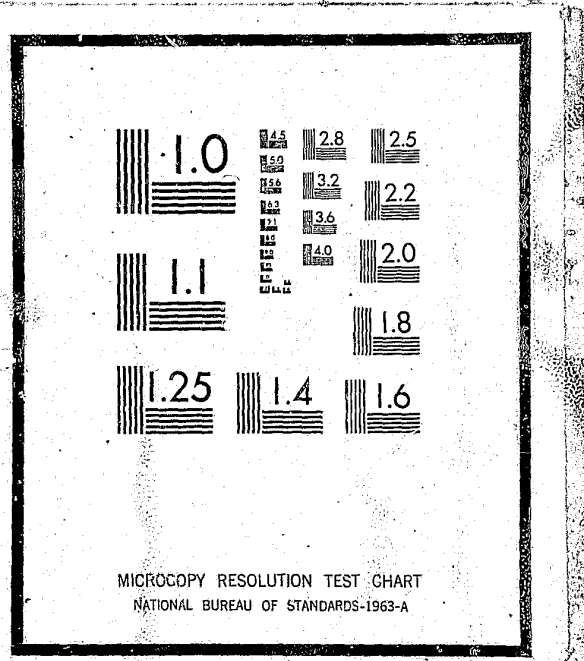


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6/3/76

MTR-6864
Rev. 1

NATIONAL IMPACT PROGRAM EVALUATION SPECIAL CRIME ATTACK TEAM: A CASE STUDY IN THE EXAMINATION OF POLICE PATROL EFFECTIVENESS

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MARCH 1975

U.S. DEPARTMENT OF JUSTICE
Law Enforcement Assistance Administration
National Institute of Law Enforcement and Criminal Justice

This document has been prepared by The MITRE Corporation, Washington Operations, under Contract F19628-75-C-0001 for the Law Enforcement Assistance Administration.

APPENDIX I

MITRE Department
and Project Approval:



ABSTRACT

The Special Crime Attack Team (SCAT) is a multi-faceted police unit in the Denver Police Department which focuses its efforts on fighting identified area crime problems. SCAT has been developed, funded and evaluated as part of the LEAA's High Impact Anti-Crime Program in Denver.

This document presents an analysis of crime level changes occurring during the anti-burglary phase of SCAT operations. Several analysis strategies are employed to assess the effectiveness of the unit in reducing crime.

PREFACE

As part of the national-level evaluation of the High Impact Anti-Crime Program, The MITRE Corporation and the National Institute of Law Enforcement and Criminal Justice have taken the opportunity provided by the large scale implementation and evaluation of crime reduction projects in this program to examine a number of commonly held assumptions underlying crime reduction strategies.

One area being investigated concerns the effectiveness of various police patrol strategies as crime deterrents. It is generally believed that certain types of police patrol activity will have an impact on crime and that increases in police patrol activity will effect a reduction in crime. This assumption, that increased police patrol reduces crime, is being investigated as part of the national level evaluation of the Impact Program.

Such an investigation necessarily involves an empirical assessment of the effect on crime of those Impact projects which were designed on the assumption that increased police patrol activity reduces crime. This document reports the findings of the first of several case studies to be conducted. Each study focuses on a specific project and its impact on crime in the target area. The project discussed in this document is the Special Crime Attack Team, a project planned and operated by the Denver Police Department in conjunction with the Denver Anti-Crime Council, the city-level administrators and evaluators of the Denver Impact Program.

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EXECUTIVE SUMMARY

This document presents the first of several case studies which examine the effectiveness of police patrol projects in reducing crime. This case is an examination of the impact of anti-burglary efforts of the Special Crime Attack Team in Denver, Colorado.

The Special Crime Attack Team (SCAT) is a flexible team police unit which acts as an overlay to regular police functions focusing its attention on a particular crime problem identified in the area, in this case burglary. The SCAT unit, while working in close cooperation with the regular police officers in the target area, implements special activities directed at reduction of the target crime. The SCAT anti-burglary effort involved increased police patrol, increased burglary investigation and public education/target hardening activities. Special attention has been given to working closely with community residents to increase public awareness of the area crime problems and community action to fight these problems.

In this examination of SCAT impact on crime, the SCAT project is evaluated as a single entity. No attempt is made to factor out the contribution of various project components. This package approach to evaluating the project was dictated by the research field. SCAT has been implemented as part of the Denver Impact Cities Program, an action program directed at crime reduction. Program expectations were that the SCAT unit and its related activities would have an impact on targeted crime problems and SCAT has therefore been evaluated from this perspective. It is anticipated that upcoming case studies which examine the effect on crime of other Impact police projects, involving some of the same activities as SCAT, will provide information on the effectiveness of other police patrol project packages. Comparison of crime reduction results of these project packages with their overlapping activity components should allow for some activity/impact attribution.

Crime level changes observed during the first phase of SCAT operations (directed at burglary reduction) are the focus of this examination. The SCAT phase I evaluation reports produced by the Denver project level evaluators are summarized, and available crime data are independently analyzed as part of the national-level assessment of project impact.

Several crime level analysis approaches are employed in the national-level analysis of SCAT impact. The approaches presented and discussed include a simple before-after approach (similar to that employed by the Denver project evaluators), an extended before-after approach and a time series analysis. The results of these three analyses are presented and synthesized to assess the crime level changes observed during the period of SCAT project operations.

In general, the results of these analyses indicate that during SCAT operations decreases have been observed for certain target area crimes which cannot be explained by either city-wide decreases in crime or by long term crime trends. On this basis it can be concluded that SCAT activities, as a "package", have had an impact on target area crime. While direct quantification of analysis results is not possible outside the context of the analysis strategy employed (see sections 5.1 - 5.3 for specific results), in general the results indicate:

- SCAT's greatest impact has been observed in burglary levels. Burglary was the target crime problem and the primary focus of SCAT activity. Despite growing trends in burglary preceding the project, decreases have been observed for the project operating period.
- Although not specifically targeted by SCAT, murder and assault have also experienced a decline in the SCAT target areas during project operations. These decreases can neither be predicted by past trends in these target area crimes nor explained by city-wide crime changes.
- Robbery and rape in target areas were the crimes exhibiting the least improvement during the SCAT treatment period.
- The analysis indicates that crime displacement into adjacent areas may have occurred in the crime categories of burglary, murder and assault.

In assessing the analytical approaches employed in the case study analysis, it has been noted that:

- The most basic, straight-forward analysis approach, a simple before-after comparison, provides the analyst with the most intuitively understandable information on the direction and magnitude of crime level changes which have been experienced during project operations. This approach, however, views target area crime levels as if they were bound in time and isolated in space. Thus the simple before-after approach fails to account for several viable, non-project related explanations for observed changes in target area crime such as long-term or city-wide trends in crime.
- Extending the simple before-after approach for analysis of target area crime level changes to include comparisons with crime level changes in previous time periods adds time perspective to the simple before-after design and helps to further address the question of SCAT effectiveness.

- Utilizing both the simple and the extended before-after approaches to assess crime level changes occurring in the remainder of the city, allows the analyst to delineate those changes which might have been expected in target areas regardless of SCAT treatment i.e., city-wide crime level changes.
- A time-series analysis of monthly crime figures before and during project operations defines project expectations in terms of past crime experience, including long-term crime trends. Applying this method of analysis to both the target area and the remainder of the city, both city-wide and long-term trends in crime are considered. While this approach takes into account more of the important considerations in projecting crime levels for the treatment period, interpretation of the results of this analysis is less clear cut in that they speak less directly to the impact of the project as experienced in situ.
- Application of these various approaches to the problem and synthesis of the results has allowed for an assessment of the impact of the project which is both more robust and rigorous than the application of any one single approach.

1.0 INTRODUCTION

1.1 The Relationship Between Police Patrol Activity and Crime

Over the past decade problems of rising crime have become acute in urban areas across the country. Fears for safety on the streets have been voiced by large portions of the American population who have sought refuge from this and other problems of the city in the growing suburbs of our nation. Citizen concern as well as actual and potential effects of an "urban crime wave" have prompted government action in terms of new programs, increased funding and applied research to curb rising rates of reported crime.

The police as an institution and their activities in crime fighting have been one focus of this increased government commitment. Because of the extent of their daily interface with the public and their direct involvement in the control of criminal activity, the police have been expected to play a major role in this crime control effort. Millions of dollars have been spent to improve the quality and range of police services. New equipment has been designed and implemented as part of daily police department activity. New methods of offering police services have been developed. All this has been done in an effort to increase the ability of the police to maintain an acceptable level of public safety on the streets.

Police patrol is the basic unit of the police which acts on the streets to serve the public. Until the relatively recent upsurge in urban crime the effectiveness of the police patrol had been, to all intents and purposes, taken for granted. It had been assumed that in general police patrol is an effective crime reduction strategy. No particular differentiation was made between the effects of various types of police patrol currently in use (i.e., foot patrol, mobile patrol, preventive patrol, two man patrol, etc.). With the large influx of resources and the expectations which have accompanied these resources, however, questions have been raised concerning the effectiveness of police patrol and the relative merits of different police patrol strategies.

1.2 State of General Knowledge and Research in the Field

The amount of research in this field is limited, resulting in a lack of conclusive information establishing the effectiveness of police patrol in combating crime. Individual research studies that have been conducted have generally been uncoordinated and available study results are rarely cumulative. Finally, the available research tends to be plagued with validity problems which make results less than useful in planning for crime reduction.¹

1.3 Purpose of This Document

This document presents the analysis and results of the first of a series of case studies which examine the effectiveness of particular police patrol units in reducing crime in their target areas. The case examined in this document is the Special Crime Attack Team (SCAT), a special patrol unit of the Denver Police Department which was developed, funded and evaluated as part of LEAA's High Impact Anti-Crime Program.

Crime level changes observed during the first phase of SCAT operations (directed at burglary reduction) are the focus of the examination. The methods of analysis used by Denver in evaluating project effectiveness are reviewed and assessed; several additional evaluation approaches are presented and applied to Denver's data. The resultant findings and methods are compared with those of the Denver project-level evaluation to assess the effectiveness of the SCAT unit in reducing crime.

This document serves several purposes. First, it provides information on the SCAT unit and its impacts on specific crime levels. Such information is useful in and of itself, in that it indicates the effects of one type of police patrol strategy. A further purpose will be realized

¹See MITRE Technical Report MTR-6817, "A Review of Six Research Studies on the Relationship Between Police Patrol Activity and Crime," dated December 1974.

when this information is utilized, in conjunction with upcoming case studies, to compare the impact of various types of police patrols on crime in their target areas. A secondary function of this document is to provide an assessment of various approaches to the analysis of crime level changes. Finally, suggestions are made for additional approaches which would increase the specification and reliability of future analysis results.

2.0 APPROACH

2.1 The Impact Program Context

The High Impact Anti-Crime Program is an LEAA action program designed to provide money (\$20 million in total over three years) to each of eight American cities to fight rising stranger-to-stranger crime and burglary. The program is federally funded via state governments with matching local funding, regionally directed in terms of crime control policy but planned and operated by the cities.

Impact Program planning at the city level was crime specific, i.e., at the outset of the program, existing crime data were analyzed in each city to identify specific crime problems particular to that urban area, and to design solutions to those problems. Specific projects were then planned and implemented in each city to address the local problems. Project level evaluation of all Impact funded activities was mandated from the outset of the program.

Throughout the course of the program, more than one hundred and fifty projects were designed and operated across the eight cities. After two years of program operation, approximately half of the projects had been evaluated in one form or another.²

Impact projects have been implemented by a range of possible sponsoring criminal justice agencies, and they incorporate numerous approaches to crime reduction (prevention, deterrence, control, rehabilitation, etc.). In several areas, including police patrol, some of the cities identified similar crime problems, employed similar strategies, and implemented similar projects to combat those problems. These sets of similar projects offer

² See "Performance Measures Used in the Impact Program", The MITRE Corporation, L. G. Siegel and W. J. Gorse, February 1975, MTR 6848.

a good opportunity for the examination of the assumptions underlying the selected strategies. This assumptions research, in turn, furnished a context for comparing the effects of the selected strategies in the various cities.

2.2 Police Projects in the Impact Program

Five of the eight Impact cities have implemented police patrol projects as part of their overall program effort. These include: the Special Crime Attack Team in Denver (the project under discussion here); a concentrated crime patrol project in Cleveland; a foot patrol project in St. Louis; a foot patrol project entitled Sixty-four Foot Patrolmen, in Baltimore; and an overtime patrol project in Atlanta. Analysis of three of these is planned in the overall study of Impact police patrol effectiveness. The lack of data pertaining to the Atlanta Overtime Patrol and the Baltimore Sixty-Four Foot Patrolmen projects has made it impossible to include them in this national level research project.

The three projects to be included in the research all involve a step-up increase in police patrol (including either a sizable increase in the number of patrolmen deployed to an area or the addition of an overlay patrol force employing a patrol mode different from that utilized by the regular patrol force) aimed at reducing area crime problems of various types. Each project will form the basis for a case study in police patrol effectiveness. Further discussion of the approach used in these case studies will be presented in Sections 2.4 and 2.5.

2.3 Constraints on Research in This Context

While the Impact program, like other action programs, provides good opportunities for applied research, research conducted in this context must necessarily operate within certain constraints. To begin with, any action program is funded and operated to provide services not to test hypotheses. Research aiming at the examination of

assumptions must operate in a fashion which does not interfere with the delivery of services. Program operators must not be overburdened with data collection tasks. Services have to be offered where needs are greatest and changes in service delivery must be made when operational needs change, despite effects on the research endeavor in progress.

Further, the Impact program was designed and implemented in the context of the "New Federalism" concept which requires local areas and cities to delineate their specific crime problems and to design their own solutions to these problems. Areas selected for special police attention in each of the eight cities therefore varied, based on the individual criteria used by each city for selection of problem areas, as well as on the general social-geographical make-up of the cities. The types of police projects chosen for implementation in each city also varied, not only because of differing crime problems, but also because of the differing philosophies and capabilities of each city police department.

This situation has placed numerous limitations on the type of research which could feasibly be conducted at a national level using Impact projects as the research field. Chief among these limitations are the following:

- (a) The field for the national evaluative research is made up of projects designed and operated by the cities; no changes in these could be made on behalf of the research endeavor.
- (b) As discussed above, the patrol projects implemented under the Impact program are similar in that they all involve a step-up increase in police patrol coverage targeting a specific area crime problem; however, the projects vary in terms of particular patrol strategies employed in each case and in the nature of target areas and their crime problems. This has meant that no one specific patrol strategy could be intensively examined and that comparisons of the results of the various strategies must be viewed with caution given the differences in target crimes and areas.

- (c) A number of the Impact police patrol projects involve a multi-faceted approach to crime reduction. Because no research inputs were made as to the types of activities involved in these projects, their location or their organization, evaluation of project effect on crime was done in terms of the impact of the project in its entirety. This "package" approach to the assessment of project impact precludes the possibility of directly isolating the effects of specific patrol activities implemented as part of the projects and thus limits the ability of the research to specify or further explain observed crime level changes.
- (d) The cities and projects were responsible for data collection and reporting. Additional research-specific data forms were deemed infeasible in this context. Research analysis was, therefore, restricted to information routinely collected in each of the three participating cities (i.e., reported crime figures).
- (e) Finally, the areas targeted by these projects are not "typical" areas. By the very nature of the crime-oriented planning process used to select projects and target areas in the Impact program, the areas selected for treatment were those which exhibited the greatest crime problems. This means that the results of this analysis are generalizable only to the impact of police patrol in similar problem areas not to the effects of police patrol in general. This selection bias also means that crime level analysis must consider the statistical artifact of regression to the mean in assessing observed crime level changes.

2.4 National Level Approach to Examination of Impact Police Projects

Given the constraints on the research outlined in the preceding section, the following approach has been selected for the examination of the effectiveness of police patrol in the Impact program:

- (a) Each of the Impact police patrol projects is utilized as a sample case in the overall research endeavor.
- (b) For each sample case, reported crime data is analyzed to address two basic questions:
 - (1) Have crime levels - both in total and for particular crime types - declined since these police patrol projects have been in operation?
 - (2) Has crime displacement occurred since changes in police patrol were instituted? (This includes crime displacement to immediately adjacent areas and non-treatment time periods as well as from outdoor to indoor locations, where data is available.)

Analysis of each case (i.e., each project) will be done individually. The results of the case studies will then be consolidated and synthesized to assess the comparative impact of the various patrol strategies on crime in their target areas.

2.5 Crime Level Measurement and Assessment

Several methods of analysis are employed to assess the crime level changes occurring during treatment time periods. Analysis is restricted to police-reported crime figures since they are the only data readily available from all of the police departments of the included cities. The evaluative approach utilized by the project level evaluators will be discussed for each case and the analysis results will be reviewed in terms of the methods employed. A time series analysis will be utilized for all case studies to place changes in crime levels during treatment in the context of the longer term crime experience in the area. This analysis approach is described in Section 5.0 and a more detailed presentation of the models utilized is available in Appendix I. This analysis is performed for target areas, adjacent areas, and for the remainder of the city.

The target area analysis, focusing upon areas which received direct police treatment, is conducted to determine project impact on the problems which were initially delineated. The adjacent area analysis is undertaken to assess whether any positive spill-over effects have occurred or whether crime displacement has taken place. The city analysis (city-wide minus target area crime figures but including adjacent areas) is used to determine if any city-wide trends could have accounted for any changes in crime levels observed in the target areas. The results of these three analyses will be utilized to assess the effectiveness of the various patrol strategies in reducing crimes.

3.0 THE DENVER SCAT CASE

3.1 Description of the SCAT Project

The Special Crime Attack Team is a flexible team-police unit designed to deal with specific urban crime problems using a comprehensive multi-faceted approach to crime reduction. The unit is deployed in areas experiencing particular crime problems and acts as an overlay to regular police operations, focusing its efforts on reduction of the target crime.

The SCAT team is a relatively small police unit, consisting of a commander and 32 other personnel including a mix of patrolmen, detectives and evidence technicians. SCAT personnel were selected from the ranks of the Denver Police Department with selection based on proven ability in each area of expertise and on the professional opinion of the commanding officer. Team organization is flexible, allowing the team leader and his assistants the opportunity to mix personnel and tactics to meet the situation upon a daily assessment of neighborhood crime trends.

The activities of the unit vary with the target area being served. In general, the unit employs three major strategies: (a) prevention, (b) interception, and (c) investigation. The actual activities initiated by SCAT are dictated by the nature of the crime problem and by the community context in which the unit is operating. The highest priority is given to working directly with community members to resolve area crime problems.

The SCAT unit is deployed on a quarterly basis and since its inception it has served numerous target areas for varying amounts of time. The unit has been deployed in areas with both burglary and robbery problems.

In this document, the first Phase of SCAT project operations is examined. Beginning in mid-December 1972, the SCAT unit was deployed to three precincts which were experiencing the highest incidences of

burglary in the city of Denver. The unit continued to serve these three burglary target precincts throughout the calendar year 1973, although during the second and fourth quarters of 1973, the unit was directing the majority of its efforts towards robbery reduction in other parts of the city.

The SCAT unit efforts in combating burglary in the target precincts involved numerous activities. In addition to the influx of visible police in the area, the unit increased the number of technical crime scene searches in the area by 198 percent over the expected rate based on 1972. There was a 38 percent increase in the clearances by arrest for all target area burglaries in 1973, during the time of SCAT attention. The SCAT members worked with the community to provide public education and target hardening services including: business and domicile security inspections with corrective recommendations, displays and demonstrations of burglary, robbery and larceny prevention measures at target area shopping centers and crime prevention instruction at local neighborhood meetings.

3.2 Project Selection and Target Areas

The target crime, burglary, and the target areas were selected on the basis of crime-specific analysis to determine the relative severity of the various possible target crime problems and the geographical locations of these problems.

The crime of burglary was selected as the target crime for Phase I of SCAT operations for a number of reasons. The SCAT grant application provides the following rationale behind this choice.

First, burglary is the most frequently occurring crime in the "Impact" categories. In 1971, Denver had 15,228 burglaries reported to the police or 2,956 burglaries per 100,000 population. When compared to the national rate of 1,050 burglaries per 100,000 population, Denver has nearly three times the national rate. During the first six months of 1972 there were 8,220 reported burglaries resulting in a dollar value property loss of \$2,859,459. Approximately 45.6 burglaries are reported to the police each day, with an average loss of \$347. The police department indicated that the juvenile and young adult offender from the immediate neighborhood was the most frequent perpetrator of the crime. Another factor considered in the

decision to attack burglary was the knowledge that many burglaries go unreported. The total number of criminal acts that occur remains unknown, and only those discovered by the police, or those reported to the police, become crime statistics. According to a 1965-66 survey of 10,000 households conducted nationally by the National Opinion Research Center (NORC) at the University of Chicago, burglary offenses were almost three times the reported rate. If this fact is accurate, Denver may have had as many as 24,660 actual burglaries in the first six months of 1972. The police were already heavily burdened with burglary investigations that tap a large amount of investigative resources. The overburdened detectives found that the sheer weight of numbers in any given day almost preclude anything but a perfunctory investigation. The clearance rate for burglaries during the first six months of 1972 was 27.8% (27.2% Residential - 28.8% Commercial). The police arrested and charged 1,117 persons with the crime of burglary. A total of 2,234 burglaries were cleared or about two (2) burglaries for each person arrested out of the 8,220 burglaries reported.

In addition to the serious nature of the problems outlined above, the concern of citizens was a paramount factor. Although burglary is generally a crime of stealth and opportunity committed by skilled and unskilled criminals, and does not generally involve violence, the average citizen has a greater fear of a burglar confronting him in the privacy of his home than of an armed stick-up man robbing him in the street.

(Source: SCAT Grant Application, DACC Form 5, page 2-2a)

For the first phase of the project three police precincts (216, 217 412) were selected as the target areas of operations specifically because they had the highest incidences of burglary in Denver. These precincts are predominantly middle class residential areas with sizable minority populations (Black and Chicano).

The total burglary target focus consisted of two geographically separate areas (as seen in Figure 1 which shows the location of the target areas within the city). One area, Precincts 216 and 217, is a large, older, residential location in the extreme Northeast corner of the city. The area residents are predominantly black, a sizable portion of the population is under 18 years of age, and unemployment is low. Homes are well-maintained and the area is free of pedestrian and traffic congestion.

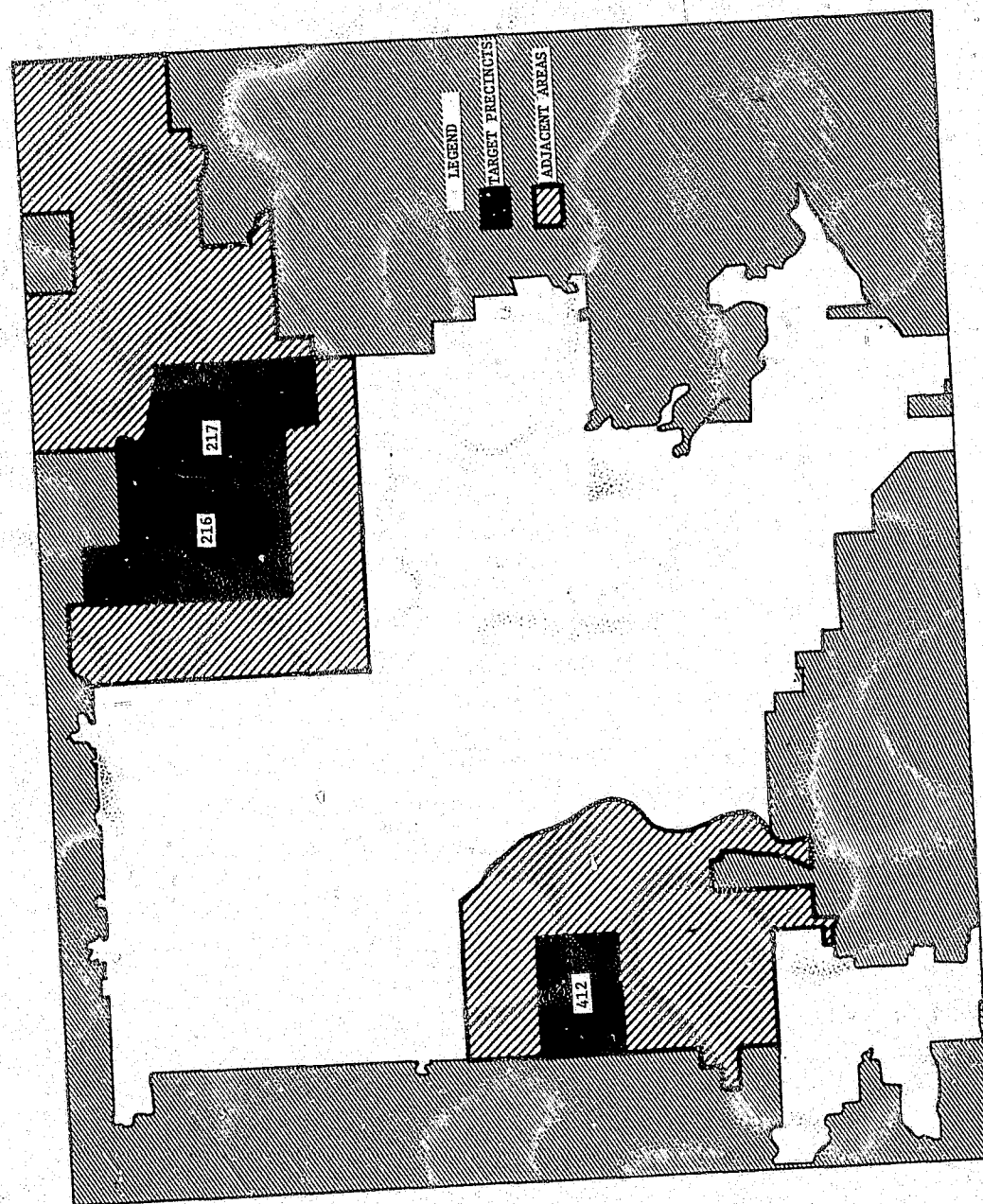


FIGURE 1
SCAT TARGET AREAS AND ADJACENT AREAS

There is very little commercial development in these precincts of the city except for a warehouse distribution district at the north end of the area where several interstate highways and the railroad lines merge. The other targeted precinct, 412, is located on the western border of the city. In this precinct, approximately one quarter of the population is Spanish-American. Similar to the target areas described above, a high proportion of the residential population is under the age of 18, there is a low rate of unemployment, and street congestion--both automobile and pedestrian--is minor. The homes in this area, however, are smaller, more recently built, and in visibly poorer condition. Further, Precinct 412 is not as large as the other precincts and is bordered on three sides by commercial strip development, with the congestion and street activity which generally accompanies it.

The map in Figure 1 also shows those areas immediately adjacent to the target area which are analyzed for possible displacement of crime from the target areas. In both cases (412 and 216/217) there are areas adjacent to the target precincts which are not under the jurisdiction of the Denver police department. No crime data is available for these areas. For precinct 412 the adjacent area is not unlike the other surrounding precincts and thus an assessment of crime displacement which excludes this area would not be expected to differ significantly from results obtained from analysis of the entire peripheral area. Similarly adjacent area analysis results should not be significantly biased by the exclusion of the area immediately north of precincts 216/217 since this is an area covered by highways and railroad tracts, now out of use. Other sections of the precincts adjacent to 216/217 include the airport; while this represents a different land use from the target area, the amount of airport crime is relatively small and should thus not bias the analysis of adjacent area effects.

Unfortunately these adjacent areas are rather large, encompassing a total of 11 precincts. Ideally one would like data for a several block

ring surrounding target precincts for assessing localized geographic displacement. However, the precinct scale is the smallest level of data aggregation available from the Denver police department so the eleven precincts as shown in Figure 1 will be used as the basis for the analysis of possible displacement effects.

4.0 PROJECT LEVEL EVALUATION

4.1 Project Level Evaluation in the Impact Program

As mandated by the Impact program, all Impact projects are evaluated to assess their progress in meeting their crime reduction objectives. The Denver SCAT project targeted a 25 percent reduction in burglary during the first year of operations in the burglary target precincts.

The SCAT unit's effectiveness in burglary reductions was assessed by city level evaluators using a simple before-after analysis strategy. Throughout the period of SCAT anti-burglary operations, month-to-month, quarter-to-quarter and year-to-year comparisons of target area burglary levels were made to assess the extent to which SCAT was having the desired impact. The results of this on-going analysis were used both in planning for the location and activities of the team and as the basis for project-level evaluation.

In the following sections of this document, the SCAT project evaluation approach will be presented and utilized to assess the SCAT unit's effectiveness in burglary reduction. A summary of the information contained in the three successive Denver SCAT evaluation reports is presented below.

4.2 Denver SCAT Evaluation Reports

The Denver Anti-Crime Council conducted the evaluation of the SCAT project in close cooperation with the project director and the project analysis. SCAT operations are directed to a certain extent by ongoing analysis of crime level changes city-wide and in the project target areas. Thus, throughout the period of SCAT anti-burglary operations,

month-to-month, quarter-to-quarter and year-to-year comparisons of target area burglary levels were made to assess the extent to which SCAT was having the desired impact. The results of this on-going analysis were used as the basis for formal project-level evaluation as well as in planning for the location and activities of the team.

The Denver Anti-Crime Council has produced three evaluation reports pertaining to SCAT effectiveness in burglary reduction. Before presenting the national-level analysis of SCAT effectiveness, the city-level evaluation findings are summarized below.

FIRST QUARTERLY EVALUATION REPORT, JANUARY-MARCH 1973

In the first quarter of project operations, January-March 1973, burglary in the total target area was down 27 percent from the same quarter the previous year. The Denver Anti-Crime Council's first quarterly evaluation report findings (see Figure 2) were that burglary was down 38 percent in one precinct and 22 percent in the other two. While a substantial decrease in crime was observed for the targeted precincts, areas adjacent to the target areas were experiencing an increase in burglary (12 percent) during the same period while the rest of the city was showing a decline, although less substantial than that observed for the SCAT areas. (See Figure 3). The report pointed out that these results were somewhat preliminary and that further evaluation would shed more light on conclusive crime level changes.

SECOND QUARTERLY EVALUATION REPORT, APRIL-JUNE 1973

The Second Quarterly Evaluation Report presented results of a similar crime level analysis for the period April through June. (See Figure 4, page 19.)

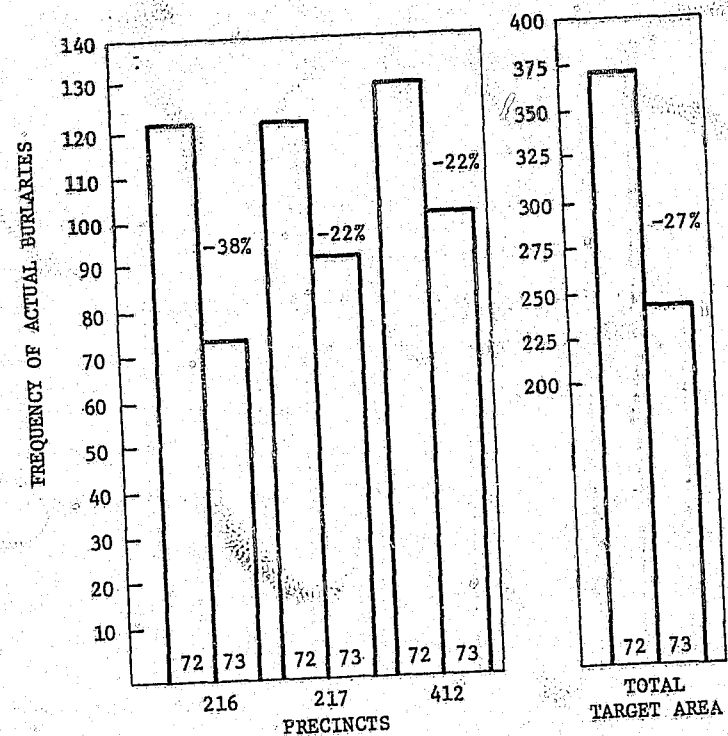
Analysis of crime figures for the second quarter of SCAT operations showed that the decline in burglaries in the target precincts observed in the first three months had continued and grown to a 50 percent decline.

SUMMARY EVALUATION REPORT, OCTOBER 1972-DECEMBER 1973

In the summary evaluation report a similar analysis was presented for the full year of project operations. Figure 5, page 20, presents the yearly results.

In terms of yearly changes in burglary, the target area experienced a 37.9 percent decline. The remainder of the city experienced a much more modest decrease of 6.2 percent while the city as a whole felt a 9.8 percent reduction, of which more than a third can be attributed to SCAT target area changes.

On the basis of these reports SCAT was regarded as successful. The unit has been refunded and moved to other target areas where other crime problems have been identified as demanding SCAT attention.



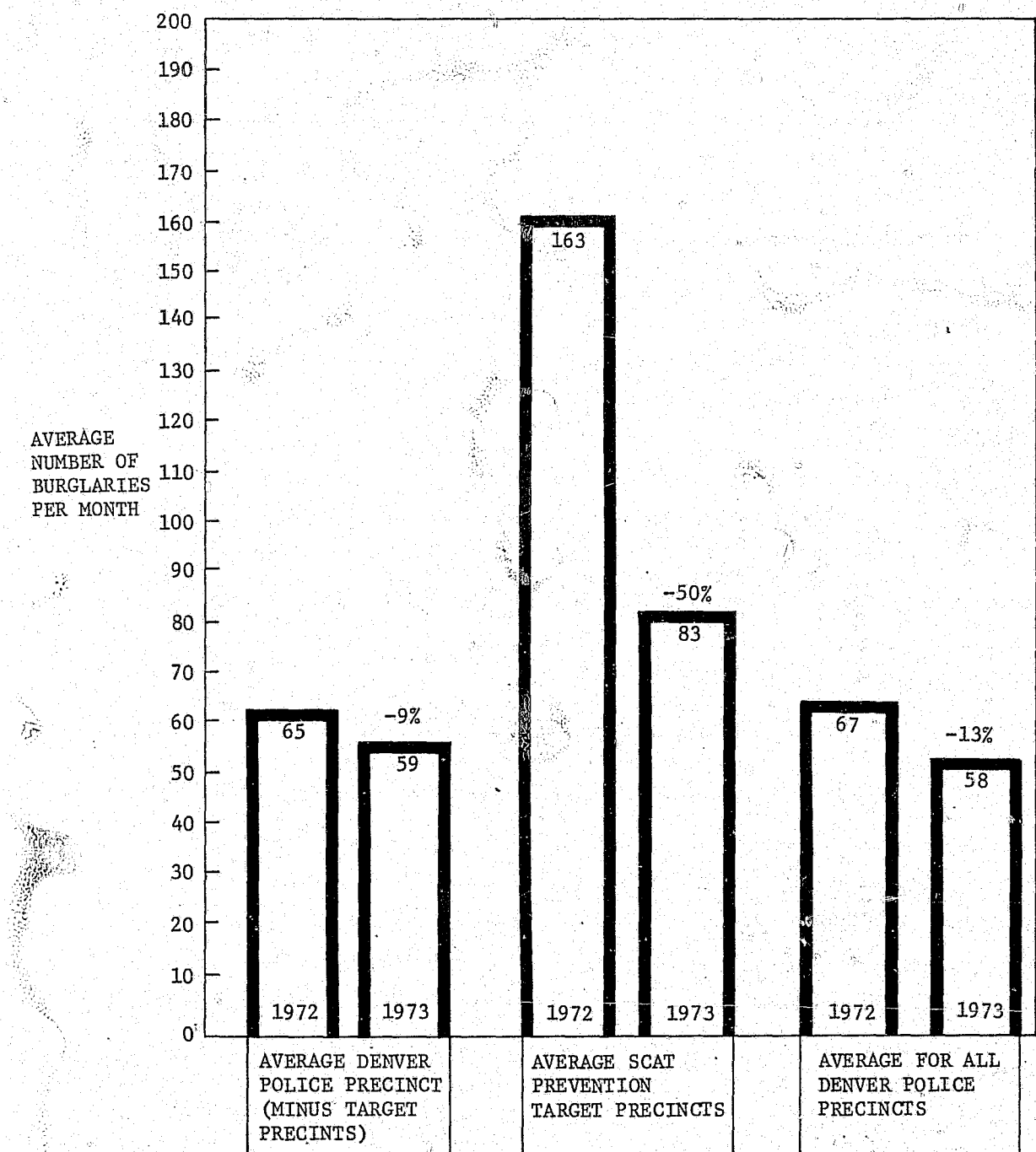
(SOURCE: FIRST QUARTERLY EVALUATION REPORT, JANUARY-MARCH 1973)

FIGURE 2
COMPARISON OF FIRST QUARTER BURGLARY FREQUENCIES FOR TARGET PRECINCTS AND TOTAL TARGET AREA, 1972-1973

	ESTIMATED POPULATION	AVERAGE NUMBER OF BURGLARIES	% INCREASE OR DECREASE OF BURGLARIES
AVERAGE FOR SCAT TARGET	10,840	90	-27%
AVERAGE FOR ADJACENT PRECINCTS	9,502	62	+12%
AVERAGE FOR REST OF DENVER	8,578	56	-10%

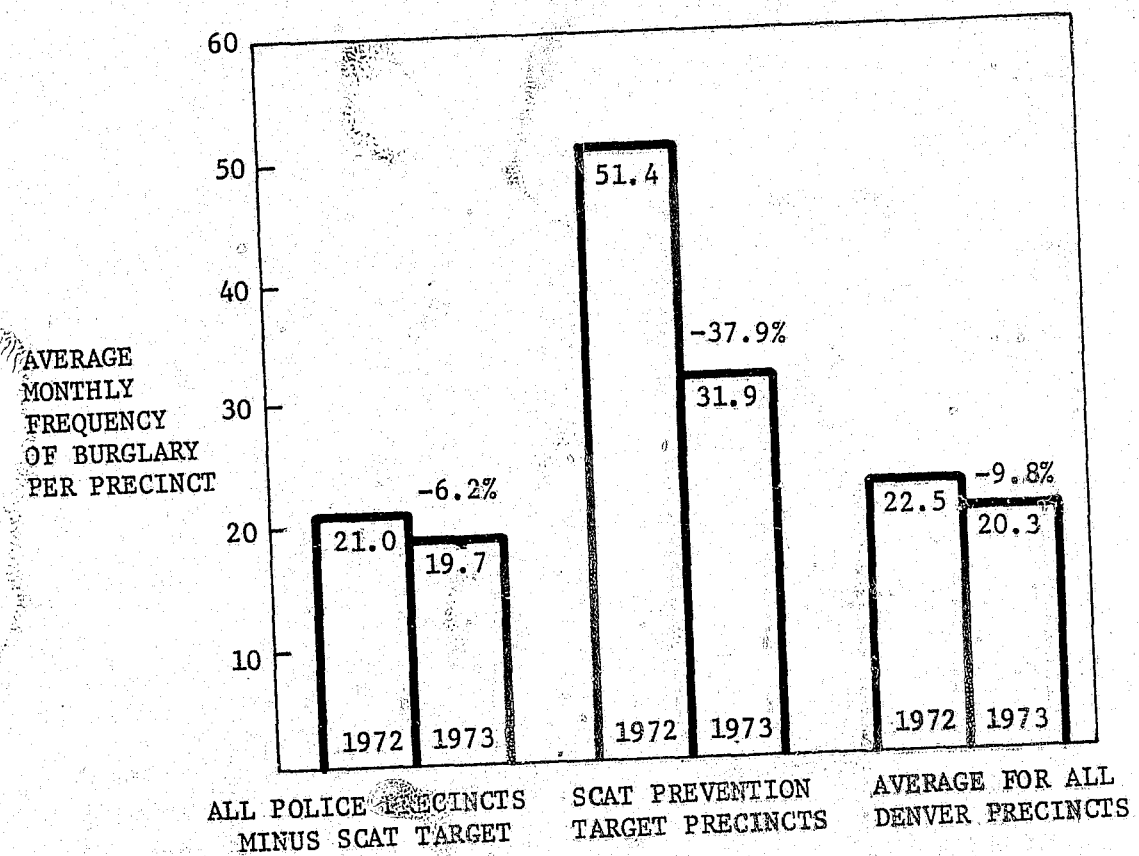
(SOURCE: FIRST QUARTERLY EVALUATION REPORT, JANUARY-MARCH 1973)

FIGURE 3
PERCENTAGE CHANGE IN BURGLARY FOR FIRST QUARTER 1973



(SOURCE: SECOND QUARTERLY EVALUATION REPORT, APRIL-JUNE, 1973)

FIGURE 4
COMPARATIVE BURGLARY RATES FOR SECOND QUARTER (APRIL, MAY AND JUNE) OF 1972 AND 1973 IN DENVER POLICE PRECINCTS



(SOURCE: SUMMARY EVALUATION REPORT, OCTOBER 1972 - DECEMBER 1973, PG. 14)

FIGURE 5
YEARLY CHANGES IN BURGLARY, 1972-1973

5.0 NATIONAL LEVEL ANALYSIS OF SCAT EFFECTIVENESS

As part of the national level assessment of the effectiveness of Impact police patrol projects, an analysis of crime data for SCAT target areas (TA), adjacent areas (AA) and for that portion of the city not receiving SCAT treatment (city-wide minus target areas but including adjacent areas: CW-TA) has been conducted for 1971 through 1973 to assess the anti-crime impact of the SCAT project. The analysis has not been restricted to the primary target crime of burglary since it is reasonable to expect that while burglary reduction was the focus of SCAT activity, the effect of the increase in police attention in target areas would be felt in other crimes as well as burglary.

Because no controls have been built into the allocation of SCAT services, the task of evaluating the project impact is a difficult one. It is not only necessary to determine what changes in crime have been experienced in the SCAT target areas and the effect that these crime level changes have had on city-wide crime levels (as has been done by the city-level evaluators in the Denver SCAT Evaluation Reports) but it is also necessary to determine to the extent possible whether these changes can be attributed to the project.

The strategy employed in this document in making such a determination is as follows: Because there are no built-in controls in the design of project operation, any control exerted in the research must be exercised in the method of analysis. A range of analysis approaches are utilized, first, to establish the nature of short term changes in the crime picture which have been experienced *in situ* and, then, to examine the role of other influencing factors which could have accounted for the observed changes rather than the project treatment itself.

The first approach presented is a simple before-after analysis of crime levels during treatment. The second is an extended before-after approach which places the short-term results delineated in the first

analysis into a longer-term time context. And finally a time series analysis is presented which uses past crime levels as the basis for estimating crime levels during treatment.

5.1 Simple Before/After, 1972 - 1973

The approach utilized in the Denver evaluation reports is a simple before-after approach involving comparisons of crime levels during treatment with crime levels during comparable time periods the preceding year. This approach can be used to present a comprehensive picture of the short-term crime reduction experience in Denver during the period of project operations.

TARGET AREAS

Three precincts were designated as a SCAT target area and were given attention by the SCAT unit for 12 months, January to December 1973. Figure 6 (page 26) displays quarterly burglary frequencies in the target area for treatment periods contrasted with comparable time periods during the previous year. The information is presented on a precinct per month basis. Percentage changes observed apply to average changes in burglary level of the target precinct.

The figure depicts dramatic decreases in target area burglary in each of the four quarters reflected in the yearly average of a 38 percent decline. The largest decreases were observed in the first two quarters of SCAT operations, notably in the second quarter. SCAT activities in the target area were most intense during the first and third quarters of 1973. The substantial decline in burglary during the second quarter may also be due to a time lag between initial unit activities and their effect on burglary occurrence. Also, the reduction in burglary expected from SCAT attention was to result from both direct unit activities and secondary activities such as community efforts in increasing awareness

of crime problems, increasing citizen/police cooperation and target-hardening activity. The second and fourth quarter decreases in burglary may be attributable in large part to these second order activities.

ADJACENT AREAS

Burglary levels in areas immediately adjacent to the SCAT target area have been assessed in a similar fashion to determine the extent to which the SCAT project has had an impact on adjacent area crime since it was possible that burglary, which has decreased in the target area, has simply been displaced to the adjacent areas. Another possibility is that the SCAT unit has had a beneficial spillover effect on burglary in nearby precincts. This is to say that the anti-burglary effect of the unit may have initiated burglary reductions in areas not directly targeted. This is particularly plausible for a unit such as SCAT due to the second order community activities initiated by the project which would not necessarily be restricted to the target area.

Results of the analysis for changes in adjacent area burglary are also presented in Figure 6. As the figure shows, while the yearly total number of burglaries has decreased 3 percent from the previous year, the quarterly results are mixed. No substantial decreases, such as those experienced in the target area are seen, and in two quarters, the first and fourth, increases in crime over the levels of the previous year were observed (12 percent and 2 percent respectively).

As in the target areas, the largest decrease in burglary over the preceding year was felt in the second quarter of the project time period. Again, this may be due to a time lag problem; the spillover effects of SCAT activities, especially second order community activities, may not have been realized until the second quarter of SCAT operations.

The increases in burglary in the first and fourth quarters may be due to displacement from the SCAT target area. However, the magnitude of these increases is small (especially the 2 percent increase in the fourth quarter) and it is equally likely that they were due to random fluctuation in burglary frequency.

ALL POLICE PRECINCTS MINUS SCAT TARGET PRECINCTS

A similar assessment of burglary level changes for that portion of the city which did not receive SCAT attention is helpful in further evaluating the situation. It is reasonable to assume that changes which have occurred in the rest of the city would have occurred in the target area regardless of the SCAT treatment. These citywide effects should not be attributed to SCAT presence.

The remainder of the city has experienced moderate declines in burglary both quarterly and in total for the year of SCAT treatment over the previous year (Figure 6). A comparison between target area and city-wide minus target area levels shows that while the remainder of the city experienced a decline during the period of SCAT operations, the decreases experienced in those areas receiving direct SCAT attention was much more substantial than for the remainder of the city. This suggests that SCAT presence has contributed to the target area declines in burglary.

CITY-WIDE

Changes in burglary levels in the city as a whole including SCAT target areas are also displayed in Figure 6.

As the figure indicates, the burglary levels in the city of Denver have declined throughout the year of SCAT operations. Using these figures it is possible to factor out the contributions to city-wide decreases which are attributable to the SCAT treatment precincts.

For the first quarter of 1973, burglary for the city as a whole decreased 8 percent from the first quarter of 1972. For those precincts in the city not receiving SCAT treatment, a decline of 6 percent was observed. Thus, for the first quarter, the burglary changes in SCAT target areas have contributed to a 2 percent decline in city-wide burglary. For the second, the SCAT target area contribution was 5 percent, for the third quarter 1 percent, for the fourth, 3 percent and finally for the yearly totals, 3 percent.

YEARLY CHANGES

Finally, to summarize, Figure 7 presents a composite display of yearly percentage changes from 1972 to 1973 in the burglary levels for target areas, adjacent areas, the portion of the city receiving no SCAT treatment and the city as a whole.

The SCAT target areas, areas of the highest frequency of burglary in the city, have experienced the most substantial declines during the period of SCAT operations. The adjacent areas have also experienced a decrease in burglary during the project time period; however, this decrease is very small and is in fact less than the declines experienced in the portion of the city which received no treatment (these areas include the adjacent areas). This suggests that some displacement from SCAT target precincts may have occurred into these adjacent areas. Moderate declines in burglary were experienced in those areas of the city receiving no SCAT attention, however, these declines were much more modest than those observed in the target area. Finally, comparing decreases observed in those precincts not receiving treatment with decreases observed in the city as a whole, it appears that the SCAT target area decreases in burglary have contributed to 3 percent of the 10 percent city-wide burglary decline for 1973 over 1972.

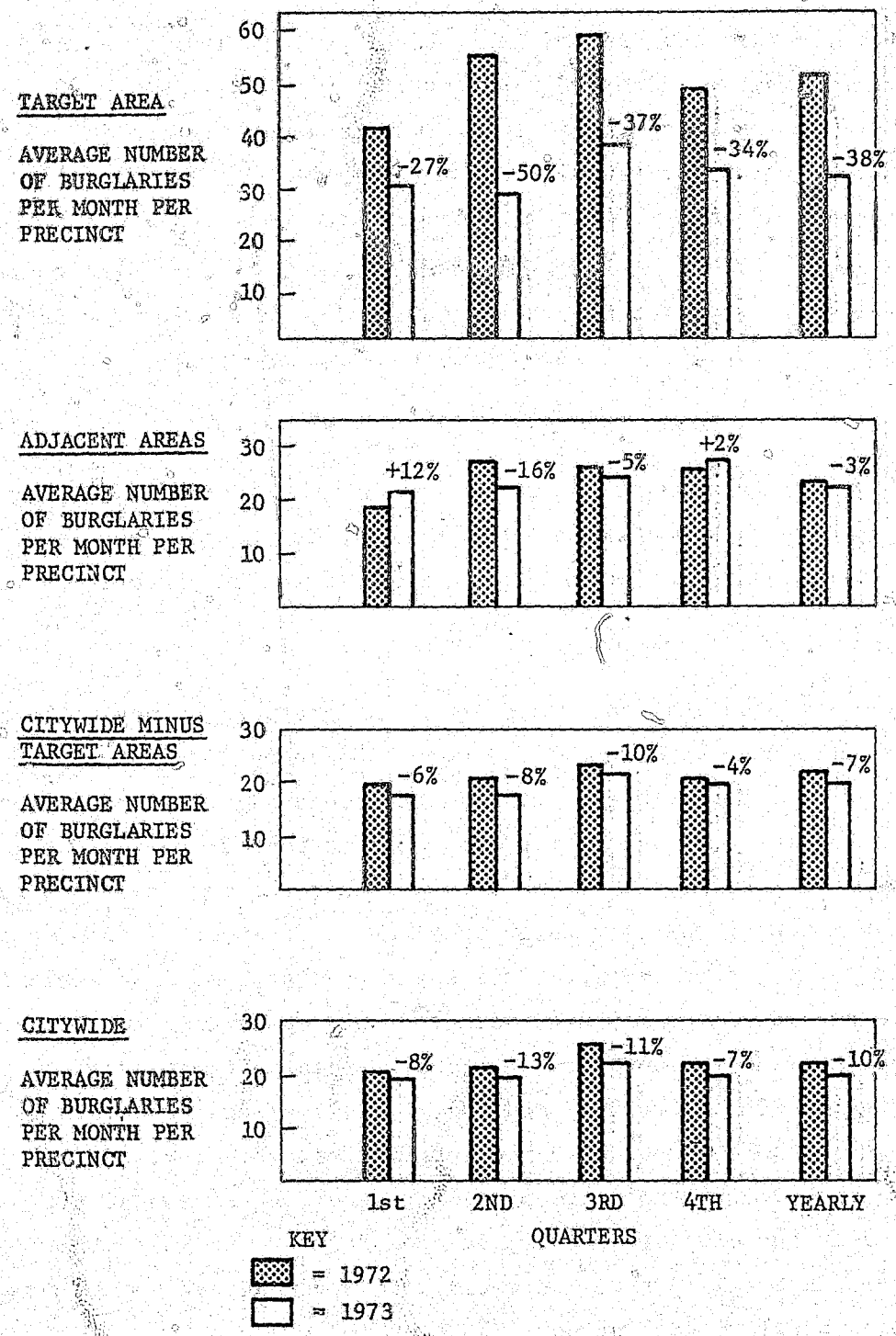


FIGURE 6
COMPARISON OF BURGLARY FREQUENCIES BY QUARTER AND YEARLY, 1972 AND 1973

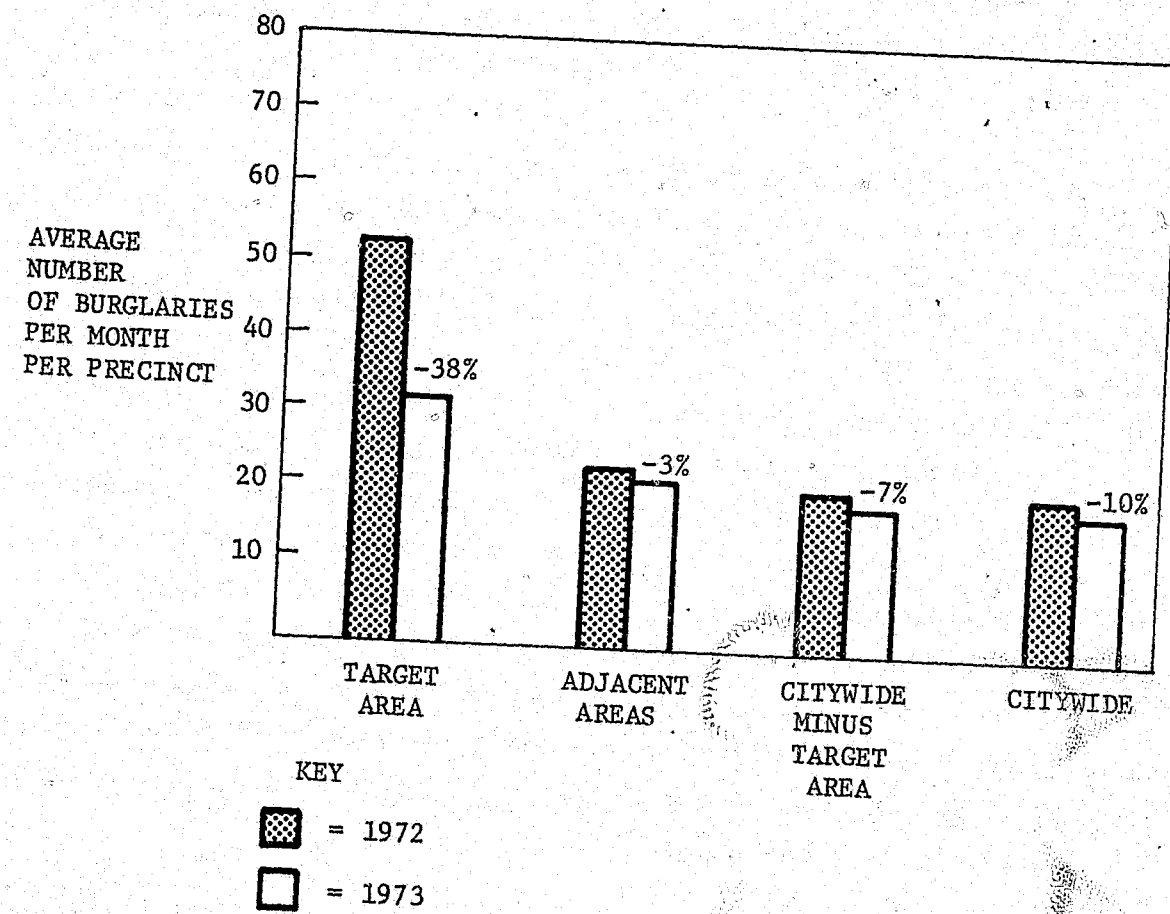


FIGURE 7
COMPARISON OF YEARLY BURGLARY FREQUENCIES, 1972-1973

The above analysis indicates that based upon a simple before/after comparison, the SCAT unit appears to have had an effect on burglary. The SCAT target precincts have experienced substantial decreases in burglary over the previous year. The target area decreases are larger than the moderate city-wide declines in burglary which were observed in 1973 over comparable periods. Because of the severity of the burglary problems in the target precincts, the decreases in target area burglaries have contributed several percentage points to the total decline in city-wide burglaries.

Thus, it appears in terms of decreases from the previous year (the most immediate time point of comparison) that the SCAT project has had the desired impact on burglary. However, this evaluative approach leaves open several possible alternative explanations for the crime level decreases experienced other than the SCAT project effort. Notably two considerations are not addressed. The first involves longer-term crime trends. While it may in fact be the case that burglary has decreased from the previous year, it may also be true that the trend in burglary may have been on a downward path and that the decreases experienced from the previous year may be part of the larger trend picture rather than a change instituted by the presence of the special treatment of the project. This may mean that the project has not contributed to the observed burglary decrease as the above analysis would indicate. By looking at past experience with burglary in these areas, this alternative explanation can be explored.

The second possible alternative explanation for the observed target area burglary declines relates to the fact that the target precincts have a higher burglary level than do the other precincts in the city. This characteristic was the basis for their selection for treatment. Because these precincts are "outliers" in terms of all the precincts in the city, it is reasonable to expect that their levels would decrease

more substantially than would other more moderate precincts, SCAT treatment notwithstanding, due to regression to the mean. Thus, decreases observed may be due to this regression artifact rather than the effect of the treatment. This is a problem frequently faced in the evaluation of action programs because these programs necessarily target problems which by definition are "outliers" relative to the rest of the system. This problem can be addressed by either estimating the extent of the bias presented by the artifact or by a longer term view of the problem which in effect averages out the problem definition to be used as a baseline comparison point and moderates the bias.

In the next sections, several other analysis approaches which address the above two considerations will be used to assess the impact of the SCAT program. These analyses provide additional information about program effectiveness.

5.2 Extended Before/After Approach 1971 - 1973

Yearly crime figures are available for 1971 through 1973 for target areas (TA), the remainder of the city not receiving SCAT treatment (CW-TA) and areas adjacent to the target areas (AA). These figures can be utilized to get a general idea of what crime trends were immediately preceding the project and thus are useful in exploring the possibility that crime reductions observed in the simple before-after analysis are due to previously established trends. Ideally, more than three years of data would produce more substantial information in this regard, however 1971 data were the earliest available at the precinct level.

Figure 8 (A-F) displays this analysis. Crime levels for 1972 and 1973 have been normalized relative to a 1971 base level. Yearly changes in crime levels relative to the 1971 base level are displayed for SCAT target areas (TA), adjacent areas (AA) and for city-wide minus target areas (CW-TA). This presentation allows for the comparison of trends in crime during SCAT operations with those preceding the institution of the projects.

Burglary

Figure 8-A presents information on burglary, the SCAT target crime. The figure shows, as was discussed in the previous section (5.1), that for the year of project operations (1973) substantial decreases in target area (TA) burglary were observed, moderate decreases were seen in burglary in the remainder of the city (CW-TA) and modest decreases were observed in areas adjacent to the target area (AA). Figure 8-A shows that all three areas had experienced an increase in burglary from 1971 to

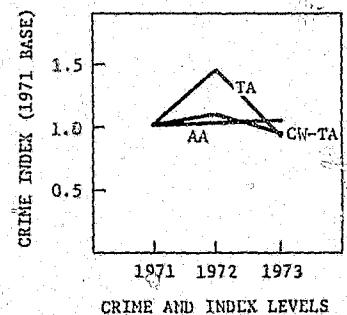


FIGURE 8-A
BURGLARY

1972 preceding the SCAT project. While increases for the untreated portion of the city and for the adjacent areas were moderate, the upward trend from 1971 to 1972 in target area burglary, however, was more sharp and the downward turn from 1972 to 1973 was equally substantial with burglary dropping to a level in 1973 lower than that observed in 1971. This indicates that the burglary decrease observed in the target area during the treatment period is not a continuation of the previous trend but is rather a departure from that trend.

Total Crime

A similar pattern is seen in total crime levels, as might be expected since burglaries comprise more than 50 percent of total crime. Figure 8-B displays this analysis for total crime (including murder, manslaughter, rape, aggravated assault, robbery, and burglary). As the figure shows, total crime in the target areas increased more substantially before treatment (1971 to 1972) than did total crime in either the remainder of the city or the adjacent areas. During treatment however, (1972 - 1973) target area crime dropped equally substantially; such decreases are not observed for either the remainder of the city or the adjacent areas.

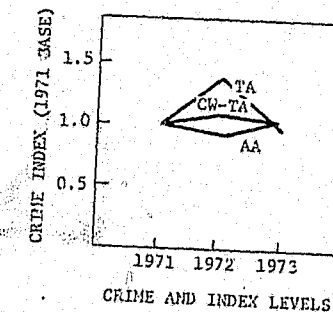
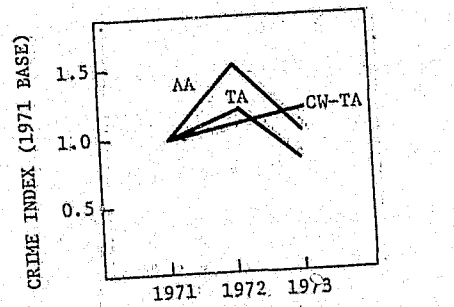


FIGURE 8-B
TOTAL CRIME

Murder

For murder (Figure 8-C), once again, all three areas experienced an increase from 1971 to 1972; however, in this case the largest increase was experienced in the adjacent areas. From 1972 to 1973, the growing trend in murder in the untreated areas of the city continued at the same pace as previously observed; while for both the target areas and adjacent areas the murder level dropped significantly with the 1973 level of target area murder falling to a point lower than that observed for 1971.

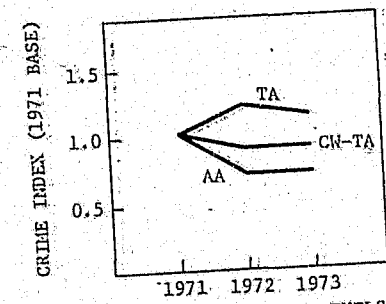


	1971	1972	1973
TA	5 (1.0)	6 (1.2)	4 (0.8)
CW-TA	77 (1.0)	83 (1.08)	91 (1.18)
AA	15 (1.0)	10 (1.5)	14 (1.07)

FIGURE 8-C
MURDER

Aggravated Assault

The picture for aggravated assault is somewhat different. Only the target areas experienced an increase from 1971 to 1972; this increase was followed by a decrease from 1972 to 1973, the treatment time period. The rest of the city, however, experienced a moderate decline from 1971 to 1972 and this decline continued, from 1972 to 1973 although at a slower rate. The adjacent areas followed a similar pattern; these areas experienced a more substantial decrease in assault during the year preceding treatment and again decreased during the treatment period, although at a more moderate pace.

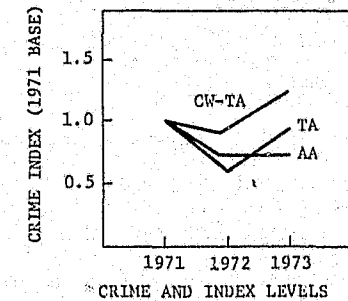


	1971	1972	1973
TA	158 (1.0)	189 (1.2)	178 (1.13)
CW-TA	1892 (1.0)	1738 (0.92)	1728 (0.91)
AA	398 (1.0)	293 (0.74)	280 (0.70)

FIGURE 8-D
AGGRAVATED ASSAULT

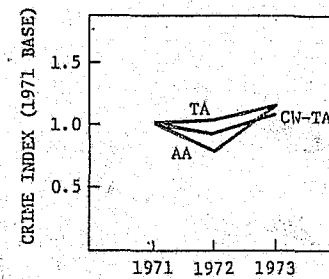
Rape and Robbery

For two crimes, rape and robbery (Figure 8-E and 8-F, respectively), the general pattern observed in Figure 8-C is, in effect, reversed. Both crimes either declined or remained the same from 1971 to 1972 in target areas, the remainder of the city and adjacent areas. From 1972 to 1973 these crimes either increased or remained the same in all three areas. For target areas, rape dropped substantially from 1971 to 1972 before treatment and rose again from 1972 to 1973, when one would have expected to see the impact of SCAT treatment. From 1971 to 1972, target area robbery remained constant and from 1972 to 1973 increased, despite the presence of SCAT in 1973. Thus SCAT does not appear to have had an effect on the level of these two crimes.



	1971	1972	1973
TA	38 (1.0)	21 (.55)	32 (0.84)
CW-TA	396 (1.0)	347 (.88)	429 (1.08)
AA	85 (1.0)	56 (.66)	57 (0.67)

FIGURE 8-E
RAPE



	1971	1972	1973
TA	127 (1.0)	128 (1.01)	147 (1.6)
CW-TA	2039 (1.0)	1885 (0.92)	2263 (1.13)
AA	354 (1.0)	310 (0.88)	399 (1.13)

FIGURE 8-F
ROBBERY

5.3 This Series Analysis, November 1970 - December 1973

Monthly crime data from November 1970 - December 1973 were analyzed to assess the regularity of crime level changes observed during SCAT operations using a number of trend models (four in total). These models are described in greater detail in Appendix I.³ These models depict crime before treatment in terms of three basic components, a base level, long term trend, and a seasonality factor (as well as a random "noise" factor). It is hypothesized that these modeled descriptions of crime patterns before treatment will be reduced by some factor (i.e. multiplied by a diminishing factor or reduced by a constant) once SCAT treatment is applied, if the treatment is having the anticipated effect on crime. The extent to which these crime reduction expectations obtain is reflected in the level of confidence generated by each of the models when applied to the crime data for the period of project operations. The higher the confidence level, the greater the regularity of observed crime level decreases.

This type of analysis incorporates the observed trend effects into the assessment of crime-level changes. Using these models, high levels of confidence in crime decreases indicate that declines in crime have been observed over and above those which would have been expected given past crime level experience.

These models make use of monthly crime figures over a 40 month time period (28 months preceding treatment and 12 months during treatment) to assess crime level changes. The assessments of crime level changes are thus more sensitive using this approach than those considered in the preceding extended before-after analysis which looks at gross yearly changes in crime levels preceding and during project operations.

³ See MITRE Technical Report, MTR-6617, "A Methodology for Conducting a Police Hypothesis Test."

These models have been utilized to analyze crime data for SCAT target areas (TA), for the areas immediately adjacent to the target areas (AA), and for the remainder of the city of Denver not receiving SCAT treatment (city-wide minus target areas but including adjacent areas, CS-TA). The confidence levels obtained for each of these areas, for each of the crime types, with each of the four models are listed on Tables I - III. These confidence level figures are summarized in Figure 9 (A-F). This figure displays the range of confidence levels that crime has declined during the period of project operations for each of the crime types in each of the areas considered.

Burglary

The time series analysis for burglary changes in target areas (TA) adjacent areas (AA), and for the remainder of the city (CW-TA) further substantiates the results of the preceding analyses. Confidence levels for crime level decreases during SCAT treatment displayed in Figure 9-E, indicate that while declines have been experienced with high regularity in the entire city including target areas, adjacent areas and the untreated areas, this decrease in burglary has been most consistent in the areas receiving direct SCAT attention, the target areas. It does not appear that their location nearby the SCAT target areas has contributed to the regularity of burglary decline in adjacent areas; in fact, these areas have experienced a relatively less consistent decline than the total portion of the city receiving no SCAT attention. This again indicates that the SCAT presence may have had a detrimental, rather than positive, impact on adjacent area burglary.

Total Crime

Again the pattern of results for total crime is similar to that observed for burglary due to the high proportion of total crimes which fall into the category of burglary. The target areas have experienced

the most consistent declines in total crime. Areas not receiving SCAT attention have declined but with less regularity, and areas adjacent to the target area have lagged behind the entire untreated portion of the city.

Murder

For murder (Figure 9-A) the target area reductions are again the most regular. Decreases in the remainder of the city and in the adjacent areas are less consistent than target area declines with a wider range of confidence level results obtained for the adjacent areas.

Aggravated Assault

The results of the aggravated assault analysis also exhibit a similar pattern but in this case the spread between the confidence levels obtained for the three areas is wider, indicating greater discrepancies in the consistency of the decreases experienced in each area.

Rape and Robbery

Rape and robbery have exhibited the lowest confidence levels for decreases during the period of project operations. The somewhat mixed results for target area rape still indicate that relative to the rest of the city, the declines in rape in the treatment areas are more consistent. Target area robberies also show more regular decreases than either the rest of the city or the adjacent areas, although the confidence levels obtained for robbery and rape are lower than for any other crime type.

TABLE I
LEVEL OF CONFIDENCE
IN CRIME LEVEL DECREASES
DURING TREATMENT BY MODEL: TARGET AREAS

	Model* #	% Confidence that Crime has Decreased During Treatment
MURDER	1	96.8
	2	100.0
	3	98.3
	4	79.0
RAPE	1	27.4
	2	45.4
	3	28.0
	4	9.2
ROBBERY	1	38.7
	2	50.9
	3	40.5
	4	34.7
AGGRAVATED ASSAULT	1	99.1
	2	99.3
	3	98.9
	4	92.8
BURGLARY	1	100.0
	2	100.0
	3	100.0
	4	100.0
TOTAL CRIME	1	100.0
	2	100.0
	3	100.0
	4	100.0

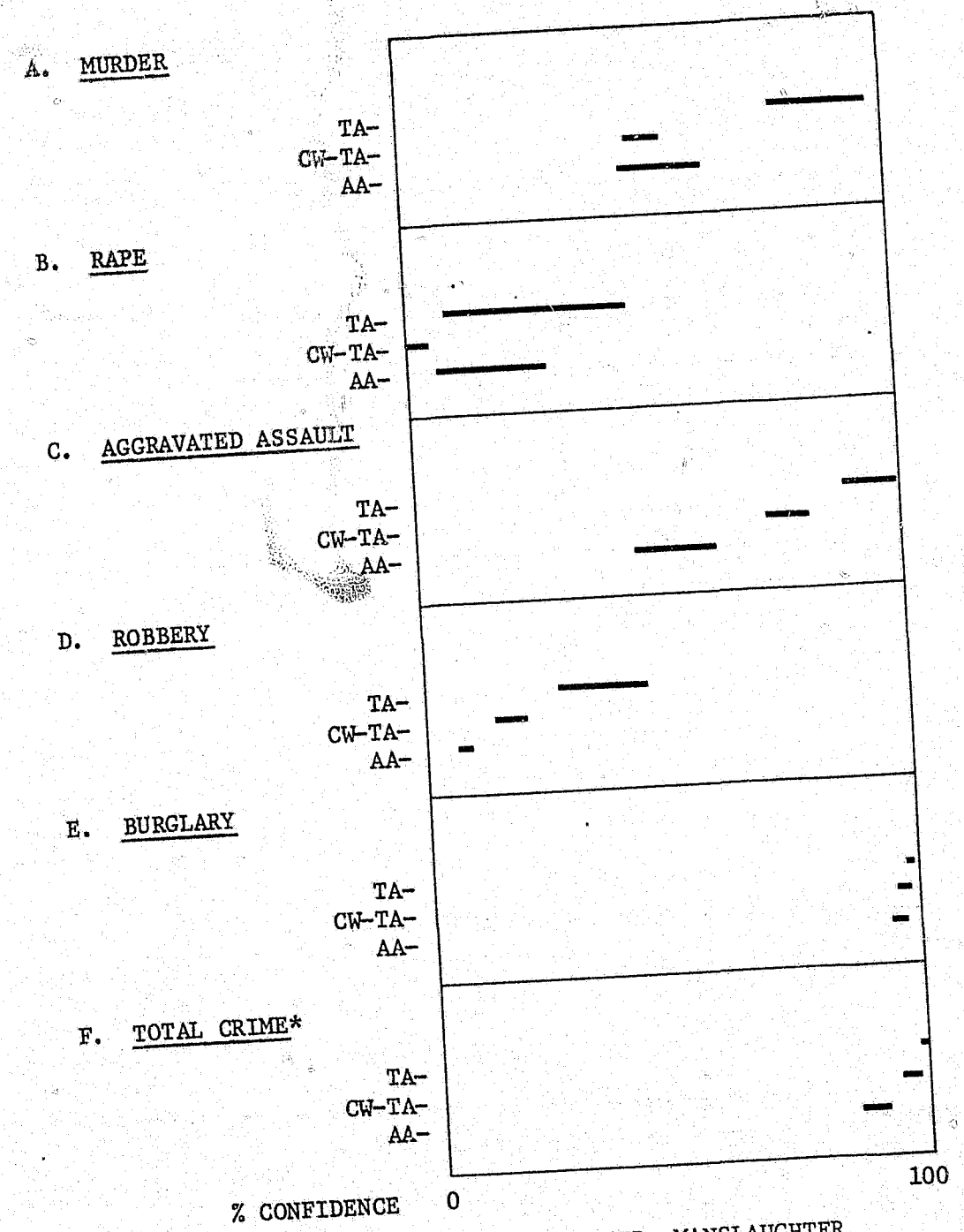
*A description of each of the 4 models can be found in Appendix I.

TABLE II
 LEVEL OF CONFIDENCE
 IN CRIME LEVEL DECREASES
 DURING TREATMENT BY MODEL: ADJACENT AREA

	Model #	% Confidence that Crime has Decreased During Treatment
MURDER	1	56.8
	2	47.3
	3	66.7
	4	54.2
RAPE	1	19.4
	2	29.3
	3	18.5
	4	8.8
ROBBERY	1	18.2
	2	18.5
	3	20.4
	4	16.5
AGGRAVATED ASSAULT	1	19.9
	2	19.8
	3	19.0
	4	10.1
BURGLARY	1	98.6
	2	99.2
	3	99.1
	4	97.8
TOTAL CRIME	1	89.5
	2	89.8
	3	90.7
	4	88.2

TABLE III
 LEVEL OF CONFIDENCE
 IN CRIME LEVEL DECREASES
 DURING TREATMENT BY MODEL: CITYWIDE MINUS TARGET AREAS

	Model #	% Confidence that Crime has Decreased During Treatment
MURDER	1	48.7
	2	53.4
	3	49.9
	4	51.4
RAPE	1	4.0
	2	4.0
	3	3.4
	4	0.6
ROBBERY	1	8.3
	2	5.4
	3	9.9
	4	8.1
AGGRAVATED ASSAULT	1	80.5
	2	74.8
	3	78.3
	4	75.6
BURGLARY	1	99.8
	2	100.0
	3	99.9
	4	99.8
TOTAL CRIME	1	94.5
	2	98.5
	3	95.8
	4	94.8



*TOTAL CRIME INCLUDES MURDER, MANSLAUGHTER, RAPE, ASSAULT, ROBBERY, AND BURGLARY.

FIGURE 9
LEVEL OF CONFIDENCE IN CRIME LEVEL DECREASES DURING TREATMENT PERIOD

6.0 CONCLUSIONS

6.1 SCAT Effectiveness: A Synthesis of Results

The three analyses of crime data (sample before-after, extended before-after, and time series analysis) for the SCAT target area and related areas in the city of Denver provide us with information on the crime level changes which have been observed during the period of SCAT project operations.

Target Area Crime

Based on all three analyses, burglary, the project target crime, appears to have decreased substantially in the SCAT target areas since the initiation of the SCAT project. Target area burglary during 1973 (the period of project operations) is down 38 percent from 1972 and burglary decreases were observed each of the four quarters of 1973 as well as for the yearly totals. While the remainder of the city also experienced decreases in burglary during the project time period (when compared to the levels of the previous year), these decreases were much more moderate than those observed for SCAT target precincts.

The target area burglary decreases were not part of the trend immediately preceding the project but rather they are a departure from an upward growth in crime observed from 1971 to 1972. When considering these trends in estimated projections for target area burglary (time series analysis), we are left with a high degree of confidence in the hypothesis that these areas have experienced a consistent decline in burglary during the period of SCAT operations.

Total crime levels in the target areas appear to have followed a similar pattern. While the project was preceded by increases in target area total crime, substantial decreases were observed during the project time period. A similar, but more moderate increase/decrease pattern was observed for the remainder of the city. The similarity between total crime and burglary is due to the fact that greater than 50 percent of total crime is burglary.

Murder in the target areas was also on the increase before the institution of the SCAT project as was the rest of the city. Once the project began, target area murder dropped, while the rest of the city continued at the established pace. Time series analysis results confirm this; the target areas have exhibited a more consistent decrease than has the remainder of the city.

Aggravated assault levels also appear to be declining with more regularity in the target areas than in the rest of the city. Unlike the rest of the city whose treatment time period decrease appears to be a continuation of a previously established trend, the decline in assault from 1972 to 1973 in the target areas is a departure from the upward trend in target area assault observed from 1971 to 1972.

Robbery and rape are the crimes which appear to have been impacted the least. Target area robbery maintained a fairly constant level prior to the project and increased during the period of project operations. Rape in the target area decreased during the year preceding period. The time series analyses for rape and robbery results show there is the least confidence in crime decreases during treatment for these two crimes than for any of the other crime types examined.

Thus in the target areas, four of the six crime categories examined appeared to have exhibited decreases during the time of SCAT operations. Total crime, burglary, murder and assault in the target areas have all declined to a greater extent than one might have expected without the SCAT treatment based on the past crime experience in the target areas and in comparison to the crime level changes observed in the remainder of the city which received no SCAT treatment, for the period of project operations.

Displacement of Crime to Adjacent Areas

Analysis of crime level changes in the police precincts immediately adjacent to the target areas has been conducted to assess what impact the SCAT project has had, if any, on those areas in close physical proximity to the treatment but not the focus of treatment attention. If an impact is felt in these adjacent areas it is expected that it will be of one of two types. Either the benefits of the project have "spilled-over" into the nearby precincts or else these precincts have become the recipient for the problems displaced from the project target areas. If the former is true, and a spill-over of benefits has occurred, then crime would have declined in the adjacent areas more than would have been expected. If a spill-over of problems (crime displacement) has occurred, crime in the adjacent areas will have increased relative to expectations without treatment.

It appears that for two crime categories, burglary and aggravated assault, crime displacement into adjacent areas may have occurred during SCAT project operations. Burglary and assault have decreased somewhat in the adjacent areas; however, this decrease is less marked and less consistent than decreases experienced in the entire portion of the city which received no SCAT attention. Adjacent area burglary actually increased during two quarters of SCAT operations over comparable periods the previous year. Thus it appears that in terms of burglary and assault (those crimes showing the greatest decreases in the target area) the adjacent areas were hampered rather than helped by SCAT activities. For the period of SCAT operations, the pattern of adjacent area murder followed the pattern of the untreated portion of the city.

For the crimes showing the least target area impact, robbery and rape, one would not expect to see any spill-over of either benefits or problems since neither is consistent with target area findings. This is born out in the analysis. While the adjacent areas show a more consistent pattern than the untreated portion of the city, the confidence

levels for both adjacent area robbery and rape are lower than that of the same crimes in the target areas and are the lowest for any crimes examined.

It thus appears that if the SCAT activities in the target areas had any impact on adjacent areas it was a detrimental one. This detrimental effect most clearly shows up in the simple before-after analysis which indicates that burglary in the average precinct untreated by SCAT decreased 7 percent from 1972 to 1973 while areas adjacent to the SCAT target areas decreased only 3 percent during the same time period.

As discussed earlier, however, the areas used for the analysis of adjacent area displacement incorporate eleven police precincts peripheral to the target areas. Analysis of crime level changes in these areas has not been susceptible to unpredictable changes unrelated to project activities. Because these areas are large in size, it is possible that other intervening influences may have contributed to observed changes in crime levels.

This analysis does not address the problem of possible displacement into other non-contiguous areas of Denver. Because little is known about the movement of crime, the relationship between place of residence of offenders and the location of criminal activities, and role of urban transportation networks in the location and movement of crime, it is difficult to assess crime displacement in the context of project evaluation on any basis other than that of changes in immediately adjacent area crime levels.

6.2 SCAT Evaluation: A Discussion of Evaluative Methods

Each of the evaluative approaches presented in this document provide information of use in assessing the impact of the SCAT unit on crime in the target areas. All three approaches (simple before-after 1972-1973, relative crime level changes 1971-1973, and the trend analysis

November 1970 - December 1973) draw upon basically the same data set of police reported crime figures. None employs a control area design. They each involve a somewhat different approach to handling the available data to address somewhat different questions involved in assessing crime level changes associated with SCAT.

The first approach presented in this document is a simple before-after design which was used by the Denver city-level evaluators in assessing SCAT impact on target area burglary, the project's target crime. The simple before-after approach is the most straightforward method presented here. The point of comparison (the "before" crime measure) used by the Denver evaluators is the level of crime in a specified time-space one year prior to treatment. This is the most immediate time point of comparison available and a before-after analysis based on this comparison point is intuitively appealing. The question addressed with this approach is "Now that we have instituted treatment, is the situation any different from this time last year?" The approach allows the evaluator to describe changes in target area problems in a manner which is meaningful to the reader and to discuss the magnitude of these changes in an immediately understandable fashion.

Once a simple before-after approach has been used to describe the changes which have occurred in target area crime since the previous year, one must pose the question, "Can these changes be attributed to the project?" This question can be addressed most directly if there exists a control area to examine, an area which would be expected to operate in a manner similar to the treatment area but which has not received the treatment. When such an area is unavailable, as is the case for the SCAT project, other approaches must be sought.

This question of attribution of effect is partially addressed by the SCAT evaluators through an examination of those areas of the city which did not receive SCAT treatment, again using a simple before-after

approach. The assumption here is that changes occurring in non-treated areas would have occurred in the treatment areas whether or not the treatment had been administered. These non-treatment related changes should be considered in assessing project impact. This approach does not address further considerations such as whether the changes observed in the target areas developed out of longer term influences unrelated to treatment itself; this is to say that the changes observed during treatment might have been due to a continuation of previously established trends in area crime rather than an effect of project activities. If long-term trends are not examined, the results of a simple before-after analysis may be misleading. Such an analysis may indicate that there has been a moderate drop in crime since treatment was instituted. If crime in the area had been decreasing steadily prior to the project, this result may be insignificant; however, if crime had been on the increase before the treatment was instituted a moderate decrease might be a good indicator of project success. In essence a simple before-after design assumes that without treatment crime will continue at the level observed in the previous time period. In a dynamic system such as the crime environment of an urban place this is often not a good assumption.

Again the most direct approach to handling the question of trend influences is through the use of control areas. If a control area is selected correctly, it can be assumed that the trends influencing control area crime levels are the same as those affecting target areas. Therefore, the control area crime levels observed during treatment time periods, the point of comparison in a control area analysis, have taken into account various exogenous factors.

When control areas are unavailable, a direct examination of the crime trends preceding project initiation can assist in factoring out the effects of these trends on observed crime levels during the project assuming that these trends remain stable. It is this type of

analysis which is presented in Section 5.2 as "Extended Before-After Approach 1971 - 1973". This approach uses comparisons among past time-period crime levels to define a context for evaluating the simple before-after analysis results.

Another way to handle this problem of long-term trends is to control for them through the method of analysis, i.e., incorporate them into estimates of project crime levels during treatment. This is in fact what has been done in the third analysis approach presented here, the longitudinal time series analysis of crime levels. The models developed and applied in this analysis take the long-term trend in crime to be one component in descriptions of crime levels prior to treatment and in projections of crime levels during treatment. Thus, when results of this time series indicate that decreases in crime levels have been observed, these decreases are relative to levels which would have been expected based on past experience (including long-term trends) in crime in the area.

These time series models address one final consideration, that is, bias which is introduced into estimates of project effect due to the fact that the target areas exhibited abnormally high burglary rates relative to the rest of the city immediately prior to project initiation. The fact that these areas were in effect "outliers" in terms of their burglary levels means that there is a greater likelihood that the levels of burglary in these areas would decline due to regression towards the mean than one might expect for other areas with more moderate burglary levels. Thus observed target area declines during treatment may be due, at least in part, to this regression artifact.

Again a control group approach avoids this problem. The regression artifact biases felt in observed target area decreases, would be seen in crime level changes in the control area as well. A comparison of changes in crime in these two areas would thus factor out the regression bias in estimates of project effect.

A time series approach to crime level analysis also addresses this problem. The time series models presented in this document use past crime history as the basis for calculation of crime levels expected during the period of project operations. Abnormally high burglary rates for the year immediately preceding the project are only one series of points considered in making crime level projections. The greater the number of points considered in making these projections the more this kind of bias will be moderated. To assess the amount of bias introduced by the high values for the year immediately preceding treatment, the models were first fit to the complete set of data. The models were then fit to the same set of data with the exclusion of the values for the proceeding year. The results of these two were then compared and no significant differences were observed. Thus it appears that this regression artifact bias can be moderated by use of a longer past time frame for calculation of crime level projections. While it would be helpful to have a longer historical base for analysis, it appears that the 28 months of crime data used in the SCAT analysis are sufficient to moderate the regression artifact biases.

These time series models have advantages in that they take into account the effects of long term crime trends and possible regression artifact biases. However, they are disadvantageous in that they do not readily lend themselves to discussion of the magnitude of the changes experienced in the time-spaces being examined and their results are not intuitively understandable in terms of tangible project results. In effect these more "sophisticated" techniques, while giving the evaluator a greater degree of confidence in the validity of this conclusions, often tend to make the conclusions themselves less absolute.

In the control area approach the evaluator has the best of both worlds. The use of control areas can directly account for those considerations which when handled through statistical control remove the evaluator to an abstract arena. The control area results are tangible and understandable and lend themselves to straightforward interpretation and presentation.

Control through random allocation of treatment is the ideal situation but is also the rarest. Only one study, the Kansas City Proactive-Reactive Deployment Experiment, has been conducted in the area of police research using a random selection in a control area design. The payoffs of such an approach remain to be determined. Random allocation of treatment is almost impossible in the action program context since the primary focus of action programs is the solutions of problems. This means that treatment is allocated to those areas with the greatest problems rather than to randomly selected areas which would be desirable for research.

Matching areas for control purposes is a common practice in cases where random allocation is unfeasible. A matching approach assumes that the researcher can identify the significant characteristics of a target area and then select a comparison area on the basis of those characteristics. Unfortunately little is known about the appropriate characteristics which can validly be used in comparison area selection. Thus, the validity of the results of an analysis conducted using matched comparison areas is dependent on the validity of the untested assumptions underlying the matching process. Frank Budnick has suggested and demonstrated an alternative approach to the selection of comparison areas in his study "An Examination of the Impact of Intensive Police Patrol". (Final Report, Pilot Grant NI-71-114-PG, 1971). Budnick's approach does not focus on the selection of areas with similar characteristics, rather, he selects areas with similar past crime trend patterns. Areas which

exhibit past crime histories similar to that of the target area are used as the basis for comparison during project treatment. A similar approach is being considered for inclusion in upcoming case studies.

When no control or comparison area is available, the use of a range of analysis approaches can provide a comprehensive assessment of project impact. As has been done in this document, several analysis approaches can be implemented and the results of these various approaches can be assessed in light of the limitations of the methods. A synthesis of the results can then be used to assess the overall impact of the project.

APPENDIX I

TIME SERIES MODELS

APPENDIX I

The third analysis strategy utilized in the assessment of SCAT impact on crime is a trend analysis of monthly crime figures. Four models have been developed and are employed in the analysis.

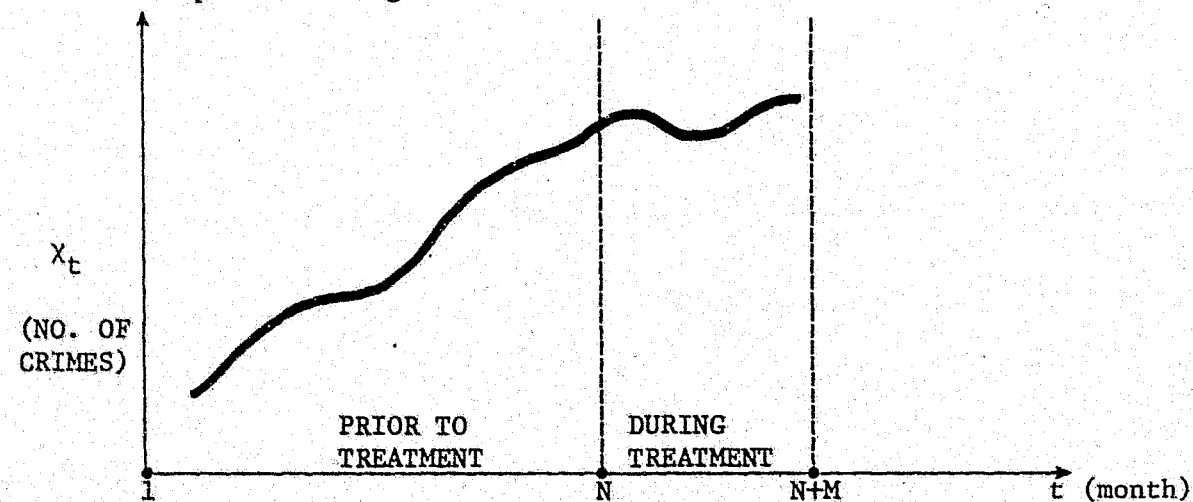
All four models describe the level of crime in a given time-space. Using historical or baseline crime data, each model is used to describe the levels of crime occurring before project interventions are introduced. These same model descriptions are then applied to the crime data for the period of project operations to determine if the decreases expected from project intervention have been experienced.

Each of the four models is presented below. A more detailed technical description of the models and their solutions is available in A Methodology for Conducting a Police Hypothesis Test (MTR-6617).

Model #1

For each space-time slot and each crime type, we can obtain data as to numbers of crimes committed (i.e., reported) each month. These will form a time series: $X_1, X_2, X_3, \dots, X_N, X_{N+1}, \dots, X_{N+M}$

where N is the number of data points prior to treatment and M is the number of data points during treatment.



Each such series is to be analyzed to determine the confidence it engenders in the hypothesis that the treatment has reduced the crime level to less than what it would have been in the absence of treatment.

To test the hypothesis, it is necessary to model the process that generates the χ_t . It seems plausible to assume that the data are generated as a sum of the following components:

1. A "reference" level of crime, denoted by "a", a constant.
2. A "long term trend", represented by "bt", where b is a constant.
3. An "annual cyclic component", represented by $c \sin \left(\frac{\pi t}{6} \right) + d \cos \left(\frac{\pi t}{6} \right)$, where c and d are constants.
4. A purely random, or "noise" component, denoted by ϵ_t .

Thus, before treatment (i.e., $t = 1, 2, \dots, N$),

$$\chi_t = a + bt + c \sin \left(\frac{\pi t}{6} \right) + d \cos \left(\frac{\pi t}{6} \right) + \epsilon_t$$

It is assumed that the effect of increasing police visibility is to change the crime rate by some factor, denoted by θ . Thus, during treatment (i.e., $t = N + 1, N + 2, \dots, N + M$),

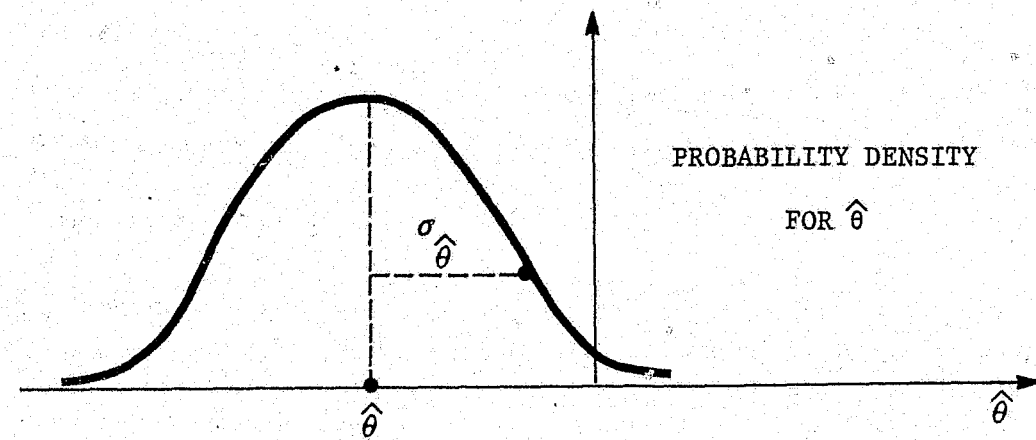
$$U_t = \left[a + bt + c \sin \left(\frac{\pi t}{6} \right) + d \cos \left(\frac{\pi t}{6} \right) + \eta_t \right] \theta$$

where for notational convenience the t, χ_t and ϵ_t are denoted by τ, U_t and η_t respectively, thus distinguishing them from the pre-treatment values.

The hypothesis, that the crime level has been reduced by the treatment to a level below what it would have been without treatment, is then mathematically equivalent to: $\theta < 1$.

The time series data is to be analyzed to estimate the quantity θ .

The estimate, $\hat{\theta}$, will be a random variable (since it is computed from data), and will contain an uncertainty, which can be depicted as:



The uncertainty is measured by the standard deviation, $\sigma_{\hat{\theta}}$, of the estimate $\hat{\theta}$.

The area under the probability density curve, for $\hat{\theta} < 1$, measures the percentage confidence that the data accords to the hypothesis, $\hat{\theta} < 1$.

What is necessary, then, are formulas for computing $\hat{\theta}$ and $\sigma_{\hat{\theta}}$ (the estimated value of $\sigma_{\hat{\theta}}$) from the data.

The required formulas can be most efficiently expressed in matrix notation. The results are as follows:

$$\hat{\theta} = \frac{X^T Y U}{X^T W X}$$

$$\sigma_{\hat{\theta}}^2 = \frac{X^T V X}{\mathbf{1}^T \text{diag } V} \left\{ \frac{1}{(X^T W X)} + \frac{(X^T Z X)}{(X^T W X)^2} \right\} \frac{(X^T Y U)^2}{(X^T W X)^2}$$

where X , U are vectors of crime data

superscript T indicates the transpose

superscript - 1 indicates the inverse

$\mathbf{1}$ is a vector whose components are all ones

and

$$\begin{cases} J = H(G^T G)^{-1} G^T \\ K = G(G^T G)^{-1} H^T H(G^T G)^{-1} G^T \\ P = G(G^T G)^{-1} H^T H(G^T G)^{-1} H^T H(G^T G)^{-1} G^T \\ R = I - G(G^T G)^{-1} G^T \end{cases}$$

where

$$G = \begin{pmatrix} 1 & 1 & \sin\left(\frac{\pi}{6}\right) & \cos\left(\frac{\pi}{6}\right) \\ 1 & 2 & \sin\left(\frac{2\pi}{6}\right) & \cos\left(\frac{2\pi}{6}\right) \\ \dots & & & \\ \dots & & & \\ 1 & N & \sin\left(\frac{N\pi}{6}\right) & \cos\left(\frac{N\pi}{6}\right) \end{pmatrix}$$

$$H = \begin{pmatrix} 1 & N+1 & \sin\left[\frac{(N+1)\pi}{6}\right] & \cos\left[\frac{(N+1)\pi}{6}\right] \\ 1 & N+2 & \sin\left[\frac{(N+2)\pi}{6}\right] & \cos\left[\frac{(N+2)\pi}{6}\right] \\ \dots & & & \\ \dots & & & \\ 1 & N+M & \sin\left[\frac{(N+M)\pi}{6}\right] & \cos\left[\frac{(N+M)\pi}{6}\right] \end{pmatrix}$$

and

- I = identity matrix
- diag R = a vector whose components are the major diagonal elements of the square matrix R.

MODEL # 2

Another representation of the process by which the X_t are generated is (for $t = 1, 2, \dots, N$):

$$X_t = \sum_{i=1}^{12} a_i v_{ti} + bt + \epsilon_t$$

where the v_{ti} are 0-1 indicator variables that specify whether month t is January, February, etc. For example, if the data started in January, one would have:

$$\left. \begin{aligned} v_{11} &= 1 \\ v_{12} &= v_{13} = \dots = v_{112} = 0 \\ v_{22} &= 2 \\ v_{21} &= v_{23} = \dots = v_{212} = 0 \end{aligned} \right\}$$

...

...

$$\begin{aligned} v_{1212} &= 1 \\ v_{121} + v_{122} &= \dots = v_{1211} = 0 \\ v_{131} &= 1 \\ v_{132} = v_{133} &= \dots = v_{1312} = 0 \\ \text{etc.} \end{aligned}$$

The advantage of this representation is that the seasonal variations, while still repeating cyclically from one year to the next, are not restricted by assumption to be sinusoidal. The disadvantage is that 13 parameters, rather than 4 (as in the sinusoidal representation assumed earlier), are required to determine the X_t . This may be

expected to lead to statistical errors in curve fitting the parameters when the number of data points (i.e., N) is sparse.

A posteriori tests of goodness-of-fit can help to determine which of these (or other) representations provides a best description of available data, in individual cases.

It is assumed, as before, that the effect of increasing police visibility is to change the crime rate by some factor θ , to be estimated. Thus, during treatment (i.e., $t = N+1, N+2, \dots, N+M$):

$$U_t = \left[\sum_{i=1}^{12} a_i \mu_{ti} + bt + \eta_t \right] \theta$$

where, again for notational convenience, the t , v_{ti} , and ϵ_t have been replaced by τ , μ_{ti} , and η_t respectively, to distinguish them from pretreatment values.

Assuming this as the appropriate representation, the resulting formulas required to estimate $\hat{\theta}$ and $\hat{\sigma}_\theta^2$ as expressed in matrix forms, are:

$$\hat{\theta} = \frac{X^T Y U}{X^T W X}$$

$$\hat{\sigma}_\theta^2 = \frac{(X^T V X)}{1^T \text{diag } V} \frac{1}{(X^T W X)} + \frac{(X^T Z X)}{(X^T W X)^2} \frac{(X^T Y U)^2}{(X^T W X)^2}$$

where X , U are vectors of crime data
superscript T indicates the transpose

$\underline{1}$ is a vector whose components are all ones

diag V = a vector whose components are the major diagonal

elements of the square matrix V

and, using superscript -1 to indicate the inverse.

$$\begin{cases} Y = \Omega(\Omega^T\Omega)^{-1}\Gamma \\ W = \Omega(\Omega^T\Omega)^{-1}\Gamma^T\Gamma(\Omega^T\Omega)^{-1}\Omega^T \\ Z = \Omega(\Omega^T\Omega)^{-1}\Gamma^T\Gamma(\Omega^T\Omega)^{-1}\Gamma^T\Gamma(\Omega^T\Omega)^{-1}\Omega^T \\ V = I - \Omega(\Omega^T\Omega)^{-1}\Omega^T \end{cases}$$

where

I - the identify matrix

and Ω, Γ are the partitioned matrix

$$\begin{cases} \Omega = (\nu \underline{t}) \\ \Gamma = (\mu \underline{r}) \end{cases}$$

where \underline{t} and \underline{r} are the vectors

$$\begin{cases} \underline{t} = \begin{pmatrix} 1 \\ 2 \\ \dots \\ \dots \\ N \end{pmatrix} \\ \underline{r} = \begin{pmatrix} N+1 \\ N+2 \\ \dots \\ \dots \\ N+M \end{pmatrix} \end{cases}$$

and ν, μ are the matrices of the ν_{ti}, μ_{ri} respectively.

MODEL #3

In Model #2 the seasonality component of crime trends is handled through monthly estimations of seasonal effects involving the estimation of 13 parameters. Because of limitations on the amount of available data it is desirable to limit the number of parameters to the extent possible. Model #3 is similar to Model #2 except that seasonality is handled on a quarterly basis. Thus the number of parameters to be fit α_i is reduced to four ($\alpha_1, \alpha_2, \alpha_3, \alpha_4$) and γ_{ti}, μ_{ri} are defined to interpolate months.

Thus for t ↔	January	1	0	0	0
	February	2/3	1/3	0	0
	March	1/3	2/3	0	0
	April	0	1	0	0

Model #3 then follows the pattern set out for Model #2.

MODEL #4

Finally, Model #4 treats seasonality and long term trends exactly as Model #3. However, Model #4 suggests that crime levels during treatment will be reduced not by a factor θ (as in Models #1-3) but rather that during treatment, the level of crime observed before treatment will be reduced by a constant (C).

Thus for Model #4:

Before Treatment:
$$X_t = \sum_{i=1}^4 \alpha_i \gamma_{ti} + bt + \epsilon_t$$

During Treatment:
$$v_\tau = \sum_{i=1}^4 \alpha_{ri} \mu_{ri} + b\tau + \eta_\tau - C$$

The hypothesis is that if treatment has had the desired effect and crime has decreased then $C > 0$.

Application of the Models

These four models were applied to Denver monthly crime figures for the period November 1970 through December 1973. The treatment period for the SCAT project was January 1973 through and including December 1973. The treatment period for the SCAT project was January 1973 through and including December 1973. Five crimes were analyzed. These include: murder, rape, robbery, aggravated assault, and burglary as well as the total of these five crimes.

Crime level changes were examined for the target area, for the remainder of the city not receiving SCAT treatment (city-wide minus target areas) and for those areas immediately adjacent to the SCAT target precincts.

MODEL RESULTS

The results listed in Tables I - III, pages 37 - 39, were obtained for target area, city-wide minus target area, and adjacent area crime levels. A fit index calculated as $\sqrt{\frac{\text{total sum of squares of errors}}{\text{total degrees of freedom}}}$ was applied to each of the four models to differentiate the models as to their goodness of fit with the data tested. The results indicated no one model fits consistently better than the others.

END