are hiring the number of staff needed to handle the workload using projections based on careful analyses of historical data.

Almost 40 percent of large center managers indicated they over-hired to accommodate routine turnover and/or unexpected absences due to disability, maternity leave, etc. The practice of proactive hiring allows managers to compensate for new employees who may be able to fill an "organizational" vacancy immediately, but still require weeks or months of training before they can truly fill the "operational" vacancy created when a fully trained employee leaves.

TIP: *The "decision rule" you use for rounding can result in an underestimate of the actual need. Here again, if it takes 2.3 people to lift a weight, then two people won't be able to lift it no matter how hard they try. Applying the same idea to the calculation of staffing needs, it means that quality criteria such as having 90 percent of calls answered in 10 seconds simply will not be met because the incoming call volume is greater than the center's call processing capability, and abandonment rates go up. There are not enough call takers to lift the extra weight (i.e. handle the workload), and the limitation has been built into the system!*

That is when a more intentional rounding "decision rule" is most useful – it allows a thoughtful decision about when to add another employee, based on historical data and performance targets. The addition of a single employee can make a huge difference in the stress experienced by employees and the services provided. Early feedback from beta testers indicates that the hourly analysis tool may be one of the most useful and powerful tools in the Staffing and Retention Tool Kit on the APCO website

The formula for volume-influenced positions

The formula for the volume-influenced calculation is FTE = Workload ÷ Employee Availability x Turnover Adjustment. The conversion of workload into hours requires information about total call volume and average processing time. Average processing time is used to calculate hourly processing capability, another hourly measure. True employee availability is based on the calculation of NAWH multiplied by a reasonable Agent Occupancy rate. The base FTE estimate is adjusted for turnover to yield a more accurate estimate of the number of employees needed.

A sample volume-influenced calculation

Let's work through the sample calculations in Table II-6. The total call volume for this sample center was 500,000 calls in the most recent year. Analysis of phone records and average wrap-up time indicates the average processing time for all of the call takers in the center is 2.5 minutes per call. Therefore, if they are working at maximum capacity, employees can handle 24 calls per hour. We divide 500,000 by 24 to obtain the total workload expressed in hours; in this case it is 20,833 call hours.

Enter the average NAWH of 1,680 hours for each employee in this position (it has already been calculated using the NAWH worksheet). An agent occupancy rate of 70 percent means each employee is actually handling calls 70 percent (.70) of the time that they are available. The NAWH is multiplied by .70 to obtain the time that each person is actually available, bringing the True Available time to 1,176 hours per person. This is the time factor that must be used to determine the number of employees needed to balance the total call hours; 20,833 call hours divided by 1,176 applied hours per person indicates a need for 17.7 workers to balance the scales when there are 20,833 call hours on the other side.

However, the center has an annual average turnover rate of 15 percent, which means productivity is going to slip and experienced employees are going to be handling more calls as new recruits work their way into the position. Increasing the staffing estimate by the turnover rate (i.e. 17.7 FTE x 1.15), results in an adjusted estimate of 20.4 FTE. Those two additional staff will make a substantial difference in service quality and reduce the need for overtime. (See the discussion under Every Body Makes a Difference earlier in this document). A blank worksheet for estimating volume-influenced positions is available at the end of this section.

Table II-6: Sample Calculation for Volume-influenced Positions	
Note: The number of Volume-influenced positions is based on call volume and average processing time.	
Position: Call Taker	
Workload:	
A. 500,000 calls	Total Call Volume for this position (TCV), from phone records
B. 2.5 minutes per call	Average Processing Time for this position (APT), from phone records
C. 24 calls per hour	Hourly Processing Capability (HPC) = 60 ÷ B (60 ÷ 2.5 = 24)
D. 20,833 calls hourly	Workload in hours (W) = A ÷ C (500,000 ÷ 24 = 20,833)
Employee Availability:	
E. 1,680	Net Available Work Hours - enter average NAWH from worksheet
F. .70	Agent Occupancy rate - enter AO, convert percent to decimal (70%=.70)
G. 1,176	True Availability per person (TA) = E x F (1,680 x .70 = 1,176)
Staff Needed:	
H. 17.7	Full Time Equivalent base estimate (FTE) = D ÷ G (17.7 = 20,833 ÷ 1,176)
I. .15	Turnover Rate from retention worksheet - convert to decimal (15% = .15)
J. 20.4	Full Time Equivalent required to accommodate turnover, prior to any adjustments based on quality indicators: FTE = H x (1 + I) (17.7 x 1.15 = 20.4 FTE)
20.4 = Estimated Staffing Need (in FTEs from Step J above)	
FTE = Workload ÷ Employee Availability x Turnover Adjustment	

This section discussed each of the components of our volume-influenced formula. Let's look at how a change in any one of those components impacts the number of FTEs estimated. The calculations in Table II-7 illustrate the impact of call volume, average processing time, net available work hours, and agent occupancy on the number of staff needed and the calls handled per employee. In each section, all other variables are held constant so it is possible to see the impact of the variable being considered. As noted earlier, balancing the scales can be accomplished by making adjustments on the side of the workload or the side of worker availability.

TIP: *These calculations are faster if you use a spreadsheet. Enter the appropriate formulas for the columns A through J (see Table II-7)…or use the Staffing tools in the Staffing and Retention Tool Kit on the APCO website.*

Table II-7: Comparing Impact of Variables on FTE Calculation for a Volume-influenced Position

	Workload				Worker Availability				Turnover Adjustment	
Step:	A	B	C	D	E	F	G	H	I	J
Calculation	Enter	Enter	= 60 ÷ B	= A ÷ C	Enter	Enter	= E x F	= D ÷ G	Enter	= H (1+ I)
Position	TCV	APT	HPC	Workload	NAWH	AO	TA	FTE	Turnover	FTE
Call Taker	500,000	2.5	24.0	20,833	1,680	.70	1,176	17.7	.15	20.4
Call Taker	**1,000,000**	2.5	24.0	41,667	1,680	.70	1,176	35.4	.15	40.7
Call Taker	500,000	**5.0**	12.0	41,667	1,680	.70	1,176	35.4	.15	40.7
Call Taker	500,000	2.5	24.0	20,833	**1,450**	.70	1,015	20.5	.15	20.5
Call Taker	500,000	2.5	24.0	20,833	1,680	**.65**	1,092	19.1	.15	21.9
Call Taker	500,000	2.5	24.0	20,833	1,680	.70	1,176	17.7	**.30**	23.0

Key: TCV = Total Call Volume APT = Average Processing Time HPC = Hourly Processing Capability W = Workload (in hours)
NAWH = Net Available Work Hours AO = Agent Occupancy rate TA = True Availability FTE = Full Time Equivalent

Analyze hourly call volume for a week

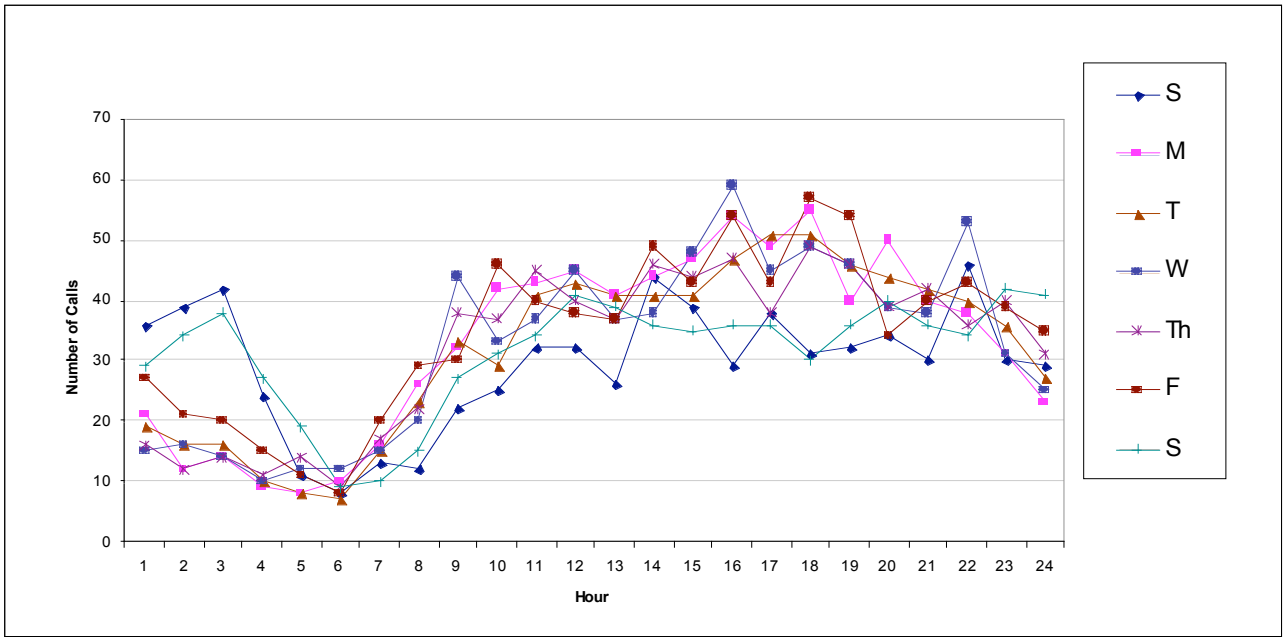
Analyzed appropriately, call center statistics make it possible to determine the rhythms of a call center -- the hourly, daily, weekly, and seasonal fluctuations that make appropriate staffing and efficient scheduling challenging.

Call volume and average processing times both vary throughout the day, the week, and the year. While it is time consuming to conduct an hourly analysis, it is also rewarding because it provides a more accurate staffing estimate and it is useful for scheduling. The *Staffing and Retention Tool Kit* available on the APCO website includes a tool for conducting an hourly analysis for a week (also referred to in this section as weekly analysis). It generates an estimate of "worker hours" needed to handle the call volume for each hour during the week. The numbers that are generated assume each worker is busy every minute of each hour, so this is not the same as estimating FTEs, because NAWH and agent occupancy must be considered in order to do that.

Graph it

Estimates of staffing needs based on historical records, analyzed in light of experience, are more accurate than a simple formula. Last year's data represent the best information available for planning this year's staffing needs, but unusual patterns in the data should not be ignored. It is these patterns in human behavior, and how they play out in terms of calls, that are revealed in a weekly analysis.

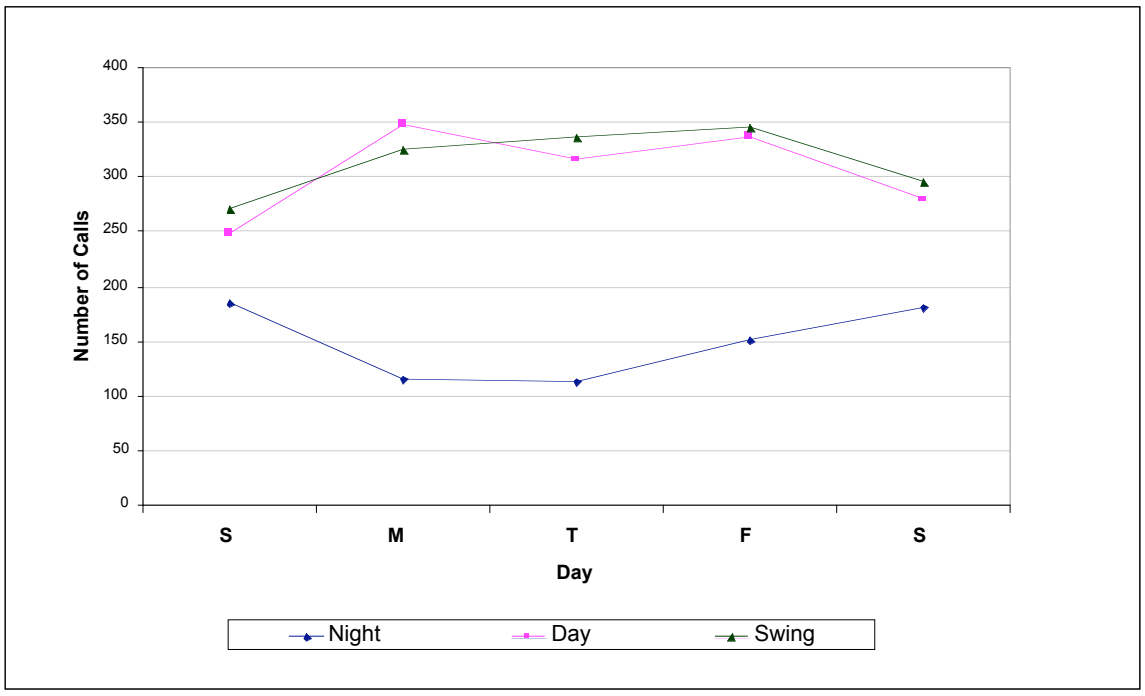
Exhibit II-1 Hourly Variation in Call Volume



The data in Exhibit II-1 are from an urban call center. They show a daily pattern with low call volume at 0500 and high call volume between 1500 and 1800, when school lets out, traffic increases as people return home from work, etc. They also show that the staff needed at 0200 on Saturday and Sunday mornings when bars typically close is about double of that needed the rest of the week during that time period.

To display variation by day of the week, organizing call volume into smaller time blocks such as shifts or portions of a shift helps illuminate the different staffing needs of different time periods on different days of the week. The organization of the call volume data into eight hour time blocks (i.e. shifts) for the graph in Exhibit II-2 shows the workload handled by shifts and clearly illustrates the contrast between the staff needed for the night shift and the other two shifts. It also shows very similar staffing needs for the other two shifts.

Exhibit II-2 Variation in Call Volume by Shift

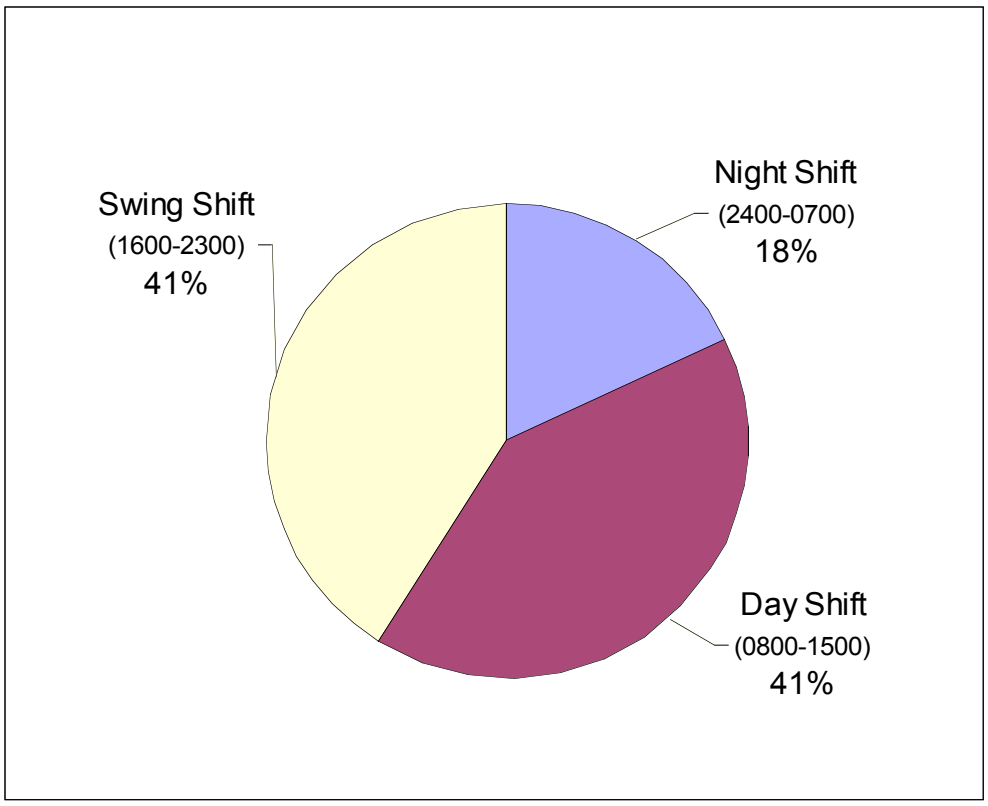


An hourly analysis can be used to analyze *average* weekly activity or to analyze a "typical week" from different seasons. For example, a center in Florida may want to compare call activity during hurricane season with "normal" call activity. A center in California may want to compare wildfire or mudslide season with the rest of the year.

Knowing when calls ebb and flow over the course of a week, and knowing which hours of the day tend to be the busiest have a practical application to scheduling. The bonus tool in the *Staffing and Retention Tool Kit* is designed to analyze hourly call volume and

staffing needs. You can do the same thing using a spreadsheet. Create a table with the days of the week down the left hand column and the hours of the day across the top. Enter the call volume into the cell representing each hour. Graph the results for a picture of the general trends as well as the variability in the call volume. If the graph is set up with the hours along the horizontal (X) axis, it displays the pattern of hourly variation. A picture truly is worth a thousand words. Even though most managers are intimately aware of these daily fluctuations, a graphic display of the variation is useful in helping decision-makers understand the rationale behind a request for additional staffing, or to explain the relationship between staffing, agent occupancy and the workload. Graphs are especially useful for visualizing scheduling needs.

Exhibit II-3: Call Volume by Shift



Another useful graph is a pie chart similar to the one in Exhibit II-3. Aligning the number of employees assigned to each shift based on the distribution of call volume during that shift is the basic process of staff allocation. In this instance, the graph indicates the allocation of staff by shift should be close to 41 percent assigned to days, 41 percent assigned to the swing shift, and 18 percent assigned to the night shift. Actual allocation must account for the minimum staffing level that is required to handle peak call volumes during a shift.

The types of graphs discussed in this section are generated automatically in the *Staffing and Retention Tool Kit.* Most spreadsheet programs offer a graphing function. We encourage you to make use of such visual displays to help explain staffing needs to decision-makers

Step 5: Compare the number of staff you have with the number you need

Once you have estimated the number of employees needed for each position, enter the information in a table such as Table II-8, to summarize the overall staffing in the center and compare current staffing levels with estimated staffing need provided by the calculations. Be sure to list results for all of the coverage and volume-influenced positions and add the function positions to the list to make it complete. A blank worksheet for comparing current staffing with estimated staffing needs is available in the Resources section. If there are substantial differences between the numbers of current staff and the estimated need, the summary will clearly show where the disparity exists.

Table II-8: Comparing Current Staffing with Estimated Staffing Needs

		Current Staffing	Estimated Need
WORK	Total Call Volume: **500,000** Total Emergency Calls: **125,000** Average Processing Time: **4.3 minutes** Hourly Processing Capability: **14 calls hourly**		
WORKERS	Coverage Positions:		
	Dispatcher	**28.5**	**30.0**
	Volume-influenced Positions:		
	Call Taker	**22.0**	**20.4**
	Function Positions:		
	Manager	**1**	**1**
	Training Supervisor	**1**	**1**
	Radio Technician	**1**	**1**
	TOTALS	**53.5**	**53.4**

Step 6: Do a reality check

Keep in mind the old saying "Garbage in garbage out." The ultimate test of the usefulness of these formulas is whether or not the number of staff estimated allows your center to handle the workload with limited use of overtime and still meet reasonable service quality targets. If the numbers used to generate the staffing estimate are not accurate, the estimate will not be accurate either.

The Staffing and Retention Tool Kit

There is no *easy* way to calculate the true number of employees needed to handle the workload in your center, just as there is no *easy* way to find people who can be successful call takers and dispatchers. The processes we have described take time and effort.

APCO has made it a little easier with the web-based *Staffing and Retention Tool Kit*. Visit the APCO website and explore the tools. You can find it by following the links to 9-1-1 and Project RETAINS. Let APCO know if you find the tools useful, and let them know about additional tools that could make your job a little easier.

Erlang calculators on the web.

Most public safety communications centers are small enough that they probably will not need to go beyond the calculations offered in this document. But for those who have the time and interest in exploring Erlang estimates (based on queuing theory), we are including a list of some useful websites in which you can download a free Erlang calculator or just plug in the numbers for your center and experiment with various combinations of variables that influence the number of staff needed.

We tested the validity of our results by using the formulas described in this section with the results we got using an Erlang calculator and found that our formulas did a good job of estimating appropriate levels of staffing. Check out some of the free Erlang calculators on the web (see text box).

SUMMARY

This section described a six-step process for estimating the number of employees needed to handle the workload in public safety communications centers. Step-by-step directions and sample calculations illustrated the process for *coverage* and *volume-influenced* positions. Basic equations for balancing workload and employee availability were explained in detail, and a rationale was provided for the use of Net Available Work Hours, an adjustment for Agent Occupancy, and an adjustment for Turnover. Several graphs for hourly or weekly analyses were described. Suggestions were made for

preparing a summary report that summarizes current staffing levels estimates and compares them with the estimated staffing levels provided by the calculations. Automated versions of these formulas, available in the *Staffing and Retention Tool Kit* located on the APCO website, were also described.

Erlang on the web

*The Ansapoint website has several free calculators (*http://www.ansapoint.com/calculator*). Plug in your targets (e.g., quality goals such as 90 percent of calls answered within ten seconds) and assumptions (e.g., average call duration and average wrap up time for a call) and the calculator tells you how many staff members you need. This site also has more complex calculators. The calculations are fast and easy, but print your results because they are not saved from one visit to the next.*

*A free software program with Erlang calculators is available on the KoolToolz website (*http://www.KoolToolz.com*). These tools let you test various models and generate forecasts based on call volume trends. You can generate graphs based on Erlang queuing theory, that illustrate the relationship between call volume and average delays, and the relationship between call volume and the number of agents needed. The professional version of these tools is less than a hundred dollars.*

*Another resource for calculating staffing needs and downloading a free Erlang calculator is The Call Center School (*http://www.thecallcenterschool.com*). The easy to use QuickStaff software is free and comes with complete instructions and great flexibility. Three tabs feature: a shrinkage calculator, a staffing calculator, and a calculator for the number of trunks needed. There is a library of well-written, easy to understand articles on staffing, and ideas for training and coaching call center employees.*

RESOURCES

Staffing and Retention Tool Kit, available on the APCO website. Built as a companion to the Effective Practices Guide, the Tool Kit contains three compartments: Staffing, Retention, and Survey. These tools are designed to make it easy for managers to either plug in their numbers or collect the data needed to assess employee satisfaction, calculate retention rates over time, and estimate staffing needs. The tools are free but registration is required. Follow the links to 9-1-1 Available at http://www.apcointl.com

Communications Center Staffing: When is Enough, Enough? Bill Weaver article discusses the concepts of fixed position vs. volume-influenced staffing (although there are errors in the formula). Available at http://www.nena.org/PR_Pubs/enpm_archives/12-99_Communication%20Center.PDF

Staffing Analysis Workbook for Jails: Second Edition (2003). An excellent discussion of the process of conducting a staffing analysis, the rationale behind using Net Annual Work Hours rather than a shift relief factor, and the factors that contribute to an accurate estimate of staffing needs. Available at http://nicic.org/Library/016827

The Call Center School offers free software and articles that address core staffing issues in call centers. Aimed primarily at commercial call center managers, the website offers a wealth of ideas that can be adapted and applied in public safety communications centers. Available at http://www.thecallcenterschool.com/

Calculating Shift Relief Factor. State of Oklahoma Worksheet is very straightforward and easy to understand. Available at http://www.doc.state.ok.us/Offtech/040113ab.pdf

South Carolina Department of Corrections document summarizes changes in the shift relief factor over time (1996-2003). Calculations include a factor called "Staffing Enhancement used to accommodate Turnover." Available at http://www.doc.sc.gov/PublicInformation/StatisticalReports/SpecialReports/ShiftReliefFactorforSecurityStaffCY1997-CY2004.pdf

NENA PSAP Staffing Survey Report, created under the auspices of the NENA SWAT initiative by L. Robert Kimball & Associates and 9-1-1 SME Consulting. Includes the results of a survey of 70 PSAPs, serving populations less than 140,000 and a staffing formula worksheet. Available at http://www.nena.org

Staffing Calculators and articles that address staffing issues. Dispatch Monthly (2004). APCO Formula for Comm Center Staffing (Jennifer Hagstrom, September, 2000; reprinted as insert in January, 2005). Great source of resources related to staffing and shift configuration. Available at http://www.911dispatch.com/shiftwork/staffing_config.html

Ansapoint website hosts several call center calculators that utilize the Erlang C formula. Erlang calculations are based on queuing theory, performance targets (such as 90 percent of calls answered in 10 seconds or less), call duration, number of lines, etc. Available at http://www.ansapoint.com/calculator/

GLOSSARY

Abandoned calls – See Call Abandonment.

Access Key - A unique computer-generated letter/number combination that allows one employee to enter a website and complete the Employee Satisfaction Survey. The access key is deactivated once it has been used.

Agent Occupancy Rate – A measure of the average amount of time when employees are busy with incoming calls or dispatch activity. It can be viewed as "available time" or "ready time" and a reasonable cushion of excess agent availability should be included in staffing estimates as a safety factor (i.e. assuring the center is able to handle unanticipated surges in call activity). Researchers in commercial call centers report increased employee turnover and "undesirable" agent behaviors when agent occupancy rates exceed 85 to 90% over extended periods of time. Detailed records are needed to calculate actual occupancy rates, so the calculations used in the Tool Kit are based on agent occupancy targets.

Anonymous – there is no identifiable or traceable link between the respondent and the data, such as with the information provided by employees in the Employee Satisfaction Survey. Employee access is controlled with the use of unique access keys, and their submissions are completely anonymous. Not even the webmaster can link a response to a specific employee.

Annual Call Volume (ACV) is the total number of calls processed by a communications center 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 call-taker time.

Authorized Positions – The number of positions in a communications center that are allowed to be filled by the budget or budgeting authority, or budgeted FTES. The authorized level may differ from the actual number of current employees.

Average actual time – The determination of Net Available Work Hours can be based on an average of actual time employees are unavailable (there always seems to be someone who never uses sick leave or never takes their vacation days). Averaging real data for the previous full year, obtainable from the Human Resources Department or from employee records, will reflect the differences due to seniority (e.g., additional vacation time for senior people) and differences in the use of leave (e.g. FMLA, or military leave).

Average allocated time – A faster but less accurate measure of employee availability is to simply use the number of days employees are allocated (whether they use them or not in a give year). For example, you might figure two weeks (80 hours) paid vacation per employee, one sick day a month (8 hours x 12 months = 96 hours per year), one-and-a-half hours per day for lunch and two 15 minute breaks (50 weeks x 1.5 hours = 75 hours per year), etc.

Average call completion time - see Call Completion Time

Average Processing Time (APT) - is determined by adding the average telephone busy time and call completion or wrap-up time. Conceptually related to *average call duration* and *calls per*

hour, it is a more general term that can be used for telephone activity alone, or for a combination of telephone and radio activity. For example, if the average time on the telephone is 1.5 minutes per call and another .5 minutes is the average time needed for associated activities such as data entry or dispatch, the APT = 1.5 + .5 = 2.0 minutes.

Average telephone busy time – The actual time spent talking on the telephone as measured by telephone software.

Average Speed of Answer – A common quality measure in communications centers, it is the time it takes from first ring to pick up by a call taker.

Basic analysis structure – This refers to the time blocks that can be selected in the web tool used for hourly analysis of weekly activity (in the APCO Staffing and Retention Tool Kit). The use of time blocks makes it easy to compare call volume and staffing if the time block is based on shift length. Centers that use multiple overlapping shift lengths can use two hour blocks. The only limitation is that time blocks must be evenly divisible into a 24 hour day.

Blocked calls – Calls that receive a busy signal when all lines are being used.

Busy time – The time when a call taker is actually 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.

CALEA – The Commission on Accreditation for Law Enforcement Agencies, Inc., in conjunction with APCO developed Standards for Public Safety Communications Agencies, and published The Standards Manual of the Public Communications Accreditation Program in January of 1999. CALEA defines size for stand-alone centers as the total number of authorized full-time personnel. They use three center size categories: A (1-15 personnel), B (16-75 personnel) and C (76 or more personnel). These categories are referred to as small, medium and large size centers in all Project RETAINS documents.

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 abandonment is taken seriously by public safety communications centers, and all abandoned 9-1-1 calls must be called back.

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

Call processing time – The amount of time spent on a call. This includes actual busy time on the telephone plus any additional time spent entering data for that call on the computer, into the CAD system, address verification, etc. There is a substantial difference in processing time if a call taker is simply routing a call to a dispatcher or ambulance service vs. providing emergency medical information and dispatching a field unit to the scene.

Call reporting software – Software commercially available for tracking telephone statistics that are not captured by the CAD system. Ideally such software can provide detailed information about the number and length of all incoming, outgoing, and internal transfer calls. Such

information is vital to determining the number of staff needed to handle the workload (calculation of FTE needs is based on number of calls and average processing times).

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. Centers 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).

Census Region – The United States Census Bureau divides the U.S. into four Regions: Northeast, South, Midwest, and West; and nine Divisions.

Communication Center – A centralized location for processing telephone calls. See Public Safety Communications Center.

Computer-Aided Dispatch (CAD) – Computer software that provides dispatch related services such as records management, mobile data, 911, links to NCIC and state databases, and interfaces to jail, property, personnel records, etc.

Confidentiality – Confidentiality means access to information is limited to specific people (e.g., researchers or a website administrator), and may not be reported in a way that allows an individual or individual center's identity to be determined. Information that is confidential is not anonymous; there is a (protected) link between the data and the source of the data.

Console – The physical space where a call taker or dispatcher works, also called a work station or post.

Contract year – The base number of days or hours in a "full time" job; typically 2080 hours per year. The term applies to legally binding formal written contracts, but in "right to work" states, such contracts do not exist.

Coverage Position – This is 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 work station, post, or console that must be staffed or "covered" for a given length of time, usually continuous service 24 / 7 / 365. For example, a fire-rescue or law enforcement dispatch console that is covered around the clock regardless of the amount of call activity is a "coverage" position. Small centers where one or two employees can handle all telephone and dispatch activity around the clock with a minimum number of staff must staff for "coverage" of those consoles. Shift supervisor or shift manager is a "coverage" positions if someone must fill that position during all shifts, or even for one or two shifts a day (note that it does not need to cover 24 hours for it to be a coverage position). A center that can handle the call load with minimum staffing around the clock must fill a basic number of coverage (sometimes called "fixed") positions. A center that requires a separate dispatcher to cover each of five different consoles 24/7/365 has five "coverage" positions. If one console is used to cover several channels during the night shift, the number of positions used to calculate coverage needs should include an appropriate fraction.

Decision Rule – A parameter set for determining when an additional employee will be scheduled to handle the workload. The hourly analysis tool (in the APCO Staffing and Retention Tool Kit) can be set up to round up at intervals other than .5; most programs have a default rounding rule: round up if over .5 and down if under .5; when exactly .5 round to the nearest even number. Providing additional control over the rounding process is intended to avoid systematically under or over estimating the number of staff needed to handle the incoming call volume.

Employee Availability - Employee availability is a measure of the actual number of hours employees are available to handle a task, expressed as Net Available Work Hours (NAWH). 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). This is referred to as "shrinkage" in commercial call centers. This adjustment is used for coverage and volume-influenced positions only. It can be calculated using the amount of time *allocated* or *actual* average time used for each category. Calculations based on actual employee data will address differences in vacation and leave time based on employee seniority. Time off that may be unique to a center could include: reduced workloads for new recruits, long-term disability, light duty assignments, leave without pay, unexcused absences, or turnover rate (based on an average for several years). See Net Available Work Hours for additional detail.

Employee Satisfaction Survey – The Employee Satisfaction Survey (ESS) is composed of questions that were used for a national survey that was developed specifically for the purpose of understanding staffing and retention issues *in public safety communications centers*. Questions were based on a list of effective practices generated by the APCO Staffing Crisis Task Force in 1999, and refined in consultation with the members of the APCO Project RETAINS (Responsive Efforts to Assure Integral Needs in Staffing) Committee in 2003. Surveys were distributed to a random sample of managers of public safety communications centers across the nation. Managers provided numerical data and information about policies and practices in their center, and passed the employee surveys on to their staff. Employees responded to questions about their satisfaction with center policies and practices. Responses were received from 153 managers and 600 employees.

Employee Satisfaction Survey Long Version: Employee satisfaction was measured with 52 items in the original survey. These items were related to the work itself, the physical environment, supervision and management, the level of support provided by the center, scheduling policies and practices, and compensation and benefits. The 52 item satisfaction scale had a reliability coefficient of .94, indicating high reliability.

Employee Satisfaction Survey Short Version: The Employee Satisfaction Survey in the web-based Staffing and Retention Tool Kit is a shortened version of the survey. Factor analysis was used to reduce the original satisfaction scale and to select the questions for the ESS, resulting in a 20-item satisfaction scale. Additional questions, on topics that predicted employee satisfaction, are also included in the ESS. These other questions are about overtime, recognition, the overall performance of the center, and future plans. The 20-item satisfaction scale was pilot tested in 2005 by four call centers and a total of 317 employees. A .86 reliability coefficient for the shortened satisfaction scale was also high.

Erlang: An Erlang is a unit of measurement for the call traffic within an hour. For example, if a center receives 30 calls in one hour and each call lasts 5 minutes, the total minutes of traffic in the hour is 150 (30 minutes x 5 minutes = 150 minutes). But there are only 60 minutes in an hour so that 150 minutes is divided by 60 to calculate an Erlang (150 ÷ 60 = 2.5 Erlangs). The higher the Erlang number, the busier the center. The Erlang is named after its inventor, Agner Krarup

Erlang of Denmark, and goes back to 1909 when he published *The Theory of Probabilities and Telephone Conversations*. There are several telephone-traffic models (formulas) that utilize the Erlang. The Erlang is generally used to estimate the number of telephone lines that are needed, but formulae that have been developed to model queuing activity allow estimates of staffing requirements based on call activity (i.e. Erlangs).

Fixed Position – These are positions that are covered at a minimum level independent of call volume and regardless of the activity level. See Coverage position.

Full Time Equivalent (FTE) - The number of full time staff it takes to cover a position for one shift. If a center 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.

Function Position - A job that is based on a specific task or function necessary to operation of a communications center. A "function" position is independent of call volume and does not require coverage. For example, if all of the time of a manager is spent on management functions, manager is a function position in the center. Additional examples of "function" positions may be training coordinator, quality assurance coordinator, radio/technical specialist, tape puller, or any other job that serves a specific role not related to covering a specific position or responding to call processing activity in the center.

Hourly Processing Capability (HPC) is the total number of calls that can be handled in an hour based on the average processing time (APT). It is a measure of *potential* call handling if every minute of the hour is devoted to processing calls. The number is an indicator of the maximum number of calls that can be safely handled in an hour. HPC can be determined indirectly by analyzing call abandonment records (i.e. callers hang up and call again if they feel they have been on hold too long). If the abandonment rate consistently increases when call volume exceeds a certain ratio of calls to call takers, you know the center has reached the hourly processing capability. For example, if 12 agents typically handle incoming calls with an abandonment rate below 5%, but when the incoming call volume exceeds 200 calls per hour the abandonment rate goes up, the indirect HPC for that center is about 16.7 calls per person (HPC = 200/12 = 16.66). Other quality indicators such as percentage of calls answered within 10 seconds can be used for an indirect estimate of HPC. The HPC is dependent on the number of tasks that need to be completed with each call, and will be shorter for agents that simply route a call through to the appropriate dispatcher vs. an agent that handles all aspects of a call from pick-up to dispatch.

Hourly Analysis – The process of analyzing call volume and staffing needs on an hour-by-hour basis, generally for a week at a time. An hourly analysis may be based on a specific week selected because it is "typical" or unique in some way (e.g., an unusually high level of activity surrounding a holiday or special event such as a football game), or averages of weekly activity (e.g., by quarter, by month, by month, by season, etc.). The bonus tool in the Staffing and Retention Tool Kit uses an hourly analysis.

Incoming Call Volume - The total number of incoming wireless and wire-line calls received in a given time period.

Minimum Staffing – The minimum number of staff scheduled at any time during a given period of time based on experience, contract, legal requirements or previous staffing studies. Set the hourly analysis tool so that the calculation never goes below the minimum.

Net Annual Work Hours (NAWH) = Total work hours minus all leave for training, vacation, holidays, sick leave, comp time, FMLA, military leave, etc. This is similar to Net Available Work Hours but restricted to an *annual* measure. See Employee Availability.

Net Available Work Hours (NAWH) - NAWH is calculated by subtracting the total hours an employee is out of the building or out of the room and unavailable for handling the core function(s) of call taking or dispatch from total work hours. When determining NAWH for a position averages should be used for all employees in that position. For example, if the number of total work hours for call takers is 2080 hrs per year (i.e. the number of hours in a year for a "full time" employee), and the averages for all call takers are 240 hours vacation time, 80 hours of sick leave, 16 hours of personal leave, 24 hours of training, and 78 hours for lunch/breaks, the total time they are actually *available* to answer calls is 2080 minus 240 + 80 + 16 + 24 + 78 = 2080 – 438 = 1642 hours. See Employee availability. Same as Net Annual Work Hours.

Over hire – Some centers are authorized to hire additional employees, beyond their authorized levels, to accommodate predictable changes in employment levels due to turnover, FMLA, etc.

Performance Targets – Quality indicators that serve as a proxy for communications center 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.

Position – A job in a communication center that has specific requirements and duties. For example, some centers have a call taker/dispatcher position in which all employees do both call taking and dispatch whenever they are on duty: the two tasks are not separated and each employee handles all calls from pick up to completion. Some centers use the term "telecommunicator" to signify the union of these duties, but whatever the name, the position is the same. Some centers divide the task into separate positions, with some individuals designated as "call takers" and others designated as "dispatchers." The *position* is "call taker" or "dispatcher" even though the individual employee who is filling that position at any given time may be cross-trained and move easily from one job to the other. The term *position* does <u>not</u> refer to rank or salary classifications. The different positions within a communication center are typically based on function, coverage needs, or call volume. Staffing for combined call taker/dispatch positions may be based on either coverage or volume-influenced calculations, depending on the size and distribution of incoming calls in the center. Dispatch positions tend to be based on coverage needs. Some centers use a combination of 8-hour and 10-hour positions. Call taker positions tend to be volume-influenced. See function position, coverage position, and volume-influenced position for additional detail.

Post – A physical space, console or work station where a specific task or job is completed. For example, there may be specific posts devoted to call taking, while other posts are devoted to law enforcement dispatch, fire-rescue dispatch or emergency medical dispatch. An employee at a dispatch post may pick up incoming calls if the call takers are unable to handle the pace of incoming calls, but the primary task at that post is dispatch.

Probationary – Staff that has been recently hired or is still in a "probationary" period that usually includes intensive training and/or mentoring, also referred to as "new hires" in the retention rate calculations.

Problem Based Learning – PBL is an instructional strategy that confronts students with the statement of a problem prior to instruction, creating a need to know and a purpose for learning. It is an instructional strategy that has been used with good success in medical schools, law schools, K-12 education, college and university courses and graduate schools. It is based on the way we naturally learn (i.e., we are confronted with a problem so we seek information that will help us understand and address that problem), so it increases student motivation and retention of the information that is learned.

Project RETAINS – See RETAINS.

PSAP – This acronym refers to the primary Public-Safety Answering Point, the first point of contact for incoming calls. Some centers that receive calls routed to them from the first point of caller contact are referred to as "secondary" PSAPs.

Public Safety Communications Center – A centralized location that receives telephone calls for service from public safety service providers. Typically this includes police/law enforcement, fire-rescue, and/or EMS services. Most public safety communications centers also dispatch field units for these service providers. In addition, many handle calls for public entities and provide call taking and dispatch services for public works or public utilities, etc. Most public safety communications centers handle 9-1-1 calls; some also handles calls from 7-/10 digit emergency service lines.

Queuing Theory – Calls do not come into a call center one at a time, and statistical equations can predict the way these calls will arrive. Call center calculators that are based on mathematical models of queuing behavior are used in communications centers that handle a very large number of calls. The most common calculators are based on various Erlang calculations. See Erlang.

Recruit – A newly hired employee, typically still in training or within the probationary period. Recruiting is an area of great interest to managers who have difficulty finding employees who can handle the work and finding enough to comfortably handle the amount of work. Study II explicitly solicited information about recruiting strategies that were particularly effective for finding potential call takers and/or dispatchers. Those strategies are available in the Employee Satisfaction Survey report and the Effective Practices Guide.

RETAINS, Project RETAINS (Responsive Efforts to Assure Integral Needs in Staffing), an APCO initiative that resulted in two national studies on staffing and retention in America's public safety communications centers. The Project RETAINS research was conducted in two steps. Study I, which included surveys of managers and employees in a random sample of public safety communications centers across the nation, was completed in 2004. Managers were asked to provide numerical data and information about policies and practices in their center, and employees were asked about their satisfaction with factors believed to impact employee satisfaction and/or center retention rates. Responses were received from 153 managers and 600 employees. Study II, completed in 2005, focused on obtaining information from managers of large centers to better understand differences due to center size (with large being defined as 76 or more employees using the Commission on Accreditation of Law Enforcement Agencies definition). Responses were received from 27 large communications centers.

Retention – The ability of an organization to keep its employees, as opposed to losing them as a result of voluntary or involuntary departure decisions. Retention is the opposite and complement of turnover.

Retention Rate - Percentage of employees that remained with an organization during a given period of time (usually annually). Calculated as [1 - Turnover Rate] * 100. A more accurate calculation, if data are available, is to use an aggregate of monthly averages.

Scheduling – The process of assigning employees to specific time slots. Staffing is the determination of the number of employees needed, while scheduling is the allocation and deployment of available employees.

Selection – The process of screening and selecting potential employees who are highly qualified and/or a good fit with the work.

Shift Relief Factor (SRF) - The number of full time equivalent staff needed to cover a position that requires coverage on a continuous basis. For example if it takes 1.7 full time staff to cover one 8-hour shift (after deducting all leave and breaks from total annual work time), and the position must be covered 24 hours a day, 3 shifts X 1.7 = 5.1 FTE to cover the position around the clock.

Shift start time – You can set the beginning time on the hourly analysis tool to make it easier to see the relationship between call volume, staffing needs, and scheduling based on your current shift structure. If you enter data on the Excel spreadsheet, do not change the layout of the spreadsheet, the tool will automatically organize the data based on the shift start time you select.

Shrinkage – The loss of employee availability due to time off for vacations, sick leave, etc. It is essentially the same concept as net available work hours, but focuses on lost time rather than available time – a glass half empty vs. a glass half full). The term shrinkage is often used by commercial call centers.

Staffing – Staffing is a broad terms that includes the process of determining the number of employees needed to handle a specific set of tasks and/or a given workload, finding, hiring and keeping the appropriate number of employees. It differs from scheduling in that staffing is about the number of employees needed to handle the work load, whereas scheduling is about the allocation and deployment of those employees.

Time period for analysis in the Staffing and Retention Tool Kit refers to the time period used to obtain the hourly data entered in the Analysis of Hourly Staffing Needs for a week. The hourly data can be an average from several weeks or months, a week selected at random, a week selected because it is fairly “typical” or a week selected because it is unusually busy. Be sure to record identifying information about the data, such as beginning and ending dates, phone lines included, and a brief description of any unique aspects of the time period (e.g., busy season, big game in town, etc.).

Total Call Volume (TCV)–Total Call Volume 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. For example, it may be appropriate to estimate staffing based on Total 9-1-1/Emergency Call Volume if all emergency calls are handled by designated call takers. If administrative calls are tracked and counted separately from emergency calls, and the center staffs these positions based on volume, staffing should be

estimated for the specific position. If incoming calls are distributed to whomever is available at the time, it makes more sense to lump all calls together and estimate staffing needs based on total call volume for the call taker position in the center. Most centers will use total annual call volume for this calculation, but the tool can also calculate staffing needs for shorter periods of time such as quarterly or during a busy season (but remember to make the time adjustment in all tools). Centers 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 measure of workload (number of incidents dispatched is considered a more realistic indicator of workload than number of push-to-talk events).

Turnover Rate – This is the ratio of the number of workers who had to be replaced in a given time period to the average number of workers, also known as attrition rate. Project RETAINS research calculated turnover as the percentage of all current positions that required replacement workers. Calculated in the Tool Kit as the total number of staff that leave employment in a given year, for any reason (i.e. both voluntary and involuntary separations), divided by the total number of employees that year. A more accurate calculation, if data are available, is to use an aggregate of monthly averages.

Volume-influenced positions – Jobs within a communication center that require different levels of staffing based on the workload; positions that require additional employees to accommodate daily, weekly or seasonal variations in call volume. They are job categories or tasks where the number of employees on any given shift is determined by the activity level ("volume") of incoming calls and/or incoming calls and dispatch. For example, if the number of call takers on duty is different at different times of the day, different days of the week, or different seasons based on the number of incoming calls, the call taker position should be considered a "volume-influenced" position.

Staffing for volume-influenced positions is based on the total call volume for that position (usually total annual call volume), and the average time it takes to process each call. The average processing time is used to calculate call handling potential or hourly processing capability an average number of calls that can be handled by agents if they are busy every minute of the hour. The average processing *capability* and the total call *volume* are used to transform total workload into total hours of work to be done. Adjustments are made for employee availability based on Net Available Work Hours, and a reasonable target for Agent Occupancy rate (expressed as a percentage of actual busy time). The result is a number of full time employees that are needed to handle an annual workload of a certain number of calls at a given rate of calls per hour.

Workload (W) – An hourly measure of the work. Workload is calculated as the number of hours spent processing telephone calls or handling calls and dispatch. It is determined by dividing total call volume by the average hourly processing capability (W = TCV / HPC). For example, if the Call Volume is 250,000 calls, and the average number of calls that can be handled in an hour is 30, W = 250,000 / 30 = 8333. The workload is expressed as 8,333 hours of call processing time.

Acronyms and Abbreviations

ACD - Automatic Call Distributor directs calls to next available agent.

AO - Agent Occupancy is a measure of the proportion of an hour that an agent is occupied with call processing activity. Desirable levels range from 80-90 percent.

APT - Average Processing Time is total telephone busy time and any additional time needed to process a call related to a single incident.

CAD - Computer Aided Dispatch

CALEA -= Commission on Accreditation for Law Enforcement Agencies

FTE - Full Time Equivalent is the number of employees needed to staff one full time position: one full time employee or two halftime employees equal 1 FTE.

HPC - Hourly Processing Capability is processing potential if every minute of every hour is used for call processing (HPC = 60 min / average processing time = 60 min/APT)

NAWH - Net Available Work Hours is calculated by subtracting total time when an agent is not available for call processing from total work hours.

PSAP – Public Safety Answering Point

TCV - Total Call Volume is the total number of calls processed in a designated time period.

W - Workload in hours is calculated by dividing total call volume by hourly processing capability (W = TCV / HPC)

Comparison of Terminology			
Factor	Concept	Similar term	Advantage of the new term
Total Call Volume (TCV)	Number of calls	Annual Call Volume (ACV)	Not limited to annual, applicable to any time frame
Hourly Processing Capability (HPC)	Number of service requests that can be handled within an hour	Calls Per Hour (CPH)	Not limited to “calls” and implies the number is a maximum number possible rather than normative.
Average Processing Time (APT)	Length of time spent handling a service request	Average Call Duration (ACD)	Provides for the additional time involved in handling a call – allows inclusion of dispatch activity
Net Available Work Hours (NAWH)	Actual time that employees are available to handle core tasks	Net Annual Work Hours (NAWH)	Recognizes availability to handle core tasks
W = TCV x HPC	Workload is total number of calls multiplied by the hourly processing capability	Total Calls (TC)	Transforms the number of calls into a measure of potential in hours.
Work Hour	Unit of measurement	Shift	Increases flexibility for centers using different combinations of shift lengths.

STAFFING ESTIMATION WORKSHEETS

A six step process for estimating the number of employees needed**:**

- **Step 1:** Identify the type of position you wish to analyze;
- **Step 2:** Determine employee availability (Worksheet A, NAWH)
- **Step 3:** Determine your turnover rate (Worksheet B)
- **Step 4:** Select the appropriate formula and analyze all positions (Worksheets C, D, E)
- **Step 5:** Compare the number of staff you have with the number you need (Worksheet F)
- **Step 6:** Do a reality check using quality indicators.

WORKSHEET A: DETERMINING EMPLOYEE AVAILABILITY

Determine Net Available Work Hours (NAWH)		
Position:		
A	_____	Total hours for one full time employee
B	_____	Average vacation and holiday leave (total hours)
C	_____	Average sick leave (total hours)
D	_____	Average personal leave (total hours)
E	_____	Average training leave (total hours)
F	_____	Average military, FMLA leave, etc. (total hours)
G	_____	Average lunch and break (total hours)
H	_____	Average other (meetings, light duty, special assignments, etc.)
I	_____	Total unavailable time = Total B through H
J	_____	Net Available Work Hours (NAWH) = A – I
_____ = Net Available Work Hours per employee (NAWH from J above)		

STAFFING ESTIMATION WORKSHEET

WORKSHEET B: CALCULATING AVERAGE TURNOVER RATE

Calculate Average Turnover Rate		Year					Average
		20__	20__	20__	20__	20__	
A	Total number of employees at the highest staffing level for that year						
B	Number of new hires that failed to complete the probationary period						
C	Number of experienced employees who left for any reason*						
D	Turnover Rate (Turnover = B + C ÷ A)						
E	Retention Rate (Retention = 1 – Turnover) x 100						

*Include all experienced employees who left for voluntary or involuntary reasons (e.g. turnover initiated by the employee, rotation, retirement, death, management action, etc.)

STAFFING ESTIMATION WORKSHEET

WORKSHEET C: CALCULATING STAFFING FOR COVERAGE POSITIONS

Estimate Staffing Needed for Coverage Positions
Note: Coverage positions must be covered regardless of call volume or level of activity.
Position:
Hours needing coverage: A. _____ Total number of consoles that need to be covered for this position B. _____ Number of hours per day that need to be covered C. _____ Number of days per week that need to be covered D. _____ Number of weeks per year that need to be covered E. _____ Total Hours needing coverage = A x B x C x D Employee Availability: F. _____ Net Available Work Hours - enter average NAWH from worksheet Staff Needed: G. _____ Full Time Equivalent base estimate (FTE) = E ÷ F H. _____ Turnover Rate - from retention worksheet, convert to decimal I. _____ Full Time Equivalent required to accommodate turnover, prior to any adjustments based on quality indicators: FTE = G x (1+ H)
_____ = Estimated Staffing Need (in FTEs from Step I above)
FTE = Hours needing coverage ÷ Employee Availability x Turnover Adjustment

STAFFING ESTIMATION WORKSHEET

WORKSHEET D: CALCULATING HOURLY PROCESSING CAPABILITY

Calculate Hourly Processing Capability	
A. _____ minutes	Average telephone busy time (call duration in minutes, using decimals), from phone records
B. _____ minutes	Average call completion time (in minutes, this includes time for data entry, address verification, etc.)*
C. _____ minutes	Average Processing Time (APT) = A + B
D. _____ calls hourly	Average Hourly Processing Capability (HPC) = 60 ÷ APT)

** Your telephone software may be able to provide detailed information about telephone busy time, but you will have to use other means to determine average wrap-up time.*

STAFFING ESTIMATION WORKSHEET

WORKSHEET E: CALCULATING STAFFING FOR VOLUME-INFLUENCED POSITIONS

Estimate Staffing Needed for Volume-influenced Positions	
Note: The number of Volume-influenced positions is based on call volume or activity level.	
Position:	
Workload:	
A. _____ calls	Total Call Volume for this position (TCV), from phone records
B. ____ minutes per call	Average Processing Time for this position (APT), from phone records
C. _____ calls hourly	Hourly Processing Capability (HPC) = 60 ÷ B
D. _____ call hours	Workload in hours (W) = A ÷ C
Employee Availability:	
E. _____	Net Available Work Hours - enter average NAWH from worksheet
F. _____	Agent Occupancy rate - enter AO, convert percent to decimal
G. _____	True Availability per person (TA) = E x F
Staff Needed:	
H. _____	Full Time Equivalent base estimate (FTE) = D ÷ G
I. _____	Turnover Rate from retention worksheet - convert to decimal
J. _____	Full Time Equivalent required to accommodate turnover, prior to any adjustments based on quality indicators: FTE = H x (1 + I)
_____ = Estimated Staffing Need (in FTEs from Step J above)	
FTE = Workload ÷ Employee Availability x Turnover Adjustment	

STAFFING ESTIMATION WORKSHEET

WORKSHEET F: COMPARISON AND SUMMARY OF STAFFING ESTIMATES

Compare Current Staffing with Estimated Staffing Needs			
WORK	Total Call Volume: Total Emergency Calls: Average Processing Time: Hourly Processing Capability:	Current Staffing	Estimated Need
WORKERS	Coverage Positions:		
	Volume-influenced Positions:		
	Function Positions:		
	TOTALS		