COLORADO SPRINGS

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POLICE

FORECASTING PATROL MANPOWER NEEDS - 1990

COLORADO SPRINGS POLICE DEPARTMENT

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I. EXECUTIVE SUMMARY

In 1987, Chief James Munger formed a task force to study manpower projection methods and to determine a procedure appropriate for the Colorado Springs Police Department. With an ultimate goal of determining manpower needs for the entire Police Department, the task force has concentrated on manpower projections for the Patrol Bureau, for both sworn and nonsworn positions.

The patrol workload is clearly the driving factor behind manpower requirements for the rest of the Department. Therefore, in order to eventually develop a department-wide manpower projection method, the first step is to adopt an accurate and reliable means for determining Patrol manpower requirements.

Through an extensive literature review and a survey of other police agencies, several manpower projection models were identified. After looking critically at the array of methods available, a computer model called Patrol/Plan was chosen as the most practical and useful for our purposes.

This is the second year the Patrol/Plan model has been used to project manpower needs for the Patrol Bureau. Relying primarily on CAD (Computer Aided Dispatch) information for the needed input data, the model was run using the following performance standards for all Division Commands:

- Officers will have an average of twenty minutes each hour to conduct random, routine patrol.
- An average of three units will be available for calls at all times.
- The probability that all units will be busy when a call is received will not exceed 5%.
- The queue delay for Priority I calls will not exceed three minutes.
- The response time for Priority I calls will not exceed eight minutes.

Given the above performance standards, the model indicated that 211 officers are required to handle the Patrol workload. Of the current total authorized strength of 248 officers, 29 are assigned to Traffic and 34 are assigned to fixed post positions, for a total of 63 unavailable for Patrol workload. This leaves 185 officers actually available for calls for service work. In order to maintain current necessary staffing in the fixed post functions, and to adequately handle expected calls for service, an additional 26 officers are needed for Patrol.

PATROL MANPOWER NEEDS

	AUTHORIZED POSITIONS	FIXED POST POSITIONS	AVAILABLE	PATROL/PLAN PROJECTIONS	CHANGE
PATROL	248	63	185	211	+26

Out of the 29 officers assigned to traffic, only 13 are currently available for traffic accident work. The model indicates that 26 officers are needed for the traffic accident investigation workload. Therefore, 13 additional officers are needed to handle the traffic workload.

TRAFFIC MANPOWER NEEDS

	AUTHORIZED POSITIONS	FIXED POST POSITIONS	AVAILABLE	PATROL/PLAN PROJECTIONS	CHANGE
TRAFFIC	29	13	13	26	+13

In summary, a total of 39 additional officers is required -- 26 for Patrol, 13 for Traffic. This increase in staffing will have an effect on all the performance measures used in the study. For example, the probability that a call will arrive when all units are busy drops from an actual citywide average of 11.8% to 3.7% with the suggested staff increase. The citywide average response time for Priority I calls drops from 8.2 minutes to 6.3 minutes. Additionally, the current average uncommitted time across all zones of 22 minutes per hour will increase to 26 minutes per hour, leaving officers more time for directed patrol, self-initiated activities, and an opportunity to become more involved in community-oriented policing.

After the Patrol workload was determined and projections for officers were made, the focus of the task force turned to other positions within the Patrol Bureau. Our analysis indicated that supervisory positions needed include 12 sergeants, and one captain to command a new Metro Division, which would consolidate the Traffic and Patrol Support Sections. Nonsworn positions needed include: an additional Public Service Representative at each Division to handle the current workload and to cover for absences; and, a secretary to support the Metro Division Captain.

II. INTRODUCTION

Choosing a Model

The variety of methods used to project manpower requirements in police agencies runs from simple ratio determinations to sophisticated computer simulation models. In last year's report, a review of manpower allocation methods covered information gleaned from a survey of the relevant literature and discussions with several police departments. (See Forecasting Patrol Manpower Needs for the Colorado Springs Police Department, August 1988.)

As a result of our search for an appropriate manpower projection method, the computer model Patrol/Plan was selected. Patrol/Plan was chosen because it determines the allocation of units based on several variables rather than a single workload determinant. It is "user-friendly", requires easy data-base preparation, and presents easily understandable output. Additionally, a validation of the model for last year's study provided favorable results.

Using Patrol/Plan

A cursory look at how Patrol/Plan operates is necessary to understand and be able to analyze its output. Patrol/Plan determines the number of units needed to satisfy all the performance objectives input into the model, using the data entered. The performance objectives -- called "constraints" in the model -- include such items as response times, call queues, and work time. Several constraints may be entered; however, only one will eventually "drive" the model. In other words, more units will be required to satisfy one particular constraint after all the other constraints have been satisfied. In determining our patrol manpower allocations, the "driving" constraint was the saturation probability -- the percent of calls arriving when all units are busy. Following is a list of all the constraints used for this study:

- Patrol units will spend no more than 40 minutes per hour (or 2/3 of their time) on actual work time. Actual work includes both calls-for-service time and non-calls-for-service time. Calls for service work is only that time spent responding to calls. Non-calls-for-service work includes administrative tasks, such as report writing; court time; directed patrol and self-initiated patrol activities; and meal breaks.

- An average of three units should be available at any given time.

- The probability that all units are busy should not exceed 5%. This means that when a call is received, there is a 95% chance that a unit will be available to respond immediately.

- The queue delay for Priority I calls should be no greater than three minutes.

- The response time for Priority I calls should be no more than eight minutes.

These represent performance objectives which would optimize the use of the units in responding to calls, in self-initiated activities, in directed patrol, and in allowing for administrative work and uncommitted time.

The design of Patrol/Plan allows the user to determine the number of patrol units needed by geographic area or by time, or both. In this study, the model was employed using geographic zone, day of week and shift. For example, North-Mondays-Shift I; North-Mondays-Shift II, etc. Data used came from the period of January 1, 1988 - December 31, 1988. In future uses of the model, input data will be projected into the future to determine manpower needs more accurately. Most of the variables based on calls-for-service or time consumed data came directly from or were calculated based on output from the CAD system. The inputs into Patrol/Plan and the operation of the model are explained in more detail in Appendix A.

Patrol v. Traffic

In an effort to accurately determine the number of personnel needed based on the given constraints, patrol and traffic data were input and run separately. The assumption was made that, ideally, a separate traffic function should not only handle enforcement activities, but should also investigate all injury accidents and approximately 65% of non-injury accidents. In order to arrive at an accurate estimate of manpower requirements for both traffic and patrol functions, the call rate and average time spent were calculated separately for each function.

In this manner, two sets of workload data were generated; one for all patrol functions plus 35% of all non-injury accidents (the Patrol workload), and another for the traffic function which included all injury accidents plus 65% of all non-injury accidents (the Traffic workload). Separate manpower projections were made for the Patrol function and for the Traffic function.

III. FINDINGS

Analysis by Day/Shift/Zone

As stated earlier, separate data sets describing the patrol workload and the traffic workload were generated for each shift, for each day of the week for each geographic zone. The model was run and output obtained for each data set for a total of 126 "runs" (3 shifts * 7 days * 3 zones * 2 workload sets - Patrol and Traffic). A sample output from the data sets is presented on the following page. Complete input and output data are contained on computer files in the Research and Development Unit.

The model was run using the following constraints for the Patrol data sets:

- amount of time spent in calls-for-service and non-call related work (40 minutes maximum);
- average units available (3);
- saturation probability or percent calls all units busy (5%);
- queue delay for Priority I calls no greater than three (3) minutes; and
- response time for Priority I calls no greater than eight (8) minutes.

For the traffic data sets, the constraints were the same. However, the unavailability factor was not considered appropriate for traffic work. The maximum time spent on calls-for-service and non-calls-for-service work was the driving factor for Traffic, while the saturation probability was the driving factor for Patrol.

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PROGRAM ANALYSIS

PATROL/PLAN

OUTPUT SUMMARY - BLOCK 1: N1MON
NO OF UNITS DISP/CFS = 1.3 11 units required
SERVICE TIME/DISP UNIT = 43.8 MIN
SERVICE TIME/CFS = 57.6 UNIT-MIN

WORKLOAD DISTRIBUTION (MIN/HR)

PRIORITY LEVEL	PRIMARY UNITS (ACTUAL)	BACKUP UNITS (ACTUAL)	TOTAL (INCOMING)
1	101.3	0.0	101.3
2	105.9	0.0	105.9
3	145.8	0.0	145.8
TOTAL	353.0	0.0	353.0

% OF PRIORITY 1 CALLS DELAYED IN QUEUE = 4.4
% OF PRIORITY 2 CALLS DELAYED IN QUEUE = 4.4
% OF PRIORITY 3 CALLS DELAYED IN QUEUE = 4.4

AVG NO OF CALLS IN QUEUE = 0.1

PRIORITY LEVEL	QUEUE DELAY	TRAVEL TIME	RESPONSE TIME
1	0.3	3.3	3.5
2	0.4	4.7	5.1
3	0.7	12.3	13.0
AVG	0.5	7.5	7.9

INCOMING CFS & NON-CFSWORK/UNIT = 32.1 MIN/HR

ACTUAL CFS & NON-CFS WORK/UNIT = 32.1 MIN/HR
ACTUAL CFS WORK/UNIT = 15.1 MIN/HR
NON-CFS WORK/UNIT = 17.0 MIN/HR
UNCOMITTED TIME/UNIT = 27.9 MIN/HR

AVG NO OF FREE UNITS = 5.1
MINIMUM PARTOL INTERVAL = 10.6 HRS

The following table shows a summary of the suggested manpower requirements for each data set. Since traffic functions are a city-wide operation, only a total of all zones is presented in Table I.

Table I

PATROL/PLAN
Suggested Unit Requirements

Day	Shift	North Zone*	West Zone*	East Zone*	Traffic All Zones**
Mon	I	11	14	14	6
Mon	II	15	18	18	6
Mon	III	9	13	12	3
Tue	I	11	14	13	5
Tue	II	13	18	17	9
Tue	III	10	13	13	3
Wed	I	11	15	12	6
Wed	II	14	18	19	8
Wed	III	12	13	13	3
Thu	I	11	13	12	5
Thu	II	15	17	18	8
Thu	III	11	13	13	3
Fri	I	11	15	13	6
Fri	II	16	18	18	9
Fri	III	12	16	15	3
Sat	I	12	13	13	4
Sat	II	15	17	18	8
Sat	III	15	18	18	5
Sun	I	10	12	11	3
Sun	II	13	16	16	5
Sun	III	13	16	16	4
TOTAL UNITS PER WEEK		260	320	312	112

* includes all patrol work plus 35% of non-injury accidents; does not include fixed posts or special assignments

** includes all injury accidents plus 65% of non-injury accidents; does not include fixed posts or enforcement units

Total Manpower Requirements

In order to identify the number of persons required for adequate staffing, the number of units suggested by Patrol/Plan must be translated into officers. This was done with the assumption that all units are one-officer units. To determine the number of officers required, the number of suggested units for each shift for each week was totalled for each geographic zone, as seen in Table I. Thus, a total of 260 units per week were required for the north zone, 320 units per week were required for the west zone, 312 units per week were required for the east zone and 112 units per week were required citywide for Traffic. In order to calculate the number of persons needed weekly, the total weekly unit requirement for each shift and zone was multiplied by 8 (number of hours in a shift) and then by 52 (number of weeks in a year). This calculation provided the total number of man-hours required per year. This figure was then divided by 1763 (the average number of hours per year an officer works).[1] The resulting number is the actual staffing of officers which are needed to meet the daily requirements for each shift. Table II indicates the number of officers which are needed on each shift in each zone. The same formula was applied to traffic data and the results also appear in Table II.

Table II

STAFFING REQUIREMENTS

Zone	Shift	Weekly Units Required	Manpower Required	
North	I	77	18	
North	II	101	24	
North	III	82	19	Total 61
West	I	96	23	
West	II	122	29	
West	III	102	24	Total 76
East	I	88	21	
East	II	124	29	
East	III	100	24	Total 74
Traffic	I	35	8	
Traffic	II	53	12	
Traffic	III	24	6	Total 26
			Total Officers	**237**

Analysis by Shift/Zone

In a separate analysis, projected units were compared to actual units for each zone and shift. Input data for the projected units were compiled and consolidated on the zone level by averaging the required inputs across each zone for each shift for all days. The data was then entered into the Patrol/Plan model, using the same constraints described earlier.

The actual units were determined by using the average number of officers assigned over Periods 3, 4, 5, and 6, multiplying by .66 (average number of officers scheduled) and then multiplying by .85 (the absentee factor). Using Patrol/Plan as a descriptive tool, the actual units were entered and the model was used to estimate current performance characteristics based on the data supplied.

The comparisons of performance characteristics of projected units and actual units are shown by zone in Tables III, IV, and V. Note that the number of units refers to the average number needed for that shift and zone on any day. Therefore, if the total number of officers needed for that zone and shift are calculated, the officers required do not exactly match the projections resulting from the day/shift/zone analysis (Table I).[2] For manpower projection purposes, the specific level of analysis was considered more appropriate. However, for an overview of performance characteristics, the shift/zone level analysis provides useful insights for shift and division commanders.

TABLE III

PROJECTED V. ACTUAL UNITS*
Selected Constraints

	PROJECTED UNITS	"ACTUAL" UNITS	PROJECTED UNITS	"ACTUAL" UNITS	PROJECTED UNITS	"ACTUAL" UNITS
SHIFT/ZONE	NORTH 1		NORTH 2		NORTH 3	
# UNITS	12	10	15	11	12	9
INCOMING CFS & NON-CFS WORK/UNIT (minutes per hour)	29.3	31.8	34.6	39.9	32.3	37.1
UNCOMMITTED TIME/ UNIT (minutes per hour)	30.7	28.2	25.4	20.1	27.7	22.9
AVG NO OF FREE UNITS	6.1	4.7	6.3	3.7	5.5	3.4
MIN PATROL INTERVAL (in hours)	5.9	7.7	5.7	9.8	6.5	10.5
% CALLS ALL UNITS BUSY	1.9	5.1	3.6	15.5	3.7	13.7
P-1 QUEUE DELAY (in minutes)	0.1	0.3	0.2	1.0	0.3	1.3
P-1 TRAVEL TIME (in minutes)	7.7	8.8	7.3	9.6	6.2	7.9
P-1 RESPONSE TIME (in minutes)	7.8	9.1	7.5	10.6	6.5	9.2

* ACTUAL UNITS = # assigned * .66 (scheduled) * .85 (absentee factor)
using Periods 3,4,5 and 6 Details for data

TABLE IV

PROJECTED V. ACTUAL UNITS*
Selected Constraints

	PROJECTED UNITS	"ACTUAL" UNITS	PROJECTED UNITS	"ACTUAL" UNITS	PROJECTED UNITS	"ACTUAL" UNITS
SHIFT/ZONE	WEST 1		WEST 2		WEST 3	
# UNITS	13	11	17	15	15	12
INCOMING CFS & NON-CFS WORK/UNIT (minutes per hour)	34.3	37.5	37.2	39.5	34.5	38.7
UNCOMMITTED TIME/ UNIT (minutes per hour)	25.7	22.5	22.8	20.5	25.5	21.3
AVG NO OF FREE UNITS	5.6	4.1	6.5	5.1	6.4	4.3
MIN PATROL INTERVAL (in hours)	4.1	5.6	3.6	4.5	3.6	5.4
% CALLS ALL UNITS BUSY	4.7	10.9	4.7	9.3	3.5	11.5
P-1 QUEUE DELAY (in minutes)	0.2	0.6	0.2	0.4	0.2	0.8
P-1 TRAVEL TIME (in minutes)	2.8	3.2	2.6	2.9	1.9	2.4
P-1 RESPONSE TIME (in minutes)	3.0	3.8	2.8	3.3	2.1	3.2

* ACTUAL UNITS = # assigned * .66 (scheduled) * .95 (absentee factor)
using Periods 3,4,5 and 6 Details for data

TABLE V

PROJECTED V. ACTUAL UNITS*
Selected Constraints

	PROJECTED UNITS	"ACTUAL" UNITS	PROJECTED UNITS	"ACTUAL" UNITS	PROJECTED UNITS	"ACTUAL" UNITS
SHIFT/ZONE	EAST 1		EAST 2		EAST 3	
# UNITS	12	10	18	14	15	11
INCOMING CFS & NON-CFS WORK/UNIT (minutes per hour)	32.9	38.9	36.5	41.3	34.3	40.2
UNCOMMITTED TIME/ UNIT (minutes per hour)	27.1	21.1	23.5	18.7	25.7	19.8
AVG NO OF FREE UNITS	5.4	4.0	7.0	4.4	6.4	3.6
MIN PATROL INTERVAL (in hours)	3.4	4.6	2.6	4.2	2.9	5.1
% CALLS ALL UNITS BUSY	4.2	10.2	3.6	13.8	3.3	16.1
P-1 QUEUE DELAY (in minutes)	0.2	0.6	0.1	0.7	0.2	1.3
P-1 TRAVEL TIME (in minutes)	2.5	2.9	2.2	2.8	2.1	2.8
P-1 RESPONSE TIME (in minutes)	2.7	3.5	2.3	3.5	2.3	4.1

* ACTUAL UNITS = # assigned * .66 (scheduled) * .85 (absentee factor)
using Periods 3,4,5 and 6 Details for data

The performance characteristics estimated from the actual number of units shows that workload is the highest, and uncommitted time is at its lowest during second shift in all zones. In each case, workload is extremely close to or exceeds the maximum of 40 minutes per hour set as a constraint for projection purposes. Work per hour decreases to more reasonable proportions with the projected number of units.

The minimum patrol interval, or the average time between passings of a given point by a free unit, is useful as a measure of the ability to provide preventive patrol. The minimum patrol intervals in the north zone are greater than east or west simply because it is a much larger geographical area with many more street miles. However, the suggested increase from the actual units to the projected units results in a significant decrease in minimum patrol interval, even in the north zone.

The saturation probability indicates the percent of calls-for-service for which no unit is immediately available. As a constraint, a maximum of 5% "all units busy" was used for both the day/shift/zone and the shift/zone analysis. In both instances, the saturation probability was the driving constraint -- it was the factor that ultimately determined the projections. As can be seen, in almost all shift/zones, the current saturation probability is quite high. For example, on East Shift III, the estimated saturation probability is currently 16.1%. This means that for about sixteen percent of the time, officers are not available to answer calls-for-service. Or, roughly one of every six calls comes in when the entire eastside patrol force is already busy.

An increase in units as suggested by the Patrol/Plan projections will bring the saturation probability to 5% or below. On North Shift I, the current estimated saturation probability is 5.1%; with the projected units, it falls to 3.1%. This might suggest that, according to the performance standards used, the current manpower allocation to North Shift I is adequate, and in fact, manpower should be redistributed from North Shift I to other shifts and/or zones which currently have higher workloads, less uncommitted time, and a higher saturation probability. Again, it is important to remember that the shift/zone analysis is based on averages. Constant fluctuations in daily workload as well as variations in daily available manpower within each shift/zone must be taken into account. The method for determining the allocation of requested manpower among zones is described in the following chapter. Although the Patrol/Plan model is a valuable tool for determining manpower needs, it does not assist decision makers in the distribution of manpower over time within each geographic area. Instead, a scheduler program should be used to appropriately deploy the manpower projected by the Patrol/Plan model.

Finally, Table VI compares citywide averages of performance measures with the suggested staff increase and without the suggested staff increase. This information can assist decision makers in determining the levels of service the Department can provide.

Table VI

COMPARISON OF PERFORMANCE MEASURES WITH INCREASED STAFFING

Citywide

	Without Staff Increase	With Staff Increase
Work per Unit (min/hr)	38.3	34.1
Avg Free Units	4.1	6.1
Patrol Interval (hours)	6.4	4.3
Saturation Probability	11.8%	3.8%
Avg Response Time Priority I Calls (minutes)	8.2	6.3

Allocation of Manpower

To determine the geographic distribution of the 26 officers requested for Patrol, the current number of fixed post positions which currently pull officers assigned to Patrol were subtracted from the current authorized positions for each zone (Table VII). The result, current available number of officers, was then subtracted from the Patrol/Plan projections to arrive at the additional officers needed in each zone (Table VIII).

Table VII

FIXED POST POSITIONS
By Zone

NORTH	WEST	EAST
1 Crime Prevention Officer	1 Crime Prevention Officer	1 Crime Prevention Officer
1 DARE Officer	3 HQ Security Officers	9 Airport Security Officers
	1 CAB Security Officer	
	1 Utilities Security Officer	
	1 Roll Call Training	
2 Fixed Post Positions	7 Fixed Post Positions	10 Fixed Post Positions

Table VIII

DISTRIBUTION OF OFFICERS
By Zone

	Current Distribution	-	Fixed Post*	=	Available for Patrol
NORTH	59	-	2	=	57
WEST	70	-	7	=	63
EAST	75	-	10	=	65

	Patrol/Plan Projected	-	Available	=	Needed
NORTH	61	-	57	=	4
WEST	76	-	63	=	13
EAST	74	-	65	=	9
	211	-	185	=	26

As seen in Table VIII, 4 additional officers are required in the north zone, 13 additional officers in the west, and 9 more officers in the east zone.

Policy Implications

Presently, there are a total of 248 officers assigned to the patrol function. Of these, 29 are assigned to traffic and 34 are assigned to fixed-post positions in patrol or other special patrol assignments such as TEU, Airport, and Building Security. Net patrol officers available are 185.[3] Based upon the constraints which were applied, the Patrol/Plan model shows that the patrol workload requires a minimum of 211 officers excluding traffic, fixed posts and special assignments. This indicates a deficit of 26 officers.

The question of adequate patrol staffing then becomes not only one of increasing officer strength but also a question of the priority which various assignments receive. It seems that if officers presently assigned to fixed posts and special assignments were transferred back to patrol duty, then patrol strength would be adequate. However, without fixed posts, we can assume that the overall workload of officers handling calls-for-service would actually increase. Fixed Post officers are currently absorbing specialized types of calls which would otherwise be handled by the field patrol officers if no fixed post/specialty positions existed. A detailed review of the Department's fixed post positions follows in Section IV.

Thus, the fixed posts are not only necessary, in some cases (such as the airport detail) they are required by law or regulation. Traditionally, though, the Patrol Bureau is the pool from which most special assignments are drawn. Many times the personnel drawn for these special assignments are not replaced, thereby creating a shortage of officers who are available to do patrol work. Therefore, a policy which would define the priority of assignments in the police department is called for, so that special assignments would not come at the expense of patrol services, or so the impact on patrol services would be realized. In the final analysis, the purpose of this project is to determine the level of personnel required for police services so that informed decisions can be made about how to deploy and allocate manpower resources.

The same logic holds true for traffic functions. The present authorized officer strength in the traffic section is 29. Of these 29 officers, 4 work DUI Enforcement, 7 work 55 m.p.h. Enforcement, 2 work school Enforcement, 2 work Hit and Run Investigations and 1 works commercial vehicle enforcement for a total of 16 officers assigned special duties. This leaves 13 officers available to do traffic accident work. Our findings indicate that 26 officers are needed to adequately handle the accident workload. The obvious conclusion is that if the special assignments and fixed posts were reassigned there would be a sufficient level of personnel available to do this work. Again, however, because calls for specialized services would be answered by all Traffic officers, returning the fixed post positions to general Traffic positions may actually result in a higher workload for all Traffic officers. Once again, it becomes apparent that although these fixed posts and special assignments are necessary, they should be created with a view toward the impact which they will ultimately have upon the ability to perform accident investigation services.

Since the department has adequate personnel to staff for patrol and traffic functions if they are reassigned from other duties, it is important to review these non-patrol and non-traffic services to ascertain their performance indicators and level of service. Further, if the Patrol/Plan model is to be used for personnel requests, the department must be prepared to defend the reasoning used to apply resources to other functions. The following section deals with these functions and the level of services they provide.

IV. FIXED POST POSITIONS

Those Patrol Bureau police officer positions not assigned to field patrol are classified as fixed post or special functions that require sworn officers. The following is a breakdown of these positions:

FUNCTION	# SWORN POSITIONS
Traffic	**29**
* Traffic Accident Investigation 13	
DUI Enforcement 4	
55 MPH Enforcement 7	
Hit and Run Investigation 2	
Commercial Vehicle Enforcement 1	
School Enforcement 2	
Patrol Support	**20**
Tactical Enforcement 10	
K-9 Unit 5	
**Neighborhood Policing 5	
Crime Prevention	**3**
Falcon Division 1	
Gold Hill Division 1	
Sand Creek Division 1	
Airport Security	**9**
Sand Creek Division 9	
Headquarters Security	**3**
Gold Hill Division 3	
CAB/Utilities Building Security	**2**
Gold Hill Division 2	
Roll Call Training	**1**
Gold Hill Division 1	
DARE Program	**1**
Falcon Division 1	
TOTAL	**68**

* The Traffic Accident Investigation positions are addressed in the Patrol/Plan analysis.

**The five NPU positions are currently budgeted in Investigations, but will be transferred into Patrol January 1, 1990.

These positions represent police officer positions in the Patrol Bureau, but are not part of regular patrol functions. All of these positions exist because of some special need or requirement. For example, the 55 MPH and DUI Enforcement functions are required by the traffic safety grants we have received; the airport security contingent is required by FAA policy; the Headquarters Security is required by City direction; and the School Enforcement officers are a response to particular community traffic safety needs.

The fixed post positions all provide necessary police services that could not be consistently and effectively provided by regular patrol officers without severely degrading patrol service delivery. For example, if regular patrol officers were also responsible for tactical enforcement services (SWAT, explosives), they would not be available for their primary mission of responding to citizen's calls for service. In addition, the level of tactical services, which requires extensive training and frequently involves life threatening situations (e.g., barricaded suspects, hostage situations), would also suffer if regular patrol officers were required to fulfill that critical function in addition to their patrol duties.

A brief description of the special functions will help acquaint the reader with the particular services they provide and the importance of the services.

Traffic

There are 11 officers assigned to traffic accident investigation. Two vacant positions are assigned to this function, giving a total of 13 positions assigned here. In addition to their primary responsibility of accident investigation, these officers file felony traffic charges, engage in selective traffic enforcement, make court appearances, handle special events requiring traffic control, and provide cover for calls-for-service.

The Patrol/Plan analysis indicates that a total of 26 officers are required to handle the accident investigation workload; subtracting the 13 positions presently assigned, there is a deficit of 13 officers in this important function.

There are four officers assigned to DUI enforcement duties. This function is the foundation of the Department's drunk driving enforcement program. The DUI enforcement officers not only detect and apprehend drunk drivers, they also process DUI arrests made by patrol officers. Last year, these four officers issued 7,741 summonses and made 1,631 DUI arrests. By processing patrol DUI arrests, the DUI officers free up patrol officers to return to their patrol duties. Just as the traffic accident investigators, the DUI officers also engage in selective enforcement, cover calls, and special events requiring traffic control.

A team of seven motorcycle officers, covering two shifts, is assigned to enforce speeding and other hazardous moving violations on I-25 and other State and Federal highways. A state traffic grant, which provided the motorcycles, requires a preponderance of

speed enforcement on State and Federal highways. The motorcycle officers also engage in selective traffic enforcement in school zones and other problem traffic areas, and work special events. We believe this high visibility traffic enforcement function has significantly contributed to the decline in traffic fatalities (1988 saw the lowest number of traffic fatalities since 1980). Last year, the motorcycle officers issued 15,600 summonses.

Two officers are hit and run traffic accident specialists, and conduct the follow-up investigations required to identify and prosecute hit and run suspects. This specialized investigative function requires the assigned officers to develop prosecutable cases by conducting interviews, gathering evidence, filing charges, and testifying in court. The two officers were assigned 750 such cases in 1988, and cleared over 400 of them. These officers are also assigned to special event traffic control.

One traffic officer is assigned to enforce commercial vehicle violations. This position was originally created due to the large number of complaints about truck and other commercial violations, which require a specialized enforcement response. Last year, the commercial vehicle enforcement officer wrote 1,382 summonses, and impounded 109 vehicles. The officer is the Department's Haz-Mat representative, and is also engaged in other selective traffic enforcement and special events requiring traffic control.

Two officers are assigned to enforce speed limits and other traffic laws within school zones. They cover more that 60 elementary schools as well as respond to problem areas and complaints. This function provides a targeted response to the critical enforcement problem of hazardous traffic violations around elementary schools when children are present. These officers also make traffic safety presentations to the students and train school crossing guards. Each school enforcement officer averages about 75 traffic summonses per month during the school year. When school is not in session, these officers are assigned to other traffic duties. The City's Student Pedestrian Safety Committee has recommended increasing the number of school enforcement officers in response to community concerns over the safety of elementary school children walking to and from school.

Patrol Support

Ten officers are assigned to the Tactical Enforcement Unit (TEU), which is a specially trained and equipped tactical response function. TEU handles exceptional incidents, often life threatening, that require special police responses. Examples of situations handled by TEU include barricaded suspects, snipers, hostage situations, high risk warrant service, hijackings, civil disturbances, VIP security, and any situation requiring a highly mobile and flexible police unit. A secondary function of TEU is to work certain directed activities, especially those involving robbery and burglary. This specialized function requires continual training to assure its response effectiveness. TEU is available to respond 24 hours a day.

One TEU officer also serves as an explosives technician who handles suspected explosive devices, conducts investigations into bombings and accidental explosions, investigates bomb threats, and provides explosives security for VIP's. This trained explosives technician is assisted by three other explosives technicians, one a TEU sergeant, another an officer assigned to the Administration Bureau, and another officer assigned to Patrol.

Five officers are assigned as canine handlers. These officers handle incidents requiring the unique services of police canines. Building searches, suspect tracking, drug and explosive detection, crowd control, and officer cover are only some of the law enforcement applications in which the canine handlers and their dogs are very effectively used. Last year, these canine teams conducted over 800 building and field searches, handled 3,220 calls for service, and made 204 arrests.

This year the Department implemented a Neighborhood Policing Unit (NPU), which applies special problem solving techniques to targeted areas of the City. Problems are identified, analyzed, and solution strategies are developed, drawing from Departmental and community resources. This group can work out of the mobile command post practically anywhere in the City. While assigned to an area, they also handle the calls for service. This year, for example, the Neighborhood Policing Unit was assigned to the South Nevada area and made substantial progress in transient displacement, prostitution removal, and cooperating with the management of a south end trailer park, literally "cleaned-up" a trailer park infested with bikers, prostitutes, and drug dealers. Over 1900 citizen contacts were made just during the first three months of this year by the NPU; in addition, they handled 210 calls for service in this first target area.

Crime Prevention

As part of the field services decentralization, one Crime Prevention Officer was assigned to each of the three Division Commands. Each Crime Prevention Officer is responsible for all crime prevention services within his Division. These service are in high demand from the community, and include the following:

1. Neighborhood Watch management
2. Civic and other community group presentations
3. Residential and business security surveys
4. Neighborhood crisis intervention and problem solving
5. School liaison and presentations
6. Public service announcements

Due to the great demand for the services of the Crime Prevention Officers, they work a flexible schedule which allows them to work evenings, weekends, and other peak demand times.

Airport Security

Nine officer positions are assigned to the Colorado Springs Airport as required by FAA policy. As a Category I airport, we must meet a five-minute response time requirement for responding to the screening station at the concourse entrance. The nine officers will allow us to meet that and other FAA security requirements at the airport, as well as provide law enforcement services at that location. The officers' salaries and overtime are reimbursed by the airport to the General Fund.

Headquarters Security

With the downtown headquarters facility separate from the Gold Hill Division Command, it is necessary to have a police officer presence at the downtown headquarters location after regular working hours and on weekends. We are trying to meet this need through the use of temporary light duty officers. Three officers are presently assigned to provide scheduled coverage at the downtown headquarters facility, so that there is at least one officer available to supervise the Public Service Representatives and to handle any situations requiring an officer. The walk-in public business at the downtown headquarters building is consistently heavy, with disorderly conduct incidents occurring in the lobby on occasion. The Headquarters Security Officer, as the only police presence in the building after hours, makes security tours regularly, takes signed complaints at the reception desk, serves warrants, monitors the holding cell to insure the safety of prisoners, and conducts warrant enhancements.

CAB/Utilities Building Security

The salary for 75% of the two positions currently providing security services to the CAB and the Utilities Building is paid for by Utilities as offsetting revenue into the General Fund. These two officers are required by City direction, and provide a variety of security services for City administration and citizens.

Roll Call Training

One officer is assigned from patrol to the Training Unit to develop, produce, and deliver roll call training to the Patrol Bureau. The officer conducts training needs assessments for patrol officers, and is primarily involved in the production of training video tapes which are shown at roll calls. This critical assignment assures that our patrol officers are receiving the most current and relevant training to perform their jobs.

DARE Program

One officer is assigned during the school year to the new, and very successful, DARE (Drug Abuse Resistance Education) program, which currently is in School District #20. This past school year the officer's position was funded by an El Pomar grant, and the

School District advises that if no other funding is available this coming school year, they will fund the position from the school budget. The DARE officer instructs a special drug prevention curriculum to elementary school children.

V. SUPERVISORY POSITIONS

Summary of Patrol Bureau Supervision Requests

	CURRENT	REQUESTED	CHANGE
Captains	**3**	**4**	**+1**
[Divisional Stations	3	3	0]
[Metro Division	0	1	+1]
Lieutenants	**11**	**11**	**0**
[Divisional Stations	9	9	0]
[Metro Division	2	2	0]
(Traffic	1	1	0)
(Patrol Support	1	1	0)
Sergeants	**33**	**45**	**+12**
[Divisional Stations	26	33	+7]
[Metro Division	7	12	+5]
(Traffic	3	7	+4)
(Patrol Support	4	5	+1)

Divisional Station Supervision

Each of the three Patrol Divisions requires a Captain as Division Commander and a Lieutenant to serve as Watch Commander for each shift. The total of fixed command positions, therefore, is twelve: three Captains and nine Lieutenants. These positions currently are fully staffed. The assumption upon which the Patrol Bureau operates is that a Sergeant will serve as acting Watch Commander whenever a Lieutenant is not assigned; or, for two days per shift per week.

The Patrol Divisions, however, are not adequately staffed to provide appropriate field supervision, an essential element of responsible police service. During each shift, the minimum staffing pattern recommended for each Division, given the present level of Patrol activity, would be one Watch Commander (or acting Commander) and two Sergeants **available for field supervision.**

For each Division, therefore, three supervisors (Sergeants and Lieutenants) at a minimum are needed for each shift, for a total of nine supervisors per shift city-wide. There are 21 shift periods per week, which means that a weekly total of 189 supervisor-shifts must be manned. As each supervisor will normally work five of these supervisor-shifts, 37.8 supervisor positions would be needed if each individual supervisor filled each position for forty hours per week and fifty-two weeks per year, for a total of 2080 hours per year. In actuality, police statistics show that an individual supervisor is available for supervisory duty for 1763

hours per year, when vacation time, holidays, training time, and average sick time and Workers Compensation time are deducted. Therefore, each supervisor is available for duty 84.76% of the needed time. To staff the 37.8 necessary positions requires a total of 45 persons.

Nine of the recommended forty-five supervisors are designated as Lieutenant positions, and it is recommended that this staffing level be continued. Thirty-six Sergeants, therefore, are necessary for proper field supervision and coverage as acting Watch Commander.

The Patrol Divisions currently are assigned twenty-six Sergeants. This leaves Patrol ten Sergeants short of the recommended strength. However, as workload statistics are not presently as heavy on the midnight shift, it would be possible for the time being to under-staff each Division by one Sergeant for that shift. It is therefore recommended that seven Sergeants be added to the Patrol Divisions, for a total strength of thirty-three Sergeants.

Metro Division Supervision

It is proposed that a Metro Division be created to consolidate all centralized Patrol components--that is, all which are not functionally a part of the geographical Division structure. Components of the proposed Metro Division would be the Traffic Section and the Patrol Support Section. Lieutenants commanding these sections at present report directly to the Deputy Chief of Patrol, an inefficient arrangement. It is therefore recommended that one Captain be added to command the Metro Division.

Traffic Section Supervision

One Lieutenant and three Sergeants are currently assigned to the Traffic Section. Each Sergeant has both general and specially-assigned supervisory responsibilities. In addition to the duties of supervising general traffic enforcement and accident investigation, both of which are very demanding, the Section also requires supervision of special enforcement activities (such as D.U.I. enforcement and 55-mph grant-funded speed enforcement) and coordinating special activities. The latter includes not only public events such as parades but also many private events and activities which require traffic coordination, such as sports events, house-moving, funerals, etc.

Traffic Section workload, as shown elsewhere in this report, has made it essential that the Section be considerably strengthened. To this end, it is recommended that three additional Sergeants be allocated. This would permit each shift to have two Sergeants, for coverage seven days a week. Sergeants would retain specialized responsibilities, but all would share responsibility for ensuring proper supervision for traffic functions as a whole.

A special request, in addition to the three Sergeant positions discussed above, is for a Sergeant to supervise School Area Enforcement and Traffic Safety Education, which have proved to be matters of special public concern. Depending upon workload factors, this Sergeant could possibly also assume supervisory responsibilities for hit-and-run investigations. Thus, it is requested that the Traffic Section be augmented by four Sergeants in total, bringing its supervisory structure to one Lieutenant and seven Sergeants.

Patrol Support Section Supervision

The Patrol Support Section consists of specialized units and activities which support the overall mission of the Patrol Bureau. Some of its functions are not regularly staffed, drawing, as needs arise, upon personnel regularly assigned elsewhere. Activities such as the SCUBA team, the Crisis Negotiation Team, and the Bomb Squad are of this nature; the Patrol Support Section serves as a channel for administration and training, and assumes operational command when the teams are activated.

Other functions of Patrol Support are performed by regularly staffed units. These are the Canine Unit, the Park Police, the Tactical Enforcement Unit, the Volunteer Enforcement Unit, and the DARE Program. During the past year the Department has created a Neighborhood Policing Unit, or Foot Patrol, which has proved very successful in targeting criminal activities in specific areas of the City. As a temporary measure, the unit has been supervised by the Sergeant of the Canine Unit. Development of the Neighborhood Policing Unit has now progressed to the point that a regularly assigned Sergeant is required. Therefore one additional Sergeant is requested for the Patrol Support Section, bringing its supervisory staffing to one Lieutenant and five Sergeants.

VI. NONSWORN POSITIONS

Although the Patrol Bureau is composed primarily of sworn personnel, also falling within the bureau are several essential nonsworn positions. These positions provide very specific functions, as follows:

FUNCTION	# POSITIONS
Park Police Officers	8
Parking Enforcement Officers (Traffic)	4
Patrol Captains' Secretaries	3
Patrol Deputy Chief Secretary	1
Public Service Representatives	15
Requested	
Metro Division Captain's Secretary	1
Public Service Representatives	3

These positions all provide functions necessary to the operation of the Patrol Bureau. Additionally, the Park Police Officers and Parking Enforcement Officers relieve sworn officers from specific tasks which would otherwise add to the field officers' responsibilities. Thus, if the field officers were to absorb the duties of Park Police and Parking Enforcement Officers, their overall workload would increase.

The captains' secretaries and the Deputy Chief's secretary perform clerical tasks as needed for their respective superiors. The Public Service Representatives are really the link between the Patrol Bureau and the public, as they are the only individuals many citizens deal with at the Police Department. Before the transition to Division Commands, the front desk was manned by a sworn officer. Again, the use of civilians in these positions enables more sworn officers to be available for calls for service work.

Each of the nonsworn functions within the Patrol Bureau are described in more detail in the following sections.

Park Police

The primary duties of the Park Police Officers are to patrol all city parks and enforce city and state laws through arrest and detention, issuing summons and verbal warnings. The Park Police Officers also respond to C.S.P.D. calls for service as primary

responders when necessary, and as cover units for other officers. Park Police Officers write case reports, auto accident reports, and reports of accidental injuries. Additionally, the Park Police Officers participate in directed activities in city parks in problem and high crime areas.

Park Police Officers are sent to calls in City Parks when Dispatch determines that the address of the call-for-service is indeed a city park. However, Dispatch often sends Park Police Officers to locations that are near, but not within city parks. Additionally, Park Police Officers are used to "fill in the gaps" when sworn officers are not available to answer calls, thereby reducing the time they have to spend patrolling and answering calls in city parks. Furthermore, because the City of Colorado Springs has over 120 parks, it is virtually impossible for the Park Police Officers to patrol every park. Therefore, enforcement is concentrated on the largest and/or most used city parks. Many parks are never routinely patrolled during the Park Police Officers' normal shift duties.

There are eight full-time Park Police Officers, working under one sergeant. Park Police Officers are on duty seven days a week. Schedule changes during the year for the Park Police Officers are based on seasonal changes in activity in the parks. Besides additional coverage, during the summer season, days off for officers are primarily limited to weekdays, with only one officer taking days off on Saturdays and a different officer taking days off on Sundays.

In the course of their regular patrol duties, Park Police Officers are not assigned to specific city parks, or specific areas of town. Therefore, officers will respond to calls or cover calls anywhere within the jurisdiction if appropriate. Directed activities can occupy a great deal of the Park Police Officers' time, particularly during the summer season. Directed activities focus on high crime areas or problem locations within city parks, e.g. the Prospect Lake Detail or the Street Level Narcotics Directed Activity.

The Park Police Officers' workload is affected by seasonal changes, daily weather conditions, the tourist season, and by special events occurring in the city parks. Many special events, e.g. Springspree, 4th of July, and the Balloon Festival require not only on-duty Park Police Officers but extra duty officers (either Park Police or P.O.'s) as well.

Although the Park Police Officers are not certified peace officers, they currently meet all requirements of the C.S.P.D. Training Academy. Some of the current Park Police Officers meet all the requirements of CLETA as well.

Parking Enforcement Officers

The primary duties of the Parking Enforcement Officers are to issue citations for expired meters, overtime violations on meters and other specified parking violations in the downtown and westside areas.

There are four full-time Parking Enforcement Officers and one temporary officer, providing coverage from 8:30 a.m. to 6:00 p.m Monday through Friday, and from 8:30 a.m. to 5:30 p.m. on Saturdays. A temporary officer works during the summer months to fill in with regular duties when permanent officers are on vacation. When all permanent officers are on duty, the temporary officer concentrates on writing citations for overtime meter violations.

Each Parking Enforcement Officer is assigned to a district, which takes approximately 30 to 40 minutes to walk. The officers do not follow a specific beat so that they do not develop a recognizable pattern. Because officers can get involved in time-consuming duties such as booting (which requires two officers to minimize conflict with citizens), it is difficult to determine the actual number of times an officer completes the whole beat.

Workload is affected by the tourist season and by special events occurring in the downtown and westside areas, when more vehicles are parked at meters. Additionally, workload is affected by weather (e.g., during inclement weather, officers work out of a car or scooter and look for specified violations, rather than meter violations).

Patrol Captains' Secretaries

Each of the three Patrol Captains has a secretary who handles the telephone answering and clerical work for the Division Captain. Secretaries answer the Captain's phone, type correspondence for the captain and the shift commanders, order office supplies, and handle other secretarial needs as they arise. The secretaries work 8:00 a.m. - 5:00 p.m., Monday through Friday. The workload is affected by the captains' and commanders' administrative work and the resulting need for clerical assistance, along with general secretarial needs of the station.

Metro Division Captain's Secretary

The recommendation for a Metro Division Captain, which would command the Traffic and Patrol Support Sections was made in the previous chapter. Clerical support, similar to the current duties of the Patrol Captains' secretaries, would be required. It is therefore suggested that an additional clerical position be added to the Patrol Bureau to serve as the secretary to the Metro Division Captain.

Patrol Deputy Chief's Secretary

As with the Captains' secretaries, the secretary to the Deputy Chief of Patrol is responsible for all clerical duties within the Deputy Chief's office. This includes screening phone calls and visitors, typing correspondence, maintaining files, and distribution of information to all Divisions. The workload for this secretarial position is clearly affected by the workload of the Deputy Chief.

Public Service Representatives

The major duties of the Public Service Representatives are to receive walk-in and telephone contacts at the Division stations, take case reports on minor offenses, handle a variety of clerical tasks, transcribe reports and other documents, and monitor the building -- especially the holding cells -- via closed circuit television.

There are currently five PSR's at each substation, providing coverage for the front desk 24 hours per day, 7 days per week. While the starting and ending times vary, the shifts basically coincide with the patrol shifts.

Since the primary responsibility of PSR's is greeting and assisting the public, the workload for PSR's is difficult to determine exactly. When the PSR's are not actively engaged in dealing with the public, however, most of their time is spent transcribing reports. Thus, the most transcribing is accomplished when there is the least contact with the public, on the third shift. On the first and second shift, when public contact is more frequent, much less transcribing and miscellaneous tasks gets accomplished.

Patrol officers are currently brought in to cover for PSR absences. Therefore, one additional PSR is needed at each Division to assume more clerical/telephone tasks, and to provide enough PSR's -- regular shifts and relief shifts -- to cover all absences.

V. RECOMMENDATIONS

The purpose of this study is to provide the background for informed decisions regarding future manpower. Although the model offers suggested manpower allocations based on several performance standards, it is up to policymakers to determine the acceptable performance standards. It is clear that changes in the performance standards have a significant effect on the number of officers projected. The intention of this report, however, is not only to determine and justify the number of officers required to handle the given workload, but to offer insight into how profoundly a change in the number of officers affects the level of service the Police Department can offer the community.

Therefore, although the net result of our analysis is the number of officers required to meet specific performance standards, several relevant issues arose during the course of the project. Following is a list of recommendations regarding the projection and publication of manpower requirements, including those areas which need to be addressed in future studies:

1. This report should form the basis for the personnel request for the Patrol and Traffic functions for the 1990 budget.

2. Future manpower projections should be conducted at least once per year using the Patrol/Plan model. This analysis should be done using projected workload data based on historical information. After the number of required officers is determined, a scheduler program should be used to determine the appropriate deployment of manpower. On a more regular basis, Patrol/Plan should be used to estimate performance measures using current data to provide an accurate assessment of the levels of service being attained.

3. Since recruit officers cannot be used to engage in calls for service work for at least nine months after they are hired, they should not be considered as viable resources to apply to the workload in the year they are hired. Therefore, the entire recruiting, hiring and training process should be reviewed and revised so that rookies will be fully trained by the beginning of the calendar year. In this way, when projections are made for a particular year, the rookie class can be considered as available manpower for that year.

4. Policies which ultimately affect the number of officers needed to respond to calls for service should be reviewed, such as cross-beat dispatching and the call priority system. An examination of all calls for service should be conducted to devise alternative ways to manage calls.

5. The Department should adopt performance standards to optimize the use of patrol and traffic units and to realize the levels of service being offered. The amount of time an officer has available for directed patrol, self-initiated activity and random, routine patrol is effectively a decision of the policy makers. If the performance estimates presented in this report are acceptable, then the following standards should be adopted:

- Patrol units will spend no more than 40 minutes per hour actual work time, leaving 20 minutes for uncommitted time.

- An average of three units should be available at any time.

- The probability that all units will be busy when a call is received should not exceed 5%.

- The queue delay for Priority I calls should be no greater than three minutes.

- The total response time for Priority I calls should be no greater than eight minutes.

FOOTNOTES

1. Ownbey, Robert; Sick Time Study, 1988.

2. To calculate the number of officers needed from the zone level analysis, multiply units * 365 (days per year, or number of shifts per year) * 8 (hours per shift), then divide by 1763 (actual hours worked).

3. Patrol Bureau Detail; April, 1989.

APPENDIX A

How Patrol/Plan Works

Patrol/Plan uses queuing theory as the basis for its patrol operation simulation in that it determines the probability that a call for service will be received when all units are busy. In other words, Patrol/Plan determines the probability of saturation, which is directly related to the calls for service rate, the number of patrol units, and the service time for each call. As the probability of saturation increases, the lower the likelihood that there will be a free unit to answer a call for service. Therefore, as the probability of saturation increases, the need to put calls in queue increases.

Patrol/Plan needs several input data items to provide descriptive performance estimates or to project manpower requirements. The inputs are defined in the following section.

Inputs

1. **Calls for Service Rate** - the number of calls for police service received in one hour. This was calculated by summing the number of calls received during a given shift for all the occurrences of that day in one year in one zone, i.e., all calls received during Shift I on Mondays during the year in the North zone. The total was then divided by the number of Mondays in the year (52) and divided by eight hours (per shift) to arrive at an hourly call rate for that zone, day and shift.

2. **Units Required Per Call** - the percent of calls requiring one unit, two units, etc. This information was calculated by the CAD system.

3. **Service Time** - the average time spent at a call scene by the first unit, second unit, etc. The total time consumed on calls for service during a shift divided by the total number of calls for service results in the average time consumed per call for the first unit. For the purposes of this study, it was assumed that the second unit spent approximately half as much time as the first unit on a call, and so on.

4. **Non-calls for Service Time** - the average number of minutes per hour a unit spends in doing work other than responding to calls (i.e., traffic stops, reports, business checks). This information was gathered from a survey of officers' log sheets, and generally conforms to findings of similar surveys in this and other departments.

5. **Dispatch Policy** - availability of backup or fixed post units to answer calls when the sector units are busy. For this study, the policy was assumed that if all units are busy, all calls for service are placed in queue and are dispatched, in priority order, as units become available. This is an assumption which can be changed and would possibly affect the

outcome of the model. It may be determined by a policy decision that fixed post units, such as canine or TEU, should answer either Priority One calls or any call when all patrol units are unavailable.

6. **Priority of Calls** - the percent of calls that are Priority I, II and III. This data was calculated by the CAD system.

7. **Region Area** - the number of square miles in the given geographic area. The model assumes three geographic zones conforming to the geographic divisions for substations. The area's square mileage was determined by the City Planning Department.

8. **Street Miles** - the miles of street in the given geographical area. The street miles were estimated for each zone by taking total miles of street in the city as determined by the Street Department, then multiplying that number by the fraction of land area in a given zone.

9. **Response Speeds** - the average response speed for units travelling to a call. This data came from CAD as a time function from dispatch to arrival at scene. Although as an input, actual response speeds were used, this variable can be listed as an output measure when setting maximum response times as performance objectives.

10. **Patrol Speed** - the average speed of the units when patrolling. This variable is used only to determine the average patrol interval in a region - how many times a patrol unit will pass a certain geographic point during its shift. Because of the nature of Colorado Springs, this was not considered an appropriate performance measure. However, since the model required an input to complete its calculations, 15 m.p.h. was used as the patrol speed.

Performance Criteria Used to Determine Required Staffing

Patrol/Plan determines the number of units needed to satisfy all the performance objectives input into the model. However, one objective will eventually "drive" the model, as a certain number of units will be required to satisfy that particular constraint which will have already satisfied the other constraints.

Patrol/Plan offers eight constraints to be used in determining manpower needs. The user can specify any or all of these constraints to be used when running the model, and the program will calculate how many units are needed to satisfy all the constraints.

- **Actual Work/Unit** - the amount of time in minutes per hour that a unit spends doing work. For this study, actual work/unit includes responding to calls for service, as well as directed patrol, administrative work, etc.

- **Uncommitted Time/Unit** - the amount of time in minutes per hour that the unit is not committed to responding to calls or doing other patrol or administrative-related work. The sum of Uncommitted Time/Unit plus the Actual Work/Unit totals 60 minutes.

- **Average Number of Free Units** - the average number of units available to answer calls at any given time.

- **Minimum Patrol Interval** - the length of time between incidents of a patrol unit passing a given geographic point in the patrol area.

- **Percent Calls - All Units Busy** - the probability that a call will be received when there are no units available to respond.

- **Queue Delay** - the maximum length of time in minutes that a call can wait in queue, by priority.

- **Travel Time** - the maximum length of time, in minutes, that a unit takes to arrive at the scene from the time it is dispatched on the call.

- **Response Time** - the maximum length of time, in minutes, from when the call is received until a unit arrives at the scene. This is actually the sum of travel time plus queue delay.

Whichever constraints are used to run the model, an output summary will show the results for all of the objectives. Furthermore, once the driving constraint is determined, for subsequent runs of the model, that is the only performance objective that needs to be entered.