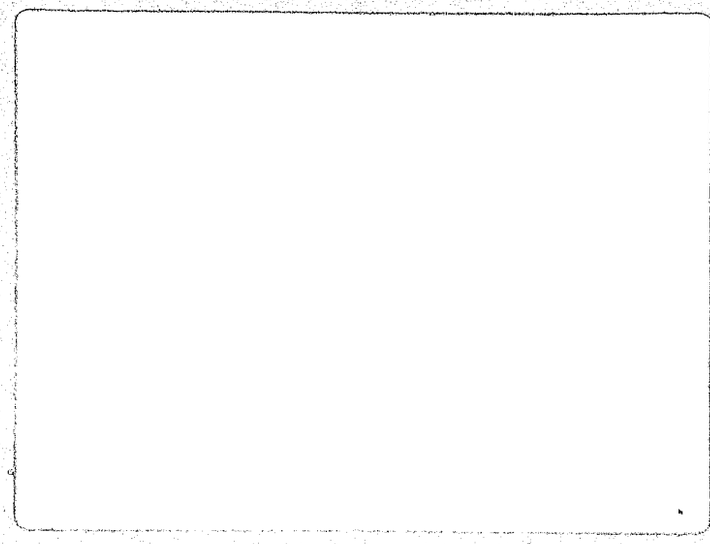

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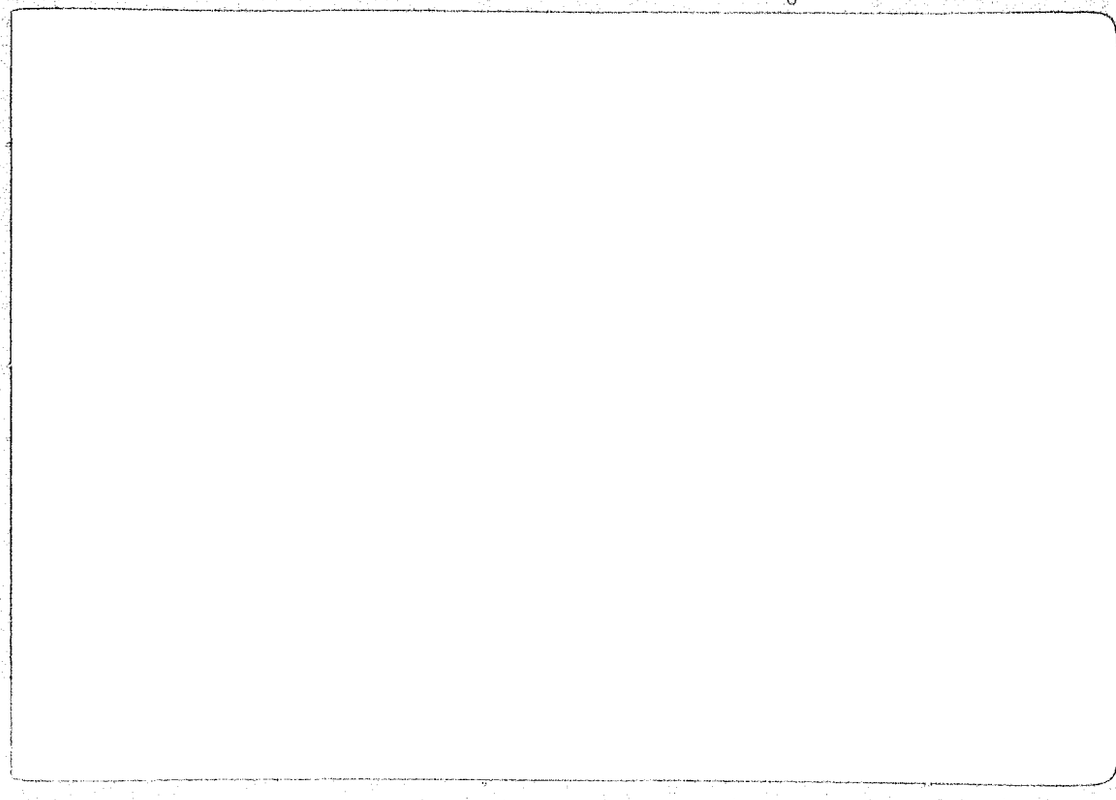

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Performance Measures for Evaluating One- vs. Two-Officer Cars

by

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Public Systems Evaluation, Inc.
Cambridge, Massachusetts

TABLE OF CONTENTS

LIST OF EXHIBITS

I. INTRODUCTION AND OVERVIEW

One- versus two-officer police cars: today few issues stir more heated debate in U.S. municipal police departments. Police management and patrol labor bargaining units represent two key actors in the debate. Also involved are citizens (both as taxpayers and as recipients of police service) and city or municipal management. Too often the debate over one- versus two-officer police cars is politicized and oversimplified, with the various sides taking extreme positions. Mechanisms for converging to negotiated agreement are sorely needed.

This report focuses on quantitative ways of structuring the debate. In Section II, we present a conceptualization incorporating police manpower levels, performance measures, and alternative deployment strategies as a way of thinking about negotiation and locating the "negotiation space". We even identify a set of points in the negotiation space which is "win-win-win": police labor representatives, city management and citizens are all better off in contrast to the "status quo" situation. In Section III, we report the results of an extensive national police survey whose major purpose was to understand what factors influence police departments to deploy (or not to deploy) one-officer patrol cars. In Section IV, we attempt to draw from the survey critical performance measures that can be used in constructing a "multi-dimensional" negotiation space. During the

process of identifying these performance measures, simple analytical models are devised which tend to shatter certain myths of one- versus two-officer cars. The models demonstrate strongly the need for quantitatively based assistance to guide the negotiation process. The report closes with a Summary and Conclusion section.

II. PERFORMANCE MEASURES AND LABOR/MANAGEMENT NEGOTIATIONS

2.1 The Key Actors

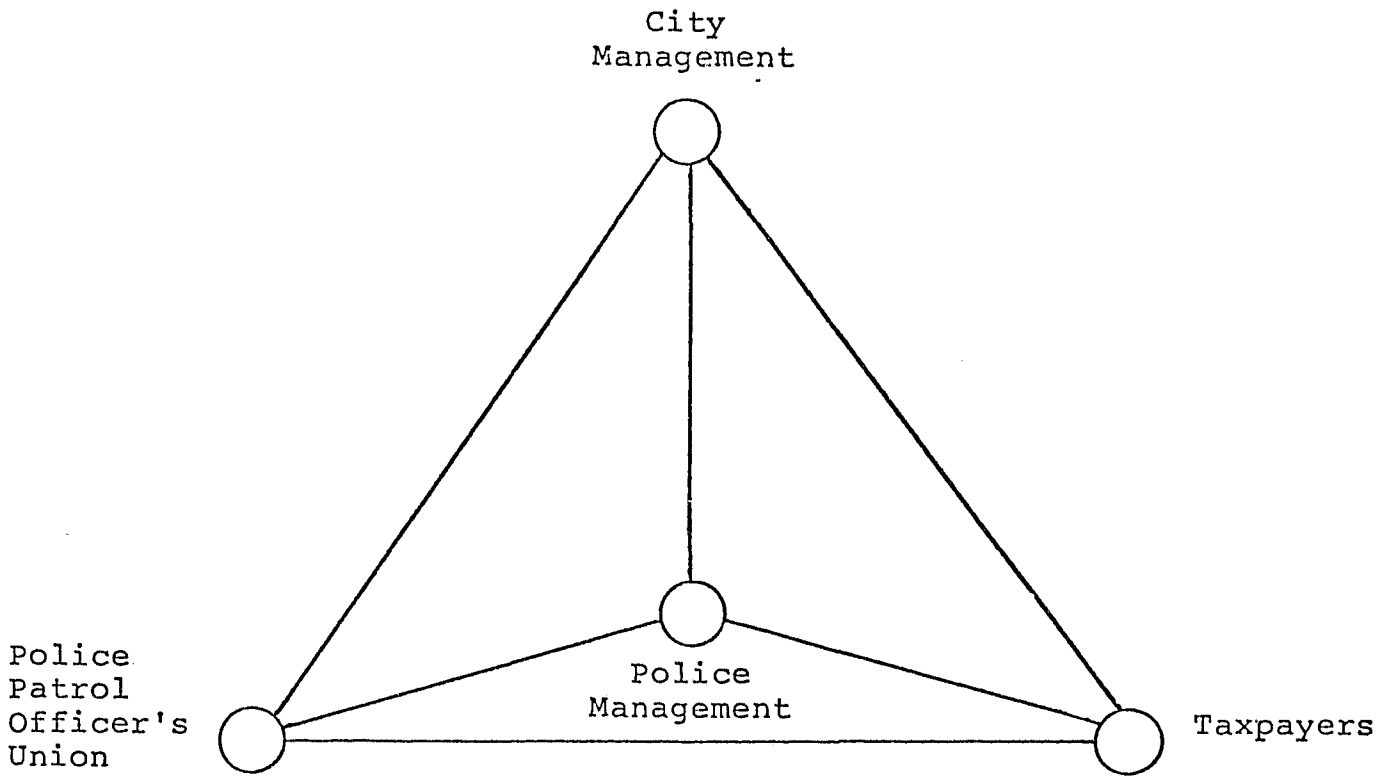
In any negotiation concerning a major policy adjustment in police department operations, such as a switch from two- to one-officer cars, there are four key "actors" who play important roles in determining the outcome of the negotiations. Three of the actors are involved directly in the negotiation process: the police patrol officers' union, the police management, and the city management. The fourth actor-group -- the citizens or taxpayers -- while not directly participating in the negotiations, can influence the other actors through political pressure or civilian review boards. Thus, they warrant designation as a key actor-group to be acknowledged in a negotiation proceeding.

2.2 Performance Measures and Conflict Interaction

One can represent the possibilities for pairwise interactions between the actors in a "conflict interaction diagram", as shown in Exhibit 2.1. In general, it may be imagined that the actor at each vertex of the conflict interaction diagram desires a certain degree of performance from the system in particular areas. Performance measures and related issues indicate the level of performance within

Exhibit 2.1

The Conflict Interaction Diagram



each area. These areas may overlap from actor to actor, but they will almost certainly conflict at key points. For instance, a manager's concern for reduced response time may be at odds with patrolmen's emphasis on workload equalization. Moreover, any individual actor can have conflicting objectives: for example, taxpayers want to be able to walk the streets at night, yet are reluctant to accept tax increases aimed at financing police-related improvements.

As an added complication, the same performance measure can be seen differently by each actor, thereby yielding further conflicts. Consider response time, a performance measure that has undergone a considerable amount of modeling and empirical research, perhaps the most famous project being the Kansas City Response Time Study. In deploying police patrol personnel, police management is usually concerned with the minimization of city-wide police response time; this is the measure to which they are most often held publicly accountable, and for which complaints are generated by phone or sometimes in the public media. The taxpayers, too, are interested in response time minimization, but more frequently are interested in equalization of response time (reflecting equal accessibility to the police) over the various neighborhoods of the city; thus, while taxpayers are interested in city-wide response time reduction, perhaps they are more interested in neighborhood equalization of

response time. City management is probably concerned with the relationship between cost and response time, perhaps as reflected by the current marginal cost per additional ten seconds, say, of response time reduced. Finally, if the police patrol plan involves one-officer as well as two-officer cars, the police patrol officers' union's interest in response time might focus on the anticipated time for a two-officer car to arrive at the scene to back up a one-officer car. Or, if all the cars are one-officer cars, perhaps a "rendezvous" system is in place in which the first arriving one-officer car takes a position near the crime scene until the second unit links up with it, at which point both of them proceed to the crime scene; in such a case the police officers' union is interested in the response time difference between the first arriving car and the second arriving car. Thus we see that even the same performance measure, in this case response time, can be manipulated in ways to suit the interests of each of the various actors in the process, which invariably results in conflicting objectives.

2.3 Performance vs. Manpower and Operating Policy

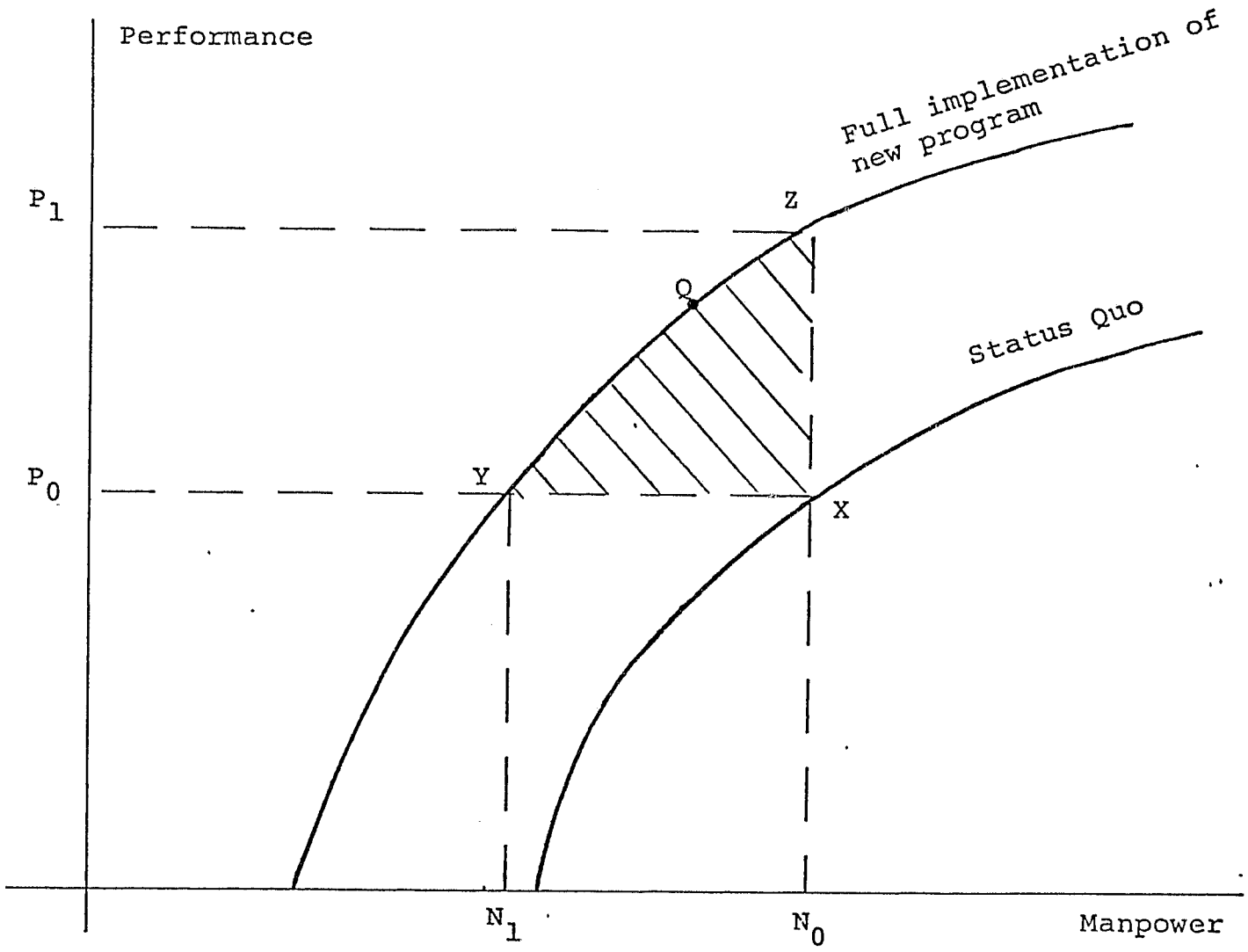
While the conflict interaction diagram is a useful conceptual tool for considering the interaction between and among key actors, it is not constructive in leading to action. For this, we need alternative procedures that

quantitatively link manpower levels, costs, program design elements and other performance measures to perception and appreciation of system performance. To this end, Exhibit 2.2 presents a simple diagram relating "performance" (measured along some unspecified index) to manpower. One motivation for this conceptualization stems from recent work that we undertook under a contract with the New York City Office of Management and Budget, assisting that office in the design and evaluation of a "Mixed-Mode" police patrol program (i.e., a program involving integrated and coordinated operation of one- and two-officer police patrol cars).

In the exhibit there are two curves showing performance as a function of manpower. The first represents the performance to be achieved at various levels of manpower under the "status quo operation" (maintaining the current operations policy), while the second shows the expected results of a proposed new program that contains productivity improvement innovations, related to the change from two- to a combination of one- and two-officer patrol cars. The shape of each curve is similar. We have assumed that a certain level of manpower is necessary to have any positive value of performance (that level is higher for the status quo operation than for the new program). Also, implicit in the curves is the concept of "diminishing returns" from each additional police officer.

Exhibit 2.2

Performance versus Manpower



Let us examine a few of the points and features of these curves. At current status quo operations, the system is operating at point X, reflecting an allocation of N_0 patrol officers and a performance level of P_0. Now assume that through negotiations it has been proposed that the innovations in the new program be implemented to the fullest extent possible, so that, in effect, the system will be made to operate on the curve depicting "full implementation of the new program". Points Y and Z represent two bargaining points within the "full implementation" proposal. At point Y, manpower is reduced to the level that will maintain the prior performance level of the system, while at point Z, manpower is maintained at the prior level, with a corresponding increase in performance. Note that points above and to the left of the "new program curve" are not obtainable given the slated innovations. Furthermore, it is reasonable to assume that the actors are implicitly under two additional constraints, namely that performance shall not be decreased and that manpower shall not be increased. Thus, the possible outcomes in terms of manpower and performance to the negotiation process has been limited to points in the shaded region in Exhibit 2.2.

Once the possible outcomes of the negotiation have been established, it is natural to ask what negotiated settlement each actor would most prefer, in terms of a point in the

shaded region. Clearly, this depends on the objectives and relevant performance measures for each actor. For example, if the city management were only concerned with saving money, they would prefer the outcome at point Y, since manpower, and hence cost, is minimized at that point. If the taxpayers or police management were only concerned about performance, then they would prefer the outcome at point Z, where performance is maximized. Finally, suppose the police union is only concerned with perceived officer safety [1] and views the use of one-officer patrol cars as life threatening. In that case, the police union would prefer not to even enter into negotiation and have the system continue to operate at point X, the status quo operating point. Note that in this case, each actor's preferred position is at one of the three verticies of the shaded region — a long way from a new contract!

[1] We use the term perceived officer safety as a summary measure describing the police union's position. In fact, their position also involves other issues, some measurable and negotiable, such as workloads, and some not measurable and often not articulated, such as officer loneliness. The term perceived is used because it is by no means clear from the research literature that one-officer cars in fact provide an increased threat to officer safety.

2.4 Negotiation

Conflicts are not solved by each actor steadfastly refusing to budge from his initial bargaining stance. The trick is to compromise in such a manner as to have each actor "give

in" some amount, but leave each in a position where he is still better off than where he began. In the situation we described above, while city management would be most satisfied at point Y and the taxpayers and police management at point Z, city management would find cost reductions in operating at any point where manpower is less than N_0, the status quo manpower, and the city residents and police management would be satisfied with any point where performance is greater than P_0 , the status quo performance level. But the police union may not want to give in on the issue of perceived officer safety unilaterally. In this situation it may be necessary to trade off one actor's performance measure against another actor's. Specifically, city management could offer the police union salary increases for some perceived sacrifice of officer safety, in this instance the use of one-officer cars. (The rate of exchange is another matter for further investigation.)

Now, let us see how this simple trade-off results in a much improved negotiating atmosphere. Suppose that the police patrol officers are willing to accept the full implementation of one-officer cars for an officer pay raise of $1,000 (in effect, this means that the officers are indifferent [in a decision theoretic sense] between their current situaiton — current pay and two-officer cars — and the proposal of a $1,000 raise and one-officer cars). Naturally, city management will not pay any more for all

police services than they currently pay so they may insist that the number of police officers be reduced -- at the minimum -- to a level where the city's new officer personnel cost, at the new salary and manning levels, is no higher than the current cost. Suppose the point of equal total costs is point Q (see Exhibit 2.2). In this case, the points on the "new program" curve from point Y to point Q have the property that : (1) all participating officers earn more money than they currently do; (2) the taxpayers and police management enjoy a higher level of performance than they currently do; and (3) the city management's total costs are smaller than they currently are. So the end result of a simple trade-off between extra dollars and perceived officer safety is to increase all actors' satisfaction compared to the status quo. This is truly a "win-win-win" situation.

2.5 Toward Developing Specific Performance Measures

The development of a fully automated procedure for labor management negotiations was beyond the scope of this grant project. However, given the conceptualization outlined above and given the project's focus on performance measures, we attempted to obtain additional information on which performance measures were thought to be most useful in considering the issue of one- versus two-officer cars. We felt that the best way to do this was to elicit responses from police departments that have actually changed operating

policies toward a policy involving additional one-officer cars. In a nationally distributed mailed survey, we asked a sequence of questions whose purpose was to discover the perceived advantages and disadvantages of one-officer cars versus two-officer cars and via the answers received, to develop a reduced list of performance measures that capture the essential features of this problem. It is hoped, then, that subsequent research can contribute to an analytically (e.g., model) based framework for facilitating the process of considering alternative implementations of one-officer cars and for informing labor/management negotiations. The remainder of this report summarizes the national survey process and results and, based on these findings, develops a reduced set of relevant performance measures. To tie the set of performance measures to the conceptualization developed above, the reader may imagine that in Exhibit 2.2 we are generating a number of different "performance" dimensions or axes and that the new "shaded zone" will in fact be a multi-dimensional shaded zone, where the number of dimensions corresponds to the number of performance measures plus one for manpower.

III. THE NATIONAL SURVEY

This section reports on a national survey of police departments utilizing both one- and two-officer cars. The survey had three major purposes:

1. To provide information on performance measures as discussed in this report.

2. To follow-up an NIJ sponsored survey of approximately 200 law enforcement agencies in 1978.

3. To provide information of particular use to New York City's police department (NYPD) and Office of Management and Budget (OMB) with regard to implementing "Mixed Mode" patrol (combined one- and two-officer cars) in New York City.

Since New York City had a direct and timely interest in the findings, the NYPD cooperated strongly by having a high ranking police officer sign the letter of transmittal accompanying the survey questionnaire.

In support of the three main purposes stated above, the survey was intended to address the types of calls for service (CFS) appropriate to one-officer car response, the results of any prior (or concurrent) studies concerning officer safety vis-a-vis patrol staffing, the perceived advantages and disadvantages of one-officer cars, the associated dispatch and backup policies and a number of related procedural issues. Generally speaking, the survey sought to understand how other large police departments

employ combinations of one- and two-officer patrol cars, what motivated them to do so and what performance changes from prior practice have been observable.

Appendix A contains the survey instrument including tabulated responses to the quantitative questions.

3. Survey Process

Conduct of the survey evolved in a multi-stage process. First, we prepared several draft versions of the survey which were subjected to careful scrutiny and review by our in-house technical staff, several outside survey specialists, and key individuals in New York City. Each sequential draft incorporated a number of modifications and enhancements recommended by the reviewers.

Second, we sought the cooperation and assistance of the Police Executive Research Forum (PERF) in developing our survey sample of police departments. In 1978, in conjunction with a National Institute of Justice-funded study of alternative response strategies, PERF conducted a survey of the approximately 200 law enforcement agencies serving the nation's largest (i.e., most populous) jurisdictions. Of those departments surveyed, 150 cities and 25 counties responded and PERF was willing to supply us with copies of the completed survey instruments. Employing

these 175 departments as a starting point, we expanded the list to include all other city police departments with populations of more than 100,000 -- according to the 1980 Census -- and 19 other county police departments with more than 500 employees --according to the Municipal Yearbook [International City Management Association, 1982]. Exhibit 3.1 identifies the 187 city departments and 44 county departments which constituted the final survey sample.[2]

Third, we sought to achieve the highest possible rate of response from the 231 sample departments. Strategically, we felt the strongest inducement would result from survey dissemination by the NYPD directly, thereby encouraging a peer response. Moreover, Deputy Commissioner Devine of the NYPD composed a cover letter which personally invited each recipient's participation in the survey. On April 25, 1983 we mailed 231 surveys -- including the personalized cover letter from Chief Devine and a self-addressed (to the NYPD) and stamped return mail envelope. It was determined that NYPD would transmit received responses to our Cambridge (Massachusetts) offices and that, as stipulated in the survey instructions, questions regarding survey content or interpretation would be directed to our staff.

[2] It should be noted that 231 sample departments include the 61 jurisdictions identified as using both one- and two-officer cars according to the Survey of Police Operations and Administrative Practices [Police Foundation, 1981].

Exhibit 3.1

Cities and Counties Comprising Survey Sample

("x" = Responded to the Survey)

x 1. Akron, OH
x 2. Albany, NY
x 3. Albuquerque, NM
x 4. Alexandria, VA
5. Allentown, PA*
6. Amarillo, TX
7. Anaheim, CA
x 8. Anchorage, AK
x 9. Ann Arbor, MI
x 10. Arlington, TX
x 11. Atlanta, GA
x 12. Aurora, CO
x 13. Austin, TX
x 14. Bakersfield, CA*
x 15. Baltimore, MD
x 16. Baton Rouge, LA*
x 17. Bayonne, NJ
18. Beaumont, TX
19. Berkeley, CA
x 20. Birmingham, AL
21. Boise, ID*
x 22. Boston, MA
23. Bridgeport, CT*
x 24. Buffalo, NY*
25. Canton, OH
26. Cedar Rapids, IA
x 27. Charlotte, NC
28. Chattanooga, TN
x 29. Chesapeake, VA*
x 30. Chicago, IL
x 31. Cincinnati, OH
32. Cleveland, OH
x 33. Colorado Springs, CO
x 34. Columbia, SC
35. Columbus, GA
x 36. Columbus, OH
x 37. Compton, CA
x 38. Concord, CA*
x 39. Corpus Christi, TX
x 40. Dallas, TX
x 41. Davenport, IA*
x 42. Dayton, OH
x 43. Dearborn, MI
x 44. Denver, CO
x 45. Des Moines, IA
x 46. Detroit, MI
x 47. District of Columbia
48. Duluth, MN
49. Durham, NC*
x 50. East Orange, NJ
x 51. Elizabeth, NJ
x 52. El Paso, TX
53. Erie, PA
x 54. Eugene, OR
55. Evansville, IN*
x 56. Evanston, IL*
x 57. Flint, MI
x 58. Ft. Lauderdale, FL
x 59. Fort Wayne, IN
x 60. Fort Worth, TX
x 61. Fremont, CA
x 62. Fresno, CA
x 63. Fullerton, CA*
64. Garden Grove, CA
x 65. Garland, TX*
66. Gary, IN
x 67. Glendale, CA
x 68. Grand Rapids, MI
x 69. Greensboro, NC
x 70. Hampton, VA
71. Hartford, CT
x 72. Hialeah, FL
73. Hollywood, FL*
x 74. Honolulu, HI*
x 75. Houston, TX
76. Huntington Beach, CA
x 77. Huntsville, AL*
x 78. Indianapolis, IN
79. Independence, MO*
80. Inglewood, CA
81. Irving, TX
82. Jackson, MS
x 83. Jacksonville-Duval Co., FL
x 84. Jersey City, NJ
x 85. Kansas City, KS
x 86. Kansas City, MO

*Did not respond to PERF Survey, but population was over 100,000 in 1980.

	87.	Knoxville, TN*
x	88.	Lakewood, CO
	89.	Lansing, MI
x	90.	Las Vegas-Clark Co., NV
x	91.	Lexington-Fayette, Co., KY
x	92.	Lincoln, NB
x	93.	Little Rock, AR
x	94.	Livonia, MI
x	95.	Long Beach, CA
x	96.	Los Angeles, CA
	97.	Louisville, KY
x	98.	Lubbock, TX
	99.	Macon, GA
x	100.	Madison, WI
	101.	Memphis, TN*
x	102.	Mesa, AZ*
x	103.	Miami, FL
	104.	Milwaukee, WI*
x	105.	Minneapolis, MN
x	106.	Mobile, AL
x	107.	Modesto, CA*
x	108.	Montgomery, AL
x	109.	Nashville, TN
x	110.	Newark, NJ
x	111.	New Haven, CT
x	112.	New Orleans, LA
x	113.	Newport News, VA
x	114.	New Rochelle, NY
	115.	Newton, MA
	116.	New York, NY
x	117.	Norfolk, VA
x	118.	Oakland, CA
x	119.	Oklahoma City, OK
x	120.	Omaha, NB
	121.	Orlando, FL
	122.	Oxnard, CA*
	123.	Pasadena, CA
x	124.	Pasadena, TX
x	125.	Paterson, NJ
x	126.	Peoria, IL
	127.	Philadelphia, PA
x	128.	Phoenix, AZ
	129.	Pittsburgh, PA
x	130.	Pontiac, MI
x	131.	Portland, OR
x	132.	Portsmouth, VA
x	133.	Providence, RI
x	134.	Pueblo, CO
x	135.	Racine, WI
x	136.	Raleigh, NC
x	137.	Reno, NV*
x	138.	Richmond, VA
x	139.	Riverside, CA
x	140.	Roanoke, VA
x	141.	Rochester, NY
x	142.	Rockford, IL
x	143.	Sacramento, CA*
x	144.	Saginaw, MI
x	145.	St. Louis, MO
x	146.	St. Paul, MN
x	147.	St. Petersburg, FL
	148.	Salt Lake City, UT
x	149.	San Antonio, TX
	150.	San Bernardino, CA
x	151.	San Diego, CA
x	152.	San Francisco, CA
	153.	San Jose, CA
	154.	Santa Ana, CA
	155.	Savannah, GA
x	156.	Scottsdale, AA
x	157.	Seattle, WA
x	158.	Shreveport, LA*
x	159.	Southfield, MI*
x	160.	South Bend, IN
x	161.	Spokane, WA
x	162.	Springfield, MA
x	163.	Springfield, MO
x	164.	Stamford, CT
x	165.	Sterling Heights, MI
x	166.	Stockton, CA
	167.	Sunnyvale, CA
x	168.	Syracuse, NY
x	169.	Tacoma, WA
x	170.	Tampa, FL
x	171.	Tempe, AZ*
	172.	Toledo, OH
x	173.	Topeka, KS
x	174.	Torrance, CA
x	175.	Tucson, AZ
x	176.	Tulsa, OK
x	177.	Virginia Teach, VA
	178.	Waco, TX
x	179.	Warren, MI
x	180.	Waterbury, CT

*Did not respond to PERF survey, but population was over 100,000 in 1980.

x 181. White Plains, NY
x 182. Wichita, KS
x 183. Wilmington, DE
x 184. Winston-Salem, NC*
x 185. Worcester, MA
  186. Yonkers, NY
  187. Youngstown, OH

---

*Did not respond to PERF survey, but population was over 100,000 in 1980.

Counties (N=44)

x 1. Alameda, CA
x 2. Anne Arundel, MD**
x 3. Arlington, VA
x 4. Baltimore, MD
x 5. Broward, FL**
6. Charleston, SC
x 7. Contra Costa, CA**
8. Cook, IL**
x 9. Dade, FL
x 10. Dallas, TX
x 11. DeKalb, GA
12. Erie, NY
13. Essex, NJ
x 14. Fairfax, VA
15. Fresno, CA**
16. Hamilton, OH
17. Hamilton, TN
x 18. Harris, TX
19. Hillsborough, FL**
x 20. Jefferson, KY
21. Jefferson, LA**
x 22. King, WA**
23. Los Angeles, CA
x 24. Maricopa, AZ
x 25. Marion, IN**
x 26. Mecklenberg, NC
27. Milwaukee, WI
x 28. Montgomery, MD
x 29. Nassau, NY
x 30. Orange, CA
x 31. Orange, FL
32. Palm Beach, FL**
33. Pima, AZ**
x 34. Pinellas Park, FL**
x 35. Prince Georges, MD
36. Riverside, CA**
37. Sacramento, CA**
38. St. Louis, MO**
39. San Bernardino, CA_*
40. San Diego, CA
41. Santa Clara, CA**
42. Suffolk, NY**
x 43. Ventura, CA**
x 44. Wayne, MI

**Did not respond to PERF survey, but has more than 500 employees.

3.2 Survey Response and Analysis Approach

The survey response rate was 71.4 percent, remarkably high for a survey of this type (see Exhibit 3.2). This result is due in large part to the enthusiastic participation of NYPD -- in particular, the staff of OMA -- and OMB in the survey development process. It should be noted that responses from three cities --Las Vegas (NV), Huntsville (AL) and Long Beach (CA) -- were received after the August 25th "cut-off" date and could not be included in the computer-based analysis. The response from the NYPD was deliberately not used in the analysis.

Our computer-based analytical approach also evolved in stages. First, every questionnaire was carefully reviewed to eliminate obviously incorrect responses resulting from misinterpretation of the questions. Failure to do so would have "contaminated" the correct responses. [3] (For example, one department improperly answered the question about numbers of CFS received with numbers of patrol units dispatched.) Next, a coding format was selected for each individual survey item. While responses to most of the questions were objective and could be coded directly, responses to the more subjective questions could only be recorded in textual form or summarized independently. While

Exhibit 3.2

Summary of Survey Response

Type of Jurisdiction	Number of Surveys Sent	Number of Responses Received	Percentage of Response
City	187	139	74.3%
County	44	26	59.1%
TOTAL	231	165	71.4%

every effort was made to extract a codable set of objective responses to the subjective questions, this did not prove feasible.

Ultimately, the 162 surveys received before the "cut-off" date were coded in 379-character records which were then keypunched and transferred to computer disk for subsequent statistical analysis. Our principal analytical software tool is the Statistical Package for the Social Sciences (SPSS) and the results of our analyses are reported in the following sections.

[3] Such contamination could often be identified from built-in "information redundancy checks" designed into the questionnaire.

3.3 The Use of One-Officer Cars

Our focus in this report is in that subset of questions in the survey instrument that sheds light on relevant performance measures. We start by examining the reported use of one-officer cars, as reflected by responses to question B.3 (see Appendix). From the reported figures, we can derive the all-important average percentage of one-officer cars deployed on each tour, expressed as a proportion of the combined numbers of one- and two-officer cars.

Exhibit 3.3 displays the overall distribution of all jurisdictions in the sample, while Exhibits 3.4 and 3.5 give the percentages for the largest police departments -- measured by number of sworn officers -- and the most densely populated jurisdictions, respectively. Two points should be clear from these exhibits. First, both cities and counties deploy a high fraction of one-officer cars; and second, that fraction varies significantly from tour-to-tour. In fact, the overall average percentage of one-officer cars used is 84 percent in the day tour, 69 percent in the evening tour, and 71 percent in the night tour. This observed tour variation confirms a point raised in the open-ended responses concerning one-officer cars --namely, that time of day is an important factor in deciding how to deploy one-officer units.

We were also interested in determining whether there is a systematic relationship between any measure of department "size" and the percentage of one-officer cars. The "Chi-Square Goodness of Fit" statistical test provides one way of measuring the degree of dependence between two variables and has been used in this case to assess the relationship between department size and the percentage of one-officer cars. Our Chi-Square tests indicated that the fraction of one-officer cars deployed is <u>independent</u> of population, CFS, and CFS per officer, but is <u>dependent</u> on the population

Exhibit 3.3

Distribution of One-Officer Cars by Tour

Percentage of One-Officer Cars	Percentage of Departments Responding			
	Day Tour (N=117)	Evening Tour (N=115)	Night Tour (N=113)	Overall (N=113)
0% - 10%	0.9%	5.2%	9.7%	0.9%
11% - 20%	0.0	2.6	0.0	0.9
21% - 30%	1.7	1.7	0.9	1.8
31% - 40%	3.4	6.1	5.3	6.3
41% - 50%	3.4	2.6	3.5	4.5
51% - 60%	3.4	7.8	6.2	7.2
61% - 70%	5.1	2.6	3.5	6.3
71% - 80%	6.8	12.2	13.3	9.9
81% - 90%	19.7	18.2	15.9	18.0
91% -100%	55.6	40.9	41.6	44.1
TOTAL	100.0%	100.0%	100.0%	100.0%

Exhibit 3.4

Percentage of One-Officer Cars in Ten Largest Responding Police Departments

Jurisdiction	Total Sworn Patrol Officers	Percentage of One-Officer Cars*		
		Day Tour	Evening Tour	Night Tour
Chicago, IL	8,893	100%	0%	0%
Los Angeles, CA	4,951	42%	18%	7%
Washington, DC	2,759	79%	76%	62%
Detroit, MI	2,149	24%	15%	0%
Houston, TX	2,052	71%	39%	34%
Baltimore, MD	1,992	79%	79%	79%
San Francisco, CA	1,323	0%	0%	0%
Dallas, TX	1,234	67%	66%	50%
Honolulu, HI	1,032	100%	100%	100%
Metro-Dade Co., FL	940	60%	57%	60%
Phoenix, AZ	907	91%	91%	91%

*

$$\frac{\text{No. of One-Officer Cars} \times 100}{\text{No. of One-Officer Cars} + \text{No. of Two-Officer Cars}}$$

Exhibit 3.5

Distribution of Injuries Occurring to One-Officer Unit Occupants Prior to Arrival of Second Officer

Percent of Injuries	Number of Departments	Percent
0% - 10%	19	45.2%
11% - 20%	6	14.3
21% - 30%	4	9.5
31% - 40%	3	7.1
41% - 50%	4	9.5
51% - 60%	0	0.0
61% - 70%	1	2.3
71% - 80%	2	4.9
81% - 90%	1	2.3
91% - 100%	2	4.9
TOTAL	42	100.0%

density. In particular, the higher the population density the more likely the jurisdiction would be to deploy a smaller fraction of one-officer cars. This result concurs with the open-ended respones on one-officer cars. Furthermore, the result is intuitively satisfying since we would expect that population density is a more reasonable proxy for the degree of risk confronting a patrol unit than, say, population.

About half of the departments responding to Question B.5 indicated that the numbers of one- and two-officer cars are not fixed. In these cases, departments stated that assignments are primarily based on the availability of manpower. Implying that there is a set number of patrol units that must be deployed, these departments further indicated that two-officer cars were deployed only if "additional manpower were available". Many departments using exclusively one-officer units (as indicated in Question B.3) said that two-officer units were used only for training purposes. Several departments suggested that assignments were based on periodic surveys designed to reassess crime trends and workloads.

Question B.5 asks about the administrative area to which one-officer cars, two-officer cars, and supervisory cars are assigned for patrol and response purposes. As an aid to the respondent, the following sample response was included:

"Each car is assigned to a separate beat in which it is responsible for general patrol. However, it may be assigned to calls for service from anywhere in its district (which generally consists of 4 to 5 beats)." A substantial majority of respondents indicated their one- and/or two-officer car patrol and response areas were identical to those in the sample response. In particular, departments using <u>both</u> one- and two-officer cars indicated the sample response applied to both types of units; that is, no particular distinctions are drawn between one- and two-officer units in terms of "area integrity".

There was also substantial uniformity in the patrol/response area relationship of the supervisor's patrolled unit. The common thread was that the supervisor patrolled an area corresponding to the response area of the patrol units (i.e., districts), but responded to CFS in the next largest unit of area (i.e., several districts).

According to Question B.6, 44.3 percent of the respondents have switched patrol modes in the past 15 years. A wide variety of responses were given as to the form of staffing used and why it was changed. Some had shifted from mostly two-officer units to mostly one-officer units, while other departments had gone the opposite way. In fact, a statistical test showed that the percentage of one-officer cars used is independent of whether or not the department

had changed patrol staffing patterns. Thus, we cannot conclude that there is a general trend toward more one-officer cars. Most responding departments indicated they have always deployed a large fraction of one-officer units.

On the other hand, whether or not a department changed staffing form does depend on whether or not their budget had increased or decreased. In particular, if a department had experienced a decrease in the patrol officers' budget, then that department is more likely to have switched to a more efficient -- i.e., one-officer -- form of patrol staffing. Recalling our conceptual discussion of performance versus manpower (Section II), it appears that many departments have switched from "point X" to "point Y" in our attempt to maintain performance levels in the face of diminishing manpower pools.

3.4 Police in Detroit and Los Angeles

To illustrate details of one-officer car deployments, we discuss here two cities - Detroit and Los Angeles - that provided us with memoranda outlining their procedures.

Detroit deploys a combination of one- and two-officer patrol cars. On the day tour, 42 percent of the patrol cars are one-officer cars. On the evening and night tours, the percentage drops to 18 and 7 percent, respectively. One-

officer cars are not restricted to any given area, but rather are restricted to daylight hours and to the selected types of runs to which they may respond.

A memorandum attached to Detroit's survey, "Guidelines for Dispatching Precinct Special Detail Car", (Detroit's term for one-officer cars) highlighted the following dispatching procedures:

1. One-officer units shall be assigned to non-emergency complaints only. These include parking complaints; injury reports at hospitals; adult missing; verify the return of a missing person; delivery of information; transportation of witnesses; latent breaking and entering, vandalism and larceny reports; and other minor complaints that can be handled by one officer.

2. One-officer cars shall respond only to runs to which they have been dispatched, with the exception of officer-in-trouble runs.

3. Dispatchers shall give priority to a radio call from a one-officer car.

4. One-officer cars shall not be given an in-service run.

5. The dispatcher shall endeavor to establish radio contact with a one-officer car that has not been heard from within a reasonable length of time. If contact cannot be made, a patrol car shall be dispatched to the last known location, and the precinct desk shall be notified.

6. One-officer cars shall obtain permission from the dispatcher before proceeding on a run assigned to another car.

7. One-officer cars shall not be referred to as "one-man cars". Instead, use a special prefix to identify the car.

8. The officer in the one-officer car shall inform the dispatcher each time he leaves or returns to his vehicle.

9. One-officer cars shall not be dispatched across sector lines.

10. No one-officer car shall be dispatched to a large complex, apartment, warehouse or site where the officer would be required to use long flights of stairs, elevators or be otherwise separated from his vehicle for unusual lengths of time.

The department did not submit any results of studies on officer safety and only indicated, "the use of one-officer cars to handle non-emergency calls has freed more manpower to handle more serious offenses".

Los Angeles also deploys a combination of one- and two-officer patrol cars: the percentages of one-officer cars on the day, evening and night tours are 42, 18 and 7 respectively. One-officer cars were first considered for use in 1950 due to personnel shortages. Since then, the Los Angeles Police Department (LAPD) has identified those types of police activities that it believes are suitable for one-officer cars. These include preliminary crime investigation and report taking, crime suppression, traffic enforcement, and accident investigation. To determine the number of one-officer cars to deploy in each area, the LAPD's primary criterion is the percent of the above listed one-officer car CFS in a particular area and at a particular time of day. Presently, one-officer cars are used in all parts of Los Angeles.

As was the case with Detroit, Los Angeles did not enclose results of any studies on officer safety, but seemed satisfied with one-officer cars in general. As they put it, "the current deployment of one-officer units is logical,

allowing the maximum utilization of these units without sacrificing officer safety, productivity or cost effectiveness".

3.5 Areas for One-Officer Assignment

Responses to the question, "What factors did your department consider in selecting an area for one-officer car use?", demonstrated that like Los Angeles, the majority of departments use some proxy for relative safety to determine where to allocate their one-officer cars. One of the most common proxies is the one Los Angeles uses -- the percentage of CFS that the department considers appropriate for one-officer car response. Two other measures of officer safety were also frequently mentioned: the demographics of the area including population density, type of dwellings, and socio-economic makeup; the size of beats, and presence of barriers to travel, to the extent that they may hinder the availability of backup units. Two departments quoted the principles articulated by the Report of the President's Commission on Law Enforcement and the Administration of Justice [1967]:

> "[an area is inappropriate for a one-officer car if characterized by] too many incidents for a one-officer car to handle in a physically limited, densely populated area; a high frequency of circumstnces in which officers are likely to be assaulted; and the high prospect of raucous misbehavior that can only be prevented by the concerted effort of two or more officers".

On the other hand, many jursidictions did not indicate that they allocate one-officer cars on a precinct-by-precinct basis. Rather, these jurisdictions apply a criterion city-wide to determine the allocation. That is, rather than saying, "Precinct A has these characteristics and so it will have one one-officer car, and Precinct B has other characteristics and so it will have three one-officer cars", these jurisdictions might say, "The ratio of one- to two-officer cars in all precincts will be 1:2." Frequently mentioned city-wide criteria were exclusive use of one-officer cars, exclusive use of two-officer cars, a fixed ratio of one-to-two officer cars, and exclusive use of one-officer cars during a particular shift. More specifically, many departments did not use one-officer cars at night, thus of course implying time of day is a key factor in one-officer car use. It is entirely possible that these jurisdictions decided on the basis of some empirical study that their city-wide criterion was the most appropriate deployment scheme. However, such criteria provide little, if any, insight into what determines if a specific area is appropriate for a one-officer car -- the primary objective of this question.

3.6 Information Relevant to Performance Measures

The principal advantages and disadvantages of one-officer cars appear now to be well known. Obviously, the same patrol force, in terms of manpower, can field twice as many one-officer cars as two-officer cars. And since common performance measures -- visibility, patrol frequency, response time -- all improve with increasing numbers of patrol units, overall system performance (in terms of these measures) will improve. On the other hand, concerns about officer safety may require additional hardware devices (e.g., shotguns, bullet-proof vests, etc.) as well as the dispatching of two cars where previously only one car would be needed. These advantages and disadvantages, along with several others mentioned in the responses, are quantifiable and measurable. However, few, if any, of the departments provided empirical data to support their responses to Question C.3, thus limiting their utility.

As expected, most of the advantages that the respondents listed were performance related. Lower response time on routine calls, better use of manpower on low-priority calls, higher police visibility, increased patrol frequency, increased flexibility with manpower, and more cost effectiveness were all frequently mentioned as advantages of one-officer cars. One department said one-officer cars provide "overall better service to the community".

The most frequently mentioned disadvantage of one-officer cars was the need for additional backup cars. Those departments that dispatch one-officer cars to crimes in progress and other high priority calls indicated they dispatch <u>two</u> one-officer cars, whereas, if they deployed two-officer cars, <u>one</u> two-officer car would handle the call. Departments complained that this complicated dispatching, increased cross-sector dispatches, and increased airtime. A few respondents said this resulted in a lowering of officer morale. Earlier it was mentioned that the lack of empirical data limited the utility of the responses to this question. This is especially true concerning the above claim that more backups are needed due to use of one-officer cars. The backup frequency data that we derived from responses do not support this claim.

Likewise, inconsistencies arose over officer safety and the cost factor of one-officer cars, as some jurisdictions stated these two issues are advantages of one-officer cars and some jurisdictions claimed they are disadvantages. A sizeable number of departments simply stated "officer safety is decreased". But an equally sizeable number said that one-officer cars had increased officer alertness, improved their judgement, and increased officer comaraderie, all leading -- they claimed -- to an increase in officer safety. A few departments said their officers preferred to work alone.

At the same time, there was no general agreement as to whether cost was an advantage or a disadvantage of one-officer cars. Those departments that claimed cost was an advantage said they could achieve the same system performance at a lower cost, while departments arguing cost is a disadvantage cited greater gasoline consumption and more vehicle maintenance. Since typically over 90 percent of the budget of an urban police department is consumed by salaries, fringe benefits, and related personnel expenses, it is surprising that departments cited "cost" as a disadvantage of one-officer cars (see Section 4.7).

Departments were asked to describe the results of any studies or investigations providing factual information on officer safety. Unfortunately, approximately 80 percent of the respondents indicated they had performed no such studies. This fact by itself is surprising, given the controversial nature of one-officer cars and officer safety. Of the respondents that did answer the question (C.4), the vast majority did not have specific results from an empirical study; rather, they simply gave a broad statement describing their general impressions. A clear majority claimed one-officer cars are as safe or safer than two-officer cars. Some comments included, "[an] unofficial survey shows that one-officer cars are the best, safest, and most productive [patrol cars]", and "our observations and information from FBI reports would seem to indicate no

correlation between the numbers of officers in a car and injury". On the other hand, one department stated, "all injuries occurred to one-officer car officers". Of the sixteen most densely populated jurisdictions, only one, Baltimore, which deploys 79 percent one-officer cars, reported any officer safety statistics. In Baltimore, 10 percent of officer injuries occurred to two-officer cars, 38 percent occurred to unassisted one-officer cars, and 52 percent to assisted one-officer cars. Seattle provided the most detailed results of an officer injury study, which are summarized in Exhibit 3.6.

The data in the exhibit show that from 1976 to 1980 the percentage of radio runs involving unassisted one-officer cars increased 34 percent, while at the same time assaults to officers in unassisted one-officer cars increased on 21 percent. It is also interesting to note that the number of assaults per 1,000 officer-runs is by far the lowest for one-officer cars assisted, but in 1976, it was 53 percent higher for two-officer cars than for unassisted one-officer cars; and in 1980, that percentage difference increased to over 190 percent!

Another question asked what percent of assaults or injuries occurred to officers in one-officer cars <u>before</u> a second officer was present. As in the previous question, a majority of the departments did not respond. Of those

Exhibit 3.6

Results of Seattle Patrol Safety Study

Year	Percent of Patrol Cars That Are:		Percent of Radio Runs Involving:			Percent of Assaults Involving Police Officers in:			Number of Assaults per 1,000 Officer-Runs in:		
	Two-Officer	One-Officer	Two-Officer Cars	One-Officer Cars Alone	One-Officer Cars Assisted	Two-Officer Cars	One-Officer Cars Alone	One-Officer Cars Assisted	Two-Officer Cars	One-Officer Cars Alone	One-Officer Cars Assisted
1976	47.0% (N=323)	53.0	49.5%	22.2 (N=221,085)	28.3	76.1%	11.2 (N=465)	12.7	1.62%	1.06	0.47
1980	20.0% (N=433)	80.0	24.1%	29.8 (N=274,416)	46.1	63.8%	13.6 (N=626)	22.7	3.02%	1.04	0.56

jurisdictions that did, the general trend was again, to downplay the danger to the officer in one-officer cars. Forty-two departments -- nearly all of the departments responding to the question -- simply reported a percentage figure. The frequency distribution contained in Exhibit 3.7 indicates that more than 50 percent of the responding departments stated that less than 20 percent of the injuries to officers in one-officer units occurred prior to the arrival of a back-up officer. This would tend to support the notion that an officer alone is not in significantly greater danger given that backup is available.

Finally, departments were asked to list safety features or precautions instituted primarily because of the use of one-officer cars. In general, the features or precautions fell into two main categories. The first might be called "hardware safety devices". These included modifications to the one-officer car itself, such as installing front/rear safety dividers, removing interior back seat door handles, and installing state-of-the-art communication equipment. Furthermore, the officer was provided with shotguns, bullet-proof vests, or portable radios. Departments that listed such devices usually cited the cost of these items as a disadvantage of one-officer cars.

Exhibit 3.7

Percentage of One-Officer Cars in Departments of Ten Most Densely Populated Jurisdictions Responding

Jurisdiction	Population Density *	Percentage of One-Officer Cars		
		Day Tour	Evening Tour	Night Tour
East Orange, NJ	18,750	90%	90%	86%
Paterson, NJ	17,253	50%	50%	0%
Bayonne, NJ	16,250	100%	100%	0%
San Francisco, CA	14,277	0%	0%	0%
Chicago, IL	13,065	100%	0%	0%
Newark, NJ	13,000	29%	0%	0%
Miami, FL	12,941	41%	59%	58%
Boston, MA**	9,795	0%	0%	0%
Jersey City, NJ	9,280	100%	0%	0%
Washington, DC	9,120	79%	76%	62%

*Measured in residents per square mile.

**Boston has deployed a number of one-officer units since the survey.

The other general category consisted of policy or procedural changes. These included increasing the frequency of backups, increasing the amount of officer training relating to one-officer cars, modifying dispatching procedures to accommodate one-officer cars (see, for example, Detroit's procedures in Section 3.4), and changing policies regarding the transportation of suspects. Again, most of the departments listing these changes also cited them as disadvantages of one-officer cars.

IV. DRAWING KEY PERFORMANCE MEASURES FROM THE SURVEY

In this section we develop a small list of specific performance measures that capture the essential features of the debate regarding one- and two-officer cars. First, we present aggregate findings from the survey, then we discuss in more detail each of the measures discovered to be important and how each such measure may be used in the negotiation process.

4.1 Summary Statistics

In Exhibit 4.1, we display statistics on the ten most frequently cited advantages and disadvantages of one-officer cars. Clearly, the most frequently mentioned advantage (27.9 percent of all respondents) is "increased patrol coverage and visibility". The most frequently mentioned disadvantage (20.6 percent of all respondents) is the set of

Exhibit 4.1

Summary of Perceived Advantage and Disadvantages of One-Officer Cars*

	Number of Responses	% of All Responding Departments
Advantages of One-Officer Cars		
Greater efficiency in use of manpower	14	8.5%
Reduced initial response time	20	12.1%
Increased patrol coverage and visibility	46	27.9%
Two officers not worked as a one officer job	14	8.5%
More cost effective	7	4.2%
More deployment flexibility by more cars fielded	26	15.8%
Officers more alert	11	6.7%
Disadvantages of One-Officer Cars		
Complications in logistics and dispatching caused by need to send multiple units	34	20.6%
Officer safety perceived to be diminished	11	6.7%
More expenditures on automobiles and fuel	14	8.5%

* Exerpted from narrative answers to Question C.3, all answers with five or more responses included (N = 165 responses).

complications in logistics and dispatching accompanying the officer backup procedures often used with one-officer cars. Two other advantages were cited by more than 10 percent of the respondents: more deployment flexibility by having more cars fielded (15.8 percent) and reduced initial response time (12.1 percent).

4.2 Increased Coverage

As stated above, "increased patrol coverage and visibility" was cited as the most popular advantage of one-officer cars. As it should be clear to most readers, a deployment of officers to one-officer cars instead of two-officer cars doubles the number of cars that can be on the street at one time. So essentially for the increased cost of fuel, maintenance and the amortized purchase costs of an additional fleet of vehicles, one gets twice as many vehicles on the road as one had with all two-officer cars.

However, the increased coverage may in fact be larger than is popularly believed. As one police department stated, "the one-officer patrol doubles the availability of response units in an area". Another police department stated that it "went from two-officer to one-officer units so as to double patrol capacity". There is often a kind of "hazard of linear thinking" with regard to one-officer cars that, in a sense, says that everything good about the patrol will be

doubled and everything bad about the patrol will be halved by switching from all two-officer cars to all one-officer cars. In fact, the situation is more complicated than this as illustrated by a simple modeling example.

Suppose that initially there are N patrol cars fielded, each with two officers, and that the average car is busy on calls for service a fraction f of the time. That means that at a random time an average of N(1 - f) cars are performing preventive patrol, by their patrolling being "visible" to both law abiding citizens and would-be criminals. Now if the department in question switches to $2 \cdot N$ one-officer cars, there is indeed of doubling of cars in the field. But assuming that there is no increase in calls for service workload, that on-scene service times remain the same, and that only one one-officer car responds to each call for service, then the average car is busy a fraction of time f/2, fully a 50 percent reduction in comparison to the two-officer force described initially. Thus, on average there are $2 \cdot N(\frac{1 - f}{2})$ cars performing preventive patrol on average at any given time.

To make the numbers meaningful, suppose that N is 100 and f is 50 percent, values typical of many police departments. Then, in the all two-officer car department, the average number of patrol cars on preventive patrol at a given time is N(1 - f) = 100(1 - 0.5) = 50 cars. These 50 cars are

moving around attempting to intercept crimes in progress, posing a threat of apprehension, and thus attempting to deter crime. The number of cars on preventive patrol at a random time appears to be a good surrogate for "police visibility and presence". If we now switch to the all one-officer car situation, we discover that the average number of one-officer cars on patrol at a given time is $2 \cdot N(\frac{1 - f}{2})$ $= 200(1 - 0.25) = 150$ cars. Thus we see a situation in which doubling the number of cars has tripled the amount of preventive patrol and thus tripled the police visibility in the area. This elementary fact appears to be unknown to the respondents of the survey questionnaire and represents a dramatic increase in patrol visibility above the "doubling" that is commonly mentioned in the responses. We see a switch to one-officer cars increases patrol coverage beyond the linear proportional amount often reported in questionnaire responses.

The observed "greater than doubling" effect on police visibility by switching from two- to one-officer cars suggests that if one only wanted doubling of patrol visibility, one could accomplish that with fewer officers than was used initially. This observation may be relevant in the labor/management negotiation process, not simply implying possible attrition of the number of officers, but perhaps in the reassignment of some of the officers to other details (such as "quality of life" policing).

The above analyses become more complicated when one includes backup vehicles, the possibility of increased on-scene service time for a one-officer vehicle versus a two-officer vehicle, and other frequently cited dispatch complications associated with the use of one-officer cars. However, the essential fact remains true that a switch from all two-officer cars to all one-officer cars almost invariably more than doubles patrol visibility as measured by average number of cars on preventive patrol at a given time. This kind of analytical reasoning would be important to incorporate into any labor/management negotiation process using the formulas outlined in Section II.

4.3 Response Time Reduction

As discussed above, the third most frequently cited advantage of one-officer cars in contrast to two-officer cars is reduced response time for the first responding vehicle. The primary reason for this is the fact that twice as many vehicles are covering the same area (in square miles), and thus the average sector or beat size is one half of what it was under the all two-officer car scenario. As a first order of approximation, one might be tempted to think that response time for the initial unit goes down by 50 percent, based on a simple "proportionality argument". However, well known analytical models have demonstrated that

travel times are proportional to the square root of the area covered in a beat. A halving of beat areas, as one would accomplish in a switch from all two-officer to all one-officer cars, would correspond to a reduction in intrabeat travel times to a level of $(1/\sqrt{2}) = 0.717$ of the original intrabeat travel times.

In fact, travel time for the initially responding vehicle decreases even somewhat faster than this due to the workload spreading phenomena discussed above for patrol coverage. If f is the fraction of time the average patrol car is busy in the all two-officer car force and f/2 is the corresponding fraction of time the average car is busy in the all one-officer car force, then it is well known in the operations research literature that average travel times (including both intrabeat and interbeat respones) in the two-officer car force are inversely proportional to the square root of $N(1 - f)$; initial response time in the all one-officer car force is inversly proportional to the square root of $2 \cdot N(1 - f/2)$. Following the numerical example cited above where N equals 100 and f equals 0.50, the proportionality factor for the all two-officer car force is $1/\sqrt{50} = 0.141$. The proportinality factor for the all one-officer car force is equal to $1/\sqrt{150} = 0.0816$, fully a 42 percent reduction in initial response time in contrast to the 29 percent reduction predicted by the simple "square root law" without patrol availability factors.

To sum up, provided call for service workloads remain the same and the same number of patrol car hours are required to perform on-scene work, patrol coverages increase faster than proportionally with deployment of one-officer cars and initial response times decrease faster than that predicted by simple square root laws that ignore availability factors; indicating extreme performance sensitivity and potential productivity improvement by switching from two-officer to one-officer cars.

The second order of reasoning indicated by these "simple back of the envelope" models was not apparent in any of the survey responses that PSE received. However, such reasoning should be an important component of any labor/management negotiation, as well as any citizen education campaign in explaining the advantages of one-officer cars.

4.4 Interbeat Dispatching

Several responding police departments indicated that a potential disadvantage of one-officer cars is the increase in interbeat dispatching due to sending backup units. Everything else being equal, police managers and officers tend to like to minimize the extent of interbeat dispatching in order to retain "officer identity" with law enforcement related conditions in his or her "own" beat. The greater

the extent of interbeat dispatching, the less this officer beat identification process occurs. Thus, increased amounts of interbeat dispatching tend to decrease perceived amounts of officers' accountability for crime levels and other law enforcement related factors associated with each individual beat.

Under regular police dispatching without use of backups, assuming that the average car is busy a fraction f of the time, then it is well known from the operations research literature that the fraction of dispatches which are interbeat dispatches is approximately f. Thus, for instance with the 100 car, 200 officer all two-officer example cited above with routine (non-backup) dispatching, fully 50 percent (equals f) of the responses would be interbeat responses. If the department shifted to all two-officer cars, yielding a reduced workload per car of f/2, then without backups the amount of interbeat dispatches would be f/2 = 0.25. Hence, without backups, switching to one-officer cars would decrease the amount of interbeat dispatching by 50 percent. Moreover, 75 percent of dispatches which would be intrabeat dispatches would be within beats only one half the size of the original beat, thereby further enhancing the process of officer beat identity.

Suppose that we now allow the complication that a fraction g of all dispatches require a backup unit. And suppose the backup unit and the first responding unit each remain at the scene of the incident for the same amount of time that a two-officer car would have remained at the scene. Then, the average fraction of time that a one-officer car is busy in the system is:

$$f^1 = f\left(\frac{1 + g}{2}\right)$$

There are now four different types of dispatch incident:

Type of Dispatch	Probability of Occurring
1. 1 car, intrabeat	$(1 - f^1)(1 - g)$
2. 2 cars, 1 intrabeat, 1 interbeat	$(1 - f^1)g$
3. 1 car, interbeat	$f^1(1 - g)$
4. 2 cars, both interbeat	$f^1 g$

It is straightforward to see that the average number of cars per dispatch is:

$$\bar{N}_D = 1\cdot(1 - f^1)(1 - g) + 2(1 - f^1)g + 1\cdot f^1(1 - g) + 2f^1g$$

and the average number of interbeat cars per dispatch is:

$$\bar{N}_{I|D} = 1\cdot(1 - f^1)g + 1\cdot f^1(1 - g) + 2f^1g$$

Thus, the fraction of dispatches that are interbeat is:

$$IB = \frac{(1 - f^1)g + f^1(1 - g) + 2f^1g}{(1 - f^1)(1 - g) + 2(1 - f^1)g + f^1(1 - g) + 2f^1g}$$

As a numerical example, we take our now familiar 200 officer force in which f = 0.50. Suppose that, when this force is switched to an all one-officer car force, 25 percent of dispatches require backup. That is, g = 0.25. In that case, the workload of the new force increased above f/2 = 0.25 to $f^1 = f(\frac{1 + g}{2}) = 0.5(\frac{1.25}{2}) = 0.3125$.

The fraction of dispatches that are interbeat is then

$$IB = \frac{(1-0.3125)0.25 + (0.3125)(0.75) + 2(0.3125)(0.25)}{(1-0.3125)(0.75)+2(1-0.3125)0.25+0.3125(0.75)+2(0.3125)(0.75)}$$

$$= \frac{0.5625}{1.25} = 0.45$$

Hence, for this particular numerical example, the fraction of total dispatches that are interbeat is 0.45, which is less than the 0.50 figure associated with all two-officer cars and no backup! Again, we see the importance of considering the effect of decreased workload per car as the force is shifted from all two-officer cars to all one-officer cars.

We do not want to leave the impression that a switch to all one-officer cars automatically reduces interbeat dispatching. On the contrary, if g is large enough, the switch may dramatically increase the amount of interbeat dispatching. For instance, consider the extreme when g = 1. That is, each incident requires a primary car and a backup car. Then, the workload of the car remains unchanged in the switch to one-officer cars, i.e., $f_1 = f$. And, from our formula, we compute that the fraction of dispatches that is interbeat is equal to:

$$IB = \frac{(0.5)\cdot 1 + 0.5(0) + 2\cdot(0.5)\cdot 1}{(0.5)\cdot 0 + 2(0.5)\cdot 1 + 0.5\cdot(0) + 2(0.5)\cdot 1} = \frac{1.5}{1 + 1} = 0.75$$

In this extreme case (in which every response requires a backup), the switch from all two-officer cars to all one-officer cars is accompanied by an increase in percentage interbeat dispatches from 50 percent to 75 percent, fully a 50 percent increase.

The point of this exercise and the previous two "back of the envelope" exercises was to illustrate that many of the simple notions associated with switching operating policies in a major way,(in this case from two-officer cars to one-officer cars) are far more complex than is popularly believed. A stereotypical response for instance, that says that interbeat dispatches will automatically increase with a change to one-office cars is, as the above examples have shown, not necessarily true. A stereotypical response that a doubling of the cars results in a doubling of patrol visibility is almost certainly not true, in that patrol visibility increases beyond doubling. And travel times for the first responding unit decrease somewhat faster than they would be expected even by "simple" square root laws. Thus, an informed negotiation process, for instance between labor and management, should almost certainly have access to the types of modeling tools that we have presented here to inform that process, to inform each side of the anticipated consequences of any particular new operating policy being contemplated, and to demonstrate to each side that the consequences that were considered likely a priori may in fact not obtain; performance measures that had been considered to become degraded may in fact may become improved, and performance measures which had been

anticipated to improve by a certain amount may in fact improve beyond that amount. Hence, intelligent exploration of the "negotiation space" as illustrated in Exhibit 2.2 would require an analytical framework as illustrated above.

4.5 Reduction of Service Time

The following is a typical response to Question C.3; "The one man car provides more area coverage, faster response to calls for service, more flexibility. Most major crimes require two units to respond which detracts from area coverage and response to calls. However, when the situation (at the scene) is resolved, one unit can get back on service and you do not tie up two officers." (words in parentheses added). This statement suggests yet another performance measure related to the debate of one- versus two-officer cars; this new performance measure would be reduction in mean service time, meaning average officer minutes spent at the scene (even for those which require backup), because of the ability of one of the officers to leave early. Only a small number of the responding departments mentioned this as a potential advantage of one-officer cars, yet in personal interviews all of those police officers and managers interviewed, agreed with the tentative conclusion that average on-scene times would be reduced because of the ability of the backup unit to leave early.

Suppose that we assume that when two one-officer cars respond to the scene, one of them can leave in a fraction $h (0 < h < 1)$ of the normal service time. That is, one of the cars would incur the usual service time and the other would incur a fraction h of the usual service time. Then it can be shown that the fraction of time that a one-officer car is busy in this system is

$$f^2 = f\left(\frac{1 + gh}{2}\right)$$

where f is the original fraction of time busy (in the all two-officer car system) and g is the fraction of calls for service that require a backup unit. This expression for the fraction of time busy can be entered into previously derived expressions to compute the fraction of dispatches that are interbeat.

Example 1: As above, suppose we are dealing with a force of N = 200 officers with an original "busyness" of f = 0.50. Suppose 25 percent of all incidents require backup, i.e., g = 0.25. However, assume that the backup car only spends half as much time at the scene as the primary car, i.e., h = 0.5. Then,

$$f^2 = f\left(\frac{1 + gh}{2}\right) = 0.5\left(\frac{1 + 0.25(0.5)}{2}\right) = 0.28125 .$$

The fraction of dispatches that are interbeat is

$$IB = \frac{(1-0.28125)\,0.25+(0.28125)\,(0.75)+2(0.28125)\,(0.25)}{(1-0.28125)\,(0.75)+2(1-0.28125)\,(0.25)+0.28125(0.75)+2(0.28125)\,0.25}$$

$$= \frac{0.53125}{1.25} = 0.425$$

This corresponds to approximately a 6 percent reduction over the amount computed earlier (0.45) when all service times were assumed to be the same.

Example 2: In the second numerical example treated in Section 4.4, we assumed that g = 1, i.e., that all calls for service required a backup unit. Suppose here too that g = 1 but, as in Example 1 above, h = 0.5. Hence, all calls require backup, but the backup unit only spends half as much time at the scene (on average) as the primary unit. In this case we find that

$$f^2 = f\left(\frac{1 + 1\cdot(0.5)}{2}\right) = 0.75 = 0.375$$

and the fraction of dispatches that are interbeat is

$$IB = \frac{(1 - 0.375)(1) + 2(0.375)\cdot 1}{2(1 - 0.375)\cdot 1 + 2(0.375)\cdot 1} = \frac{1.375}{2.00} = 0.6875$$

This compares to a figure of 0.75 when the backup car spends as much time at the scene as the primary car.

This sequence of simple models has shown how successive complications in operating policy can be incorporated in a sequential, and logical manner in a way to consider rationally the consequences of alternative operating assumptions in the one-versus two-officer car context.

Again, we believe that at least this kind of logic will be necessary for an informed negotiation in the allowable policy space, as discussed in Section II of this report.

4.6 Manpower Efficiency

Many of the responding police departments in the survey mentioned the greater efficiency in the use of manpower as the key advantage of one-officer cars. A typical response to Question C.3 is "reduced response time through smaller beats, more coverage with the same amount of personnel, avoid costs..., less released scheduling, direct accountability for actions taken". While only 8.5 percent of the respondents mentioned "efficiency" per se, a much larger number of respondents indirectly referred to efficiency through uses of such terms as productivity, cost effectiveness, performance per dollar, etc.

Efficiency is usually defined as performance per dollar allocated. For instance, it could be preventive patrol miles covered per eight hour tour divided by the cost of fielding that patrol force during that eight hour tour. The point is that one can define efficiency more precisely using performance measures such as discussed above for the numerator of the efficiency equation and using dollars or a surrogate, such as number of personnel, in the denominator. The additional point is that the true effect on efficiency

is multifacted and must include the types of issues discussed above in a serial progressively complex manner. Whatever degrees of complexity are involved, however, it appears from the illustrative computations above and in similar computations not reported here, that efficiency and productivity of the patrol force is improved by switching from all two-officer cars to all one-officer cars.

4.7 Higher Cost of Fuel and Maintenance

Fully 8.5 percent of the responding departments mentioned as a primary disadvantage of one-officer cars additional expenditures on automobiles and fuel. In this section, we illustrate by numerical example that the additional amount expended on automobiles and fuel is extremely small in percentage terms.

In New York City, the average police patrolman cost the City of New York in excess of $50,000 per year; this figure ignores a proportionate amount of supervisory time and other overhead, and is ultimately the direct marginal cost of hiring one additional patrolman. The figure does include fringe benefits, the largest single item being the City's contribution to the employees' pension plan. In order to keep one two-officer car on the road 24 hours a day, seven days a week, it is required that the police department schedule 10 individual officers for that car. At any given

time there are two officers in the car, the passenger officer and the driving officer. But to fill one post for 3 tours a day, on weekends and over holidays and vacation periods, it is required typically that one must have at least 5 individual officers. Thus, for a two-officer car one needs at least 10 individual officers. At a cost of $50,000 per officer, the personnel costs associated with one two-officer car on the road around the clock is $500,000 per year. This is ignoring or course the amortized cost of the vehicle and the cost of the fuel. The similar personnel cost attributable to a one-officer car is $250,000 per year. Using contemporary figures for the number of miles per gallon achieved when driving the car, the cost per gallon of fuel and the number of miles driven per day, it is not unreasonable to assume that the cost per vehicle per year is less than or equal to $10,000 per vehicle. This figure will include the cost of fuel, maintenance and amortized purchase cost, where the cost of amortization period is over five years. If these figures are approximately true, then the total marginal cost of a two-officer car per year is approximately $510,000 whereas the marginal cost of a one-officer car per year is approximately $260,000. Thus, the total cost for two one-officer cars around the clock is $520,000 in contrast to $510,000 for one two-officer car.

The difference of $10,000 out of a total of $510,000 corresponds to approximately 2 percent increase in cost to the department per officer fielded. In productivity terms, if it could be argued that there is at least a 2 percent increase in productivity or performance by shifting to the all one-officer fleet, then the shift more than pays for itself in dollar terms. The models presented above clearly demonstrate performance improvement far in excess of 2 percent, thereby showing the "near-sightedness" of those who complain about increase in costs due to expenditures on automobiles, fuel and maintenance. Most likely, these additional expenditures are seen as marginal increments on a police department's annual budget, whereas the cost of personnel are viewed as fixed charges and therefore are somehow subtracted out from the "accounting" associated with the switch to a one-officer car program.

4.8 Officer Safety, Alertness and Morale

What is striking about the responses to the mailed survey was the number of respondents claiming that officer safety was improved in one-officer cars (in contrast to two-officer cars) due to increased alertness by the single officer, and more often than not, morale was improved in one-officer situations in contrast to two-officer situations. We found no department that had conducted a study that revealed that officer safety was placed in jeapordy in one-officer cars.

However, one must consider that in the responses departments with one-officer cars had carefully chosen allocation patterns by location, time of day and dispatch procedure. There is no blanket statement that officer safety in one-officer cars is improved in contrast to two-officer cars, if prudent actions are not taken in recognition of the limitations of the single officer in the car.

From a performance measure point of view, we were unable to identify simple performance measures that relate to officer safety, alertness and morale. However, perhaps in future research, those with different professional backgrounds may be able to develop some psychological or other measures that would be appropriate for entering into the "policy iteration" outlined in Section II of this report.

4.9 Dispatching Complications

As mentioned before, the key disadvantage of one-officer cars (cited by 28.6 percent of all responding departments) referred to were the complications in logistics and dispatching caused by the need to send multiple units. Often sending multiple units requires rendezvous of the units near the scene prior to final movement to the scene. These complications probably greatly increase the time workload on dispatchers as well as their anxiety levels. However, we have been unable to pinpoint precise measures

which would relate to these issues and perhaps this could be done in further research. It is important to emphasize that "iterations in the policy space" of Section II should consider complications in dispatching since it is by far the most frequently mentioned disadvantage of one-officer cars.

V. SUMMARY AND CONCLUSIONS

In this report we have attempted to provide a quantitative, performance-measure-based methodology for structuring the debate over one- versus two-officer police patrol cars. We have provided the details for a multi-dimensional conceptualization of this debate, interpreted the results of an extensive national survey, and reduced the survey results to a set of performance measures that adequately represent each side's concerns.

A summary of the major findings is as follows:

- There are four key actors in the debate over one- versus two-officer cars: police management, police patrol officers' union or other labor organization, city management and citizens (acting both as taxpayers and as reciepients of police services).

- Diagrams that illustrate the interaction between manpower levels, performance measures and operating policies provide a visual way of thinking about negotiation and identifying the negotiation space.

- Careful consideration of alternative points within the negotiation space often allow us to identify "win-win-win" sets of points within the negotiation space.

- In order to use the negotiation space concept, there is a need for precisely defined performance measures that adequately and accurately represent concerns of the various sides of the debate.

- As a consequence of the national survey, it is apparent that the use of one-officer cars is extensive throughout large United States police departments.

- The careful use of one-officer cars is not thought to jeapordize officer safety (as a result of the national survey), nor are there any studies that suggest that officer safety is threatened in one-officer cars.

- Respondents to the national survey list (in order of frequency) the following as the major advantages of one-officer cars: increased patrol coverage and visibility, more deployment flexibility by having more cars fielded, reduced initial response time, greater efficiency in the use of manpower, two officers not needed on a one officer job, officers more alert, and more cost effective.

- The major disadvantages of one-officer cars, in order of their frequency of mentioning, are as follows: complications in logistics and dispatching caused by need to send multiple units, more expenditures on automobiles and fuel, and officer safety perceived to be diminished.

- In a switch from all two-officer cars to all one-officer cars the level of patrol coverage and visibility almost invariably more than doubles.

- In a switch from all two-officer cars to all one-officer cars, response time of the initial unit is reduced beyond that attributable solely to beat size reduction. The greater increase here as well as the greater increase in police visibility (cited just above) is due to a reduction in the fraction of time that an officer is busy on calls for service, due to twice as many "service units" responding to the same level of calls for service.

- Interbeat dispatching is not necessarily increased by switching from all two-officer cars to all one-officer cars; in fact it is often decreased significantly.

- In a switch from all two-officer cars to all one-officer cars, the average officer service time at the scene can often be reduced because the "second officer" can leave the scene when he or she is no longer needed.

- Because of extra fuel, maintenance and car purchase costs, two one-officer cars typically might cost 2 percent more than one two-officer car, fielded around the clock, 365 days per year. Thus, if performance improvements above 2 percent can be attributed to the switch to all one-officer cars,

then the switch more than pays for itself. The calculations done throughout the report suggest that the performance improvements are dramatically above the 2 percent level, which would indicate that the extra costs due to fuel, maintenance and car purchase are insignificant.

- Simple "back-of-the-envelope" models relating the various performance measures to alternative operating strategies have suggested that certain "myths" surrounding the debate over one- versus two-officer cars are not valid. Even the back-of-the-envelope models demonstrate sufficient complexity in the interaction of various of these quantitites that a truly informed debate through the negotiation space should be aided by a "negotiation support system" that has access to these types of models. In that way all actors in the debate will understand the quantitiative consequences of operating at alternative points within the negotiation space. Perhaps further research could attempt to construct a prototype of this process and test it in field settings.

APPENDIX

Summary of Survey Results

The City of New York

POLICE DEPARTMENT

NEW YORK, N. Y. 10038

The City of New York is currently undertaking a study of our patrol dispatch and response procedures. Its purpose is to analyze and select a "mixed-mode" patrol program that uses, in a mutually supportive way, both one-officer and two-officer cars. The aim is to obtain improvements in NYPD patrol performance at our current manpower levels.

As many of you may remember in October, 1981 we sent teams to a number of cities throughout the nation to examine one-officer car patrol and we may have visited your city. We are now particularly interested in learning from the experiences of other departments with a mix of one-officer and two-officer cars as well as other strategies designed to increase patrol productivity. To this end, we are requesting your assistance by filling out the attached questionnaire. It asks about patrol assignments, dispatching procedures, and response strategies.

Some portions of the questionnaire may look familiar - in that the Police Executive Research Forum (PERF) and San Diego Police Department conducted a survey of patrol practices in 1978. Several questions in the current survey "update" their study. We hope to learn how departments have adapted to the fiscal realities of the past five years.

We hope this survey will be of benefit to all departments, not just the NYPD. Results will, of course, be sent to all participating departments who request them.

Although this study was initiated and is sponsored by the City of New York, the survey (and other analysis) is being conducted by ENFORTH Corp., a criminal justice research firm under the contract to the City of New York. We ask that the questionnaire be returned to us and if you have no objection they will be provided to Enforth for analysis.

Your assistance with this effort is appreciated.

Respectfully yours,

William J. Devine

William J. Devine
FIRST DEPUTY COMMISSIONER

POLICE PATROL PRACTICES SURVEY

On the following pages you will find a number of questions asking about patrol practices and call-for-service response procedures in your department. Police agencies in approximately 200 cities and counties across the country have been asked to complete this questionnaire. Your help is greatly appreciated.

Agency Name: SURVEY RESULTS

Please give the name, rank, unit, and telephone number of the person who had primary responsibility for completing this questionnaire:

Name: _____

Rank: _____

Unit: _____

Telephone Number: _____

Date Completed: _____

Would you like a copy of the survey results? ☐ Yes ☐ No

When completed, please mail this questionnaire along with any associated materials in the attached stamped and addressed envelope. If the envelope is missing, please mail to:

William J. Devine
First Deputy Commissioner
New York Police Department
1 Police Plaza
New York, NY 10038

If you have any questions, please feel free to call _____ at Enforth Corp., the firm conducting this survey for the NYPD. She may be reached (collect) at (617) 547-8859.

TO THE PREPARER:

- While this form may appear lengthy, most questions merely ask you to check the appropriate response or fill in blanks.
- Some questions use the term beat car. Beat car refers to the unit assigned to a specific geographic area for the purpose of answering calls for service from that area.
- Please feel free to attach any additional information, such as departmental policies or procedures, related to the items in this questionnaire.

A. BACKGROUND

Page 1 of 17

1. Number of square miles your department serves: Mean = 252 Median = 68 N=159

2. Population (1980 census or most recent estimate) of your department's jurisdiction: Mean = 361,391 Median = 200,452 N=159

3. Jurisdiction (i.e., cities and/or county served): City = 136 County = 26 N=162

4. Department's operating budget (including fringes and pensions) for fiscal year 1982: Mean = $34,027,117 Median = $14,805,000 N=157

5. City's or county's operating budget (including fringes and pensions) for fiscal year 1982: Mean = $302,585,813 Median = $112,005,000 N=150

6. Authorized number of sworn officers in 1982: Mean = 739.3 Median 387.5 N=158

7. Actual number of sworn officers in 1982: Mean = 730.0 Median = 362.5 N=158

8. Number of civilian employees in 1982: Mean = 225.7 Median = 119.67 N=159

9. Number of citizen-initiated requests for service your department received in

1978: Mean = 286,284 Median = 119,978 N=129

1982: Mean = 281,398 Median = 128,334 N=149

B. PATROL ASSIGNMENTS

Page 2 of 17

1. How many sworn officers were actually assigned to patrol in

1978: Mean = 491.2 N=135 1982: Mean = 459.3 N=156

2. Of the sworn officers assigned to patrol, approximately what percent, if any, were assigned to specialized field units (for example, traffic, accident investigation, evidence, K-9) in

1978: Mean = 13.2% N=130 1982: Mean = 13.8% N=147

3. For each shift listed below, please list the number of patrol units typically assigned by type of unit.

	Day Shift Mean	Evening Shift Mean	Night Shift Mean	Other Shift Mean
1-officer cars:	35.3 N=151	34.0 N=147	28.7 N=146	14.0 N=71
2-officer cars:	6.7 N=118	15.4 N=120	11.8 N=118	3.0 N=65
Supervisory cars:	8.9 N=153	9.0 N=153	8.0 N=152	2.6 N=73
Other units:*	9.3 N=102	7.5 N=109	4.1 N=80	3.2 N=44
TOTAL patrol units:	55.6 N=145	60.2 N=145	47.5 N=144	19.2 N=77

*Please describe: _____

4. If the numbers of 1-officer and 2-officer cars are not fixed (that is, they are changed on a daily, weekly, or monthly basis), please describe how these assignments are made: _____

5. What is the administrative area (e.g., beat, precinct, district) within which 1-officer cars (if used), 2-officer cars (if used), and supervisory cars are assigned for patrol (that is, the area to which a car is assigned when it is not responding to calls for service) and response (that is, the area within which the dispatcher would typically assign calls for service to that car)?

Unit	Administrative Area	Description
Sample Response 1-officer car	Patrol: *beat* Response: *district*	*Each car is assigned to a separate beat in which it is responsible for general patrol. However, it may be assigned to calls for service from anywhere in its district (which generally consists of 4 to 5 beats).*
1-officer car	Patrol: Response	
2-officer car	Patrol: Response:	
Supervisory car	Patrol: Response:	
Other _____	Patrol: Response:	

6. Has your department ever operated with a different form of patrol unit staffing within the past 15 years (e.g., switched from all 2-officer cars to both 1-officer and 2-officer cars)? N=158

44.3% ☐ Yes —> please respond below
55.7 ☐ No —> please go to question 7

Please describe the form of staffing used and why it was changed:_____

7. Is any change in your current patrol unit staffing contemplated or desired in the near future? N=157

22.3% ☐ Yes —> please respond below
77.7 ☐ No —> please go to section C

Please describe these staffing plans and why a change is desired:_____

C. 1-OFFICER CARS

1. Does your department assign 1-officer cars to patrol? N=160

97.5% ☐ Yes —> please answer questions 2-6 below

2.5 ☐ No —> please go to section D

2. What factors did your department consider in selecting an area for 1-officer cars to patrol? _____

3. What advantages or disadvantages have been experienced by your department as a result of 1-officer car operations? _____

4. Please describe the results of any studies or investigations your department has conducted which provide factual information on officer safety (e.g., differences in line-of-duty injuries, traffic accidents, or assaults on officers) in 1- vs. 2-officer cars. _____

5. Of the assaults on or injuries to patrol officers in the last 5 years, about what percent have occurred to officers in 1-officer cars before a second officer was present? _____

6. What safety features or precautions, if any, were instituted primarily because of the use of 1-officer cars? _____

C. 1-OFFICER CARS

1. Does your department assign 1-officer cars to patrol? N=160

97.5% ☐ Yes —> please answer questions 2-6 below

2.5 ☐ No —> please go to section D

2. What factors did your department consider in selecting an area for 1-officer cars to patrol? _____

3. What advantages or disadvantages have been experienced by your department as a result of 1-officer car operations? _____

4. Please describe the results of any studies or investigations your department has conducted which provide factual information on officer safety (e.g., differences in line-of-duty injuries, traffic accidents, or assaults on officers) in 1- vs. 2-officer cars. _____

5. Of the assaults on or injuries to patrol officers in the last 5 years, about what percent have occurred to officers in 1-officer cars before a second officer was present? _____

6. What safety features or precautions, if any, were instituted primarily because of the use of 1-officer cars? _____

D. DISPATCHING CALLS FOR SERVICE

1. For each call type listed below, please check the box which corresponds to the type of unit typically assigned as the first responding unit.

	1-Officer Car	2-Officer Car	Beat Car	Closest Car	Other*	None	
Officer in trouble	☐ 25.0%	☐ 8.5%	☐ 8.5%	☐ 80.2%	☐	☐	N=152
Robbery, in progress	☐ 22.6%	☐ 20.0%	☐ 25.8%	☐ 53.0%	☐	☐	N=155
Burglary, cold	☐ 41.4%	☐ 3.2%	☐ 72.0%	☐ 1.9%	☐	☐	N=157
Suspicious car or person	☐ 31.4%	☐ 16.9%	☐ 62.8%	☐ 10.6%	☐	☐	N=159
Unarmed dispute or fight	☐ 30.4%	☐ 21.5%	☐ 56.3%	☐ 14.6%	☐	☐	N=158
Noise	☐ 38.8%	☐ 7.9%	☐ 69.7%	☐ 2.7%	☐	☐	N=152

*Please describe: _____

2. For each call type listed below, please check the box which corresponds to the type of unit typically assigned as a backup unit.

	1-Officer Car	2-Officer Car	Beat Car	Closest Car	Other*	None	
Officer in trouble	☐ 27.8%	☐ 12.3%	☐ 3.4%	☐ 78.9%	☐	☐	N=147
Robbery, in progress	☐ 26.6%	☐ 16.2%	☐ 7.1%	☐ 72.0%	☐	☐	N=154
Burglary, cold	☐ 45.2%	☐ 6.9%	☐ 31.5%	☐ 31.5%	☐	☐	N=73
Suspicious car or person	☐ 43.6%	☐ 8.4%	☐ 21.1%	☐ 44.4%	☐	☐	N=133
Unarmed dispute or fight	☐ 42.0%	☐ 8.3%	☐ 17.9%	☐ 49.6%	☐	☐	N=145
Noise	☐ 47.6%	☐ 3.9%	☐ 24.8%	☐ 39.0%	☐	☐	N=105

*Please describe: _____

3. For each call type listed below, please estimate the percent of such calls which are assigned only 1 backup unit and the percent assigned 2 or more backup units.

	1 backup unit Mean			2 or more backup units Mean		
Officer in trouble	14.9	%	N=78	96.4	%	N=152
Robbery, in progress	39.4	%	N=95	78.5	%	N=146
Burglary, cold	13.5	%	N=142	2.6	%	N=102
Suspicious person	65.8	%	N=151	8.9	%	N=98
Unarmed dispute or fight	75.0	%	N=151	20.1	%	N=102
Loud noise	41.6	%	N=150	4.7	%	N=99

4. When 2 or more units are dispatched to a call for service, which has responsibility for the disposition of the call (i.e., writes any reports and leaves the scene last)? N=161

57.8% ☐ Beat car, regardless of type (i.e., 1-officer, 2-officer) or assignment (i.e., first responding or backup unit)

26.1 ☐ First responding unit, regardless of type (i.e., 1-officer, 2-officer)

0.6 ☐ Backup unit, regardless of type (i.e., 1-officer, 2-officer)

0.6 ☐ 1-officer car, regardless of assignment (i.e., first responding or backup), if both a 1-officer car and a 2-officer car were dispatched

0.0 ☐ 2-officer car, regardless of assignment (i.e., first responding or backup), if both a 1-officer car and a 2-officer car were dispatched

14.9 ☐ Other (please describe): _____

_____

5. Are there any types of citizen calls for services to which your department typically does not send a police unit? N=161

73.3% ☐ Yes —> please respond below

26.7 ☐ No —> please go to question 6

a. What year was this policy adopted? Mean = 1977 N=91

b. Please list the calls for service for which this policy is used:

_____

_____

_____

_____

(attach policy, if available)

c. About what percent of all calls for service were handled this way in

1978: Mean = 10.5% N=66 1982: Mean = 16.7% N=82

6. Do you have a computer-aided dispatching (CAD) system? N=161

39.8% ☐ Yes —> what year did it become operational? Mean = 1978 N=62

60.2 ☐ No

E. CALL PRIORITY

1. For each call type listed below, please check the box which most closely corresponds to the urgency with which your department would respond, where a 1 represents the highest priority response and a 4 represents the lowest priority response. If your department does not usually respond to a call type, please check no response.

	Highest Priority 1	2	3	Lowest Priority 4	No Response	
Assault in progress	☐80.1%	☐19.3	☐ 0.6	☐ 0.0	☐ 0.0	N=161
Burglary in progress	☐83.2%	☐16.1	☐ 0.6	☐ 0.0	☐ 0.0	N=161
Robbery in progress	☐94.4%	☐ 5.0	☐ 0.6	☐ 0.0	☐ 0.0	N=160
Assault, cold	☐ 0.6%	☐35.0	☐50.0	☐ 11.9	☐ 2.5	N=160
Burglary, cold	☐ 1.9%	☐24.4	☐56.9	☐ 16.2	☐ 0.6	N=160
Larceny, theft, cold	☐ 0.0%	☐12.6	☐47.8	☐ 27.0	☐ 12.6	N=159
Bicycle theft, cold	☐ 0.0%	☐ 6.3	☐22.5	☐ 45.0	☐ 26.2	N=160
Motor vehicle theft, cold	☐ 1.9%	☐13.7	☐46.2	☐ 25.6	☐ 12.5	N=160
Vandalism, cold	☐ 0.0%	☐ 6.9	☐27.7	☐ 44.0	☐ 21.4	N=159
Fraud, forgery, bad checks	☐ 4.4%	☐16.4	☐39.6	☐ 30.8	☐ 8.8	N=159
Officer in trouble	☐100.0%	☐ 0.0	☐ 0.0	☐ 0.0	☐ 0.0	N=159
Auto accident, damage only	☐ 1.3%	☐45.9	☐39.6	☐ 8.8	☐ 4.4	N=159
Injured, sick persons	☐48.4%	☐32.7	☐ 9.4	☐ 0.0	☐ 9.4	N=159
Alarm, victim-triggered	☐60.4%	☐30.2	☐ 6.9	☐ 1.3	☐ 1.3	N=159
Alarm, standard burglary	☐52.5%	☐39.4	☐ 8.1	☐ 0.0	☐ 0.0	N=160
Lost property	☐ 0.6%	☐ 4.4	☐11.9	☐ 49.7	☐ 33.3	N=159
Suspicious person	☐11.5%	☐59.2	☐28.7	☐ 0.6	☐ 0.0	N=157
Disorderly conduct, crowd	☐23.6%	☐56.7	☐18.5	☐ 1.3	☐ 0.0	N=157
Domestic disturbances	☐21.4%	☐60.4	☐15.7	☐ 2.5	☐ 0.0	N=159
Unarmed dispute or fight	☐20.6%	☐63.1	☐15.6	☐ 0.6	☐ 0.0	N=160
Harassment or threats	☐ 1.3%	☐23.3	☐45.3	☐ 25.8	☐ 4.4	N=159
Annoying, obscene phone call	☐ 0.6%	☐ 5.7	☐28.3	☐ 40.9	☐ 24.5	N=159
Drunk person	☐ 3.1%	☐25.2	☐53.5	☐ 17.0	☐ 1.3	N=159
Noise	☐ 0.0%	☐11.9	☐44.7	☐ 42.8	☐ 0.6	N=159
Barking dog	☐ 0.6%	☐ 5.7	☐16.4	☐ 64.2	☐ 13.2	N=159
Traffic or parking troubles	☐ 0.0%	☐10.0	☐40.6	☐ 48.7	☐ 0.6	N=160
Missing persons, runaways	☐ 3.8%	☐19.5	☐42.8	☐ 21.4	☐ 12.6	N=159

2. Does your department rank calls for service by priority of response? N=156

80.8% ☐ Yes —> please attach, if available, a call priority list

19.2 ☐ No

3. If a unit is assigned to a suspicious person call, will you interrupt the unit to assign it to a call for:

Officer in trouble?	☐ Yes 97.5%	☐ No 2.5	N=160
Burglary, cold?	☐ Yes 1.2%	☐ No 98.7	N=160
Robbery, in progress?	☐ Yes 97.5%	☐ No 2.5	N=160
Unarmed dispute or fight?	☐ Yes 41.5%	☐ No 58.5	N=159
Loud noise?	☐ Yes 0.6%	☐ No 99.4	N=160

4. If a unit is assigned to an unarmed dispute or fight call, will you interrupt the unit to assign it to a call for:

Officer in trouble?	☐ Yes 95.6%	☐ No 4.4	N=160
Burglary, cold?	☐ Yes 1.9%	☐ No 98.1	N=160
Robbery, in progress?	☐ Yes 91.2%	☐ No 8.7	N=160
Suspicious car or person?	☐ Yes 6.3%	☐ No 93.8	N=160
Loud noise?	☐ Yes 0.6%	☐ No 99.4	N=160

5. If a unit is assigned to a cold burglary call, will you interrupt the unit to assign it to a call for:

Officer in trouble?	☐ Yes 98.1%	☐ No 1.9	N=159
Robbery, in progress?	☐ Yes 96.2%	☐ No 3.8	N=159
Suspicious car or person?	☐ Yes 49.4%	☐ No 50.6	N=160
Unarmed dispute or fight?	☐ Yes 60.6%	☐ No 39.4	N=160
Loud noise?	☐ Yes 6.9%	☐ No 93.1	N=160

6. If a unit is assigned to a robbery in progress, will you interrupt the unit to assign it to a call for:

Officer in trouble?	☐ Yes 61.8%	☐ No 38.2	N=157
Burglary, cold?	☐ Yes 3.1%	☐ No 96.9	N=160
Suspicious car or person?	☐ Yes 2.5%	☐ No 97.5	N=159
Unarmed dispute or fight?	☐ Yes 2.5%	☐ No 97.5	N=159
Loud noise?	☐ Yes 2.5%	☐ No 97.5	N=159

7. Does your department stack or formally delay response to some types of calls for service? N=160

88.7% ☐ Yes —> please respond below

11.2 ☐ No —> please go to section F

a. Under what conditions is a call for service stacked or delayed? N=139

15.1% ☐ Beat car is busy

73.4 ☐ All cars in area are busy

11.5 ☐ Other (please describe): _____

_____

b. When is a patrol car assigned to a stacked or delayed call? N=139

30.2% ☐ When the beat car is available

23.7 ☐ When the closest car in the area is available

30.9 ☐ When any car in the area is available

2.9 ☐ When a special car designated to respond to stacked or delayed calls is available

12.2 ☐ Other (please describe): _____

_____

c. Is the citizen who requests service informed of the length of delay to expect? N=141

80.9% ☐ Yes

19.1 ☐ No

d. Please list the calls for service which may be stacked or delayed:

_____

_____

_____

_____

_____

(attach policy, if available)

F. ALTERNATIVE RESPONSE STRATEGIES

1. Does your department ask citizens requesting some types of police services to file a report at a police facility in lieu of dispatching a police car? N=160

53.1% ☐ Yes —> please respond below

46.9 ☐ No —> please go to question 2

a. What year was this policy adopted? Mean = 1976 N=56

b. Please list the calls for service for which this policy is used:

_____

_____

_____

_____

_____

(attach policy, if available)

c. About what percent of all calls for service were handled this way in

1978: Mean = 8.2% N=38 1982: Mean = 11.3% N=48

2. Does your department ask citizens requesting some types of police services to make a telephone report in lieu of dispatching a police car? N=16

78.7% ☐ Yes —> please respond below

21.2 ☐ No —> please go to question 3

a. What year was this policy adopted? Mean = 1978 N=106

b. Please list the calls for service for which this policy is used:

_____

_____

_____

_____

_____

(attach policy, if available)

c. About what percent of all calls for service were handled this way in

1978: Mean = 6.0% N=57 1982: Mean = 13.0% N=81

3. Does your department ask citizens requesting some types of police services to schedule an appointment with an officer or civilian in lieu of immediately dispatching a police car? N=160

15.0% ☐ Yes —> please respond below
85.0 ☐ No —> please go to question 4

a. What year was this policy adopted? Mean = 1977 N=13

b. Please list the calls for service for which this policy is used:

(attach policy, if available)

c. About what percent of all calls for service were handled this way in

1978: Mean = 1.7% N=7 - 1982: Mean = 4.1% N=7

4. Does your department ask citizens requesting some types of police services to mail a report to the department in lieu of dispatching a police car? N=161

21.1% ☐ Yes —> please respond below
78.9 ☐ No —> please go to the question 5

a. What year was this policy adopted? Mean = 1977 N=22

b. Please list the calls for service for which this policy is used:

(attach policy, if available)

c. About what percent of all calls for service were handled this way in

1978: Mean = 1.9% N=11 1982: Mean = 5.8% N=12

5. Does your department use any other alternative methods to handle or respond to calls for service that have not been mentioned? N=160

18.8% ☐ Yes —> please respond below
81.2 ☐ No —> please go to question 6

Please describe these alternative methods and the calls for service to which they apply:

(attach policies, if available)

6. Has your department abandoned the use of any alternative methods to handle or respond to calls for service because the method was found to be ineffective, or for other reasons such as the lack of appropriate funding or a change of administration? N=160

10.6% ☐ Yes —> please respond below
89.4 ☐ No —> please go to section G

Please describe these alternative methods, the calls for service to which they applied, and the reasons they were abandoned:

(attach policies, if available)

G. ALARM RESPONSE POLICIES

1. Has your department adopted a false alarm ordinance or alarm response policy designed to reduce the number of false alarms? N=159

62.3% ☐ Yes —> please attach a copy and answer questions 2-4 below

37.7 ☐ No —> please go to section H

2. What year was the ordinance or policy adopted? Mean = 1979 N=89

3. Which of the following techniques to control false alarms does your department use (check all that apply)? N=100

35.0% ☐ Alarm owners must obtain a permit (permit fee = $_____)

60.0% ☐ Alarm owners are charged a fine for each false alarm in excess of a stated maximum (fine = $_____; max. = _____)

15.0% ☐ The department will not respond to an alarm if the number of false alarms in a given period exceeds a stated maximum (max. = _____)

20.0% ☐ An alarm owner's permit is revoked if the number of false alarms in a given period exceeds a stated maximum (new permit fee = $_____; max. = _____)

62.0% ☐ Automatic telephone dialers are prohibited to connect (i.e., dial directly) with the department's phone system

32.0% ☐ Audible alarms must shut off within a specified time period

29.0% ☐ Other (please describe): _____

4. What has been the effect of this ordinance or policy on the number of false alarms received by your department? _____

H. CIVILIAN EMPLOYEES

1. Does your department use civilians (volunteers and/or employees) in any capacity within the patrol function? N=159

73.6% ☐ Yes —> please answer questions 2-5 below

26.4 ☐ No —> please go to section I

2. In general,
   a. do civilian volunteers work: ☐ with sworn officers as a team? 43.2%
      N=88 ☐ without sworn officers 25.0 ☐ both 31.8
   b. do civilian employees work: ☐ with sworn officers as a team? 18.8%
      N=85 ☐ without sworn officers 69.4 ☐ both 11.8

3. a. How many civilian volunteers worked in patrol in

   1978: Mean = 51.4 N=97 1982: Mean = 57.3 N=107

   b. How many civilian employees worked in patrol in

   1978: Mean = 35.8 N=105 1982: Mean = 41.6 N=106

4. What types of services do civilians provide? (check all that apply)

	Civilian Volunteers	Civilian Employees	
Call for service response	☐ 62.7%	☐ 22.0	☐ 15.3
Preventive patrol	☐ 88.3%	☐ 3.3	☐ 8.3
Traffic	☐ 60.9%	☐ 21.7	☐ 17.4
Animal Enforcement	☐ 31.8%	☐ 65.9	☐ 2.3
Crowd Control	☐ 84.5%	☐ 5.2	☐ 10.3
Chaplains	☐ 68.5%	☐ 30.1	☐ 1.4
Evidence Gathering	☐ 31.7%	☐ 59.2	☐ 8.2
Family Disturbances	☐ 92.3%	☐ 5.1	☐ 2.6
Parking	☐ 36.7%	☐ 53.3	☐ 10.0
Accident Investigation	☐ 63.2%	☐ 28.9	☐ 7.9
Medical (paramedic) assist	☐ 61.9%	☐ 38.0	☐ 0.0
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐

5. What calls for service, if any, do civilians respond to? _____

I. DEPARTMENTAL OPERATIONS

1. Several characteristics of departmental operations are listed below. For each, please indicate (check the appropriate box) whether there was an increase, decrease, or no change from 1978 to 1982. (Leave blank if an item does not apply to your department.)

		Increase	Decrease	No Change		Change Due To: Budget Cutback	Budget Increase	Policy/ Procedure	
Total budget for:									
-patrol	N=153	☐ 89.5%	☐ 8.5	☐ 2.0		☐ 10.9%	☐ 85.9	☐ 3.1	N=128
-department	N=153	☐ 90.2%	☐ 8.5	☐ 1.3		☐ 11.5%	☐ 86.3	☐ 2.3	N=131
No. of sworn officers in:									
-patrol	N=157	☐ 52.9%	☐ 32.5	☐ 14.6		☐ 30.8%	☐ 46.7	☐ 22.5	N=120
-department	N=154	☐ 51.9%	☐ 35.1	☐ 13.0		☐ 35.3%	☐ 50.4	☐ 14.3	N=119
No. of paid civilians in:									
-patrol	N=120	☐ 40.0%	☐ 22.5	☐ 37.5		☐ 31.6%	☐ 32.9	☐ 35.5	N=76
-department	N=146	☐ 58.2%	☐ 27.4	☐ 14.4		☐ 33.6%	☐ 37.9	☐ 28.4	N=116
Hours of overtime in:									
-patrol	N=148	☐ 51.4%	☐ 29.7	☐ 18.9		☐ 30.0%	☐ 29.0	☐ 41.0	N=100
-department	N=145	☐ 55.2%	☐ 25.5	☐ 19.3		☐ 29.3%	☐ 31.3	☐ 39.4	N=99
Hours of employee training in:									
-patrol	N=153	☐ 59.5%	☐ 11.8	☐ 28.8		☐ 15.0%	☐ 18.0	☐ 67.0	N=100
-department	N=151	☐ 56.3%	☐ 11.9	☐ 31.8		☐ 15.5%	☐ 18.6	☐ 66.0	N=97
Maintenance budget for:									
-patrol cars	N=149	☐ 72.5%	☐ 10.1	☐ 17.4		☐ 13.9%	☐ 72.2	☐ 13.9	N=108
-department facilities	N=146	☐ 67.1%	☐ 9.6	☐ 23.3		☐ 14.7%	☐ 69.6	☐ 15.7	N=102
Average age of patrol cars	N=150	☐ 27.3%	☐ 19.3	☐ 53.3		☐ 39.0%	☐ 24.7	☐ 36.4	N=77

2. Estimate the average response time (dispatch delay + travel time) to a call for service in

1978: Mean = 8.5 minutes N=107 1982: Mean = 8.0 minutes N=128

3. Estimate the average on-scene time for a call for service in

1978: Mean = 27.2 minutes N=85 1982: Mean = 27.3 minutes N=117

THANK YOU!!!