INTEGRATED CRIMINAL APPREHENSION PROGRAM

A PRELIMINARY GUIDELINE MANUAL FOR PATROL OPERATIONS ANALYSIS

June 30, 1977

LAW ENFORCEMENT ASSISTANCE ADMINISTRATION

U.S. DEPARTMENT OF JUSTICE

INTEGRATED CRIMINAL APPREHENSION PROGRAM

A PRELIMINARY GUIDELINE MANUAL

FOR

PATROL OPERATIONS ANALYSIS

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1. INTRODUCTION

The National Advisory Commission on Criminal Justice Standards and Goals, Task Force on Police, has recommended that the following standard relating to deployment of patrol officers be implemented by all police chief executives:

- Every police agency immediately should develop a patrol deployment system that is responsive to the demands for police services and consistent with the effective use of the agency's patrol personnel. The deployment system should include collecting and analyzing required data, conducting a workload study, and allocating personnel to patrol assignments within the agency.

The proper use of available resources is one of the most important aspects of administration faced by law enforcement agencies today. Efficiency of patrol force allocation and deployment is of interest because it has the potential of alleviating the cost pressures felt by police departments everywhere.

The greatest expenditure of police efforts in response to citizen demands is, in its vital features, reflected in the patrol response. This is so for several reasons. First, the patrol force consumes a plurality, or more usually a majority, of the entire work force of the typical municipal police agency (70 percent and up). Second, the

major expenditure of resources takes place in the patrol area. The majority of a department's vehicles and communication facilities are devoted to the patrol function. In other words, the greatest allocation of departmental overhead is related to support of patrol. Third, the patrol force provides the most services actually delivered to the public; patrol responds to the greatest number of calls, provides the widest range of services, and in the aggregate, devotes the greatest time of all department elements responding to citizen demands. Finally, patrol units can and do provide most of the specialized services theoretically the province of other units; the citizen in need usually seeks and, in most situations, is entirely served by patrol units.

These factors alone would justify a comprehensive effort to ensure the efficient delivery of patrol services. In addition to these general considerations, however, there are other, operational imperatives for effective planning and management of the patrol effort. Typically, most citizen encounters with the police are with patrol elements, leading to client evaluation of the entire department based on the performance of one division or function. The initial, and frequently the only, response to emergencies and high-priority incidents is invariably made by patrol units. In addition, the work of specialized service elements depends largely on information and assistance from the patrol force. Thus, the probability of solution for most crimes, even after prolonged investigation, is described by a steeply declining curve plotting the number of minutes required for patrol units to arrive on the scene of the initial call for service.

To be consistent with the standard for deployment of patrol resources established by the National Advisory Commission, the effective management of the patrol function requires the collection and assessment of information affecting decisions related to the employment of department resources. At a minimum, the following should be considered:

- *Workload* or the demands made for patrol service.
- *Manpower* available to meet those demands.
- *Assignment* of that manpower to patrol commensurate with the workload requirements.
- *Allocation* of the assigned manpower to shifts in proportion with the occurrence of service demands.
- *Distribution* of manpower allocated to each shift in such a way as to relate rationally to the geography of the service demands.
- *Analysis* of incidents occurring.
- *Identification* of suppressible incidents, their location, times, and characteristics.
- *Tactics* calculated to direct the efforts of individual officers against suppressible incidents in the most effective manner.
- *Evaluation* and refinement of patrol efforts after assessment of such suppressive tactics.

Existing techniques for evaluating service demands, or workload, are generally one of two types: The mathematical or hazard formula introduced by Vollmer in the 1930's, and the recent computer programs operating more or less predictive models for patrol activity based on pre-selected performance criteria. Both methods have recently been criticized.

The hazard formula has come under attack for its failure to provide any reliable indication of the effects of using different allocation schemes. Further, it cannot be used to develop an allocation scheme that will meet some specified criterion of performance. Most computer simulation techniques, on the other hand, are oriented toward a proactive rather than a reactive philosophy. Proponents of the proactive patrol philosophy tend to over emphasize the availability and in-service status of a patrol unit to respond to calls for service. In addition, the tendency of modern methods to require flexibility in beat boundaries and unstructured distribution of patrol units ignores the benefits obtained from a beat patrolman's familiarity with his sector.

The procedure for conducting a patrol operations analysis study outlined in this manual is presented for those departments which have not previously undertaken such a task. The method of analysis is based on the measurement of patrol time consumed by three categories of activity: calls-for-service, patrol-initiated activity, and personal or administrative activity. The analysis of patrol activity

using a time consumption technique is certainly not a new approach, but appears to be the most feasible technique in comparison to both the hazard formula and modern computer predictive methods. The rationale for a consumed time study is one likely to appeal to most police administrators:

- Experience shows that using the number of calls-for-service and the number of arrests *without regard for time expended* is of little or no value in determining workload. For example, the same number of service calls and arrests may occur on two different shifts. All the activities on one shift, however, may take twice as long as on the other shift. Therefore, using only the number of incidents would indicate falsely that the workload was the same on both watches.

In practice, it *is* important that the theoretical base for resource decisions be demonstrable to the patrol officers and commanders who will be required to abide by those decisions and to operate the data-collection system necessary to the planner. Otherwise, the quality of the data will be insufficient for *any* reliable determinations regardless of the techniques employed, and prospects for institutionalizing the technique will be limited.

In addition, for departments that have been using hazard formulae, only slight computational adjustments will be necessary for, in effect, the hazard formulae were attempts to arrive at the same thing prior to adequate data collection for measurement of time factors.

2. REVIEW OF PERTINENT RESOURCE ALLOCATION MODELS

During the past 70-odd years, law enforcement administrators have been presented with a number of techniques or methods for allocating and deploying patrol resources. Prominent among these techniques has been the so-called *Hazard Formula*, or principle of workload equalization, first introduced by Vollmer in 1909. Hazard formulas attempt to identify all police hazards throughout a jurisdiction. In effect, this requires an identification of those factors that are believed likely to induce an incident requiring police action. Each hazard is assigned a weight that reflects both its relative importance and the amount of time required to handle the incident. "Hazards" generally include: Crime and attempted crimes, arrests, street miles to patrol, business types, and population characteristics.

Workload formulas are based on the same general concept as hazard formulas except that they extend the range of activities associated with police action to include: Population density, school populations, special problems of residents, number of businesses, etc. Although the terms *hazard* and *workload* are used synonomously, the term *hazard* generally refers to crime-related factors. *Workload* is an expansion of the hazard formula where factors accounting for the total patrol service requirement are taken into consideration.

Because the collection and analysis of workload data can often be a time-consuming and tedious process, recently a number of computer programs have been developed to assist both small and large departments in patrol

deployment. These programs can develop schedules for individual patrol units, as well.

The discussion in this section is a brief review of the hazard, workload, and computer-assisted methods.

2.1 Hazard or Weighted Workload Formulas

A hazard or workload formula requires a priori division of potential incidents into categories or groups, usually three to seven in number. A typical schedule might include the Uniform Crime Reporting Part I and Part II crime categories, traffic services, administrative services, and arrests. Each category is assigned a weight, from a low of one to a high equal to n, the number of categories. In the list given, the high weight would probably be 5. For some sample periods, the total number of calls in each category is tabulated and that category sum is multiplied by the weighting factor for the particular category. These weighted totals are then added together to arrive at a total workload index figure. Sometimes a divisor is used to arrive at an estimated time value (e.g., when each unit of weight is assumed to represent 45 minutes of a patrol officer's time, the weighted total is reduced by multiplying it by .75 and the result is assumed to represent manhours of demanded service). In practice, both the weights and any time adjustments are arbitrary factors assigned by the operator, hopefully with the benefit of actual patrol experience as a guide.

Not only is this processing open to attack on experimental design, but it produces exactly the opposite effect to that intended. As Sohn

and Kennedy have demonstrated, where the intent of the hazard formula is to assign a greater number of officers to areas with greater numbers of heavily weighted incidents, the effect of such a calculation is to *reduce* the recommended assignment of officers to those areas. This is because the large numbers of low-weight incidents will more than overcome the weighted values of the high-priority incidents.

To adapt Sohn and Kennedy's example, one can assume a police jurisdiction with three patrol areas to which units can be assigned. It further can be assumed that the planner has identified three categories of incidents -- Crimes, Emergency Services (of a noncriminal nature), and Other Services occurring as follows:

Category	Precinct 1	Precinct 2	Precinct 3	Total
Crimes	60	80	100	240
Emergencies	80	100	120	300
Other	1,400	1,800	2,200	5,400

In accordance with hazard formula theory, the planner assigns a weight of one to each category -- that is, all incidents will be evaluated as being of equal importance:

$$W_1 = (1 \cdot 60) + (1 \cdot 80) + (1 \cdot 1{,}400) = 1{,}540$$

$$W_2 = (1 \cdot 80) + (1 \cdot 100) + (1 \cdot 1{,}800) = 1{,}980$$

$$W_3 = (1 \cdot 100) + (1 \cdot 120) + (1 \cdot 2{,}200) = 2{,}420$$

If it is given that N units available for distribution among these three precincts:

Precinct 1 will receive $\frac{1,540}{5,940}N$ units, or 25.9 percent of the available force.

Precinct 2 will receive $\frac{1,980}{5,940}N$ units, or 33.3 percent of the available force, and

Precinct 3 will receive $\frac{2,420}{5,940}N$ units, or 40.7 percent of the force, where all incidents weigh equally.

If the hazard formula were to work as desired, it should be possible to increase this allocation in the precincts with heavier occurrences of crimes and emergencies. Thus, the planner assigns a weight of 4 to Crimes and Emergencies and a weight of 1 to Other Services. The resulting workload calculations are:

$W_1 = (4 \cdot 60 + (4 \cdot 80) + (1 \cdot 1,400) = (240) + (320) + (1,400) = 1,960.$

$W_2 = (4 \cdot 80) + (4 \cdot 100) + (1 \cdot 1,800) = (320) + (400) + (1,800) = 2,520.$

$W_3 = (4 \cdot 100) + (4 \cdot 120) + (2,200) = (400) + (480) + (2,200) = 3,080.$

Precinct 1 will receive $\frac{1,960}{7,560}N$, or 25.9 percent of the available force, exactly what it received before; Precinct 2 will receive $\frac{2,520}{7,560}N$, or 33.3 percent of the available force; and Precinct 3 will receive $\frac{3,080}{7,560}N$, or 40.7 percent. Thus, with weights that might reasonably be related to time factors (that is, if one assumed a crime or emergency took one hour to handle, a not unlikely figure, the minor incidents would be allowed only 15 minutes), no change occurs in the distribution of manpower. If one increases the realtive weights, say to 8 for crimes, 8 for other emergencies, and 1 for other services, the figures are:

W_1 = 2,240 ; (2240/8640)N = 25.9 percent

W_2 = 2,880 ; (2880/8640)N = 33.3 percent

W_3 = 3,520 ; $\frac{3520}{8640}$N = 40.7 percent.

Clearly, weights have no effect in changing manpower distribution in this imaginary jurisdiction. In addition, the manipulation of a completely different weighting scheme would not result in any meaningful changes.

In summary, while hazard and workload formulas may appear to be satisfactory models for basic application in most departments, there are a number of serious shortcomings associated with their use:

- The additive weighted combinations of hazards and other factors affecting police patrol do not reflect highly complex social relationships nor the relative importance of single factors.
- The formulas reflect the past rather than forecasting future problems.
- Meaningful effectiveness measures are not related to operational policies.
- Application of weighted factors often results in a totally opposite effect to that originally desired.

2.2 Computer-Assisted Techniques

Over the past 10 years, much research has been devoted to the development of computerized programs for patrol force allocation and deployment. To overcome the recognized inadequacies in hazard and weighted workload techniques, the designed computer-based models calculate a variety of performance measures and recommend allocations that meet specified patrol objectives. Three examples of computer-based models that focus on the development of work schedules, temporal allocation schemes, and beat designs are briefly discussed in the following paragraphs.

2.2.1 Computer-Designed Work Schedules

A computer program has been developed that enables law enforcement agencies to schedule officers so that the number of officers deployed to each watch and day of the week is proportional to the average demand for service during these periods. The purpose of this program is to deploy more officers during the busier periods of each day and to reduce staffing during the less busy periods. In addition, it will equalize the patrol workload among officers on each watch. Perhaps the major advantage of this program is that it not only develops an allocation plan, but also prepares a schedule that conforms to fluctuations in the patrol workload for the entire patrol force and for individual officers. Finally, this program can be used to develop a deployment scheme and schedule based upon 24-hour and 168-hour graphs.

Data inputs for the program can be in the form of the number of calls for service, number of reported crimes, or the number of hours spent

servicing calls. This workload information should be available for each watch and each day of the week. For those departments that are not currently collecting this data, it is possible to sample past records or to collect new data over a 28-day period. The program allows patrol managers to specify a number of schedule design features, including the maximum and minimum length of both duty periods and days off, the upper and lower limits for the number of on-duty officers needed on each watch, and the period of time officers are assigned to each watch. Finally, for those agencies that are on a rotating watch schedule, this program will design a rotation plan which deploys officers proportional to the workload on each watch.

The computer program produces a deployment plan for the entire department or for individual precincts that matches the number of officers scheduled to the average workload on that shift. In addition, an individual schedule is produced for each officer.

2.2.2 Patrol Car Allocation Model

The Patrol Car Allocation Model (PCAM) is a computer program designed to enable departments to determine the number of patrol units that should be on duty during various times of the day. Although the program allows departments to determine the number of units on each watch, it does not provide the detailed work schedules and rotation plans available from the workload-based scheduling program (described in Section 2.2.1).

Whereas workload-based allocation formulas seek to equalize the calls for service workload across watches, the goal of the PCAM formula is to

deploy officers so that dispatch delays and response times can be optimized. The PCAM program has frequently been referred to as a performance-oriented system, because it provides patrol performance objectives (dispatch delay and response time). Although this program enables patrol administrators to deploy officers to geographic commands, it will not facilitate the design of individual beats.

The PCAM program requires several categories of data for input. In addition to the average number of calls per hour, departments must also enter the amount of time needed to service a call, estimates of average patrol speed and travel time to calls, as well as the amount of time consumed by non-calls-for-service work. PCAM offers departments a wide range of possibilities for specifying the number of regular and overlay watches during which officers can be deployed. In addition, departments can divide calls-for-service into three different priority categories.

PCAM can be operated in a descriptive or prescriptive mode. When operated descriptively, the agency can evaluate the performance capability of various allocation plans, including its current allocation plan. When operated prescriptively, the program will recommend to the user the best temporal allocation of existing resources. The "best" allocation can be defined by setting parameters for the average number of calls placed in queue, the average length of time that priority calls can be held prior to dispatch, and the total dispatch and response times.

2.2.3 Hypercube Model: Beat Design

The hypercube queuing model is a computer program that can assist patrol managers in the design of individual patrol beats. The goal of the program is to provide planners with performance information about the ability of a patrol unit to answer service calls in various patrol beats. The program does not construct beat boundaries. Rather, it calculates performance measures for various beat designs that are prepared by planners. Hence, patrol managers can evaluate current beats as well as other hypothetical beat structures and then choose a design which best meets the department's needs.

To run the hypercube model, the community must be divided into reporting units that are smaller than beats. Some agencies have used census block areas as the basic reporting unit. When the reporting units have been established, the number of incidents, the time required to service each incident, and the number of street miles in each reporting unit as well as the travel time between reporting areas must be recorded. In addition, the average speed of patrol units must also be estimated.

Because the hypercube program does not design beat structures but instead computes performance characteristics of various beat structures, it requires considerable program planner interaction. Using the hypercube to design beats is a trial-and-error process. A convenient starting place is an analysis of the performance characteristics of the existing beat structure. When this has been done, the beat structure can be changed by patrol planners in an attempt to create a structure that

produces the best performance characteristics. The program outputs performance information about the entire patrol command, individual beats within the command, as well as information about each reporting area. The performance measures include the workload of each unit, average travel time to an incident, proportion of dispatches outside a beat, and the patrol frequency within each beat.

3. PRELIMINARY CONSIDERATIONS

3.1 Incident and Activity Recording

To accomplish a consumed-time patrol study, the time expended by patrol officers on various field activities must be collected. To facilitate the collection of relevant data, three main categories of activities are identified.

This first category, calls-for-service, includes those activities assigned to patrol officers through the dispatch or communications center. The majority of departments already have prepared an incident code list for use by dispatch personnel in assigning appropriate numerical codes for citizen requests for service. These lists are usually standardized in most departments to account for virtually every type of call received. Normally, however, these code lists reflect an attempt to further categorize activity either by type or, in some cases, according to seriousness of the incident.

Since the dispatcher is the central link between the patrol units and the department, it is recommended that time expended on calls-for-service be captured in the communications center. A proven method of recording the necessary data is through the use of police dispatch or incident cards. These cards are completed by the dispatcher to record all assignments made to patrol officers and, in some cases, to account for various activities initiated by the officers themselves. A suggested dispatch/incident card, together with accompanying instructions for its use, is presented in Section 3.2. It should be borne in mind

that the actual structure of a police dispatch/complaint card, or any other data-gathering instrument, will be influenced by many local factors. Among these factors are the peculiar time stamping equipment used, specific local needs such as whether a control number is required, and many other situational aspects, including local preference.

The second category, patrol-initiated activity, includes those activities actually initiated by the patrol officer during the normal tour of duty and which are directly related to the patrol function. Included in this category are routine vehicle checks, followup investigations, and arrests generated by the officer himself and not as a result of a call-for-service. The purpose of separating assigned and officer-initiated events and backup data is to determine the amount of self-initiated events for which field officers are responsible. The level of officer-initiated activities will be directly influenced by the amount of unobligated time.

An important element to be considered is that consumed-time patrol studies measure only the actual time engaged in activities. Officer-generated activities require patrol time -- time to find or observe the activity. This patrol time must be considered in relation to the work it produces, since few activities would be generated by officers if they lacked the time in which to observe them. All of the consumed time recorded during the study, whether initiated by the patrol officers or the public, can be lumped into one figure for allocation and deployment purposes. However, if the events are not separated initially at the

time they are recorded, there will be no means to analyze the activities individually at a later time. This particular step in the patrol planning process is vitally important for eventual analysis of time factors for preemptive patrol efforts and increased understanding of the service problem by management personnel.

The third and final category of activity that should be included in a time consumption study is personal and administrative time. This includes an accounting of total time spent eating meals, servicing equipment, rollcall training, and other related activities. Once obtained, this information can have obvious implications for decision-making regarding the expenditure of on-duty time. For purposes of a patrol time consumption study, identification of gross time expended in this category allows for determination of actual time available for services and patrol.

In most cases, selected expenditures of patrol time included in this category can be reasonably estimated, based upon expected occurrences for predetermined durations. An example would be the computation of gross time consumed by meals and coffee breaks. Rather than have the dispatcher record such instances on a dispatch/incident card each time they occur, the planner conducting the consumed-time study can just as easily compute the time expenditure by simply multiplying the number of officers available for the duration of the time study by the total time allotted for each activity. An important consideration for dispatchers in this particular case is the service status of a unit

while taking a meal or coffee break. In some departments, these breaks are taken as the call-for-service rate permits, and it is not unusual for a unit to remain available for service calls even though dispatchers or patrol supervisors have authorized the activity. Consequently, departments engaged in a time consumption study will necessarily have to decide for themselves whether certain activities in the personal and administrative category should be recorded. In any case, the determining factor should be the service availability of the patrol unit.

As an alternative for those departments that view the accumulation of times for all three categories as burdensome, it is suggested that a separate officer activity record be maintained by each patrol officer to record non-calls-for-service activity. Administrative and personal activities should be recorded on the officer activity record, regardless of whether initiated by the officer or assigned by the dispatcher.

3.2 Police Dispatch and Incident Reporting Card

The principal data collection instrument in use by many police departments is a record of various aspects of the dispatch process and the police response as they relate to each individual incident reported to the department. Commonly in the form of an index or tab card and usually filled out by the dispatcher, this instrument is variously called an "Incident Card," "Dispatch Card," "Run Card," "Complaint Card," or a myriad of other similar names indicative of its function. In the interests of efficient use of manpower, the card should be as easy to fill out and as little time-consuming as possible. The card

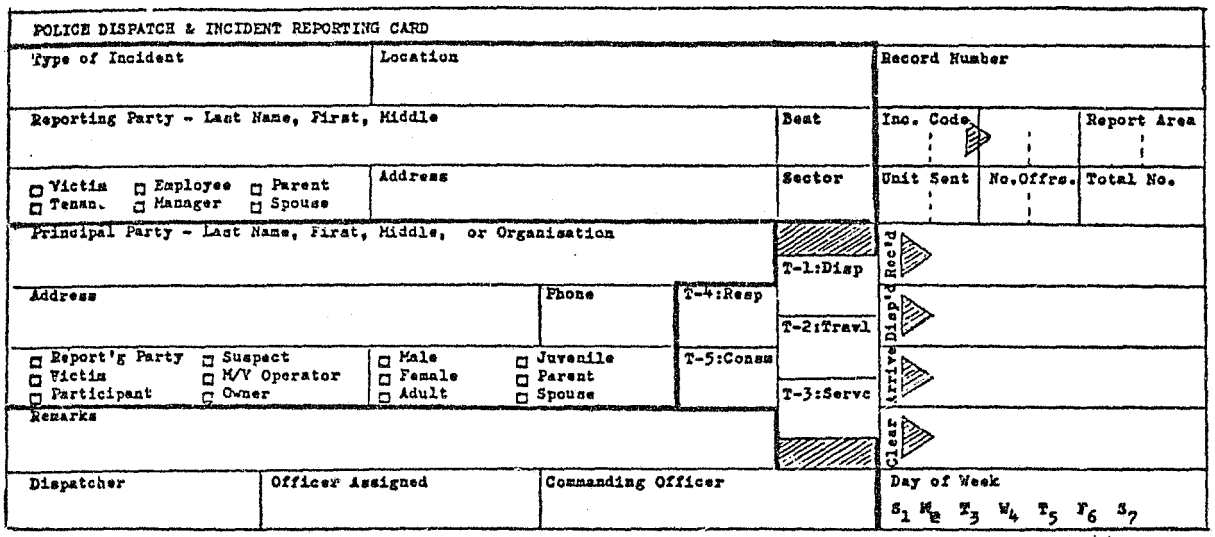
should also serve more than the bare purposes of statistical tabulation, since it contains a rich collection of information about the dispatch, patrol, and complaint processes. Thus, the data collection instrument generally serves the department in three important ways:

- It is the basic record of the dispatch process.
- For many minor events, it may be the sole departmental record of an event.
- It frequently forms the basic card index for entry into the records system.

An example of a dispatch and incident reporting card is shown in Figure 3-1. Designed to meet the three basic departmental functions listed above, it is also intended to provide the basic material for crime, incident activity, and manpower analysis, whether manual or automated.

The face of the Police Dispatch and Incident Reporting Card is divided into the following five fields of information:

- Type and location of incident and the way in which it was reported. This is the basic information for initiating the dispatch process.
- Principal party, or the main person connected with the incident. This is the basic information necessary for creating a name index to the record of the event.



POLICE DISPATCH & INCIDENT REPORTING CARD

Type of Incident | Location | Record Number

Reporting Party - Last Name, First, Middle | Beat | Inc. Code | Report Area

☐ Victim ☐ Employee ☐ Parent ☐ Tenan. ☐ Manager ☐ Spouse | Address | Sector | Unit Sent | No.Offrs. | Total No.

Principal Party - Last Name, First, Middle, or Organization | T-1:Disp | Rec'd

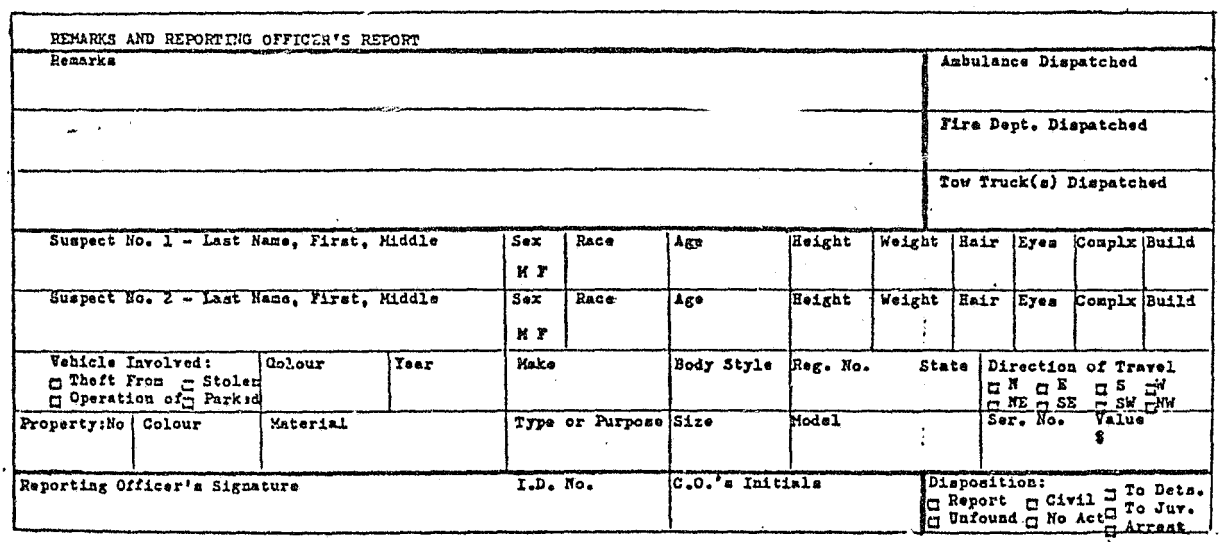
Address | Phone | T-4:Resp | T-2:Travl | Disp'd

☐ Report'g Party ☐ Victim ☐ Participant ☐ Suspect ☐ M/V Operator ☐ Owner | ☐ Male ☐ Female ☐ Adult ☐ Juvenile ☐ Parent ☐ Spouse | T-5:Consm | T-3:Servc | Arrive

Remarks | Clear

Dispatcher | Officer Assigned | Commanding Officer | Day of Week S1 M2 T3 W4 T5 F6 S7

Front



REMARKS AND REPORTING OFFICER'S REPORT

Remarks | Ambulance Dispatched

Fire Dept. Dispatched

Tow Truck(s) Dispatched

Suspect No. 1 - Last Name, First, Middle | Sex M F | Race | Age | Height | Weight | Hair | Eyes | Complx | Build

Suspect No. 2 - Last Name, First, Middle | Sex M F | Race | Age | Height | Weight | Hair | Eyes | Complx | Build

Vehicle Involved: ☐ Theft From ☐ Stolen ☐ Operation of ☐ Parked | Colour | Year | Make | Body Style | Reg. No. State | Direction of Travel ☐ N ☐ E ☐ S ☐ W ☐ NE ☐ SE ☐ SW ☐ NW

Property:No | Colour | Material | Type or Purpose | Size | Model | Ser. No. | Value $

Reporting Officer's Signature | I.D. No. | C.O.'s Initials | Disposition: ☐ Report ☐ Civil ☐ To Dets. ☐ Unfound ☐ No Act ☐ To Juv. ☐ Arrest

Rear

Figure 3-1. Sample Incident Card

- Miscellaneous and departmental control information, such as the recording dispatcher, patrol officer assigned, and the officer in command of the shift or area who will ultimately be responsible for the handling of the incident and adequacy of reporting.
- Basic statistical information, including the type of incident in numerical code, the reporting area of occurrence, the number of officers responding to the call, the benchmark times for the department's handling of the incident.
- Small, pyramidal field of elapsed times, for later calculation from the four benchmark times recorded by the dispatcher.

The reverse side of the Police Dispatch and Incident Reporting Card allows more room for remarks and general information primarily of value to the actual dispatching process. Standard formats for recording data on suspects and any vehicle or property involved in the report of the incident assist the dispatcher in making a prompt broadcast, as well as in taking a report on a minor incident where the original telephone call is the sole contact with the complainant.

To assist in understanding the proper use of this instrument, a more detailed analysis of the various fields on the dispatch and incident reporting card follows:

- Nature of the Incident -- Located in the upper left-hand corner of the face of the card, this field gives the essential information about the type of incident reported and where it was reported to have occurred. This would be recorded by the dispatcher, preferably during the conversation with the reporting party. The name of the reporting party and his or her relation to the event should be written or checked off, as the case may be. As an example, if a clerk in a store were to report a robbery, the clerk's own name would be written as the reporting party. Beat and sector can be entered later from the location, and as time permits.
- Principal Party -- This is the person or organization with the greatest connection with the event. Frequently the victim, it can also be a suspect or other person intimately involved with the incident. It is always the name under which the principal record of the event will be filed. Basic information about the Principal Party and his or her connection with the event can be checked off here. In some cases, dispatchers will be able to obtain this information during the original call, es-

pecially where the Reporting Party is also the Principal Party, or is an employee in the case of an organization. Frequently, however, completion of the Principal Party entry will be delayed until the responding officer has completed his preliminary investigation. In the example of the robbery mentioned above, where a clerk in a store was the Reporting Party, the name of the store would be placed as Principal Party, and the Victim box would be checked to show the link between the fields.

- Remarks -- The lower-left-hand field on the face of the card is self-explanatory. The dispatcher, responding officer, or commander would enter information thought relevant as the individual case may dictate. The *names*, not signatures, would be placed in the boxes at the bottom.
- Codes -- The field down the entire right-hand portion of the face of the card is for the statistical and chronological tabulation of information necessary for incident and manpower analysis. The Record Number at the top is a unique identifying number assigned to the incident to facilitate the records process. In

many departments, these numbers are only assigned to major incidents on which extensive reporting is required. In these systems, the number serves as the tie between the card in its later role as an index card and the file in which the report is contained. In other departments, every incident receives a sequential number for better control of cards, logs, and dispatch records. The Incident Code is a numerical designator for the type of incident, drawn from a standard list. The first box contains the code identifying the class of incident that was originally reported to the dispatcher. As many incidents are discovered by responding officers to be other than as reported, any such change in designator is recorded in the second box to which the arrow points. This record of the change gives the experienced reviewer an immediate understanding of the progress of the incident through its handling by the department. Report Area refers to a small area on a map of the jurisdiction defined for statistical purposes and, preferably, rather smaller than the beats patrolled by individual units, so that each

patrol sector or beat would be comprised of several reporting areas. This assists in tabulating and displaying the activity of the patrol division by area -- a major part of incident analysis. Unit Sent refers to the radio call or designator of the patrol unit assigned as the initial response to the incident. No.Offrs. refers to the total number of patrol officers sent on the call, as initial responding unit(s). Total No. is the total number of officers assigned to the call, to include initial and backup support personnel. This is a necessary item for reasonably accurate manpower analysis.

- Benchmark Times -- The four spaces with arrow inserts are for the times that define the stage of an incident's handling by the department. These should be filled in with time and date, as they occur, with a mechanical stamp of the kind produced by an ordinary industrial time clock. The four times should be recorded as follows:

- "Rec'd," or time call is received, is the time at which the initial contact was made between the reporting party and any department element, usually a complaint clerk, telephone operator, or dispatcher.
- "Disp'd," or time the initial response unit was sent on the call, is the time *immediately* after transmission of the service call to patrol responding units.
- "Arrive" is the time the first unit acknowledges arrival at the scene of the incident.
- "Clear" is the time the first unit to clear the call is through on the scene and signals that it is available for further assignments. It should be noted that, where multiple unit responses are concerned, the Arrive and Clear times should follow the rule of first-in/first-out; in other words, the Clear marks the departure of the first unit to leave the scene. This is to avoid misleading indications of total manpower expenditure that would result from a contrary policy.

Day of Week is to be circled according to the calendar day on which the incident was reported. This is to assist manual tabulations for workload, incident, or manpower analysis by day-of-the-week.

The fields on the back of the card provide for more extensive remarks by the reporting officer, and are sufficient to permit the complete reporting of most minor incidents on the card itself. The formats for recording persons, vehicles, and property concerned in the incident are for use by the dispatcher to facilitate entering the pertinent information. The departmental information at the bottom consists of formal acknowledgments by the reporting officer and his supervisor of their part in first writing, then reviewing, the report. Also included are a checkoff series of common dispositions. The three time slots in the upper right-hand corner permit the use of the time clock to record the dispatch of emergency equipment and the time and date of its notification.

3.3 Dispatch Procedures

The dispatcher should be seated at a desk with a status rack, a pile of blank incident cards, and a time recorder (time clock) before him. The status rack is a board with a column for each unit subject to dispatch, and rows of slots down those columns: One for received calls awaiting dispatch of the unit (as when a call in that unit's sector comes into the desk while the unit is tied up), one for calls to which the unit has been dispatched but at which it has not yet arrived,

one for calls at which a unit has arrived but from which it has not cleared, and one for cleared calls for each unit.

Upon receipt of a call from a member of the public or a unit in the field that has discovered some incident in the course of patrol, the dispatcher punches the Rec'd time on the card and begins to fill in the Nature of the Incident and its Location from the information given by the Reporting Party. Upon notification to the response unit of its assignment, the Disp'd time is punched in; this can be done literally with one hand while the other opens the transmitter key. All times should be punched simultaneously with the events they record to the extent possible.

When the first unit to arrive on the scene signals its arrival, the dispatcher removes the card from the Dispatched slot of the status rack where it has been waiting and punches the Arrive time, placing the card in the Arrived slot. He thus has an immediate visual check on the progress of each call or each unit. By a glance down that unit's column on the status rack, the position of the unit is apparent from the position of the cards representing assignments.

When the first unit to free itself from the scene calls in for reassignment, the card should be removed from the Arrived slot in the rack, punched in the Clear block on its edge, and replaced in the Clear slot in the rack. At the end of the shift, all cards representing incidents handled by any unit will have collected in the bottom slot of that unit's column on the status rack.

This process permits accurate calculation of the time factors involved in calls-for-service (CFS) and patrol-initiated activity (PIA). In the latter case, the time of receipt is both the time of dispatch and arrival, since the notification comes from the unit already on the scene. Depending on local preference, personal and administrative time (P&A) should be handled in the same way, with the unit's calling in when it goes off the air and the dispatcher's punching a card marked with the incident code for the type of activity (whether report writing, gassing cruisers, meals, rest stops, or whatever). As an alternative, these times can be accurately estimated for all situations through the conduct of limited time in motion studies. Estimates of average time consumed by P&A can then be applied to all calculations as a constant.

Since units in the field should continually keep the dispatcher informed of their status and activities and, since the dispatcher must write this information on something (even if only a piece of scratch paper), the use of the card as the record by the dispatcher does not add to the time needed to handle a call. In fact, a dispatcher can punch four times on one card in less overall time than would be required to write the time and date once by hand.

3.4 Time Factors

The four milestone times for the handling of each incident by the department define three stages in the life of the incident. The time that elapses between the receipt of the call and the dispatch of the first unit, called "T-1" (or Dispatch Time Elapsed), is the delay in-

volved in getting the information on the call for transmittal to the patrol unit. To use the model of a motor vehicle operator's stopping distance, it is that time necessary for perceiving an obstacle and setting the muscles in motion in response.

The time that elapses from dispatch of the first patrol unit to arrival of the first unit on the scene is called "T-2" (or Travel Time Elapsed). This is the time necessary for a unit to get to the scene once it has been notified. While this entire period may not be spent driving to the scene (but may be consumed by disengaging from a previous scene or picking up backup officers), it is, for all practical purposes, the unit response time to the call.

The time from arrival of the first unit to the clearing of the call by the first unit is referred to as "T-3" (or Service Time Elapsed). This is the basic measure of the length of time necessary for a patrol officer to handle the incident or to deliver the necessary service to the scene.

The first two elapsed times, Dispatch Time Elapsed (T-1) and Travel Time Elapsed (T-2), together make up "T-4" (or Total Response Time). This is actually the time difference between Received and Arrived and is the basic quantitative measure for evaluating police emergency response systems.

The following equation defines T-4:

Received To Dispatched	Dispatched Time Elapsed (T1)	
	+	= Total Response Time (T4)
Dispatched To Arrived	Travel Time Elapsed (T2)	

The sum of the time differences between Dispatched and Received, and between Arrived and Dispatched equals Total Response Time (or T-4).

The second two elapsed times, Travel Time Elapsed (T-2) and Service Time Elapsed (T-3) together make up "T-5" (or Total Patrol Time Consumed). Of the four original milestone times, T-5 is the difference between Dispatched and Clear. For time consumption analysis, T-5 represents the time required to handle an incident by patrol units in the field. The following equation is provided:

Dispatched To Arrived	Travel Time Elapsed (T2)	
	+	= Total Patrol Time Consumed (T5)
Arrived To Clear	Service Time Elapsed (T3)	

The sum of the time differences between Dispatched and Arrived, and Clear and Arrived, equal Total Patrol Time Consumed (or T-5).

The exemplar shown in Figure 3-1 was designed for manual extraction of these times from the time punches and entry of the results right on the face of the card. These calculations can be made with a calculating machine, if nothing else is available, and recorded in the appropriate spaces for later use.

3.5 Alternative Systems

3.5.1 Dispatcher-Operated System

An obvious pattern of organization, particularly for the small and medium-sized departments, is a dispatchers-only recording and time extraction system. The personnel receiving calls from the public also record the details on the incident or dispatch cards, punch in the relevant times, and perform the subtraction and addition necessary for elapsed time and total time consumption calculations on a time-available basis.

This is subject to various disadvantages, particularly inaccuracies due to confused work patterns, and possible omission of significant events. For management, however, it is the simplest to institute and represents the smallest out-of-pocket outlay. It is thus the most likely model for the majority of departments, despite its inherent limitations.

3.5.2 Dispatchers and Research Team System

In this model, the dispatchers or other communications unit personnel record the basic data on each call, including the basic time components. The additional work of extracting and totaling elapsed times is performed by separate planning or research personnel, whose number will depend on the size of the operation, subsequent to the dispatch process.

While this system does nothing more than the previous one to reduce operator error in the dispatch recording, it might produce less hostility and reduce the sources of error. It would certainly give greater assurance of accurate time subtractions and calculations, at the cost of the separate full-time personnel to run it.

3.5.3 Separate Research Personnel

Probably the most satisfactory system from the viewpoint of line personnel is to use completely separate research personnel operating both the time-recording system (without involvement in dispatch procedures) and time calculations. In the absence of automated data processing, with real-time recording of each incident's milestones, a completely autonomous research effort would require something like an industrial time-and-motion study, a massive undertaking where any significant number of incidents occur. Appealing as this alternative might appear to communications personnel, it is unlikely to be widely accepted in practice.

3.5.4 Shift Commander's Individual Assignment

For management, the most rational approach is to give the responsibility for the recording and time extraction functions to the shift commanders. Each commander would receive an explanation of the objectives of the system and would have the responsibility for attaining those objectives in any feasible manner he might choose. While inconsistent with the operating style of most municipal agencies, this would very likely prove a fruitful source of new methods and patterns for time consumption recording and calculation.

4. DATA COLLECTION

The first step in collecting incident data is capturing data; the next is organizing the data collection. Each feasible method and each feasible pattern has drawbacks and advantages. It is for the individual managers in the various municipal agencies to decide on the methods and patterns best adapted to their situations.

4.1 Extraction of Times

There are various ways of extracting the required elapsed and total times from the times punched on the cards by the dispatchers. The simplest involves manual extraction by paper and pencil or calculating machine. The most complex involves keypunching of the data or analysis by specially prepared electronic data processing (EDP) programs. What is essential for the operation of an incident and crime analysis system, let alone a manpower analysis system, is that time duration data for various classes of incident be extracted in some reliable fashion.

Judicious sampling may be needed to obtain average times for the different classes of incident (three are recommended herein). The duration and extent of such sampling must depend on the volume of incidents handled. The greater the volume, the quicker a statistically valid sample may be compiled. It is recommended that a standard text on graduate statistical methods be consulted for guidance on sampling techniques.

Whatever method is employed, it must be remembered that the objective is to extract, for the three classes of data, mean times to complete the format shown in Figure 4-1.

	Differences of Benchmark Times			Sums of Differences	
Incident Categories	T-1 (Dispatch Time Elapsed)	T-2 (Travel Time Elapsed)	T-3 (Service Time Elapsed)	T-4 (Response Time) (T-1 + T-2)	T-5 (Patrol Time Consumed) (T-2 + T-3)
Calls-for-Service					
Patrol-Initiated Activity					
Personal & Administrative					

Figure 4-1. Extraction of Times -- Sample Format

4.2 Incident Tallies

The information from the incident cards should be aggregated in several different ways because each desirable end use has differing requirements. Basically, a *minimum* of three tallies should be considered, each being summarized into monthly and yearly totals. In ascending order of complexity (and descending point of use in the organization of the department), these are general categorical aggregations used by the chief and his immediate staff to:

- Gain an overall picture of departmental activity and trends.
- Derive shift and reporting area tabulations for use by bureau and shift commanders to make deployment decisions and to picture activity trends within their respective spheres of responsibility.
- Formulate time consumption calculations used by the planning staff to make recommendations for staffing and deployment.
- Accomplish crime and incident analysis as well as manpower availability and requirements analysis.

The end product at the first level should give at least the activity by the three categories (calls-for-service, patrol-initiated activity, and personal and administrative) by months, as shown in Figure 4-2. These monthly categorical summaries give the possibility of annual comparisons, eventually revealing trends in the data, as shown in Figure 4-3.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Calls-for-Service	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Patrol-initiated Activity	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Personal and Administration	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
TOTAL	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXXX

Figure 4-2. Reported Police Activity by Categories and Months -- Sample Format

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Calls-for-Service	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
Patrol-initiated Activity	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
Personal and Administration	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
TOTAL													

Figure 4-3. Percent Comparison Between 1976 and 1977 -- Sample Format

This information can then be used for comparisons from year to year, as a way of making the information more meaningful. One easy comparison is in the percentage of change from one year to another, as illustrated in Figure 4-3, where it is the relative amount by which 1977 activity varied from 1976. Like all percentages, it expresses a relationship, not absolute quantities of values.

If kept in categorized form as shown in Figures 4-1 through 4-3, the information would be more comprehensive than the Index crimes alone. This would not contribute very much to understanding *when* the activity occurred, an important factor in estimating manpower needs and distribution. The effort saved by tabulating the activities in groups can and should be reinvested in keeping the tabulations broken down by time. It is recommended that police activity be tabulated by hour of the day for the particular sample period under study. The resulting summaries would be arranged in a format similar to that shown in Figure 4-4.

This time analysis would give the chief some idea of whether his men are distributed onto shifts in a way that reflects the demand for their services. There are other factors, but time analysis should be the main consideration. Keeping activity records this way would give the department a basic analysis capability with very little additional expenditure of effort.

This information can be used in several ways to picture the department's changing demands. One is to tabulate the yearly percentage changes by month, and this information can be presented graphically. It is this

Hour of Day	Calls-for-Service	Patrol-Initiated Activity	Personal/Administrative
00-01			
01-02			
02-03			
03-04			
04-05			
05-06			
06-07			
07-08			
08-09			
09-10			
10-11			
11-12			
12-13			
13-14			
14-15			
15-16			
16-17			
17-18			
18-19			
19-20			
20-21			
21-22			
22-23			
23-24			

Figure 4-4. Police Activity Summary -- Sample Format

sort of clear, simple analysis of the activity records that is likely to mean much more to the mayor and council members -- the parties to whom the annual report is actually made -- than long lists of miscellaneous figures.

Even if a department instituted a system of recording activity by time that will only allow eventual judgments about the assignment of patrolmen to shifts, results will give little guidance in determining where officers should be assigned. For the chief to be able to accomplish this important step in the planning process, a geographical breakout of the information is needed. There are a number of ways of doing this, some more cumbersome than others. As with many efforts, the return (in usable information) is proportional to the effort invested (in record-keeping and cross-tabulating). One system that seems to offer a reasonable compromise between too little information to be objectively useful and too much clerical demand to be feasible is to record the activity by shift.

Each tabulation by category and shift, however, should be kept separately for specific geographical areas called *geo-codes*. For example, if 25 areas are found to be desirable, then there would be 27 tabulation sheets for each reporting period (one for each geo-code area, one for "out of town," and one for incidents in which the location is unknown). These would be compiled into 27 annual summaries, then into one consolidated annual summary. These areas would be for reporting purposes only, not patrol districts. There should be a sufficient number that each patrol district would be composed of a number of geo-codes, so that

adjustments can be made back and forth between districts as future analysis suggests fluctuations in the demands for service.

After some experience with the tabulation process, modifications can appear desirable. There are a number of considerations in making such a division: Dividing lines (should they follow streets and natural barriers, or allow the line of houses fronting on each street to be included?), the size of area to be included (very large for ease of tabulation or very small for maximum flexibility in data use?), inclusiveness (for example, what areas present special problems?). These are best decided by the people who will use the data after it is assembled.

Armed with a system of tabulation by area and by shift, the department will be able to sit down and evaluate its deployment and activity characteristics and needs. To do this at all adequately, probably a full year's information will be needed to reflect a true picture of all seasons and influences. As it passes, each year will improve the data base, and trends will become more clearly defined over time. This process is very similar to that of analyzing traffic problems for selective enforcement, and the same personnel could very likely do it on a regular basis.

It is entirely possible that the department would find more useful a breakout giving functional or classified groupings of incidents on the first and second level tabulations. That is, the available types of calls-for-service might be tallied more extensively so as to give trend data on incident code list classifications, which are made with a view to reflecting the functions the patrol personnel perform.

For example, crimes might be given as a separate group, broken down by Index crimes to permit comparison with the annual national Uniform Crime Reports (UCR) published each year by the U.S. Federal Bureau of Investigation. Another group might include all emergency medical services (EMS), since these are now subject to many specialized Federal and State regulatory agency standards. Another might include traffic accidents, because of the importance of traffic safety planning in the reduction of life and property damage hazards. The resulting tabulations might give an annual summary such as the example shown in Figure 4-5. These expanded summarizations would result in an expanded comparison, shown in Figure 4-6. The expanded summary by shift is shown in Figure 4-7.

The tabulation system adopted should form a unified whole with the records system and any other information handling in the department. To achieve this, one should bear in mind the ultimate uses of the information collected.

The records of a police department serve many purposes, both for supporting day-to-day operations and as a source of historical data. Aside from personal recollection, the records are the only source of continuity in a police department. An adequate records system is necessary for:

- Determining the nature, extent, and distribution of crime and other police-related activities.
- Aiding management in deployment of the patrol force.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Index Crimes	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Other Crimes	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Emergency Medical Services	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Fatal Accidents	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Other Accidents	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Other Calls-for-Service	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XXX
TOTAL	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXXX

Figure 4-5. Reported Police Activity by Categories and Months -- Expanded Sample Format

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Index Crimes	±X	±X	±X	±X	±X	±X	±X	±	±X	±X	±X	±X	±X
Other Crimes	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
Emergency Medical Services	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
Fatal Accidents	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
Other Accidents	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
Other Calls-For-Service	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X
TOTAL	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X	±X

Figure 4-6. Percent Comparison Between 1976 and 1977 -- Sample Format

Shift	Index Crimes	Other Crimes	Emergency Medical Services	Fatal Accidents	Other Accidents	Other Calls-for Service	TOTAL
1	X	X	X	X	X	X	XX
2	X	X	X	X	X	X	XX
3	X	X	X	X	X	X	XX
TOTAL	XX	XX	XX	XX	XX	XX	XXX

Figure 4-7. Expanded Police Activity Summary by Shift -- Sample Format

- Controlling the investigation of crime.
- Highlighting the modus operandi as an aid to criminal apprehension.
- Providing basis for democratic control and protection of department personnel.
- Revealing unusual, emerging, or recurring situations.
- Providing a data base of analysis of crime and traffic accidents.
- Aiding investigators.
- Controlling arrests and their dispositions.

To meet the above needs and be fully effective, a police records system must:

- Be comprehensive, and include every police incident reported to the department.
- Be adequately indexed to permit ready reference.
- Be centralized to provide adequate control and minimum utilization of clerical personnel.
- Be as simple as possible, while maintaining its completeness.
- Lend itself to summarization and analysis to permit periodic appraisal of police services.

The table of comparisons of incident categories from year to year gives an example of the type of general information that a records system should generate. More detailed and specific information is also possible using manual methods.

4.3 Four Alternatives for Processing Incident Data

The information from the incident cards must be converted into time consumption data for manpower analysis. A hierarchy of four ways is briefly outlined here, from a wholly manual method suitable to a small department without electronic data processing (and which is rather laborious) to a wholly electronic method for a department with access to data processing. With manual methods, the volume of material to be handled makes it impractical to process each individual card by hand, so sampling techniques must be used to estimate the total values.

4.3.1 Alternative One -- A Manual Method

Two items of information are necessary to manpower calculations: The *numbers* of incidents or police activities, by categories, that occurred during a sample period; and the *length of time* required to handle each category. For hand calculations, tally sheets must be used to collect the numbers of incidents in each category occurring on each shift. The time factors must be extracted separately. This process will also illustrate concepts necessary to an understanding of more technological systems. Two recommended levels of manual processing of data are shown in the next section.

Given the small number of categories used in this wholly manual method, however, the average times derived may have little theoretical advantage over the hazard equations disparaged in Chapter 1.

4.3.2 Alternative Two -- A Mixed Manual and Mechanical Method

For the department with access to keypunching equipment, much effort can be saved by having each incident card keypunched for incident code,

area, benchmark times, the day of the week, and the elapsed times (if these are subtracted out by dispatchers or clerks on each shift as the cards are made out). Mechanical card sorters or a standard sort program available with most EDP equipment permit sorting for any chosen factors. For example, all incidents occurring on the first shift can be sorted out; then, of these, all calls-for-service among them sorted out; then among these, all calls-for-service occurring in a certain area. This sorting process on keypunched data provides an easier and relatively less painful method of tabulating the incident cards than hand work.

These mechanical incident tallies can be multiplied together with hand-sampled average times to derive more extensive time consumption estimates than any entirely manual method permits. For example, it would be possible to estimate time consumed in each individual reporting area on each shift, far too complicated if tallied by hand.

4.3.3 Alternative Three -- A Semiautomated Method

Where data processing equipment and some programming is available, it is possible to keypunch cards, tally the incidents by shift and area or even by hour-of-the-day, by area, for each category. It also becomes practical to use more categories, since the labor of tallying is eliminated. A relatively simple program is required for extraction of the elapsed times. Such a program can also add them up to give an actual total of time consumed, rather than an estimate.

The U. S. Law Enforcement Assistance Administration has supported the development of programs which, while they do not go so far as to give the sum of all incident times, will give the average times and the incident tallies by hour-of-the-day, by

shift, and by area. Thus, only relatively simple hand calculations are required to convert the average times and numbers of incidents into time comsumption estimates. Otherwise, the planner should seek to find a local resource where equipment can be rented for keypunching data, and sorting of data cards can be accomplished using a mechanical sorter.

4.3.4 Alternative Four -- A Fully Automated Method

Presently under development as an elaboration of the systems mentioned above, programs will soon be available for direct conversion of key-punched incident card data into time consumption factors for manpower analysis. Extensive and flexible tallies of incidents (such as time consumed by hour-of-the-day, by area, by category) and the simpler raw tallies of incidents (numbers of incidents by hour-of-the-day, by area, by category) will of course remain available.

Without canned programs, it is always possible for a department with data processing skills available to produce a program on its own. In any event, a fully automated system permits maximum concentration of limited planning resources on use of the data rather on the manipulations necessary to acquire it.

5. PATROL TIME CONSUMPTION ANALYSIS

5.1 Manual Processing

The analysis of patrol time consumed during a sample period is extremely time consuming and is obviously subject to a high degree of error. By necessity, the processing of high volumes of data severely restricts the study to bare minimum considerations. Any attempt by a department to conduct a consumed-time patrol study where there is a large volume of activity should be accomplished only on a limited basis. Consequently, manual processing is deemed advisable only for smaller departments that are unable to gain access to automated equipment.

There are two levels of analysis recommended for departments processing data manually. The first level is based upon the application to raw incident tallies of sampled average consumed times obtained for each incident category. The second level is for those departments that desire a more exacting analysis of patrol time consumed; it relies heavily on laborious computations of expended time from completed incident and dispatch cards.

5.1.1 Manual Processing -- Level 1

Under Level 1 manual processing, it is assumed that the department has adopted a procedure outlined in previous sections where the following minimum data is captured:

- Raw tallies of incidents by shift according to three categories (calls-for-service,

patrol-initiated activity, and personal and administrative).

- Sample of dispatch and incident recording cards from each of the three categories to obtain total patrol time consumed averages for each category.

Through use of the Patrol Time Availability and Expenditure form shown in Figure 5-1, the following should be accomplished daily at the end of each shift (each time entry should be in terms of minutes):

(a) Determine Patrol Time Availability during the shift by multiplying the number of officers assigned to patrol by the duration of the shift (i.e., 8 hours, 10 hours, etc.). Enter the result in the Patrol Time Available block for the appropriate shift.

(b) Determine calls-for-service average total consumed time by multiplying the number of calls for service received during the shift by the average consumed time determined from a sampling of cards in the category stack. Enter the result in the CFS block. (Remember, if two officers respond to the call, the time is doubled).

SUMMARY
Patrol Time Availability & Expenditure
by Category

SHIFT 1	Sample Period	Patrol Time Available	CFS	PIA	P&A
	Total				
			%	%	%

SHIFT 2	Sample Period	Patrol Time Available	CFS	PIA	P&A
	Total				
			%	%	%

SHIFT 3	Sample Period	Patrol Time Available	CFS	PIA	P&A
	Total				
			%	%	%

All Shifts				
	Total	%	%	%

Final Summary

Shift 1	#			
		%	%	%
Shift 2	#			
		%	%	%
Shift 3	#			
		%	%	%

Figure 5-1. Daily End-of-Shift Compilation Form

(c) Determine patrol-initiated activity average total consumed time by multiplying the number of officer-initiated activities recorded during the shift by the average consumed time determined from a sampling of cards in the category stack. Enter the result in the PIA block. (Note: For some departments, patrol-initiated activity data will be difficult to separate from calls-for-service data unless a previous policy has been established where patrol-initiated activity cards are given a peculiar identifying characteristic such as "PI" written on the card. In cases where the patrol-initiated activity data cannot be obtained, simply assume that calls-for-service contains both categories, and ignore the PIA block).

(d) Determine personal and administrative average total consumed time by multiplying the number of personal and administrative activities recorded by the average consumed time determined from sampling of the cards. Enter this figure in the P&A block.

(e) Depending upon the length of time covered by the form (maximum = 3 days), total all entries in all columns and enter the results in the Total block under each category.

(f) To determine percent of time consumed in each of the three categories, divide the individual category total consumed times by the corresponding patrol time available entry, and multiply by 100. The result will show shift variations in time consumed by activity. The amount of unobligated time is determined by simply adding the percents from each category, subtracting the sum from 100, and multiplying the remaining percent by total patrol time available.

(g) To obtain a reflection of time consumed on all shifts, add the corresponding entries for all shifts and enter the totals in the appropriate column in the All Shifts field. Percents of consumed time for each category, as well as unobligated time, are calculated the same way as was done in Step f.

(h) Final Summary entries for each shift or a series of shifts are obtained by adding the totals under each category for each shift and entering the results in the appropriate block in the Final Summary field. Percentage calculations can then be computed on the basis of total patrol time available during the period covered.

Depending upon available resources, a number of other variations can be developed, using the same data base and sampling technique. For example, shift totals can be further broken down into hourly figures by individual beat. The results will be valuable, but the amount of effort involved in such an undertaking is immense. However, for the smaller departments, this extended approach can be worth the effort, given the low incident volumes and increased analysis capability. Level 2, described in Section 5.1.2, is addressed to those departments which find the extended approach more desirable and practical.

5.1.2 Manual Processing -- Level 2

Considerably more time-consuming and comprehensive, Level 2 manual processing embodies the same basic objectives and output level as those of automatic processing of data; however, it is considerably less comprehensive in content. Level 2 manual processing requires the use of two additional forms to record the data, shown in Figures 5-2 and 5-3.

Since Level 2 processing involves hand computations from each Police Dispatch and Incident Reporting Card, it is recommended for ease of handling that the Patrol-Initiated Activity category not be considered separately. Thus, the calls-for-service or service activities would include both calls-for-service and patrol-initiated activity. The second category would remain as personal and administrative time.

Using the Patrol Time Availability and Expenditure Form in Figure 5-2, perform the following steps:

PATROL TIME AVAILABILITY AND EXPENDITURE BY DAY OF MONTH

DATE	AVAILABLE TIME	CFS	PERSONAL	PATROL	TOTAL
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
TOTAL					

SHIFT _____ MONTH _____

Figure 5-2. Daily Compilation Form

SUMMARY

REPORT PERIOD

PATROL BEAT CONSUMED TIME

PATROL BEATS

	12	13	14	15	16	17	18	19	20	21	TOTALS
0-1											
1-2											
2-3											
3-4											
4-5											
5-6											
6-7											
7-8											
SSHIFT TOTAL											
8-9											
9-10											
10-11											
11-12											
12-13											
13-14											
14-15											
15-16											
SHIFT TOTAL											
16-17											
17-18											
18-19											
19-20											
20-21											
21-22											
22-23											
23-0											
SHIFT TOTAL											
TOTAL											

Figure 5-3. Patrol Beat Compilation Form

(a) Collect all Police Dispatch and Incident Reporting Cards for each shift. Ideally, the procedure should be repeated at the end of each shift. However, at a minimum, the process should be accomplished on a daily basis.

(b) Separate the cards by shift.

(c) For each shift, separate the cards that reflect patrol personal and administrative time.

(d) Total all personal and administrative patrol consumed time.

(e) Enter the total personal and administrative consumed time for the shift in the personal column for the appropriate day-of-the-month.

(f) Total all expended time on the remaining service cards, and enter the result in the CFS column for the appropriate day-of-the-month.

(g) Using department records, if necessary, determine total patrol time available for the shift by multiplying total number of patrol officers by the number of hours in the shift. Enter the result in the Available Time column for the appropriate day-of-the-month.

(h) Determine patrol time by subtracting the total of calls-for-service and personal and administrative

consumed time from available time. Enter the result in the Patrol column.

(i) Sort all calls-for-service cards into chronological order by hour-of-the-day.

The remaining steps in the procedure apply to Patrol Beat Consumed Time form (Figure 5-3).

(j) Beginning with the first hour-of-the-day, enter the total patrol time consumed for each patrol beat with reported and recorded activity. Continue to enter patrol time consumed by beat for each hour-of-the-day.

(k) After each hour has been accounted for, compute and enter the Total for each shift, and Total by beat for each hour-of-the-day.

(l) At the end of each day, total all shift patrol time consumed by incident category using a separate Daily Compilation Form (Figure 5-2). Repeat the same process every day until the end of the month, when monthly totals can be computed. In addition, at the end of each day, compute daily totals on the Patrol Beat Compilation Form (Figure 5-3). Continue the process for each day of the month. Use a separate Patrol Beat Compilation Form to reflect monthly summary of all beats by hour-of-the-day.

5.1.3 Analysis of Manual Data

Data extracted manually from the Police Dispatch and Incident Reporting cards should at least provide the administrator with the capability to determine workloads by shift, as reflected in Level 1 processing. This allows for time consumption analysis in terms of the three major categories of patrol activity and enables the administrator to determine how the total time allocated to patrol has been utilized. More importantly, he is able to get a reasonably accurate picture of the total unobligated time during patrol shifts. Whatever the extent of analysis, each user should be aware that totals reflected for consumed time have been achieved through application of averages drawn from samples of cards in each category. As a result, decisions made based on the data should be thoroughly considered before implementation of major changes in allocation or deployment of patrol resources.

Level 2 data provides the basic information necessary to evaluate present workloads according to area and time, the minimum standard for analysis of patrol deployment systems as recommended by the National Advisory Commission on Criminal Justice Standards and Goals. Geographic distribution of service demands is obtained through the collection of data according to police beat.

For more extensive analysis, the use of geo-codes or individual report areas is recommended. Use of the data collection instruments on a daily basis allows analysis of service demands according to seasonal, daily, and hourly variations. Finally, workload analysis

can be accomplished through the collection of data on demands for police service and the time consumed by activities of patrol personnel.

5.2 Mechanical Processing

For departments handling a large volume of data on a daily basis, the use of a mechanical or electronic processing capability is essential. To reflect the community's need for various police services and the types of activities performed by patrol officers, medium-sized and large departments must have the capability to collect and analyze vast amounts and types of data. For collection and analysis of patrol deployment data, it is essential that all demands for and drains on police service resources be accounted for. This requires the collection of data in the dispatch area in a form that will permit subsequent analysis by:

- Crime type.
- Service type.
- Time.
- Location or area.
- Patrol beat.
- Patrol unit.
- Total Response Time.
- Total Patrol Time Consumed.
- Seasonal variations.
- Day-of-the-week variations.
- Workload.

Time and geographic variations are critically important when evaluating crime patterns, calls-for-service, trends, and other deployment factors. Geographic distribution of deployment data is necessary in developing area assignments and evaluating present beat distributions. Response time is essential for proper evaluation of effective service demand delivery in the community. Patrol time consumed factors are critical to the agency's evaluation of workload and police patrol activity. Chronological distribution of the demands for services, and the resulting workloads, is important for determining seasonal, daily, and hourly fluctuations. Each one of these factors must be included in a patrol deployment analysis system. The following paragraphs are taken from the National Advisory Commission on Criminal Justice Standards and Goals - The Police, Standard 8.3, Deployment of Patrol Officers:

> "The first step in developing a deployment data base is to determine the distribution of patrol personnel workload. The workload study must include a comprehensive assessment of the demands for patrol services in the community, and the types of activities, services, and duties routinely performed by patrol personnel. Three fundamental patrol operation responsibilities must be considered in determining workload distribution: crime, calls for service, and arrests.
>
> "Reported crimes and calls for service should be analyzed by type, date, time, and location of occurrence. The time spent by patrol officers in both cases should be analyzed by assigned area, date, shift, and average time expended. An analysis should also be made of delay time in dispatching calls and response time to calls for services.
>
> "Arrests by patrol personnel also should be analyzed by type, date, time, location, and average time expended. Comparisons of apprehensions to reported crimes should be made by assigned area and type.
>
> "Data on crime, calls for services, and arrests, however, will not provide a complete picture of patrol supply and demand. It is necessary to determine what percentage of

> total patrol time is expended on nonemergency and non-criminal matters not directly connected with the primary duties of crime repression, criminal apprehension, and handling calls for services. A workload study should include an analysis of factors influencing field unit availability such as time spent on community interaction meetings, vehicle maintenance, court appearances, and all other public service and administrative activities."

This section is devoted to a description of a time consumption or workload analysis data system required for proper implementation of the National Advisory Commission's recommendations. The process of data capture is covered, and suggested minimum aggregations of data is presented. It should be noted that all data aggregations and computations are assumed to be performed by either mechanical or electronic means. In the case of mechanical means, some hand processing and calculating of data will be necessary.

5.2.1 Data Collection

Collection of incident data for time consumption analysis requires the use of a dispatch and incident recording card similar to that shown in Figure 3-1, with all of the analysis data elements located on the right hand portion of the card. Unlike data capture for manual processing, collection of time consumption data for mechanical or electronic processing requires that only the four benchmark times (Receipt, Dispatch, Arrival, Clear) be keypunched. Time consumption factors to include Travel Time Elapsed (T2), Service Time Elapsed (T3), Total Response Time (T4), and Total Patrol Time Consumed (T5) are calculated by the computer.

In addition, a complete incident code list is used, with individual incidents broken down by major categories. An example of a completed incident code list for time consumption analysis is shown in Table 5-1. As a result, time consumption analysis includes only those services, incidents, or patrol activities that are reported to and recorded by the dispatcher. Any patrol activity not reported to the dispatcher is not included in the analysis.

5.2.2 Individual Report Content

Time consumption analysis requires computer processing of incident and dispatch data to form seven separate reports. Each report is discussed briefly in the paragraphs below, and a sample format for each report is shown.

5.2.2.1 Average Times by Incident and Category

This report lists each incident by category with separate notations reflecting the number of reported incidents, average time per incident, and total average time consumed by each incident and each incident category. An example report format is shown in Figure 5-4. The Number of incidents column represents the raw totals of reported incidents during the sample period.

The Average Time Per Incident represents the average patrol time consumed (dispatch-clear) for each incident and category. Average time is calculated by taking the total patrol time consumed for all reported incidents (i.e., robbery) and dividing this figure by the raw incident totals.

TABLE 5-1

Incident List by Category

Part I Crimes

Criminal Homicide
Forcible Rape
Robbery
Aggravated Assault
Burglary
Larceny
Motor Vehicle Theft

Part II Crimes

Other Assaults
Arson & Bombing
Forgery & Counterfeiting
Fraud
Embezzlement
Stolen Property
Vandalism
Weapons Violations
Prostitution
Sex Offenses
Drug Law Violations
Gambling
Offenses Against Family and Children
O.U.I.
Violation of Liquor Laws
Disorderly Conduct
Other Part II Offenses
Juvenile Offense
Violation- Local Laws

Miscellaneous Incidents

Patrol Field Investigation
Civil Complaint
Missing Person
Missing Property
General Disturbance
Family Disturbance
School Disturbance
Gang Disturbance
Noise Complaint
Annoying Phone Calls
Suspicious Activity
Officer Wanted
Escort Service
Prisoner Transport
Citizen Assist

Miscellaneous (continued)

Building Check
Message Delivery
Animal Complaint
Assist Municipal Agencies
Fire Alarm
Burglar Alarm
Assist Other Agencies

Arrests/Safekeeping

Field Arrest
Arrest on Process
Protective Custody

Emergency Medical Service

Ambulance
Medical/Mental Service
Reported Death

Traffic Service

Traffic Complaint
Motor Vehicle Complaint
Radar Assignment
Abandoned Vehicle
Vehicle Stop (Summons, Citation, Warning, etc.)

Accidents

Motor Vehicle Accident
  Fatal
  Personal Injury
  Property Damage
  Fatal & Personal Injury

Administrative Service

Intra-Department Service
Court Appearance
Service Cruiser
Meal Break
Coffee Break
Report Preparation
Other

AVERAGE TIME BY INCIDENT AND CATEGORY

PART I INCIDENTS	Number	Ave. Time Per Incident	Tot. Ave. Consumed Time
Criminal Homicide			
Forcible Rape			
Robbery			
Aggravated Assault			
Burglary			
Larceny			
Motor Vehicle Theft			
Total			

PART II INCIDENTS

Other Assaults			
Arson & Bombing			
Forgery & Counterfeiting			
Fraud			
Embezzlement			
Stolen Property			
Vandalism			
Weapons Violations			
Prostitution			
Sex Offenses			
Drug Law Violations			
Gambling			
Offenses Against Family & Children			
O.U.I.			
Violation of Liquor Laws			
Disorderly Conduct			
Other Part II Offenses			
Juvenile Offense			
Violation Local Laws			
Total			

Figure 5-4. Average Time Compilation Form
(Page 1 of 4)

MISCELLANEOUS INCIDENTS	Number	Ave. Time Per Incident	Tot. Ave. Consumed Time
Patrol Field Investigation			
Civil Complaint			
Missing Person			
Missing Property			
General Disturbance			
Family Disturbance			
School Disturbance			
Gang Disturbance			
Noise Complaint			
Annoying Phone Calls			
Suspicious Activity			
Officer Wanted			
Escort Service			
Prisoner Transport			
Citizen Assist			
Building Check			
Message Delivery			
Animal Complaint			
Assist Municipal Agencies			
Fire Alarm			
Burglar Alarm			
Assist Other Agencies			
Total			

ARRESTS/SAFE KEEPING

FIELD ARREST			
ARREST ON PROCESS			
PROTECTIVE CUSTODY			
TOTAL			

Figure 5-4. Average Time Compilation Form
(Page 2 of 4)

TRAFFIC SERVICES	Number	Ave. Time Per Incident	Tot. Ave. Consumed Time
Traffic Complaint Motor Vehicle Complaint Radar Assignment Abandoned Vehicle Vehicle Stop (Summons, Citation, Warning) Total			

EMERGENCY MEDICAL SERVICES

Ambulance Medical/Mental Service Reported Death Total			

ACCIDENTS

Motor Vehicle Accident Fatal Personal Injury Property Damage Fatal & Personal Injury Total			

Figure 5-4. Average Time Compilation Form
(Page 3 of 4)

ADMINISTRATIVE SERVICES	Number	Ave. Time Per Incident	Tot. Ave. Consumed Time
Intra-Department Service			
Court Appearance			
Service Cruiser			
Meal Break			
Coffee Break			
Report Preparation			
Other			
Total			

ALL CATEGORIES			
PART I INCIDENTS			
PART II INCIDENTS			
ARRESTS/SAFE KEEPING			
TRAFFIC SERVICES			
EMERGENCY MEDICAL SERVICES			
ACCIDENTS			
ADMINISTRATIVE SERVICES			
TOTALS			

Figure 5-4. Average Time Compilation Form
(Page 4 of 4)

Many service calls require backup units, which increases the department's expenditure of manpower considerably. The Police Dispatch and Incident Reporting Card (see Figure 3-1) accounts for multiple responses with a separate block on the card for Total Officers. As a matter of administration, a backup unit should be available for the entire duration of the call whenever one is needed. This allows complete coverage of any officer needing assistance with a minimum loss of time. The alternative (and more precise) method of calculation would require that backup time be recorded at the dispatch area using a separate card identified with a different color.

The average times should be adjusted for actual manpower time consumed by multiplying the duration of the patrol service by the number of police officers on the scene. The result for each incident is average time per incident.

Total Average Time Consumed is obtained by multiplying the Number of raw incidents by the Average Time Per Incident. To obtain category averages, the same procedure is used except that raw totals of incidents and average times are calculated using the sums for each category.

5.2.2.2 Incident Categories by Time-of-the-Day

A sample format for the Incident Categories by Time-of-the-Day is shown in Figure 5-5. The report is simply a breakdown of reported incidents in each category by time-of-the-day. Shift totals for each category, as well as grand totals, are reflected in the report.

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
00-01									
01-02									
02-03									
03-04									
04-05									
05-06									
06-07									
07-08									
SHIFT TOTALS									

Figure 5-5. Incident Categories by Time-of-the-Day
(Page 1 of 3)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
08-09									
09-10									
10-11									
11-12									
12-13									
13-14									
14-15									
15-16									
SHIFT TOTALS									

Figure 5-5. Incident Categories by Time-of-the-Day
(Page 2 of 3)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
16-17									
17-18									
18-19									
19-20									
20-21									
21-22									
22-23									
23-00									
SHIFT TOTALS									

Figure 5-5. Incident Categories by Time-of-the-Day
(Page 3 of 3)

5.2.2.3 Incident Patrol Time Consumption by Time-of-the-Day

The Incident Patrol Time Consumption by Time-of-the-Day report, an exemplar of which is shown in Figure 5-6, reflects the total average time in minutes consumed for each category of incident by time-of-the-day. Shift totals, hourly totals, and grand totals are included.

5.2.2.4 Incident Category Workload by Time-of-the-Day

The Incident Category Workload by Time-of-the-Day report, shown in Figure 5-7, indicates the percentage workload for each incident category by time of day, with corresponding hourly and shift totals. Percentage workload is computed in terms of time consumed or minutes of patrol time. The percentage for each category by hour-of-the-day is calculated by taking the total average time consumed throughout the duration of the sample. The result is then multiplied by 100 to obtain a percent.

5.2.2.5 Average Response Time by Category

A sample report format for Average Response Time by Category is shown in Figure 5-8. This report indicates raw incident totals (II) and average response times (ART) for each incident and category by individual shift. Response times can be calculated on the basis of elapsed time from dispatch to arrival, or from receipt of initial call to arrival. For purposes of patrol time consumed, the former is preferred.

Average response times are obtained by adding together the elapsed patrol response time for each incident and dividing the total by the

(MINUTES)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
00-01									
01-02									
02-03									
03-04									
04-05									
05-06									
06-07									
07-08									
SHIFT TOT TOTALS									

Figure 5-6. Incident Patrol Time Consumption by Time-of-the-Day
(Page 1 of 3)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
08-09									
09-10									
10-11									
11-12									
12-13									
13-14									
14-15									
15-16									
SHIFT TOTALS									

Figure 5-6. Incident Patrol Time Consumption by Time-of-the-Day
(Page 2 of 3)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin	TOTALS
16-17									
17-18									
18-19									
19-20									
20-21									
21-22									
22-23									
23-00									
SHIFT TOTALS									

Figure 5-6. Incident Patrol Time Consumption by Time-of-the-Day
(Page 3 of 3)

CONTINUED

1 OF 2

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
00-01									
01-02									
02-03									
03-04									
04-05									
05-06									
06-07									
07-08									
SHIFT TOTALS									

Figure 5-7. Incident Category Workload by Time-of-the-Day
(Page 1 of 3)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
08-09									
09-10									
10-11									
11-12									
12-13									
13-14									
14-15									
15-16									
SHIFT TOTALS									

Figure 5-7. Incident Category Workload by Time-of-the-Day
(Page 2 of 3)

Category / Hour	Part I	Part II	Miscel.	Arrest	EMS	Traffic	Accidents	Admin.	TOTALS
16-17									
17-18									
18-19									
19-20									
20-21									
21-22									
22-23									
23-00									
SHIFT TOTALS									

Figure 5-7. Incident Category Workload by Time-of-the-Day
(Page 3 of 3)

PART I INCIDENTS	SHIFT I		SHIFT II		SHIFT III		TOTAL	
	#	ART	#	ART	#	ART	#	ART
Criminal Homicide								
Forcible Rape								
Robbery								
Aggravated Assault								
Burglary								
Larceny								
Motor Vehicle Theft								
TOTALS								

PART II INCIDENTS				
Other Assaults				
Arson & Bombing				
Forgery & Counterfeiting				
Fraud				
Embezzlement				
Stolen Property				
Vandalism				
Weapons Violation				
Prostitution				
Sex Offenses				
Drug Law Violations				
Gambling				
Offenses Against Family/Children				
O.U.I.				
Violation of Liquor Laws				
Disorderly Conduct				
Other Part II Offenses				
TOTALS				

Figure 5-8. Average Response Time by Category
(Page 1 of 2)

Miscellaneous Incidents	SHIFT I		SHIFT II		SHIFT III		TOTAL	
	#	ART	#	ART	#	ART	#	ART
Civil Complaint								
Missing Person								
General Disturbance								
Family Disturbance								
School Disturbance								
Gang Disturbance								
Noise Complaint								
Annoying Phone Calls								
Suspicious Activity								
Officer Wanted								
Escort Service								
Citizen Assist								
Animal Complaint								
Fire Alarm								
Burglar Alarm								
TOTAL								

EMS/ACCIDENTS								
Ambulance								
Medical/Mental Service								
Reported Death								
Vehicle Accident								
TOTAL								

Figure 5-8. Average Response Time by Category
(Page 2 of 2)

number of incidents reported. Category averages are obtained by adding together the total elapsed response times and dividing the sum by the number of incidents in each category. Individual shift totals for each incident and incident category are reflected.

5.2.2.6 Category Workload by Beat/Sector

The Category Workload by Beat/Sector report, shown in Figure 5-9, depicts raw totals and consumed time workload percentages for each patrol beat or sector report area. For each category of incident, a beat raw total and workload percentage by shift is shown. Percentage workloads by beat are obtained by dividing the average consumed time for each beat by the total average time consumed during the duration of the report period. Separate sheets can be used if the number of beats or sector report areas exceeds the number shown on the report form.

5.2.2.7 Category Workload by Day-of-the-Week

Shown in Figure 5-10, the Category Workload by Day-of-the-Week report reflects the raw totals of incidents and consumed time workload percentages by day-of-the-week for each incident category. Workload percentages are obtained by dividing the patrol time consumed (minutes) for a given day by the total patrol time consumed for each day during the sample period, and multiplying the result by 100 to obtain a percentage.

Category / Sector/Beat	Part I #	Part I %	Part II #	Part II %	Miscel. #	Miscel. %	Arrests #	Arrests %	EMS #	EMS %	Traffic #	Traffic %	Accidents #	Accidents %	Admin. %	Admin. %
Sector/Beat 12 Shift I Shift II Shift III																
Sector/Beat 13 Shift I Shift II Shift III																
Sector/Beat 14 Shift I Shift II Shift III																
Sector/Beat 15 Shift I Shift II Shift III																
Sector/Beat 16 Shift I Shift II Shift III																

Figure 5-9. Category Workload by Beat

CATEGORY	SUNDAY #	%	MONDAY #	%	TUESDAY #	%	WEDNESDAY #	%	THURSDAY #	%	FRIDAY #	%	SATURDAY #	%
PART I														
PART II														
MISCEL.														
ARRESTS														
EMS														
TRAFFIC														
ACCIDENTS														
ADMIN.														
TOTALS														

Figure 5-10. Category Workload by Day-of-the-Week

6. MANPOWER ANALYSIS

6.1 Manpower Available to Meet Service Demands

The first requisite for manpower analysis is the determination of what manpower is assigned to the patrol function (that is, what is potentially available) and then what fraction of that assigned manpower is actually available on the street. This availability is conditioned by various time-off factors (vacations, days off, etc.) and, for planning purposes, is best expressed in terms of an "average patrolman" or "average daily strength." These are statistical conveniences for *predicting* the amount of work time to be expected from any one officer or the number of officers likely to be on duty any day.

Since no officer works 365 days a year with no vacations, days off, illness, injuries, or other reasons for absence, the number of officers *available* for duty will always be some fraction of the total number *assigned*. The ratio of officers assigned to the number actually available is called the Assignment/Availability Factor.

The availability of police personnel to perform routine patrol functions is one of the most important considerations for a manpower analysis study. Among those factors that directly affect the assignment of personnel are:

- The daily work schedule for the entire department.
- Sick leave.

- Injured leave.
- Vacation.
- Training.
- Area to be covered.
- Patrol vehicles available for patrol.

The task for the police administrator is to have patrol officers available at the times and places needed to best serve the community. The department's total strength must be evaluated in terms of:

- Requirements for followup investigative service by specialists.
- The scope of activity that can be assigned to patrol officers.
- The nature of duties that result in officers being unavailable for patrol for any other reason.

To illustrate the sequence of calculations and judgments necessary for manpower analysis, sample data from a fairly typical, medium-sized city are shown. For the full year January 1 through December 31, 1976, the police department had 47 full-time patrolmen who each worked the full year. (Those working only the full year are used to simplify the calculations.) These 47 patrolmen had a potential 17,155 man-days available for duty that year (47 x 365 = 17,155). The calculations are shown in Table 6-1.

TABLE 6-1

Total Man-Days Actually Available

Gross Man-Days Available			17,155
Less:	Days Off	5,640	
	Sick Leave	497	
	Holidays	--	
	Vacation Days	1,089	
	Injury Leave	0	
	Training	10	
	Death in Family	0	
	Conventions	0	
	Military Leave	14	
	Miscellaneous	0	
	Subtotal	7,250	7,250
			9,905

Total Man-Days Actually Available (17,155 - 7,250) = 9,905

For every man who was actually available for duty, 1.73 officers must have been assigned. This ratio of 1.73 to 1 is designated as the Assignment/Availability Factor. In other words, the average patrol officer worked 211 days per year (58 percent) and was off patrol duty 154 days per year (42 percent).

To staff one position on one shift required 1.73 (i.e., 2) officers on the force; to staff one position around the clock (three shifts) required three times as many, 5.19 (i.e., 5) officers.

Similar ratios can be calculated for supervisory personnel (1:1.74 for the seven patrol sergeants in 1976), for ranking officers (1:1.82 for the eight lieutenants and above in 1976), or for all patrol personnel (patrolmen and sergeants together).

6.2 Allocation of Patrol Manpower to Shifts

The purpose of patrol resource allocation is generally considered to be distributing the workforce in proportion to the workload. This should clearly be by time (that is, onto shifts in such a way that the manpower available during a given hour relates reasonably to the work demanded during that hour) and by area (that is, that the sectors are assigned patrolmen in some reasonable relation to the geography of the occurrences). While the value of this proportional distribution has been called into question by some theoreticians, academics, and statisticians, it has not received much criticism from practitioners, police executives, and patrolmen.

The demand for patrol services is commonly assessed in terms of *how many* (that is, how many homicides, how many breaks, how many noise complaints, on down to how many telephone calls were received in a given period). This raw count, the "incidence of incidents," is essential for an understanding of *what* the patrol division confronts and for incident analysis leading to directed or crime-specific patrol. For manpower analysis, however, it is not how many, but rather for *how long* (or how much time is demanded for various classes of service). This should be totalled and arranged by hour of the day, as shown in Table 6-2.

In the hypothetical department shown in Table 6-2, there are three patrol sergeants and 46 patrolmen assigned to regular shifts. Of these 49 persons, each represents 2.04 percent of the available workforce. The workload shown in Table 6-2 and the present manpower distribution are shown together graphically in Figure 6-1. The staffing pattern producing manpower distribution is shown in Table 6-3. If this distribution is reduced to an average hourly percentage of total manpower, the results are those shown in Table 6-4. It should be noted that these percentages apply whether the numbers of men are viewed as assigned (potentially available) manpower or as actually available manpower (that is, deflated by the Assignment/Availability Factor). Application of a constant ratio to the assigned manpower will not alter the percentage distribution.

TABLE 6-2

Percentage Distributions of Workload and Manpower by Hour

Hours	Total Hourly Workload %	Current Average Hourly Distribution of Total Manpower (%)
0000-0059	4.96	4.34
0100-0159	3.84	"
0200-0259	3.44	"
0300-0359	1.94	"
0400-0459	1.09	"
0500-0559	0.99	"
0600-0659	1.55	"
0700-0759	2.57	"
0800-0859	2.37	3.83
0900-0959	2.85	"
1000-1059	2.83	"
1100-1159	2.49	"
1200-1259	2.30	"
1300-1359	2.10	"
1400-1459	2.65	"
1500-1559	2.71	"
1600-1659	9.20	4.34
1700-1759	7.97	"
1800-1859	6.61	"
1900-1959	6.75	"
2000-2059	9.25	"
2100-2159	8.26	"
2200-2259	6.02	"
2300-2359	5.26	"

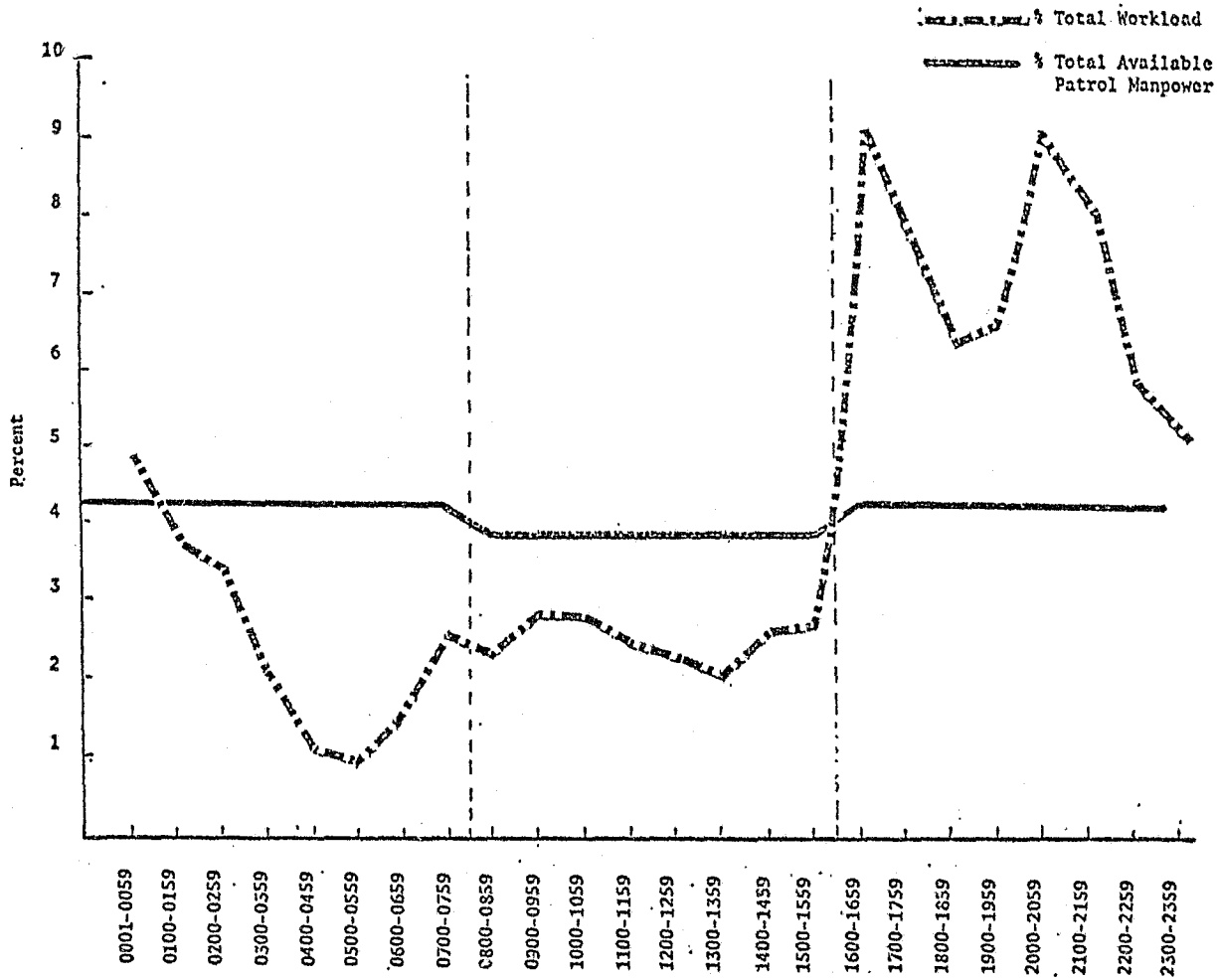


Figure 6-1. Workload Distribution Vs. Manning Level by Hour

TABLE 6-3

Manning Levels in the Patrol Force, 1975-76

Shift	Rank	No. of Officers
I	Sergeant	1
	Patrolmen	16
	Total	17
II	Sergeant	1
	Patrolmen	14
	Total	15
III	Sergeant	1
	Patrolmen	16
	Total	17
Total	Patrol	49

TABLE 6-4

Average Hourly Percentage of Total Manpower

Shift	Percentage of Total Patrol Manpower Allocated to Each Shift	Average Hourly Percentage of Total Manpower
I	34.69	4.34
II	30.61	3.83
III	34.69	4.34

After upcoming staffing changes, there will be 50 sworn officers assigned to patrol duties; an easier number for calculations:

6 Patrol Sergeants

44 Patrolmen

50 Sworn Officers

These 50 officers, each working an 8-hour shift, will provide a total of 400 man-hours assigned to patrol duty daily. The problem is to distribute them to shifts in a way that approximates the distribution of workload shown in Table 6-2 and Figure 6-1. While the recorded activity shown in this distribution is only a fraction of the officers' total available time, two factors suggest its use for distributing the total available time: (a) It is highly probable that calls-for-service reflect the pattern of total police activity, and (b) the consumed time for calls-for-service is the only measure readily available for such manpower distributions.

Table 6-5 shows the percentage of this recorded workload occurring in each hour and the ideal number of man-hours (rounded off to the nearest whole hour) that would distribute the 400 assignable man-hours in exact proportion to that workload. The last column gives the number of men assigned to that hour under the proposed shift pattern. This cannot exactly duplicate the workload distribution or the ideal manpower, since each man must work a full 8-hour shift at something approximating normal shift hours.

The comparison of workload and proposed manpower distribution is shown graphically in Figure 6-2. The proposed shift pattern is shown

TABLE 6-5

Derivation of Proposed Hourly Manpower Levels

Hours	Total Hourly Workload %	"Ideal" Hourly Distribution Of Manpower Proportionate To Workload		Proposed Hourly Manpower Distribution	
				Number	%
0000-0059	4.96	19.84	(20)	20	5.00
0100-0159	3.84	15.36	(15)	15	3.75
0200-0259	3.44	13.76	(14)	15	3.75
0300-0359	1.94	7.76	(8)	5	1.25
0400-0459	1.09	4.36	(4)	5	1.25
0500-0559	0.99	3.96	(4)	5	1.25
0600-0659	1.55	6.20	(6)	5	1.25
0700-0759	2.57	10.28	(10)	5	1.25
0800-0859	2.37	9.48	(9)	10	2.50
0900-0959	2.85	11.40	(11)	10	2.50
1000-1059	2.83	11.32	(11)	10	2.50
1100-1159	2.49	9.96	(10)	10	2.50
1200-1259	2.30	9.20	(9)	10	2.50
1300-1359	2.10	8.40	(8)	10	2.50
1400-1459	2.65	10.60	(11)	10	2.50
1500-1559	2.71	10.84	(11)	10	2.50
1600-1659	9.20	36.80	(37)	20	5.00
1700-1759	7.97	31.88	(32)	25	6.25
1800-1859	6.61	26.44	(26)	25	6.25
1900-1959	6.75	27.00	(27)	35	8.75
2000-2059	9.25	37.02	(37)	35	8.75
2100-2159	8.26	33.04	(33)	35	8.75
2200-2259	6.02	24.08	(24)	35	8.75
2300-2359	5.26	21.04	(21)	35	8.75

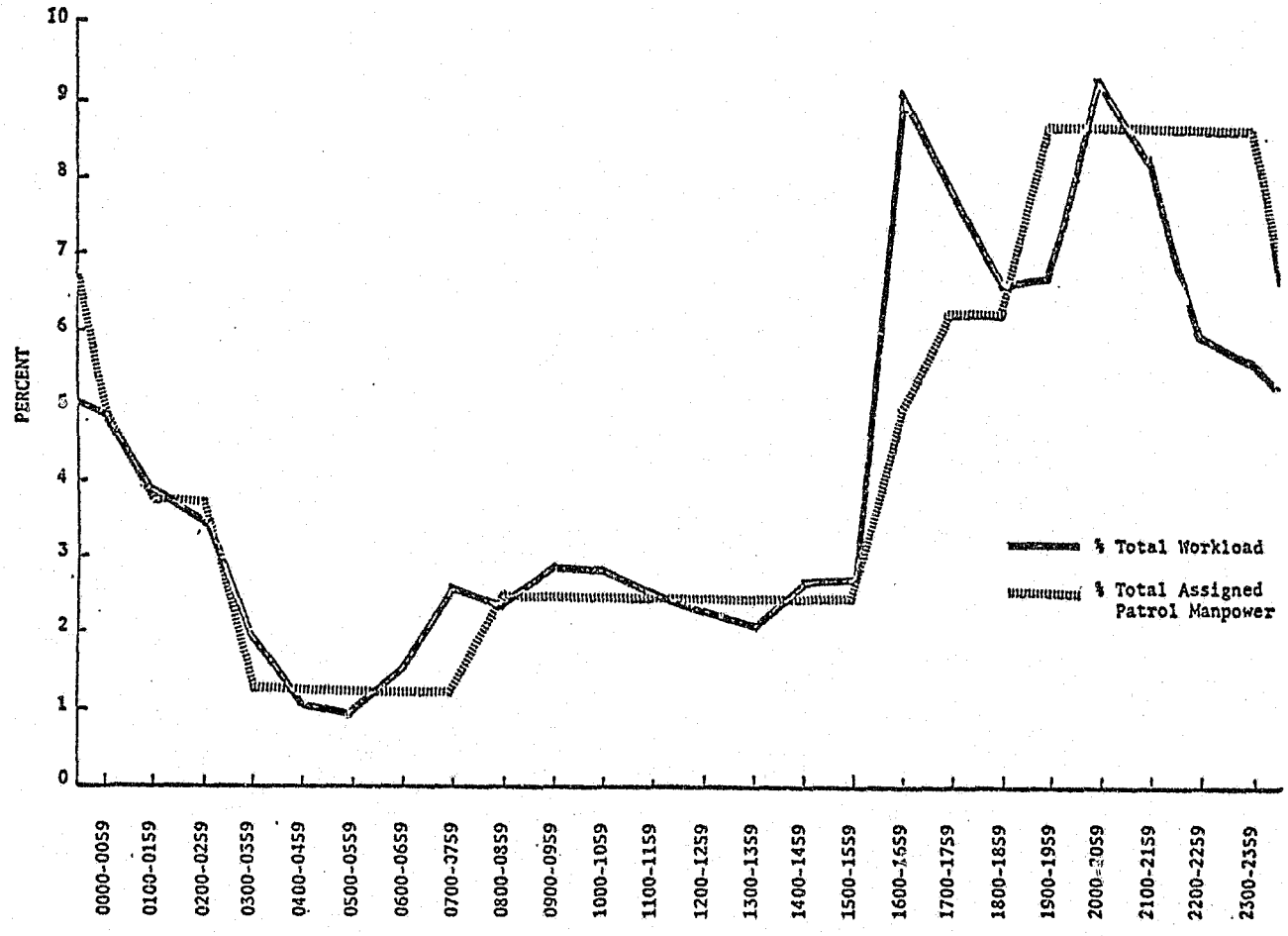


Figure 6-2. Workload Distribution vs Proposed Manning by Hour

in Table 6-6. The proposed shifts were worked out by hand on graph paper by an empirical (cut and try) technique. For any but the largest departments, this is probably more feasible than mathematical techniques using "average hourly deviations from average shift workload" and similar textbook exercises.

6.3 Geographical Distribution of Shift Manpower

Once the available manpower has been assigned to shifts on a rational basis, each shift commander should be given the responsibility for distributing the officers assigned to his or her shift. It is quite possible for this to be done in exactly the same way as the assignments: Determine the workload in each beat or sector, calculate the percentage of the shift's workload represented by that sector, and assign a similar percentage of the shift's manpower to it.

Sectors are typically rather small areas. Therefore, one or two events of some duration could easily influence the workload allocated to the sector in which they occur, so as to give it a disproportionately high workload and consequent manpower distribution. The result could easily be an officer or two's riding around in response to events that will never recur or at best can recur very infrequently. A better technique is to determine some fraction of the available patrol strength that will be dedicated to the routine and recorded-service demands, the remainder to be used in preemptive crime-specific patrols or followup investigations.

TABLE 6-6

Proposed Shift Schedule for Hypothetical Police Department

Shift	Hours	No.	Rank
I	0000-0800	1	Sergeant
		4	Patrolmen
II	0800-1600	1	Sergeant
		4	Patrolmen
III	1600-2400	1	Sergeant
		19	Patrolmen
		1	Sergeant
		4	Patrolmen
IV	1900-0300	1	Sergeant
		9	Patrolmen
Days Off:		1	Sergeant

For example, it can be assumed that the First Shift (Midnight - 0800) in a department is assigned 15 patrol officers, with an Assignment/Availability Factor of 1:1.8, to cover five beats or sectors. It can be further assumed that the relative workload between the five sectors on that shift is:

Sector	Relative Workload on Shift I (Percent)
1	32
2	28
3	20
4	15
5	5
	100

The shift commander knows that on an average day he will have 8.33 officers available for duty. It can be assumed that, of these, he decides to devote one-third to preemptive patrol; therefore, 2.8 officers will be assigned according to the results of a crime analysis effort, being directed to follow specific crime-suppression tactics developed from the analysis of target crimes.

The remaining 5.56 officers can be distributed to the sectors according to their relative workloads:

Sector	Officers Assigned
1	1.78
2	1.56
3	1.11
4	0.83
5	0.28
	5.56

The fractions can be taken care of by: (a) Using part of an officer's time in one sector and part in another; (b) assigning joint or overlapping responsibilities for some sectors; or (c) aggregating sectors together until whole numbers are reached. The exact method should be left to the discretion of the commander concerned.

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