Form R-396 (1/1/87)

Standard Title Page -- Report on State Project

Report No.	Report Date	No. Pages	Type Report: Final	Project No. : N/A
VTRC 87-R13	February 1987	163	Period Covered: 1/1/84 - 12/31/84	Contract No.: N/A

Title and Subtitle

Evaluation of the 1984 Selective Speed Enforcement Projects in Virginia

Author(s)

Stephen M. Sharkey

Performing Organization Name and Address

Virginia Transportation Research Council
Box 3817, University Station
Charlottesville, Virginia 22903-0817

Sponsoring Agencies' Names and Addresses

Va. Dept. of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

University of Virginia
Charlottesville
Virginia 22903

Key Words

crashes
speed
speeding
selective enforcement
selective traffic enforcement
STEP

Supplementary Notes

Project funded by: Virginia Department of Motor Vehicles
Transportation Safety Administration

Abstract

This report describes evaluations of Virginia's 1984 selective speed enforcement projects, one of the various types of highway safety programs classified as selective traffic enforcement projects (STEPs) partially funded by the federal government under the Highway Safety Act. As a condition of the grant, the federal government requires that the effectiveness of the programs be evaluated. The evaluations reported here focused on the effects of increased enforcement of speed laws on the number of total crashes, injury and fatal crashes, and speed-related crashes. This report is the third in a series prepared in compliance with the federal requirements and follows much of the analytic framework established in the two prior evaluation reports.

Each of the local projects is described, including problem identification, project goals, proposed enforcement activity, and results achieved. The evaluations compare the crash reduction goals set by the project directors against the number of crashes reported in 1984, and examine project effectiveness using data on speed-related crashes, those in which the police identified speed as a factor contributing to the occurrence or the severity of the crash.

Many localities had experienced too few serious crashes and speed-related crashes for the computation of statistical values with which to make comparative analyses. Consequently, a more general approach is used to compare crash data from the selective enforcement community against hypothetical comparison communities derived from statewide data. The analysis revealed that few communities had met their crash reduction goals, but greater success had been achieved by those communities that had identified specific speed-related crash problems, had received adequate funding for more than one year, and had restricted enforcement activity to certain roads or sites.

EVALUATION OF THE 1984 SELECTIVE SPEED ENFORCEMENT PROJECTS IN VIRGINIA

by

Stephen M. Sharkey
Research Scientist Assistant

A Report Prepared by the Virginia Transportation Research Council under the Sponsorship of the Transportation Safety Administration of the Department of Motor Vehicles

Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Transportation and the University of Virginia)

Charlottesville, Virginia

February 1987
VTRC 87-R13

SAFETY RESEARCH ADVISORY COMMITTEE

W. E. DOUGLAS, Chairman, Director, Planning & Programs Development, Department of Motor Vehicles

V. M. BURGESS, Transportation Safety Administrator, Department of Motor Vehicles

J. T. HANNA, Deputy Commissioner, Department of Motor Vehicles

C. P. HEITZLER, JR., Program Manager, Department of Information Technology

T. A. JENNINGS, Safety/Technology Transfer Coordinator, FHWA

B. G. JOHNSON, Supervisor, Driver Education, Department of Education

F. W. JOHNSTONE, Chief of Police, Albemarle County Police Department

C. W. LYNN, Reseach Scientist, VTRC

R. M. MCDONALD, Project Director, Transportation Safety Training Center, Virginia Commonwealth University

J. T. PHIPPS, Director, Roanoke Valley Alcohol Safety Action Project

C. M. ROBINSON, Field Supervisor, Department of State Police

ANDREW SISSON, Director, Substance & Abuse Services, Blacksburg, Virginia

F. F. SMALL, Highway Engineering Program Supervisor, VDOT

J. A. SPENCER, Assistant Attorney General, Office of the Attorney General

C. W. THACKER, Director, Office of Substance Abuse Services, Department of Mental Health and Mental Retardation

E. W. TIMMONS, Director of Public Affairs, Tidewater AAA of Virginia, Norfolk, Virginia

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	v
FINDINGS	vii
CONCLUSIONS	ix
RECOMMENDATIONS	xi
INTRODUCTION	1
SELECTIVE ENFORCEMENT PROGRAMS	2
THE SPEEDING PROBLEM IN VIRGINIA	2
PURPOSE	4
METHODOLOGY	7
Evaluation Data	7
Methodology for Enforcement Projects	8
Methodology for Equipment Projects	11
Limitations	12
INDIVIDUAL EVALUATIONS OF ENFORCEMENT PROJECTS	12
Albemarle County	13
Goochland County	25
City of Lynchburg	37
City of Petersburg	47
City of Portsmouth	61
City of Richmond	71
Department of State Police	85

TABLE OF CONTENTS (continued) Page

INDIVIDUAL EVALUATIONS OF EQUIPMENT PROJECTS..... 99

Town of Herndon..... 99

City of Manassas Park..... 105

City of Norfolk..... 111

REFERENCES..... 117

APPENDICES

Appendix A -- Tables and Exhibits for State of Virginia Crash Data..... A-1

Appendix B -- Tables and Exhibits for Virginia Counties Crash Data..... B-1

Appendix C -- Tables and Exhibits for Virginia Cities Crash Data..... C-1

Appendix D -- Demographic Information on STEP Communities... D-1

Appendix E -- Rank Ordering Methodology..... E-1

Appendix F -- Rank Ordering of Virginia Communities..... F-1

Appendix G -- Comparison of Changes in Crash Data for Virginia Communities..... G-1

ACKNOWLEDGEMENTS

This report was prepared in accordance with federal regulations requiring that highway safety projects funded with federal moneys be evaluated for their effectiveness. The author gratefully acknowledges the aid of the members of the Virginia Transportation Research Council without whom the report would not have been possible. Special thanks go to Wayne Ferguson for his patience. Special thanks are due Charley Stoke for his continued guidance and many suggestions, for his watching over the project during my many absences, and most of all for his constructive criticism. Thanks also go to Jack Jernigan for sharing his work on problem identification and his general comments on the report. Acknowledgement is made of Bill Kelsh for his assistance with the computer graphics, Harry Craft for his editorial review, and the staff of the Report Section for the production of this report.

FINDINGS

For the convenience of the reader, Exhibit 1 presents a summary of results of one statewide and six community-based selective speed enforcement projects and for the three community-based speed enforcement equipment grants. The exhibit is based on the table entitled Summary of Results included in each of the evaluations of the individual projects. The reader is directed to the sections on the projects funded in 1984 for detailed descriptions, analyses, findings, and conclusions.

1. Four communities conducting Selective Traffic Enforcement Projects (STEPs) were rated as having high priority speed-related crash problems under two separate ranking processes. One community was rated as having a high priority problem under one ranking and a low priority under the other. One community was rated as having a low priority problem under both rankings.

2. Crash reduction goals were achieved in two of the six communities -- Goochland County and the city of Petersburg. These two communities were the only two that also met two or more of the measures of effectiveness used in this report. The projects in these communities shared three characteristics:

   a) they were multiyear projects
   b) they received comparatively more funds per registered vehicle than other STEPs
   c) they targeted specific roads for project activities

3. Between 1982 and 1984, the funding priorities shifted from counties to cities. In 1982, counties received 36% of all speed enforcement funds and cities 19%; in 1984, counties received 6% and cities 26%. Funds allocated to the Department of State Police were relatively constant, but accounted for a larger percentage of total funds as these totals dropped. The 1984 grant to the Department of State Police represented 67% of all selective speed enforcement funds.

4. None of the communities conducting STEPs thoroughly documented a local speed-related crash problem in their grant applications. Few grant applications described the proposed projects in terms of sites, days, or hours of activity.

5. The selective enforcement program conducted by the Department of State Police was extremely difficult to evaluate. The absence of site specific crash data in the baseline period, and activity and crash data during the project period worked against an adequate evaluation of this project, which had the greatest expenditure of funds.

EXHIBIT 1

SUMMARY OF FINDINGS

	WERE CRASH REDUCTION GOALS ACHIEVED?	DID THE NUMBER OF SPEED-CRASHES REPORTED IN 1984 FALL BELOW PROJECTIONS?	WAS THERE A POSITIVE CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS?	WAS THE % CHANGE IN SPEED-CRASHES NOTICEABLY BETTER IN STEP COMMUNITY THAN FOR OTHER VA COMMUNITIES?	NUMBER OF PREVIOUS STEP GRANTS	GRANT FUNDS/ REGISTERED VEHICLE
I. SELECTIVE ENFORCEMENT PROJECTS						
COUNTIES						
Albemarle	NO	NO	YES	NO	0	$0.14
Goochland	YES	NO	YES	NO	1	$1.85
CITIES						
Lynchburg	NO	NO	NO	NO	0	$0.60
Petersburg	YES	YES	YES	YES	2	$0.85
Portsmouth	unknown	NO	NO	NO	0	$0.36
Richmond	NO	NO	YES	NO	1	$0.18
STATE						
Dept. of State Police	NO	N/A	N/A	N/A	5	$0.11
II. EQUIPMENT PROJECTS						
Herndon	NO	NO	N/A	NO	0	N/A
Manassas Park	N/A	N/A	N/A	N/A	0	$0.48
Norfolk	N/A	YES	YES	YES	0	$0.03

SOURCE: This exhibit is derived from the Summary of Results table included as part of each evaluation report. For a description of the four tests of effectiveness above, see Methodology section, page 8.

CONCLUSIONS

1. The 1984 selective speed enforcement projects generally did not reduce the number of total crashes, fatal crashes, or personal injury crashes. There were, however, indications that projects that identified specific speed-related crash problems, received adequate funding, and restricted enforcement activity to certain roads or sites may have reduced the number of speed-related crashes in the communities.

2. The selection process successfully directed grants to communities with high priority speed-related crash problems, as determined by the ranking system used in this report.

3. While the data and analyses are not conclusive, there is evidence that STEPs are more effective if they are funded for more than one year, if they receive significant grants, if they have defined the local speed-related crash problem, and if they have designed specific measures to address that problem.

4. The allocation of funds to the various political subdivisions in 1984 suggested that the priority of funding is first to the state, then to cities, and finally to counties.

RECOMMENDATIONS

1. The grant application process should require documentation of a speed-related crash problem. The documentation should include crash and citation data for prior years and should be specific as to location, day, and hour of enforcement activities. Adequate documentation is vital to the selection of projects to be funded, to the proper design of effective projects, and to the accurate evaluation of results.

   Since fiscal year 1984, when the projects evaluated in this report were selected, the Transportation Safety Administration has improved substantially the documentation requirements for local agencies applying for federal highway safety funds. To that extent, this recommendation has been implemented by the Transportation Safety Administration.

2. Law enforcement agencies receiving selective enforcement grants should be assisted in the design and implementation of their local projects. Community projects should be planned and implemented according to the speed-related crash problem identified through analyses of citation and crash data. Projects should attempt to concentrate enforcement activity on specific sites, days, and hours according to a predetermined plan.

3. Requirements for data collection by communities conducting STEPs should be made more stringent. These requirements should be explicitly stated in the grant application and award process, and there should be some monitoring or reporting of data collection during the grant period. Without adequate site-specific local data, the required evaluation must be prepared using statewide data sources.

4. The grant award process should be amended to favor those communities that have developed a specific plan -- including targeting roads, days of the week, and times of day -- for addressing the local speed-related crash problem. Consideration should be given to funding all new projects for more than one year and to making fewer but larger grants.

5. The Department of Motor Vehicles should consider whether the current allocation priorities reflect the best use of funds to address the speed-related crash problem in Virginia.

6. While the Department of State Police should not be directed as to how its projects are to be designed and implemented, the Superintendent should encourage each division commander to conduct projects in his region in a manner that facilitates an evaluation of project effectiveness. These projects should be limited to certain roads, hours, and days, or should meet other criteria that would allow them to be effectively evaluated.

EVALUATION OF THE 1984 SELECTIVE SPEED ENFORCEMENT PROJECTS IN VIRGINIA

by

Stephen M. Sharkey
Research Scientist Assistant

INTRODUCTION

The Highway Safety Act of 1966 (1) authorizes the Secretary of Transportation to allocate federal funds to states for highway safety projects (2). Among the uses to which these funds may be applied are "traffic control ... [and] surveillance of traffic for detection of high or potentially high accident locations... (3)." Federal funds can thus be used in selective traffic enforcement programs because the programs involve identifying high accident locations and focusing police patrols on these locations. The statute requires that the U.S. Secretary of Transportation establish performance criteria for selective traffic enforcement programs (STEPs), and these criteria require the states to evaluate the effectiveness of the projects in reducing accidents (4). This report presents the results of evaluations of seven selective speed enforcement projects and three equipment projects conducted in Virginia during 1984.

Under the Highway Safety Act, each state decides (within federal guidelines) how it will use federal funds to address local traffic safety problems. In Virginia, the Transportation Safety Administration of the Department of Motor Vehicles (TSA/DMV) is the agency empowered to distribute highway safety funds (5). The federal statute requires that at least 40% of the state's allocation of federal funds be passed on to local jurisdictions to conduct highway safety projects (6). In addition, the federal regulations for highway safety projects require that the jurisdiction conducting the project identify a particular safety problem and implement appropriate measures to reduce that problem (7).

SELECTIVE ENFORCEMENT PROGRAMS

Selective enforcement is an effort by police officers to enforce traffic laws relating to identified accident problems. Normally, this effort is complementary to the routine patrol activities conducted by the local police force. The goal of selective enforcement programs is to address identified accident problems through countermeasures designed to fit these problems. Selective enforcement projects may be divided into four phases: (1) identifying and selecting locations with accident problems, (2) developing a comprehensive plan to address the problems and setting performance goals, (3) implementing the plan and recording data on plan activities and results, and (4) evaluating performance and results.

Selective enforcement programs work by deterrence: by raising public awareness about the risks of apprehension, such programs make drivers less inclined to violate traffic laws. The two primary activities used in these programs are public information campaigns and stringent enforcement of traffic laws. Generally, enforcement is emphasized over information. STEPs may be applied to a number of traffic safety problems, including speeding and driving under the influence of alcohol. This report will refer only to STEPs addressing speed-related safety problems, unless otherwise noted.

A successful STEP should cause a decline in the number and severity of crashes. In theory, communities should be awarded grants based on an existing speed-related crash (referred to here as a speed-crash) problem. Prior to specialized enforcement activity, the number and severity of speed-crashes for the STEP community should exceed those of the average or control community. In the early phases of the program, the number and severity of speed-crashes should decrease for the STEP community relative to those of the control community. Later, as drivers become acclimated to intensified enforcement, improvements in highway safety should reach a point of diminishing returns and the number of speed limit violations and speed-crashes should level off. At this point, in theory, less enforcement activity should be needed to keep the number of crashes at a reduced level.

THE SPEEDING PROBLEM IN VIRGINIA

Between 1980 and 1984 there were 4,353 crashes in Virginia which resulted in one or more fatalities (based on state police traffic crash data). Police issued speeding citations in 1,813 of these crashes, so that speeding was identified by the reporting officer in 42% of all fatal crashes in this period. Speed was identified in 23% (47,616 of

211,344) of the personal injury crashes occurring over the same five years. By comparison, speed was identified in only 16% (57,976 of 368,168) of those crashes resulting in property damage alone over the same period. These data indicate that speeding is a contributing factor to highway fatalities and injuries.

The relation between speed and crash severity is especially significant because, motor vehicle accidents account for a major portion of all fatalities and injuries in the state. In 1980, motor vehicle accidents were the sixth leading cause of death in Virginia. For Virginians between the ages of 10 and 34, motor vehicle accidents were the leading cause of death, accounting for 29% of total deaths in this age group (8). Motor vehicle accidents are the cause of an even higher percentage of major injuries. Thus, regardless of whether excessive speed is a leading cause of highway crashes, there is no doubt that it contributes to death and personal injury throughout the state.

Some characteristics of the speed-crash problem in Virginia can be described. First, experience suggests that the speed-crash problems of rural areas are more severe than those in urban areas. The slower road speeds, greater congestion, and greater traffic control in the city than on the open road obviously restrain auto speed. Crash data support this intuition. There are more speed-crashes in rural areas than in urban areas. The number of speeding citations issued to drivers in serious accidents (those resulting in a death or injury) in rural areas is almost twice the number issued in urban areas (an annual average of 6,343 for Virginia counties over 1980-1983 compared to 3,366 for Virginia cities). Also, in Virginia's counties, more serious crashes are speed-related than in its cities. Between 1980 and 1983, an average of 26.1% of the serious crashes in rural communities were speed-related, compared to 19.2% of the serious crashes in urban communities (See Appendices A, B, and C). A second characteristic is that crashes in which speeding is identified are more serious than non-speed-related crashes (referred to here as "non-speed-crashes"). While 46.0% (49,429/107,405) of all speed-crashes between 1980 and 1984 involved a fatality or personal injury, only 34.9% (166,268/476,460) of the non-speed-crashes did.

A regression analysis of statewide crash data revealed a decreasing trend in the number of speed-crashes over the 1980 to 1983 period (See Appendix A). This is supported by a gradual decline in the percentage of crashes that are speed-related. In 1980, 19.1% of all Virginia crashes were speed-related; by 1983, that figure had changed to 18.2%. Similarly, the percentage of serious crashes that were speed-related fell from 24.3% to 22.3%. Over the same time, crash severity was increasing across Virginia: in 1980, 34.7% of all crashes were serious, and in 1983 the figure was 38.8%.

The data, then, suggested that the speed-crash problem was lessening across the state. However, significantly more speed-crashes were reported in 1984 than were projected under the regression analysis (See Appendix A). Thus, despite suggestions that the situation was improving, the 1984 data lead to a pessimistic outlook for the future.

PURPOSE

In 1984, the enforcement agencies of two counties, seven independent cities, and the Department of State Police received funds under the federal highway safety program (Table 1). Seven grants provided wages to officers working STEP patrol (enforcement projects), and four grants funded the purchase of modern radar equipment (equipment projects); the city of Petersburg, received both types of grants. The distribution of funds statewide is presented graphically in Exhibit 2. Relevant demographics appear in Appendix D.

The federal regulations regarding highway safety programs require the state to perform an administrative evaluation of all federally funded projects, and to perform some evaluation of the effectiveness of projects addressing impact problems (9). Violations of speed laws are an impact problem, as speeding is "directly related to accidents, fatalities and/or injuries, and may be corrected by application of countermeasures designed to minimize the effect [of speeding]... (10)." Federal regulations express a preference for evaluating the effectiveness of projects in terms of the number of accidents, deaths, and injuries. Accordingly, the evaluations in this report assess the effects of increased enforcement of speed laws on the number of total accidents, serious accidents, and speed-related accidents. The results of each local project are evaluated and compared to its stated goals. The effectiveness of each project is assessed by means of the methodology described below.

This report is the third in a series evaluating Virginia's federally funded STEP projects in accordance with federal requirements (11). It incorporates much of the framework of the previous evaluations. It is important to note that both these prior evaluations were published in 1985. Since they were unavailable when the 1984 projects were selected, designed, and implemented, it would be unreasonable to expect the recommendations in the two earlier reports to have been implemented in the 1984 projects. Thus, the purpose of this report is not to analyze and evaluate project procedures -- selection, planning, and implementation -- but the effectiveness of each project. There is no attempt to compare project selection, design, or implementation with results. In this

TABLE 1

GRANT HISTORY FOR 1984 STEP COMMUNITIES

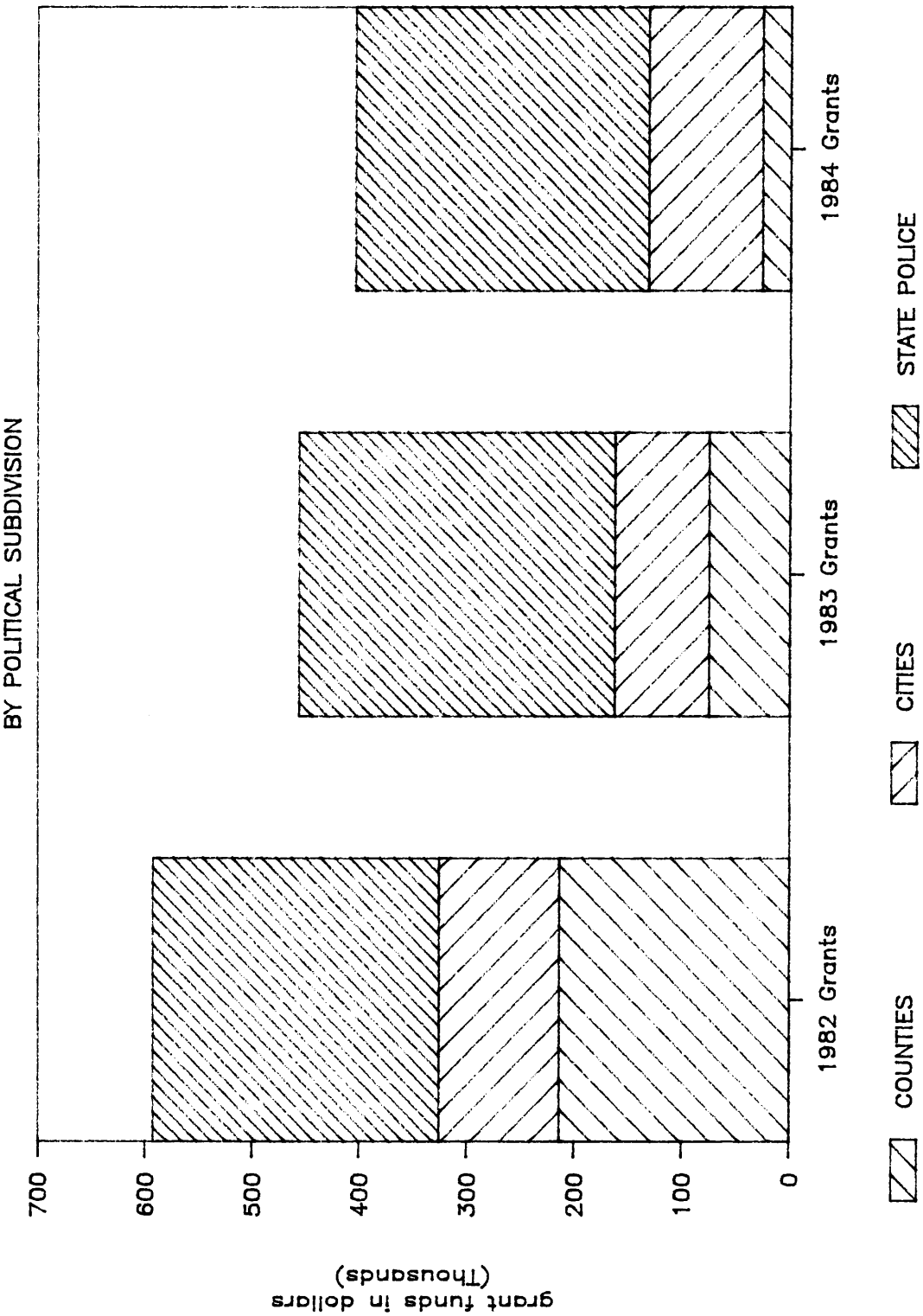
Community	1982 Grants		1983 Grants		1984 Grants		1984 Grant Purpose	1984 Grant per Regist Vehicle +
	$ amount	% total	$ amount	% total	$ amount	% total		
COUNTIES								
ALBEMARLE	0	0.0%	0	0.0%	6,240	1.5%	ENFORCEMENT	0.14
GOOCHLAND	0	0.0%	10,000	2.2%	20,000	4.9%	ENFORCEMENT	1.85
others	214,355	36.2%	65,500	14.4%	NA	0.0%		
CITIES								
HERNDON	0	0.0%	0	0.0%	2,500	0.6%	EQUIPMENT	NA
LYNCHBURG	0	0.0%	0	0.0%	27,000	6.7%	ENFORCEMENT	0.60
MANASSAS PARK	0	0.0%	0	0.0%	2,000	0.5%	EQUIPMENT	0.48
NORFOLK	0	0.0%	0	0.0%	4,000	1.0%	EQUIPMENT	0.03
PETERSBURG 1	26,508	4.5%	20,000	4.4%	20,092	5.0%	ENFORCEMENT	0.85
PETERSBURG 2	0	0.0%	0	0.0%	2,500	0.6%	EQUIPMENT	0.11
PORTSMOUTH	0	0.0%	0	0.0%	22,620	5.6%	ENFORCEMENT	0.36
RICHMOND	0	0.0%	15,000	3.3%	25,000	6.2%	ENFORCEMENT	0.18
others	85,007	14.3%	52,220	11.4%	NA	0.0%		
STATE								
STATE POLICE	266,675	45.0%	293,576	64.3%	272,276	67.4%	ENFORCEMENT	$0.07
TOTALS								
COUNTIES	214,355	36.2%	75,500	16.5%	26,240	6.5%		
CITIES	111,515	18.8%	87,220	19.1%	105,712	26.2%		
STATE POLICE	266,675	45.0%	293,576	64.3%	272,276	67.4%		
	592,545		456,296		404,228			$0.11

+ based on 1984 registration figures

EXHIBIT 2

ANNUAL STEP GRANTS

BY POLITICAL SUBDIVISION



way, the present report differs from the 1982 report, which did compare results and procedures. This report also differs from the 1983 report in employing somewhat more sophisticated techniques to evaluate local speed-crash problems and project results.

METHODOLOGY

This section describes the methodology adopted to evaluate the individual STEPs. Generally, statewide crash data were used to identify and describe the characteristics of the local speed-crash problem for each community and to evaluate the success of each STEP in reducing the number of speed-crashes. The following subsections describe the source of the data for the evaluations, the objective measures used to estimate the extent of the local speed problem, the objective measures used to evaluate the success of the local project in addressing the identified problem, and the limitations of the methodology adopted.

Evaluation Data

The primary source of crash data used in this report is Mini-Crash Facts (12), a publication developed by the Virginia Transportation Research Council and prepared by the Department of Motor Vehicles Transportation Safety Administration. Mini-Crash Facts presents crash data for each county and independent city in the Commonwealth based on data compiled by the Department of State Police from the FR 300P Accident Reporting Form. The best source of this data would have been locally gathered data tailored to the specific locations, times, and dates of enforcement. However, few communities could provide crash data with this kind of specificity. Thus, a statewide source was used to establish a baseline for comparison. Two other reasons for using the statewide source were (1) it allowed standardized data gathering and analysis techniques and (2) many local accident recording systems failed to identify speeding in crashes. Although the grant periods ran from October 1, 1983, to September 30, 1984, calendar year data were used because the cost of converting the data to fiscal year 1984 was prohibitive.

Crashes have been categorized into four types: (1) all crashes, (2) serious crashes, (3) speed-crashes, and (4) non-speed-crashes. Of these crash types, only the third and the fourth are mutually exclusive. Thus speed involvement percentages have been computed for both the class of all crashes and the smaller class of serious crashes. Likewise, crash severity percentages have been computed for both the class of all crashes and the class of speed-crashes. Speed involvement in crashes was measured by convictions issued for exceeding the posted speed limit and convictions for exceeding the safe speed under the conditions. The

number of these convictions was used as a surrogate for the number of speed-crashes themselves, as convictions were the only information relating to speed available from this data source.

A four-year baseline, from 1980 through 1983, was used for STEP communities. Data were also collected for all Virginia independent cities over the baseline period, and for all Virginia counties over a three-year period from 1981 through 1983. The shorter period was used for Virginia counties because of the difficulty in collecting these data.

The directors of the individual projects were notified prior to the writing of this report that each project would be evaluated individually; they were supplied with the crash data used in this report and invited to submit any other data or information that would be relevant to an evaluation of the effectiveness of their projects. Those communities providing such additional information were evaluated on the basis of both the local and the statewide sources.

Methodology for Enforcement Projects

The two counties and six cities funded for STEPs (See Table 1) were evaluated according to a standardized approach. Each evaluation has four parts:

1. Problem Statement
2. Proposed Activities and Project Goals
3. Project Results
4. Conclusion

The following sections of this report detail the purpose and analytical approach for each part of the evaluations. A different approach was adopted for evaluating the STEPs conducted by the State Police because these differed greatly in scope and nature from those conducted by the localities. A description of the methodology used for the State Police projects is part of the evaluation section for those projects.

Problem Statement

This part of the evaluation contains both subjective and objective descriptions of the local speed-crash problem. The subjective descriptions were provided by many communities in their applications for project funds and are supplemented by information drawn from a number of sources, including the 1982 and 1983 evaluation reports. Unfortunately, detailed descriptions of the local speed-crash problems were not re-

quired by the state, such as the locations (by route number or street name) of sites with speed-crash problems, the number and nature of speed-crashes, and the times and days of speed-crashes. Since any description provided by the localities for this report would have been after the fact, communitywide objective criteria were used to examine the nature and magnitude of local speed-crash problems.

Three objective criteria were used to assess the nature and degree of local speed-crash problems: a rank ordering of all Virginia cities and counties, a regression analysis of speed-crashes, and speed involvement and crash severity percentages. Rank orders were made twice, once using the number of speed-crashes, and once using the percentage of speed-crashes. The procedure for determining the rank orders was based on the techniques developed by Jack Jernigan for the Virginia Transportation Research Council in its report, The Comprehensive Community Based Traffic Safety Program Phase I: Problem Identification for District 2 and District 7 (13). The procedure is outlined in Appendix E of this report. The results of the rankings are presented in Appendix F; the localities are grouped into high, medium, or low priority categories with respect to their speed-crash problems. By this method, the speed-crash problems of the STEP communities were placed in perspective with those of other Virginia localities.

The second objective measure was a straight-line regression analysis of speed-crashes. This analysis was employed to ascertain trends over the baseline period for each locality and to predict the number of speed-crashes in 1984. A separate analysis was completed for all speed-crashes and for serious speed-crashes.

The third technique for assessing local speed-crash problems was the use of speed involvement percentages and crash severity percentages. Speed involvement percentages were calculated as the percentage of all local crashes that were speed-related; crash severity percentages were calculated as the number of fatal or injury crashes divided by all crashes. These percentages were used to indicate the frequency of speed-crashes within the locality.

For the two STEP counties, a fourth analysis was used in which the routes with the highest number of serious accidents (high accident roads) were identified for each year during the baseline and grant periods. Serious crash experience on these routes was examined before the initiation of STEP activity. This analysis focused attention on roads with apparent crash problems where selective speed enforcement countermeasures seemed to be indicated. Although this contributed to an understanding of the local speed-crash problem, it was of limited help

since it lacked information on both location and speed involvement. This analysis could not be prepared for the the STEP cities, as the data source did not specify street locations of city crashes.

Proposed Activities and Project Goals

This section of the individual community evaluations describes the proposed activities for each project and the project goals. This information was also provided by several communities in their grant applications. Since the source of this information, TSA/DMV grant applications, was not detailed, the treatment here is cursory.

It is important to note that the proposed activities and project goals were prepared in 1983 for the 1984 grants. Thus, implementation of the projects may have varied significantly from the original proposals. No attempt was made to reconstruct the details of the projects as implemented, because the projects had been completed, the grant money had been expended, and a considerable amount of time had elapsed between completion of the projects and the writing of this report.

Project Results

In the third part of each evaluation, the crash data for each STEP community are compared against four criteria to determine project results. These criteria are:

1. Did the project achieve its stated crash reduction goals? Because of differences among communities, their speed-crash problems, and the designs of their selective enforcement projects, it is appropriate that each community set its own project goals and activities. Two universal goals of the projects were to increase enforcement activity and to reduce speed-crashes.

2. Did the number of 1984 speed-crashes fall below projections? This criterion represents a simplified "before and after" test of effectiveness. Using the regression analysis for determining trends in crash data described above, the expected number of speed-crashes was calculated for 1984 and compared against the actual number of such crashes reported.

3. Did annual changes in speed-crash data reflect a positive response to STEP activity in the community compared to data for control groups? This determination represents a simplified "with and without" test of effectiveness, in which the results of STEP data are compared against non-STEP data for

the same period. Two control groups were used: first, the number of non-speed-crashes within the STEP community, and second, the number of speed-crashes aggregated for all Virginia cities or counties, as appropriate. The annual percentage change in the number crashes was computed for each STEP community, and compared against similar changes in the control groups. This information was graphed and is presented for each community.

4. Was the change in 1984 crash data for the STEP community noticeably different from that for non-STEP communities? A baseline average number of speed-crashes was computed for all Virginia cities and counties. The percentage change from this average to the number of speed-crashes reported in 1984 was then computed and graphed to display the distribution of these changes among the Virginia communities. These computations and graphs appear in Appendix G. Data for STEP communities are labelled in the graphs for identification, so that the reader can compare the percentage change in speed-crashes for any STEP community against the changes for other Virginia communities. Note that only communities with 20 or more crashes in the particular crash category are included, because of the disproportionate percentages that would otherwise result.

For the two STEP counties, the crash experience on the identified high accident roads was also reviewed to determine whether these roads showed improvement after the initiation of the STEPs.

Methodology for Equipment Projects

Three Virginia cities received federal grant funds to acquire modern radar units under the speed enforcement module of the state Highway Safety Plan. Such equipment purchases are allowable under federal guidelines. Each of these grants was made as a part of local traffic enforcement efforts. Since the amounts given to these localities were used exclusively for equipment purchases and were small in comparison to total program funds, effectiveness evaluations of these "equipment projects" are summary. The addition of one or two additional radar units in cities and towns with thousands of registered vehicles would not in itself reduce the number of local crashes.

Generally, the approach was the same as that for enforcement projects: trends were identified, the number of speed-crashes was projected, changes in speed-crashes were compared against those for the controls, and changes in the number of crashes in the community were

compared to changes in other Virginia communities. The same tabular and graphic formats used in the evaluation of enforcement projects were used for these projects as well.

Limitations

Several limitations on the methodology employed in this report should be noted. First, the analyses are statistically crude. The emphasis on percentage change used to normalize results may overstate changes for communities with small numbers of crashes. Second, the effects of other selective enforcement projects, such as alcohol-related selective enforcement projects and previous speed-related selective enforcement projects, are not integrated into the analyses. The most important of these is the effect of previous speed-related projects. Since selective enforcement is based on public awareness, projects conducted over several years should have a greater long term effect than shorter projects, but a lesser incremental effect in later years. Where possible, data were interpreted in light of previous selective enforcement.

Finally, the data for all analyses in this report were drawn from the 1980 to 1984 Mini-Crash Facts, using statewide data compiled by the Department of State Police. The most reliable evaluation data would have been those kept by local police officers at the enforcement site, with data on other local sites kept as a control.

INDIVIDUAL EVALUATIONS OF ENFORCEMENT PROJECTS

The following sections of this report contain the evaluations of the selective enforcement projects of the Department of State Police and the six communities which received federal grant money to conduct selective speed enforcement projects. A description of the project, baseline data, numerical analyses, and graphic representations are presented for each community. Crash data for the high accident routes are presented for the STEP counties.

Albemarle County

Problem Statement

Albemarle County was one of two counties awarded federal grant money for the 1984 grant year. It was the first such award to Albemarle County for a selective speed enforcement program. The grant application prepared by the county police department provided crash data for calendar year 1982, but did not describe the nature, extent, or location of the local speed-crash problem.

Table 2 contains the crash data for Albemarle County broken down into the six categories of crashes used in this report. Crash data in the table are first divided into all crashes, speed-crashes, and non-speed-crashes; then each of these groups is subdivided into serious and total crashes. Because several projects stated their goals in terms of fatal and injury crashes, serious crashes are further subdivided into these subcategories. The data in Table 2 show that the number of crashes in Albemarle County increased over the baseline years for most crash categories. The number of total crashes increased from 1,239 in 1980 to 1,330 in 1983. The number of serious crashes grew from 398 in 1980 to 477 in 1983; non-speed-crashes increased from 976 in 1980 to 1,076 in 1983. Only the number of crashes in the two speed-crash categories decreased. Total speed-crashes fell from 263 to 254, and serious speed-crashes from 106 to 96. The movement in these data can be observed in the two "bar" graphs included as Exhibit 3. The first graph displays the annual number of all crashes, divided into speed-crashes and non-speed-crashes. The second displays the annual number of serious crashes, again divided into speed-crashes and non-speed-crashes.

Table 2 also presents the results of two percentage calculations derived from the crash data. The speed involvement percentages represent the percentages of all crashes and of serious crashes that were speed-related, and indicate the frequency in which speed was identified in local crashes. The crash severity percentages represent the number of all crashes and of speed-crashes that were serious and provide an indication of the severity of local crashes. The speed involvement percentages for Albemarle County declined between 1980 and 1983, both for all crashes and for serious crashes. Thus, although the number of crashes was increasing throughout the baseline years, the relative number of speed-crashes was decreasing. The crash severity percentages showed no improvement over the baseline years, but no other conclusions could be drawn from them.

Exhibit 4 displays the results of a regression analysis on the number of speed-crashes and serious speed-crashes. The graphs in the

exhibit plot the annual number of speed-crashes and a regression line through these points for 1980 through 1983. Separate straight-line regression analyses were performed and graphed for speed-crashes and for serious speed-crashes. The regression analysis of speed-crashes in Albemarle County displayed a decreasing trend over the baseline years (See Exhibit 4), but the evaluator believes this trend is overstated by the 18.8% drop in the number of 1982 speed-crashes. Changes in the number of property-damage-only speed-crashes between 1981 and 1982 accounted for all of this 18.8% change and this could have been attributable to the increase in the dollar limit reporting requirement in 1982. Serious speed-crashes also showed a decreasing trend over the baseline.

Table 3 presents the annual percentage change for each crash category in Table 2. These percentages did not reveal a definite trend for any crash category in Albemarle County, as the number of crashes in each category increased in some years and decreased in others. Of the six categories, four increased between 1980 and 1981, five decreased between 1981 and 1982, and five increased between 1982 and 1983. Exhibit 5 graphically presents the annual percentage change in the county's speed-crashes and non-speed-crashes, based on the calculations in Table 3, and the annual percentage change in the rural average number of speed-crashes, based on the calculations in Appendix B. The exhibit provides a means to compare visually the annual change in the number of local speed-crashes against changes in the number of local non-speed-crashes and the rural average number of speed-crashes. The pattern for all three groups was an increase between 1980 and 1981, a decrease between 1981 and 1982, and an increase between 1982 and 1983. In general, speed-crash data for Albemarle County followed data for both control groups in the direction, but not magnitude, of annual change. The percentage change in county speed-crash data was much more volatile than those in the other two groups, moving from an increase of 18.8% between 1981 and 1982 to a reduction of 22.1% between 1982 and 1983.

The rank-ordering process (described in Appendix E) produced mixed estimates of the relative severity of Albemarle County's speed-crash problem. On the one hand, the county's high number of speed-crashes earned it a high priority status, ranking 10th highest of 95 counties in the absolute number of speed-crashes and 33rd in speed-crashes normalized by the number of registered vehicles (Appendix F). On the other hand, the county was rated as a low priority in the speed involvement percentages. Albemarle County ranked among the bottom 10% of all counties in the percentage of all crashes that were speed-related and in the percentage of serious crashes that were speed-related (Appendix F). On the average, over the four-year baseline, 19.4% of all crashes and 21.3% of the serious crashes in the county were speed-related. By comparison, in the average Virginia county, 21.2% of all crashes and 26.1% of all serious crashes were speed-related.

Finally, the analysis of high accident roads revealed a concentration of approximately 50% of all serious crashes inside the county occurring on four routes. These routes were, in descending order of the number of serious crashes, 29, 250, 20, and 631 (See Table 4). Although the percentage share of the total serious crashes in the county occurring on these four roads remained approximately the same throughout the baseline years, the number of serious crashes on these routes increased from 186 in 1980 to 223 in 1986, an increase of 19.9%. The rank order of these four routes remained stable throughout the four years.

In summary, Albemarle County ranked as a high priority in its speed-crash problem because of the large number of local crashes. All other measures used in this report indicated a medium-to-low priority speed-crash problem and a downward trend in the number of speed-crashes. The county's speed-crash problem was concentrated on four routes.

Summary of Speed-Crash Problem

1.	OVERALL TRENDS IN NUMBER OF CRASHES	generally increasing
2.	PERCENTAGE INDICATORS --	
	Speed Involvement	decreasing
	Crash Severity	no conclusion
3.	REGRESSION ANALYSIS --	
	Speed-Crashes	decreasing
	Serious Speed-Crashes	decreasing
4.	RANK ORDERING PROCESS --	
	Number of Speed-Crashes	high priority
	Percentage Indicators	low priority
5.	HIGH ACCIDENT ROAD ANALYSIS	crash concentration of 50%

Proposed Activities and Project Goals

Albemarle County received $6,240 in grant funds to conduct its 1984 STEP. This represented $0.14 per registered vehicle, the second lowest such figure for any STEP community. These funds were to pay one officer 12 hours of overtime per week for nighttime patrol on weekends. No other description of the project was available.

The stated goals of the project were to:

(1) reduce traffic accidents by 5% of 1982 totals (61 total crashes, 22 serious crashes, 10 speed-crashes), and

(2) increase traffic and DUI arrests by 5% over 1982 totals.

Project Results

Available crash data were ambiguous regarding the effectiveness of Albemarle County's first federally funded STEP. The project did not achieve its crash reduction goals, as all crashes increased 8.4% from 1983 levels and serious crashes increased 12.6%. On the other hand, the number of speed-crashes fell by 9.4% from 1983. The magnitude of this reduction may be overstated because of the large swings in speed-crash data noted above. A more accurate picture may be reflected by the more modest 6.2% decrease in the number of speed-crashes in 1984 compared to the baseline average number of such crashes. There were fewer serious speed-crashes in 1984 also, 1.0% less than in 1983 and 4.3% less than in the baseline average number. It was significant that the two speed-crash categories were the only ones among the six measured which had fewer crashes in 1984 than in 1983, and fewer in 1984 than in the baseline average. Note also that these reductions occurred against a background of an average 7% increase in speed-crashes for Virginia counties.

The decrease in both categories of speed-crashes compared favorably to changes in the controls; speed-crashes in the county dropped 9.4%, while speed-crashes in the average county increased 6.9%, and non-speed-crashes in the county increased 12.6%. In addition, data in Appendix G suggest that the percentage change in the number of speed-crashes ranked favorably among all Virginia counties. The graphs presented in Appendix G allow the reader to compare the percentage change in the number of crashes for each STEP community with the changes experienced by other Virginia communities. The changes were measured as the percentage change between the number of crashes reported in 1984 and the baseline average number. The number of communities with changes within a specified range were counted and graphed, with the STEP communities highlighted and noted. Virginia cities and counties were grouped independently and the six crash categories for each group were graphed separately. The percentage change for Albemarle County in the number of all crashes, serious crashes, and non-speed-crashes fell close to the average of all Virginia counties, while the percentage change in the number of Albemarle County speed-crashes fell within the upper third (See Appendix G). Thus, the change in the number of Albemarle County's speed-crashes was somewhat more favorable than the changes in the number

of the county's crashes in other categories and somewhat more favorable than the changes in the number of speed-crashes in other counties.

However, the crash data also invite a skeptical assessment of the effectiveness of the 1984 project. The number of speed-crashes reported in 1984 was close to the number projected by the regression analysis for both speed-crashes and for serious speed-crashes (See Exhibit 4). This suggests that the first year of the federally funded speed STEP added little to those factors responsible for the preexisting declining trend in speed-crashes. Also, there were 34 more serious crashes on the four identified high accident routes -- on which countermeasures would seem to have been most appropriate -- in 1984 than in the 1983, a 15.2% increase (See Table 4). This increase did not significantly raise the percentage share of community total serious crashes occurring on these routes, though, because the total number of crashes in the county increased 8.4% in 1984 over 1983.

Conclusions

Crash data were ambiguous regarding both the magnitude of Albemarle County's speed-crash problem and the effectiveness of its 1984 STEP. While the county had a high priority problem by one measure, it ranked as a low priority by the others. Similarly, some measures of effectiveness -- specifically the percentage change in speed-crashes compared to those for control groups and for other Virginia counties -- suggested positive results, while other measures suggested no discernible improvement.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	NO
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	NO
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	YES
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	NO

TABLE 2

BASELINE CRASH DATA: ALBEMARLE COUNTY

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	398	448	443	477	537	442
Fatal	22	11	15	10	10	15
Injury	376	437	428	467	527	427
TOTAL	1,239	1,275	1,217	1,330	1,442	1,265
SPEED-CRASHES						
SERIOUS	106	95	100	96	95	99
Fatal	7	3	6	1	3	4
Injury	99	92	94	95	92	95
TOTAL	263	256	208	254	230	245
NON-SPEED-CRASHES						
SERIOUS	292	353	343	381	442	342
Fatal	15	8	9	9	7	10
Injury	277	345	334	372	435	332
TOTAL	976	1,019	1,009	1,076	1,212	1,020
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	21.2	20.1	17.1	19.1	16.0	19.4
Serious Crashes	26.6	21.2	22.6	20.1	17.7	22.5
CRASH SEVERITY PERCENTAGES						
All Crashes	32.1	35.1	36.4	35.9	37.2	34.9
Speed-Related	40.3	37.1	48.1	37.8	41.3	40.5

TABLE 3

CHANGES IN CRASH DATA: ALBEMARLE COUNTY

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	36	-58	113	112	177
Percentage Change	2.9	-4.5	9.3	8.4	14.0
SERIOUS CRASHES					
Numeric Change	50	-5	34	60	96
Percentage Change	12.6	-1.1	7.7	12.6	21.6
ALL SPEED-CRASHES					
Numeric Change	-7	-48	46	-24	-15
Percentage Change	-2.7	-18.8	22.1	-9.4	-6.2
SERIOUS SPEED-CRASHES					
Numeric Change	-11	5	-4	-1	-4
Percentage Change	-10.4	5.3	-4.0	-1.0	-4.3
ALL NON-SPEED-CRASHES					
Numeric Change	43	-10	67	136	192
Percentage Change	4.4	-1.0	6.6	12.6	18.8
SERIOUS NON-SPEED-CRASHES					
Numeric Change	61	-10	38	61	100
Percentage Change	20.9	-2.8	11.1	16.0	29.1

NOTE: Negative numbers reflect a reduction in the number of crashes.

TABLE 4

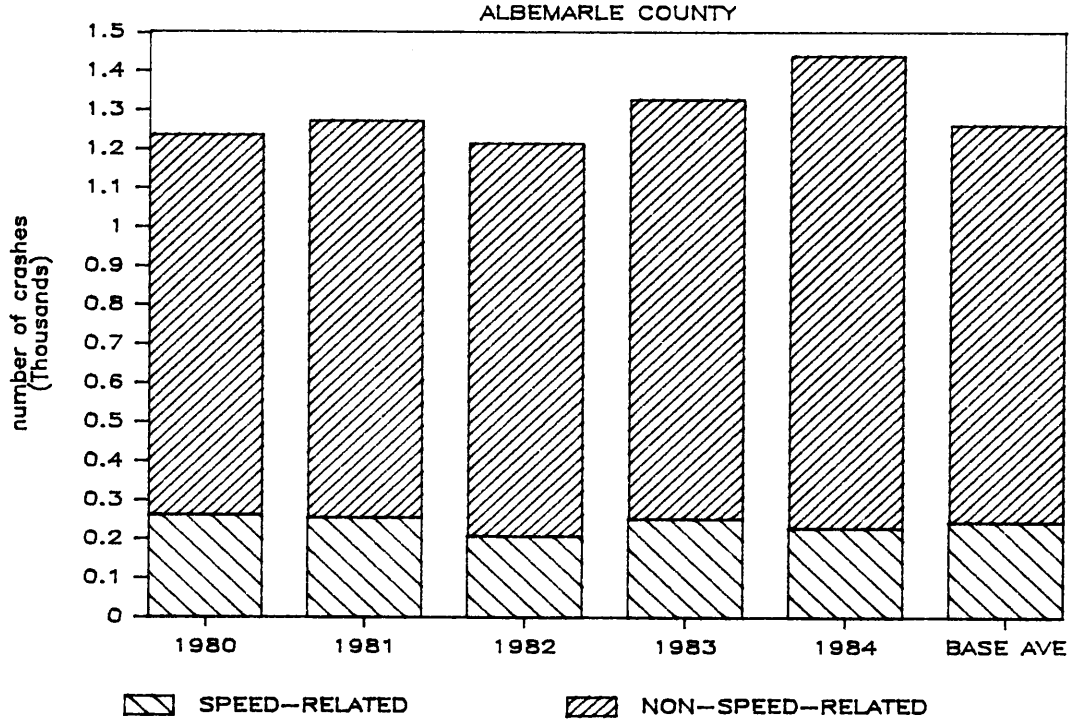
HIGH ACCIDENT ROADWAY CRASH DATA
ALBEMARLE COUNTY

	1980	1981	1982	1983	1984
1st Road					
Route Number	29	29	29	29	29
Serious Crashes	73	86	82	86	100
% Total Serious Crashes in Community	18.3	19.2	18.5	18.0	18.6
2nd Road					
Route Number	250	250	250	250	250
Serious Crashes	63	60	68	74	78
% Total Serious Crashes in Community	15.8	13.4	15.3	15.5	14.5
3rd Road					
Route Number	20	20	20	631	20
Serious Crashes	31	38	47	34	40
% Total Serious Crashes in Community	7.8	8.5	10.6	7.1	7.4
4th Road					
Route Number	631	631	631	20	631
Serious Crashes	19	22	25	29	39
% Total Serious Crashes in Community	4.8	4.9	5.6	6.1	7.3
FOUR ROAD TOTAL					
Serious Crashes	186	206	222	223	257
% Total Serious Crashes in Community	46.7	46.0	50.1	46.8	47.9

EXHIBIT 3

SPEED INVOLVEMENT – ALL CRASHES

ALBEMARLE COUNTY



SPEED INVOLVEMENT – SERIOUS CRASHES

ALBEMARLE COUNTY

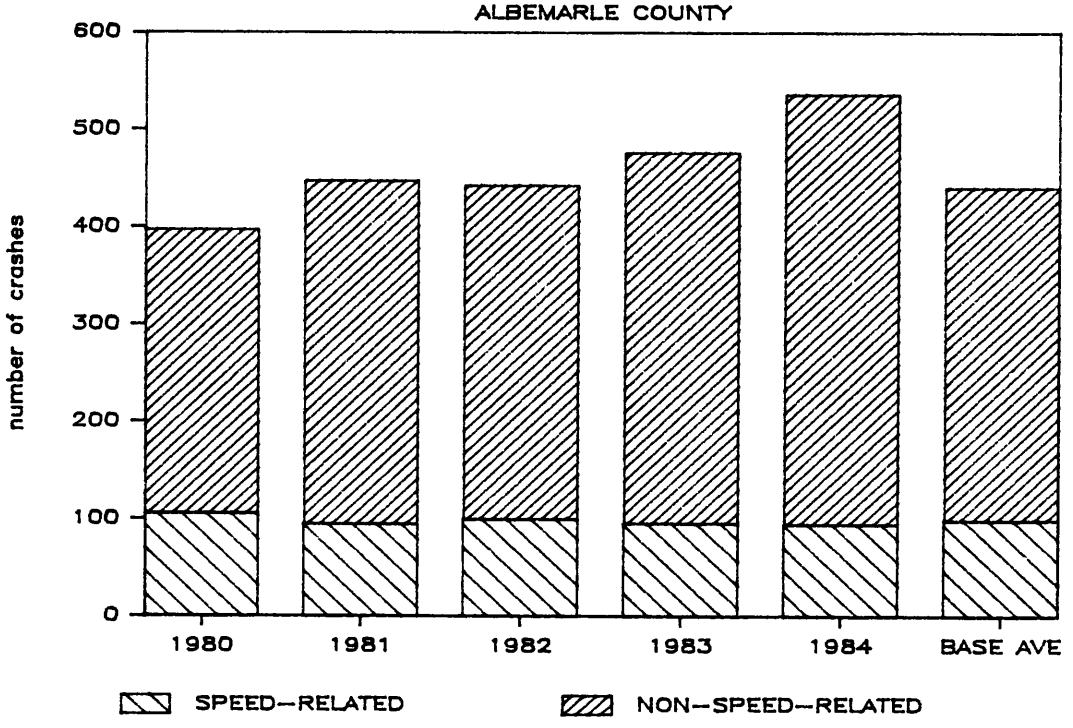
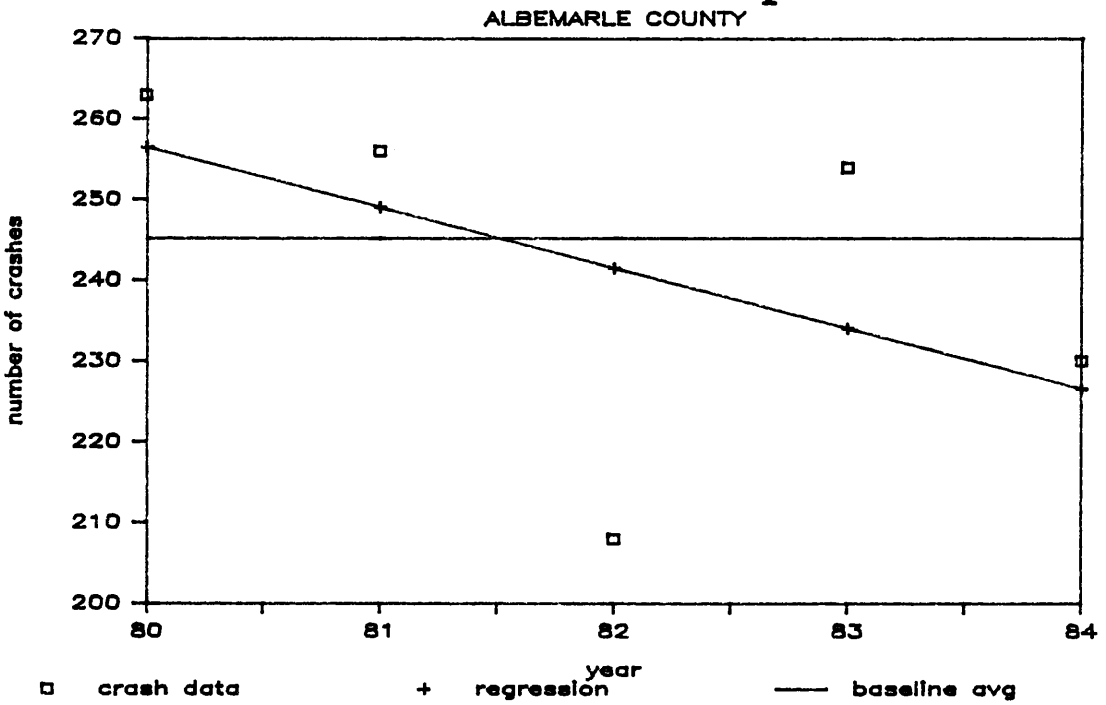


EXHIBIT 4

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

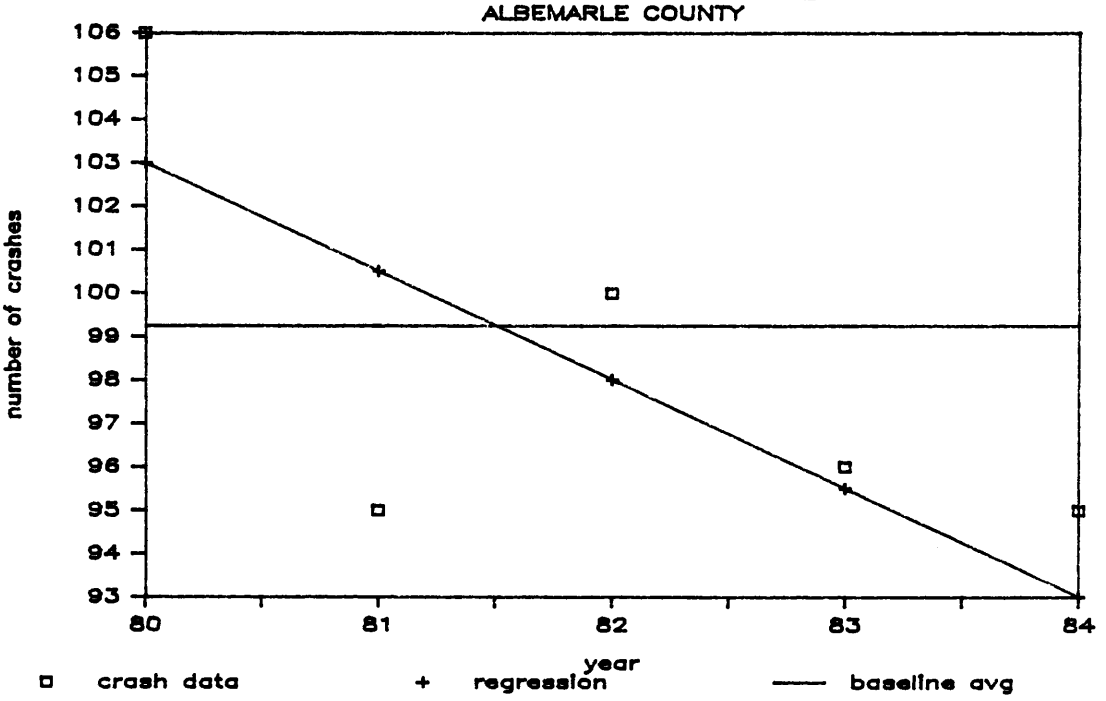
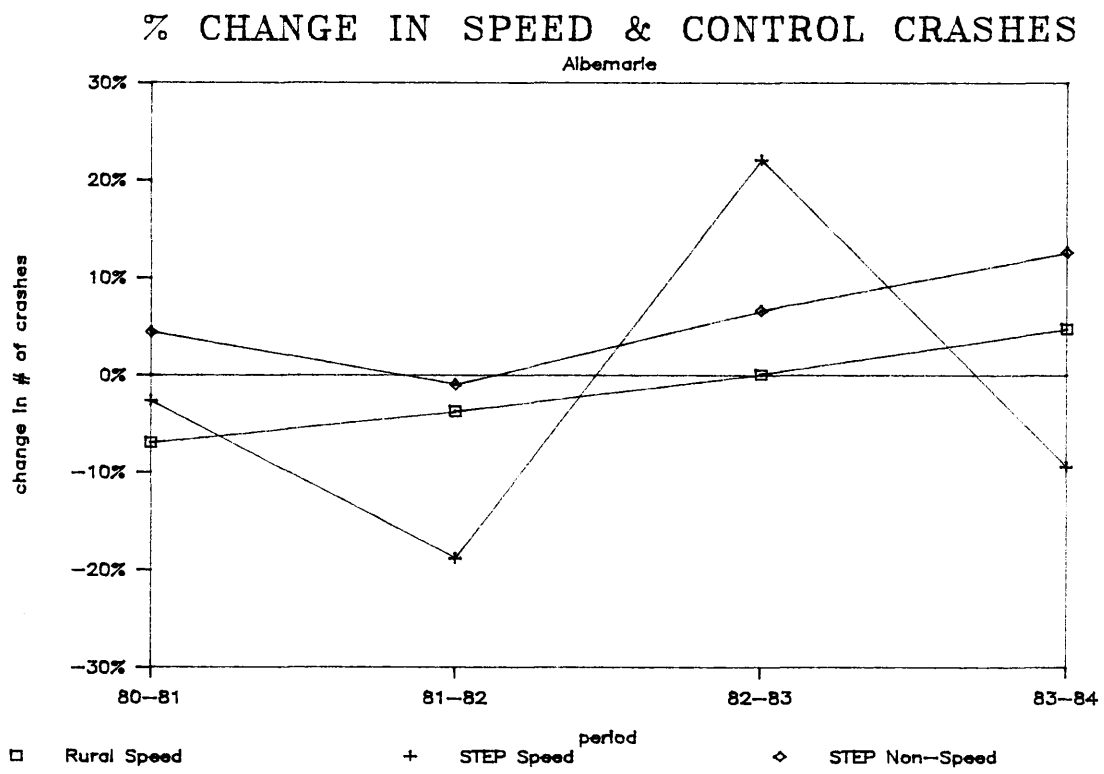


EXHIBIT 5


% CHANGE IN SPEED & CONTROL CRASHES
Albemarle
30%
20%
10%
0%
-10%
-20%
-30%
change in # of crashes
80-81
81-82
82-83
83-84
period
Rural Speed
STEP Speed
STEP Non-Speed

Goochland County

Problem Statement

Goochland County was one of three communities to receive a STEP award in both the 1983 and 1984 fiscal years. In the 1983 grant application, the sheriff's department described the local speed-crash problem as a high incidence of weekend crashes on three county roads. According to the department, almost half of the county's crashes occurred during weekends on Routes 6, 250, and 522. The 1984 grant application also noted that there were limited resources available to the department to patrol these roads during the problem days and hours.

The crash data in Table 5 and Exhibit 6 indicated an overall declining trend in the number of crashes in the county over the baseline years. Total crashes fell from a high of 253 in 1981 to a low of 226 in 1983. Similarly, speed-crashes fell from a high of 57 in 1981 to a low of 32 in 1983. The number of serious crashes and non-speed-crashes, however, remained relatively stable throughout the baseline period. These trends are reflected in the changes in the percentage indicators presented in Table 5. The speed involvement percentages indicated that the ratio of speed-crashes to total crashes was declining over the baseline period. Movement in the crash severity percentages was ambiguous, but clearly the ratio of serious crashes to total crashes was not declining over the baseline.

The regression analysis in Exhibit 7 demonstrated that the number of speed-crashes and serious speed-crashes was tending to decline over the baseline period. Together with the declining speed involvement percentages, these analyses suggested that speed-crashes were becoming less of a problem in Goochland County. Goochland County ranked as a low priority community in both the comparative ranking based on number of crashes and the ranking based on the speed involvement percentages (See Appendix F).

While Goochland County ranked as a low priority in its speed-crash problem compared to other Virginia counties, it ranked close to the average of Virginia counties in crash severity, based on the crash severity percentages. For the Virginia county average, 38.7% of all crashes were serious over the baseline years, while 41.1% of all crashes in Goochland County were serious. Thus, it appeared that the county's crash severity problem was independent of its low priority speed-crash problem.

Percentage change calculations, which were derived from the crash data in Table 5, are presented in Table 6 and Exhibit 8. Based on these

calculations, the changes in the number of speed-crashes in Goochland County followed changes in the number of rural speed-crashes, but the changes in Goochland County were of a greater relative magnitude. For example, between 1980 and 1981, both the number of rural speed-crashes and the number of speed-crashes in Goochland County increased. However, rural speed-crashes rose by 216 in that period, a 3.4% increase, while local speed-crashes rose by 10, a 21.3% increase. Similarly, between 1981 and 1982, rural speed-crashes fell by 7.9%, while county speed-crashes fell by 33.3%. Between 1982 and 1983, rural speed-crashes increased by 0.8%, while county speed-crashes fell by 15.8%. The pattern of change for non-speed-crashes appeared to be inverse to that for speed-crashes in the county, so that when the percentage change for speed-crashes rose, the percentage change for non-speed-crashes fell (See Exhibit 8).

Available crash data confirmed the characteristics of the local speed-crash problem described by the sheriff's department in its 1983 grant application. Data in Table 7 show that routes 6, 250, and 522 accounted for more than 40% of all serious crashes reported in the county over the baseline period. No conclusion about trends over the baseline period in the number of crashes on these roads could be drawn from the data in Table 7.

The above review of the local speed-crash problem should be read with the knowledge that the county operated a STEP in 1983. Thus, one would expect both a lower number of speed-crashes and a greater percentage change in Goochland County for 1983 than for the average Virginia county. The evaluation of the county's 1983 STEP concluded that the project was somewhat successful in reducing the number of local speed-crashes.

Summary of Speed-Crash Problem

1.	OVERALL TRENDS IN NUMBER OF CRASHES	generally decreasing
2.	PERCENTAGE INDICATORS --	
	Speed Involvement	decreasing
	Crash Severity	no conclusion
3.	REGRESSION ANALYSIS --	
	Speed-Crashes	decreasing
	Serious Speed-Crashes	decreasing
4.	RANK ORDERING PROCESS --	
	Number of Speed-Crashes	low priority
	Percentage Indicators	low priority
5.	HIGH ACCIDENT ROAD ANALYSIS	medium concentration

Proposed Activities and Project Goals

Goochland County was awarded $20,000 in grant funds to conduct its 1984 STEP, twice the amount granted for its 1983 project. The sheriff's department planned to average 6 hours of selective enforcement patrol per day, using officers on an overtime basis. The 1984 grant application provided few details of the proposed project's implementation, but the sheriff's department noted its intention to focus activity on high demand hours and high accident locations. The 1983 application proposed that STEP patrols be placed exclusively on Routes 6, 250, and 522. The 1984 application also proposed public education talks inside the community regarding the effects of speeding on highway safety.

The stated goals of the 1984 project were to:

(1) reduce the percentage of speed-related accidents by 10%, and

(2) reduce fatalities by 10%.

Project Results

Although there was some uncertainty over exactly what measure the first stated goal meant to employ, the 1984 Goochland County STEP did not achieve its stated goals when 1983 and 1984 crash data were compared. The number of speed-crashes and fatal crashes each changed by one crash -- speed-crashes down from 32 in 1983 to 31 in 1984, and fatal crashes up from 2 in 1983 to 3 in 1984. Serious speed-crashes increased from 14 to 17. Based on these numbers, neither goal was met. These numbers demonstrate the problem that small numbers of local crashes pose in applying and interpreting the effectiveness indicators used in this report. For instance, one additional fatal crash represented a 50% increase in this crash category for Goochland County and one fewer speed-crash resulted in a 3.1% decrease.

Given the volatility of several percentage measures for Goochland County, the evaluator felt that it would be more meaningful to compare 1984 crash data against baseline average numbers than against 1983 data. The number of crashes in the two speed-crash categories were lower in 1984 than in the baseline average (See Table 6). There were 13 fewer speed-crashes, for a reduction of 28.7%, and 4 fewer serious speed-crashes, for a reduction of 19.0%. There were 3 fewer fatal crashes, a reduction of 42.8%. Each of the four other measured categories increased 8% or more in 1984 over the baseline average. Under this alternative set of data, the Goochland County STEP did meet its goals. Additionally, the reduction in the number of speed-crashes occurred against

a background of an increasing number of crashes in the county overall. There were 37 more non-speed-crashes reported in 1984 than in 1983, a 19.1% increase, and 34 more than in the baseline average, a 17.3% increase.

The number of speed-crashes reported in 1984 fell very close to the number projected by the regression analysis (See Exhibit 7). However, this analysis may have underestimated the number of expected speed-crashes for 1984 since the projection included 1983 data, when the county had already been conducting a STEP.

The percent change in the number of Goochland County's speed-crashes, illustrated in Exhibit 8, was below the percentage change for the Virginia county average. The number of speed-crashes increased 6.9% in the county average but fell 3.1% in Goochland County. Both Goochland County and the Virginia county average had higher percentage changes in the number of speed-crashes between 1983-1984 than between 1982-1983. Goochland County's percentage change rose from a 15.8% decrease between 1982-1983 to a 3.1% decrease between 1983-1984 (a smaller decrease); the county average moved from a 0.8% increase to a 6.9% increase. Thus, while the number of speed-crashes in the county decreased between 1983 and 1984, the percentage decrease was less than in the two prior years.

The graphs in Appendix G plot the percentage change in the number of total, serious, non-speed, and serious non-speed crashes for Goochland County at or below the percentage change for crashes in the Virginia county average. The county's percentage change in both of the two speed-crash categories ranked among the highest percentage reductions for all Virginia counties. Thus, the change in the number of speed-crashes in Goochland County between 1984 and the baseline average was noticeably better than for other Virginia counties.

Although the high accident road analysis included all three routes identified by the sheriff's department for STEP activity, the analysis provided no insights into the effectiveness of the STEP. None of the three roads recorded significant changes in the number of serious crashes over the prior four years of data. The combined share of community crashes occurring on these roads changed little between 1983 and 1984.

Conclusions

The evaluation of the Goochland County 1983 STEP concluded that the project was successful under the effectiveness measures used in that report. That conclusion is repeated here. When measured against baseline average numbers, the project met its goals. The changes from those

averages, in terms of percentage change, were noticeably different from most other Virginia counties, and the reductions were reported against an increasing trend in other types of crashes. Still, the project could not be proclaimed to be a total success. The declining trend in speed-crashes prior to the two STEPs, the absence of positive data from the very roads planned to be patrolled, the effect of magnifying small changes in the number of crashes into large percentages, and the failure of the project to meet stated goals as measured against the prior year's data leave some doubts regarding the effectiveness of these projects.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	* YES
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	NO
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	YES
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	YES

* The STEP achieved its goals when the number of 1984 crashes is compared to baseline average figures. The STEP failed to meet its goals when the number of 1984 crashes is compared to 1983 figures.

TABLE 5

BASELINE CRASH DATA: GOOCHLAND COUNTY

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	109	93	105	101	117	102
Fatal	8	10	7	2	3	7
Injury	101	83	98	99	114	95
TOTAL	234	253	249	226	262	241
SPEED-CRASHES						
SERIOUS	21	26	23	14	17	21
Fatal	4	5	3	0	1	3
Injury	17	21	20	14	16	18
TOTAL	47	57	38	32	31	44
NON-SPEED-CRASHES						
SERIOUS	88	67	82	87	100	81
Fatal	4	5	4	2	2	4
Injury	84	62	78	85	98	77
TOTAL	187	196	211	194	231	197
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	20.1	22.5	15.3	14.2	11.8	18.1
Serious Crashes	19.3	28.0	21.9	13.9	14.5	20.6
CRASH SEVERITY PERCENTAGES						
All Crashes	46.6	36.8	42.2	44.7	44.7	42.4
Speed-Related	44.7	45.6	60.5	43.8	54.8	48.3

TABLE 6

CHANGES IN CRASH DATA: GOOCHLAND COUNTY

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	19	-4	-23	36	22
Percentage Change	8.1	-1.6	-9.2	15.9	8.9
SERIOUS CRASHES					
Numeric Change	-16	12	-4	16	15
Percentage Change	-14.7	12.9	-3.8	15.8	14.7
ALL SPEED-CRASHES					
Numeric Change	10	-19	-6	-1	-13
Percentage Change	21.3	-33.3	-15.8	-3.1	-28.7
SERIOUS SPEED-CRASHES					
Numeric Change	5	-3	-9	3	-4
Percentage Change	23.8	-11.5	-39.1	21.4	-19.0
ALL NON-SPEED-CRASHES					
Numeric Change	9	15	-17	37	34
Percentage Change	4.8	7.7	-8.1	19.1	17.3
SERIOUS NON-SPEED-CRASHES					
Numeric Change	-21	15	5	13	19
Percentage Change	-23.9	22.4	6.1	14.9	23.5

NOTE: Negative numbers reflect a reduction in the number of crashes.

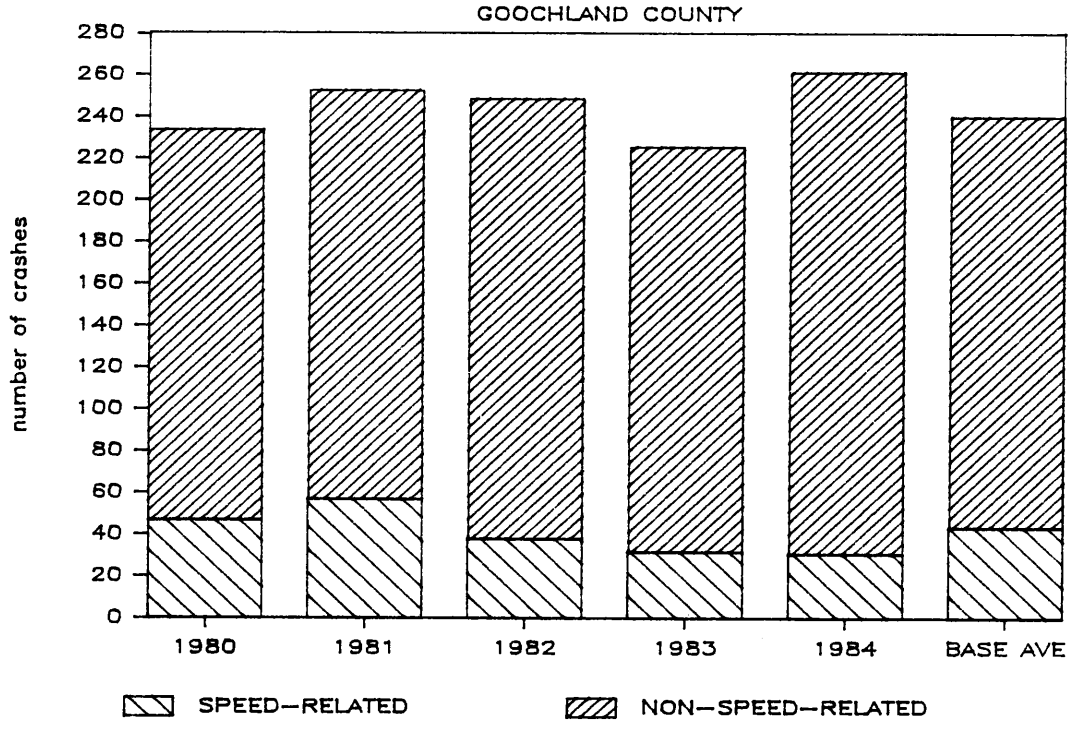
TABLE 7

HIGH ACCIDENT ROADWAY CRASH DATA
GOOCHLAND COUNTY

	1980	1981	1982	1983	1984
1st ROAD					
Route Number	6	6	6	6	6
Serious Crashes	22	20	18	20	18
% Total Serious Crashes in Community	20.2	21.5	17.1	19.8	15.4
2nd ROAD					
Route Number	250	250	250	250	250
Serious Crashes	19	20	18	15	18
% Total Serious Crashes in Community	17.4	21.5	17.1	14.9	15.4
3rd ROAD					
Route Number	522	522	522	623	522
Serious Crashes	9	3	8	7	9
% Total Serious Crashes in Community	8.3	3.2	7.6	6.9	7.7
4th ROAD					
Route Number	621	621	621	522	650
Serious Crashes	3	3	9	3	5
% Total Serious Crashes in Community	2.8	3.2	8.6	3.0	4.3
FOUR ROAD TOTAL					
Serious Crashes	53	46	53	45	50
% Total Serious Crashes in Community	48.6	49.5	50.5	44.6	42.7

EXHIBIT 6

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

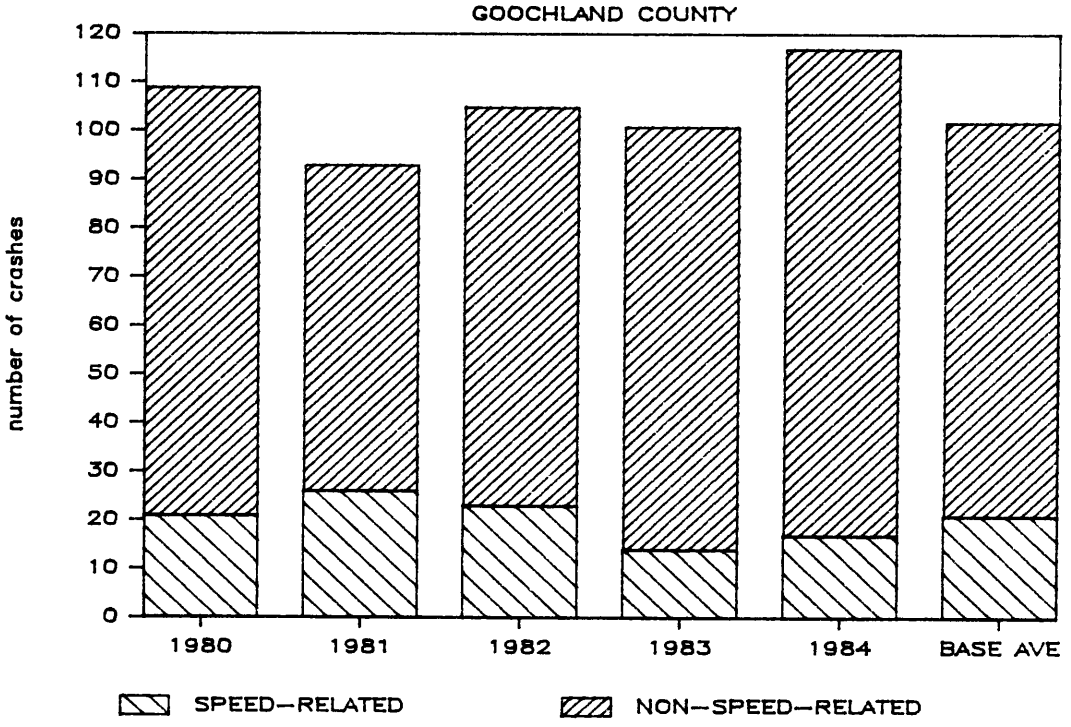
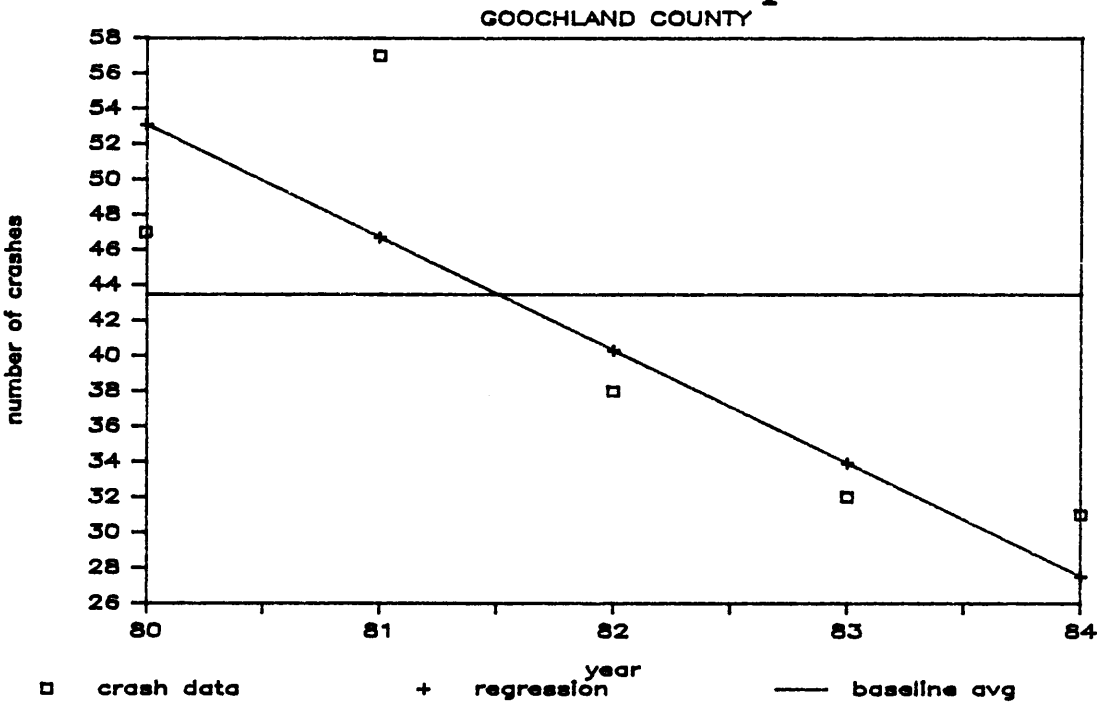


EXHIBIT 7

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

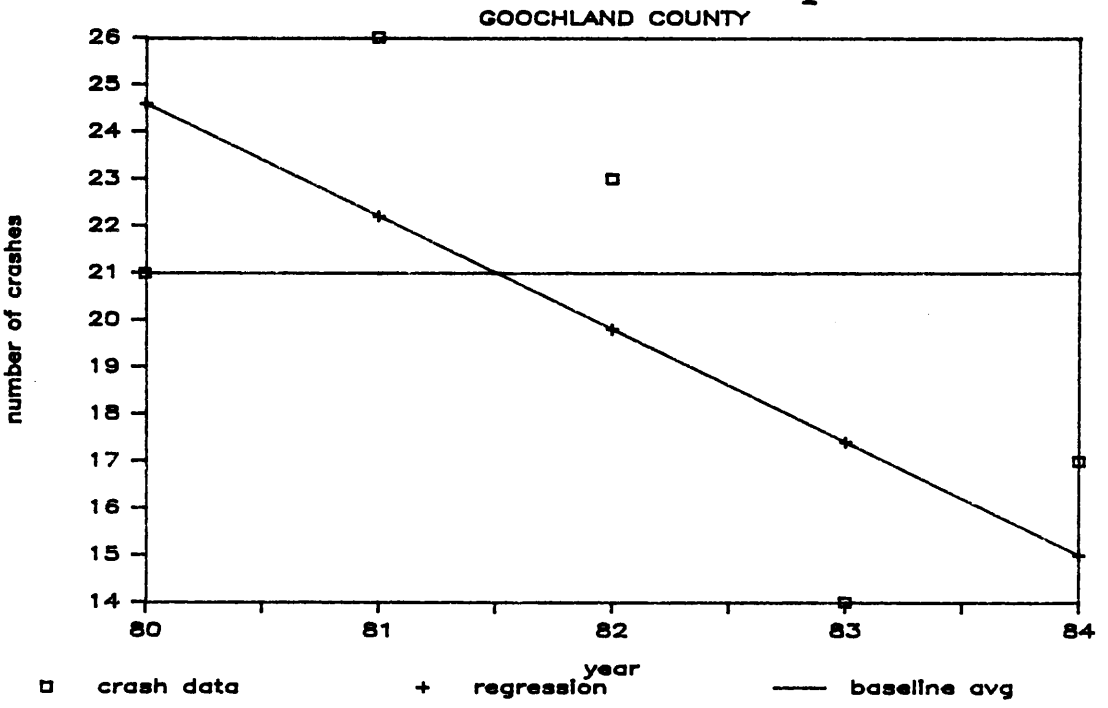
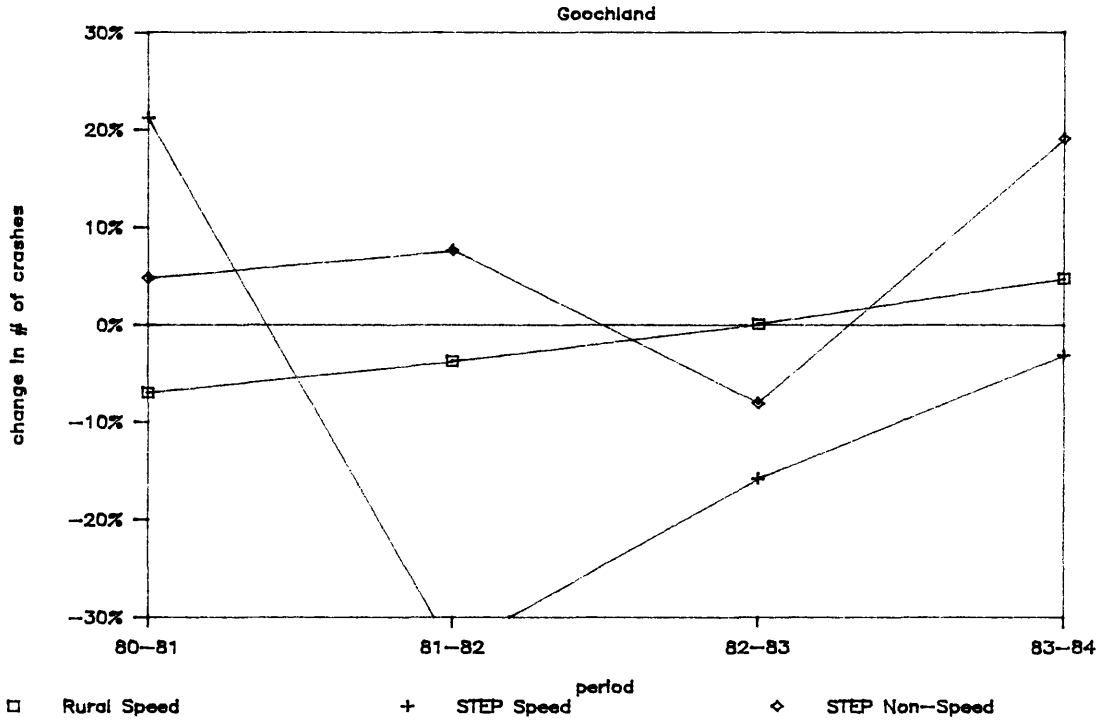


EXHIBIT 8

% CHANGE IN SPEED & CONTROL CRASHES



City of Lynchburg

Problem Statement

Basic crash data for the city of Lynchburg are presented in Table 8 and Exhibit 9. Overall, the number of crashes in the city declined over the baseline period. Total crashes declined from a high of 1,675 in 1981 to a low of 1,475 in 1983; speed-crashes declined from 269 in 1980 to 227 in 1983; and non-speed-crashes declined from 1,412 in 1981 to 1,248 in 1983. The general decline in the number of crashes occurred after 1981, however, since between 1980 and 1981, four of the six crash categories increased. In contrast to the general declining trend in crashes, the number of serious crashes remained relatively constant over the baseline period.

These changes in the number of the city's crashes appeared to be part of the larger trend in Virginia's urban areas in which the total number of crashes was declining, but the number of serious crashes was not (See Appendix C). Lynchburg also appeared to be part of the declining trend in the number of speed-crashes occurring in Virginia's urban areas. The speed-involvement and crash severity percentages in Table 8 support these observations. The percentage of crashes that were speed-related fell from 16.6% in 1980 to 15.1% in 1983. The percentage of crashes that were serious rose from 26.2% in 1980 to 28.4% in 1983.

The regression analysis presented in Exhibit 10 showed a declining trend in the number of speed-crashes from 1980 to 1983. While the number of serious speed-crashes increased between 1982 and 1983, the number of these crashes generally declined over the baseline years overall. Note that the speed-crash data points in Exhibit 10 fell very close to the regression line, lending confidence to the predictive power of the analysis. The serious speed-crashes data points did not "fit" as well with the regression line, creating doubt in the predictive power of the analysis for serious speed-crashes.

In Exhibit 11, the annual percentage change in the number of Lynchburg's speed-crashes was compared to the percentage change in local non-speed-crashes and urban average speed-crashes. The exhibit revealed a close association between changes in the two categories of local crashes over the baseline period. Thus, changes in the number of local speed-crashes were about the same as changes in the number of non-speed-crashes. The association between speed-crashes in the city and speed-crashes in the urban average was more attenuated.

Lynchburg ranked as a high-priority community in its speed-crash problem under both comparative ranking processes (See Appendix F). The

city placed 10th among 43 independent Virginia cities in the average number of speed-crashes over the baseline years, and 13th in the number of speed-crashes per registered vehicle. The city ranked 15th in speed involvement in all crashes and 8th in speed involvement in serious crashes.

In summary, the objective measures used in this report indicated that the city of Lynchburg had a high priority speed-crash problem, but the number of speed-crashes was declining. This decline was part of the general declining trend in the number of crashes throughout the city and corresponding declining trend in the number of speed-crashes throughout Virginia cities during the baseline years.

Summary of Speed-Crash Problem

1.	OVERALL TRENDS IN NUMBER OF CRASHES	generally decreasing
2.	PERCENTAGE INDICATORS --	
	Speed Involvement	decreasing
	Crash Severity	increasing
3.	REGRESSION ANALYSIS --	
	Speed-Crashes	decreasing
	Serious Speed-Crashes	decreasing
4.	RANK ORDERING PROCESS --	
	Number of Speed-Crashes	high priority
	Percentage Indicators	high priority

Proposed Activities and Project Goals

The Lynchburg Police Department received $17,000 to conduct its 1984 STEP. The department intended to use these funds to provide 2,377 hours of overtime, an average of 45 man-hours per week. The department planned to coordinate a public relations program informing citizens about the project with its intensified enforcement efforts.

The goal of the project stated in the grant application was to reduce the number of traffic accidents by 5% to 10% from 1982 levels.

Project Results

The 1984 Lynchburg STEP did not achieve its stated goal. The number of crashes in each of the six crash categories increased in 1984

over 1983 and baseline average numbers. Compared to 1983, all crashes were up 12.5%, serious crashes 14.8%, speed-crashes 10.6%, and non-speed-crashes 12.8% (See Tables 8 and 9, and Exhibit 9). These increases followed two consecutive years of reductions in all crashes and speed-crashes and only minor increases in serious crashes.

Significantly more speed-crashes of both categories were reported in 1984 than projected by the regression analyses (See Exhibit 10). This result is particularly meaningful for speed-crashes, because of the close fit between the data points and the regression line over the baseline period.

The 10.6% increase in the number of speed-crashes between 1983 and 1984 was close to the 12.8% increase in the number of non-speed-crashes. Thus, the close association in the changes in speed-crashes and non-speed-crashes continued after the STEP countermeasures were introduced in the city, suggesting that the 1984 Lynchburg STEP did not reduce the number of speed-crashes in comparison to non-speed-crashes (See Exhibit 11). Note, however, that the association between serious speed-crashes and serious non-speed-crashes was not maintained in 1984. While the number of serious speed-crashes in 1984 was 4.3% higher than the number in 1983, the number of serious non-speed-crashes increased 17.7%. Prior to 1984, changes in the number of these two categories had been within a few percentage points. The percentage increases in speed-crashes and non-speed-crashes were higher than the corresponding urban average increases.

The percentage change in the number of Lynchburg's speed-crashes was the same or worse than that of other Virginia cities. The city fell near or below the urban average in its percentage change for each of the crash categories (See Appendix G).

Conclusions

The 1984 Lynchburg STEP did not achieve its stated goals. Crash data indicated that the project did not reduce the number of speed-crashes in the city in comparison with non-speed-crashes. The percentage increase in the number of crashes in each category was greater than or about the same as that for the urban average.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	NO
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	NO
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	NO
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	NO

TABLE 8

BASELINE CRASH DATA: LYNCHBURG

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	424	433	411	419	481	422
Fatal	5	4	8	8	9	6
Injury	419	429	403	411	472	416
TOTAL	1,621	1,675	1,535	1,475	1,659	1,577
SPEED-CRASHES						
SERIOUS	94	94	88	92	96	92
Fatal	2	1	2	3	5	2
Injury	92	93	86	89	91	90
TOTAL	269	263	239	227	251	250
NON-SPEED-CRASHES						
SERIOUS	330	339	323	327	385	330
Fatal	3	3	6	5	4	4
Injury	327	336	317	322	381	326
TOTAL	1,352	1,412	1,296	1,248	1,408	1,327
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	16.6	15.7	15.6	15.4	15.1	15.8
Serious Crashes	22.2	21.7	21.4	22.0	20.0	21.8
CRASH SEVERITY PERCENTAGES						
All Crashes	26.2	25.9	26.8	28.4	29.0	26.8
Speed-Related	34.9	35.7	36.8	40.5	38.2	36.9

TABLE 9

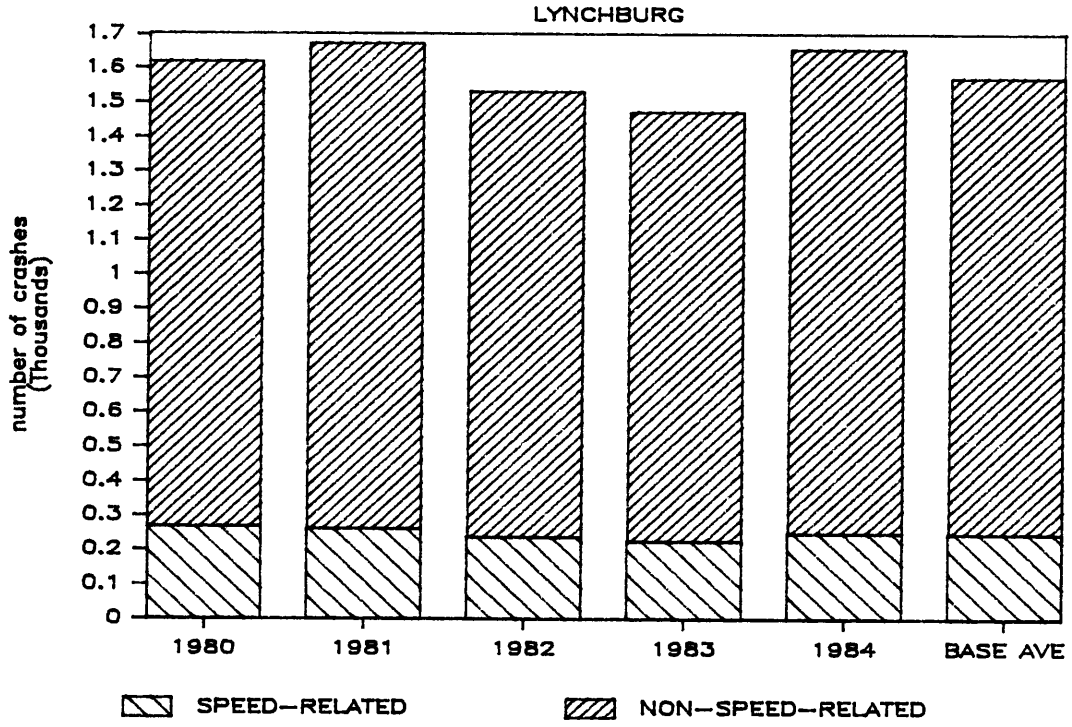
CHANGES IN CRASH DATA: LYNCHBURG

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	54	-140	-60	184	83
Percentage Change	3.3	-8.4	-3.9	12.5	5.2
SERIOUS CRASHES					
Numeric Change	9	-22	8	62	59
Percentage Change	2.1	-5.1	1.9	14.8	14.0
ALL SPEED-CRASHES					
Numeric Change	-6	-24	-12	24	2
Percentage Change	-2.2	-9.1	-5.0	10.6	0.6
SERIOUS SPEED-CRASHES					
Numeric Change	0	-6	4	4	4
Percentage Change	0.0	-6.4	4.5	4.3	4.3
ALL NON-SPEED-CRASHES					
Numeric Change	60	-116	-48	160	81
Percentage Change	4.4	-8.2	-3.7	12.8	6.1
SERIOUS NON-SPEED-CRASHES					
Numeric Change	9	-16	4	58	55
Percentage Change	2.7	-4.7	1.2	17.7	16.8

NOTE: Negative numbers reflect a reduction in the number of crashes.

EXHIBIT 9

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

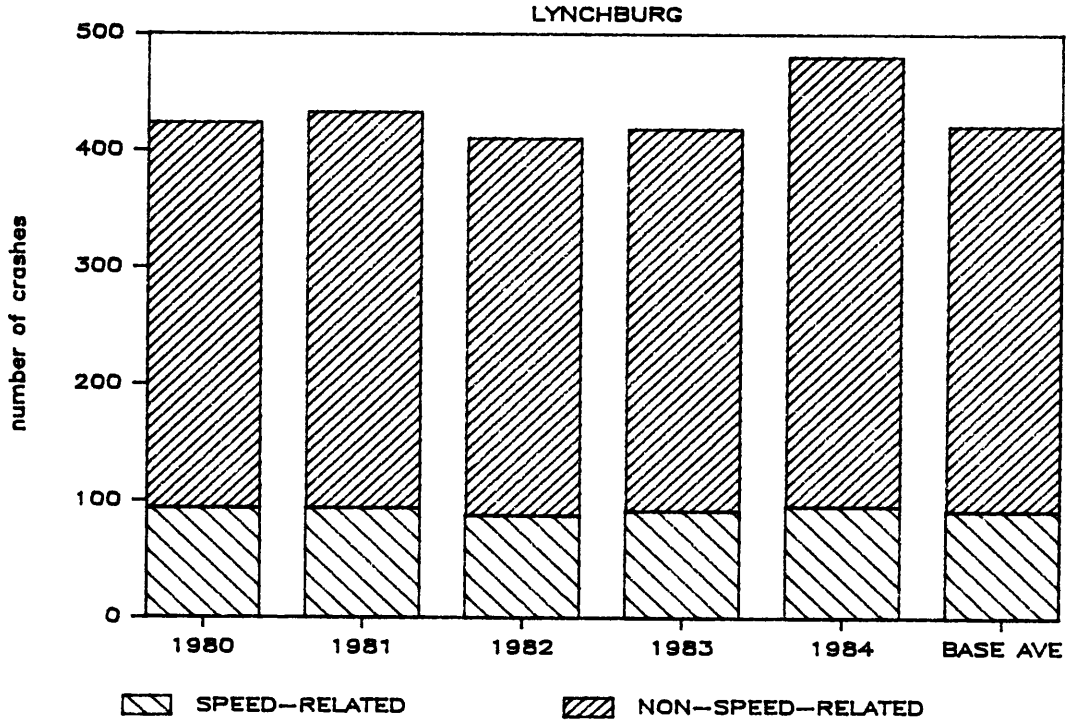
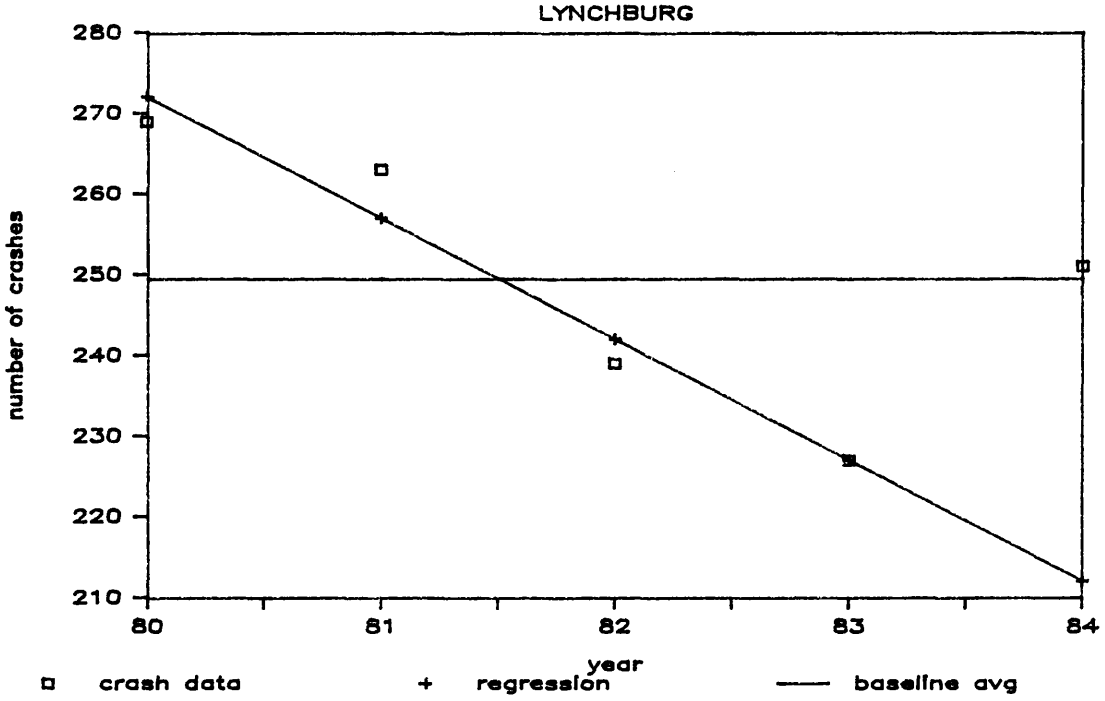


EXHIBIT 10

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

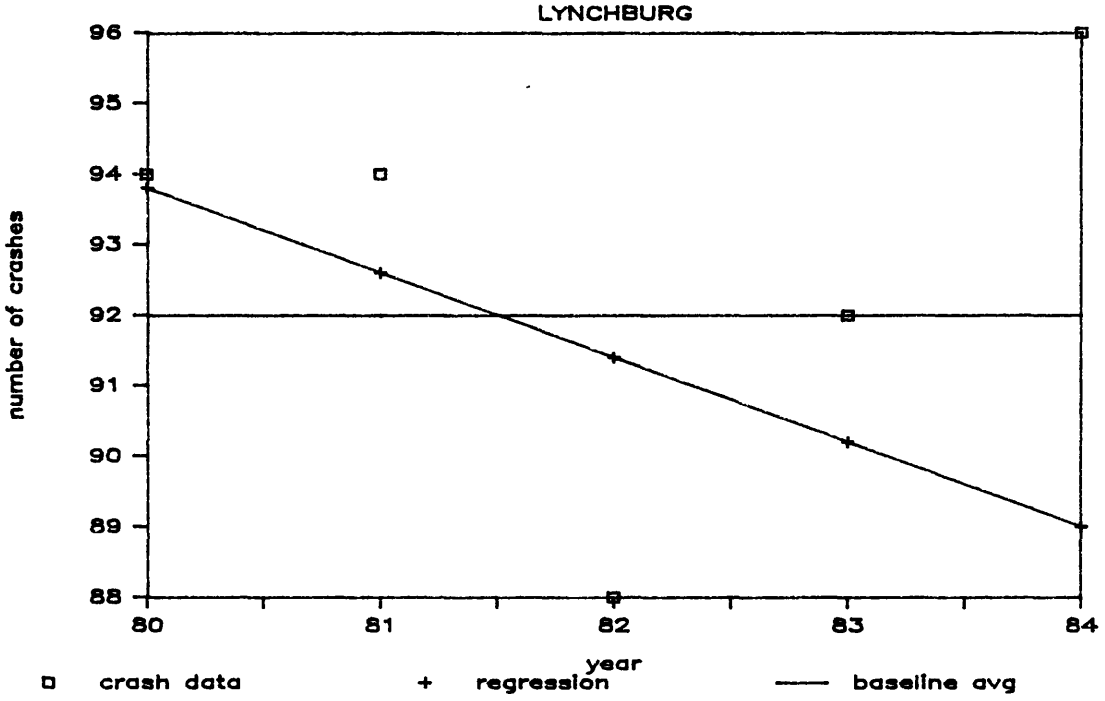
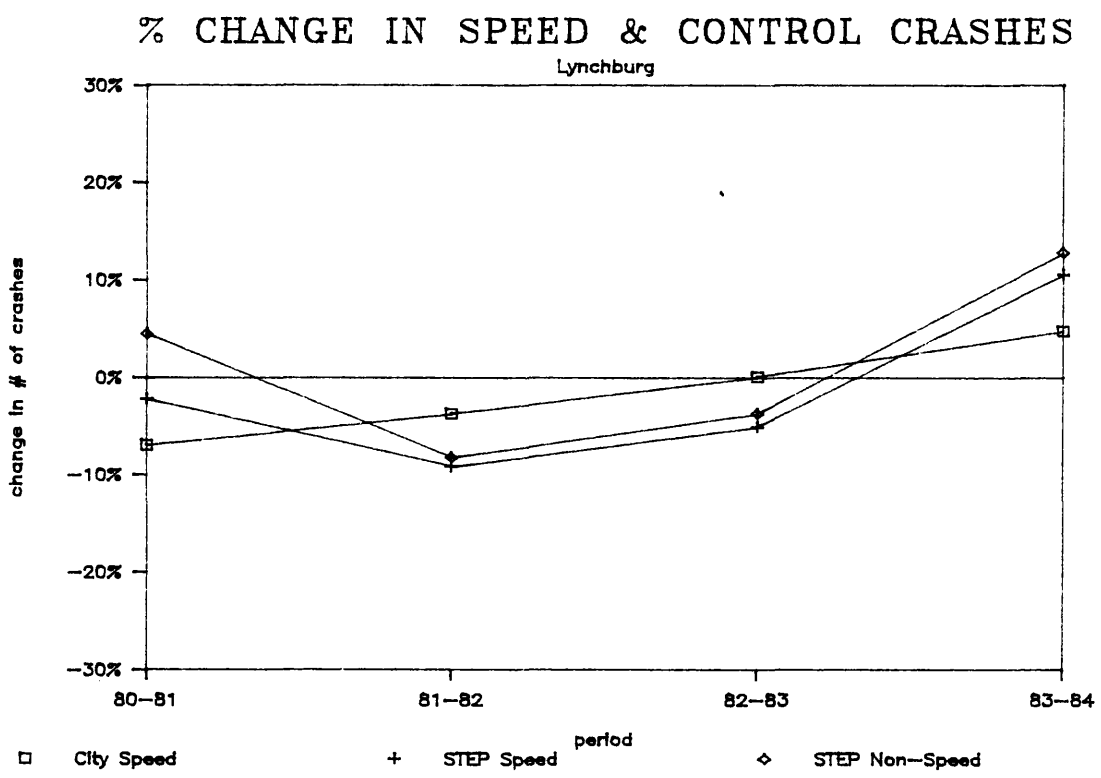


EXHIBIT 11


% CHANGE IN SPEED & CONTROL CRASHES
Lynchburg
30%
20%
10%
0%
-10%
-20%
-30%
change in # of crashes
80-81
81-82
82-83
83-84
period
City Speed
STEP Speed
STEP Non-Speed

City of Petersburg

Problem Statement

The 1984 Petersburg STEP provided a unique opportunity for an effectiveness evaluation for several reasons. The city had a high priority speed-crash problem. The local police department expended time and money to identify streets where the crash problem was concentrated. The department had conducted federally funded STEPs since 1982, with relatively level funding throughout. The amounts of the grants, approximately $0.80 per registered vehicle, were large enough to expect positive results. In theory, each of these features -- STEP activity over several years, adequate funding, identification of the local speed-crash problem, and a project designed to alleviate the specific problem -- should have improved the chances that the Petersburg STEP would reduce the number of local speed-crashes. In addition, the local police department maintained crash data on the streets where and the times when selective enforcement activity took place, as well as having data for the baseline period and for streets with no STEP activity.

The evaluation of the 1984 Petersburg STEP, which was named the Selective Police Accident Remedies project (or SPAR), was more detailed than evaluations of other projects because of the features described above. The local problem was examined and the results evaluated by separately considering state maintained data and local data. Note, however, that both sets of data were imperfectly suited to the analyses used here. The four-year baseline used for other projects and based on statewide data was not sufficient to establish a reliable baseline for the Petersburg SPAR, since SPAR activity occurred in three of the four years between 1980 and 1983. Hence, under the state maintained data there was no "before" period for comparison. To compensate for this, the baseline for the locally maintained data was extended to include 1979 data. Locally maintained data, on the other hand, suffered in not identifying speed involvement in crashes.

In the statewide crash data, three trends were identifiable over the baseline period. First, the total number of crashes in the city declined (See Table 10 and Exhibit 12). Second, the number of serious crashes generally rose throughout the the period. Third, the number of speed-crashes fell each year. The regression analysis presented in Exhibit 13 displays this decreasing trend in speed-crashes, with the data points lying close to the regression line. Although the descriptive power of this analysis is good, its predictive power is flawed by employing two years of data in which SPAR projects were in place. The regression analysis also identified a slight increasing trend in serious speed-crashes. However, the dispersion of data and small base number of

these crashes reduces confidence in both the descriptive and predictive value of this analysis.

No conclusion could be drawn about the speed-crash problem from changes in the speed involvement percentages, as these percentages fluctuated without a pattern. The crash severity percentages showed that crashes in the city were becoming more serious over the baseline years. In 1980, 33.7% of all crashes in the city were serious; by 1983, 41.0% of all crashes were serious. It appears that the local speed-crash problem was neither abating nor worsening, but that the crash severity problem was becoming worse.

The percentage change computations in Table 11 and Exhibit 14 yielded additional information about the decreasing trend in speed-crashes. The percentage change in speed-crashes for Petersburg was very close to that for the urban average over 1980-1981 and 1981-1982. The percentage change for urban data continued to rise in 1982-1983, but declined sharply for Petersburg during the second year of the SPAR. Between 1981 and 1982, the number of speed-crashes in Petersburg fell 1.0%; between 1982 and 1983, they dropped 15.9%. Exhibit 14 also shows that the number of non-speed-crashes in Petersburg appeared to change in an inverse relationship to the number of speed-crashes.

Statewide data also revealed that Petersburg experienced an aggravated speed-crash problem over the baseline years. Petersburg fell within the high priority group in the comparative ranking of speed-crash problems of localities. It was 11th of 43 independent cities in the number of speed-crashes, and 4th in each of the remaining three criteria: speed-crashes per registered vehicle, percentage of crashes that were speed-related, and the percentage of speed-crashes that were serious. The two percentage indicators -- speed involvement and crash severity -- confirmed the magnitude of the local problem. Over the baseline years, 19.2% of all crashes in Petersburg were speed-related and 44.6% of speed-crashes were serious. In comparison, the urban averages were 15.4% and 41.8%.

Local data indicated that the city's overall crash problem was site-specific and abating. These data, which were furnished by the Petersburg Police Department, were compiled for 1979 to 1984, thereby providing data for three years before SPAR activity and three years during SPAR activity. For the purposes of this report, this data had limited usefulness since it did not identify speed involvement in crashes. The local data, summarized in Table 12, demonstrated that crashes in Petersburg were concentrated on four streets: Sycamore Street, Washington Street, Wythe Street, and Crater Road. Between 1979 and 1983, crashes on these streets accounted annually for 34% to 37% of all crashes in the city, and 34% to 49% of serious crashes. In 1982 and

1983, the SPAR focused activity on these four streets. Total crashes fell significantly between 1979 and 1983: from 1,973 in 1979 to 1,394 in 1983, a 29.3% decrease. Unfortunately, serious crashes did not decrease during the same time period.

The local crash data for the four targeted streets and for all other city streets (referred to here as "non-targeted streets") showed that changes in the number of property damage crashes on the targeted streets corresponded closely with changes in the number of such crashes on non-targeted streets (See Exhibit 15). Property damage crashes declined between 1980-1983 both on the targeted streets and on the non-targeted streets. In contrast, the number of serious crashes on the two different sets of streets demonstrated an inverse relationship. The two seemed to be converging in their respective shares of total city crashes between 1979-1981; in 1981 targeted streets accounted for 49% and the non-targeted 51%. In 1982, however, they diverged when the number of serious crashes on targeted streets remained about the same as the prior year and the number on the non-targeted streets rose 8.0% (See Table 12 and Exhibit 15). This inverse relationship continued into 1983, when serious crashes fell 6.0% on the targeted streets and rose 18.4% on the non-targeted streets.

This relationship may have been the result of a "shifting" of crashes from one set of streets to the other. For example, there were 35 fewer crashes on all city streets in 1981 than in 1979, but there were 73 fewer crashes on the non-targeted streets considered alone. Crashes on the targeted streets increased by 38 crashes, for a net reduction of 35 (reduction of 73 less increase of 38 equals net citywide reduction of 35). In effect, 38 crashes shifted from the non-targeted streets to the targeted streets. Similarly, between 1981 and 1983, 11 crashes shifted back from the targeted streets to the non-targeted streets. In addition, all of the citywide increases in the number of serious crashes occurred on the non-targeted streets in these years. Note that the second shift described above coincided with the initiation of SPAR activity on the targeted streets.

There was evidence that Petersburg's 1982 and 1983 SPARs improved traffic safety on the targeted roads. Between 1979 and 1983, total crashes on the targeted streets fell 33.1%, compared to 28.0% on other city roads. In the years of SPAR activity, serious crashes increased on the city roads not targeted, but fell on the targeted streets. Although the local data do indicate improvements in the overall crash problem, they do not provide evidence relating to the local speed-crash problem the projects were designed to address. State data provided some evidence to fill this gap; it reveal a divergence between the changes in the number of speed-crashes in Petersburg from changes in the urban average numbers.

Although this combination of state and local data indicated the STEPs in the prior two years had produced some crash reduction, it is not conclusive. An evaluation report on the 1982 project (11) concluded that the project exceeded its activity goals, but failed to meet crash reduction goals. A report on the 1983 project found that crash reduction goals were exceeded, but it could not definitively link the reductions to the project.

Summary of Speed-Crash Problem

1.	OVERALL TRENDS IN NUMBER OF CRASHES	generally decreasing
2.	PERCENTAGE INDICATORS --	
	Speed Involvement	no conclusion
	Crash Severity	increasing
3.	REGRESSION ANALYSIS --	
	Speed-Crashes	decreasing
	Serious Speed-Crashes	increasing
4.	RANK ORDERING PROCESS --	
	Number of Speed-Crashes	high priority
	Percentage Indicators	high priority

Proposed Activities and Project Goals

The Petersburg project was originally designed to run for two years. In its grant application for a third year of SPAR operation, the Petersburg Police Department requested $41,584 to provide salaries to two full time traffic officers. The department also proposed to pay the salaries of two other full time officers, and 20% of a lieutenant's salary to oversee the project. The city received $20,000, which is approximately the amount for one full time officer and 20% of a lieutenant's time.

The Department proposed to continue the existing SPAR project. The project was designed as a comprehensive effort, combining selective enforcement, public education, and recommendations for engineering changes. In prior years, the SPAR included both selective speed and alcohol enforcement efforts. As stated in the grant application, the goal of the 1984 SPAR was to maintain the reduced number of crashes on the four target streets that had been achieved through the prior two projects.

Project Results

SPAR results were evaluated using state and local data separately. In the statewide data, fewer crashes in four categories were reported in 1984 than in the prior year. There were 31 fewer speed-crashes reported in Petersburg in 1984 than in 1983, for a 17.8% reduction (See Table 11). Total crashes fell 5.1%, serious speed-crashes 1.0%, and non-speed-crashes 2.3%. The number of crashes in the two remaining categories increased only minimally, with an 0.8% increase in serious crashes in 1984 and an 1.3% increase in serious non-speed-crashes. The percentage increases for these two categories were significantly less than same percentages for the urban average.

The number of speed-crashes reported in 1984 fell significantly below the number projected by the regression analysis (See Exhibit 13). This was interpreted as a sign of effectiveness because the predictive power of the regression line seemed high given the close fit of the regression line and the crash data over the baseline. More serious speed-crashes were reported than would have been predicted by the regression analysis, but this was discounted somewhat because of the dispersion of data points about the regression line in the baseline.

Exhibit 14 presents a graph of the percentage change in speed-crashes for Petersburg, in the urban average number of speed-crashes, and in the local number of non-speed-crashes. The 17.8% reduction in the number of speed-crashes in Petersburg was much more favorable than the 2.3% decrease in the number of non-speed-crashes in the city or the 4.8% increase in the urban average number. The large percentage reduction in speed-crashes followed a 15.9% decrease recorded for 1982-1983, while the percentage change for both controls was higher in 1983-1984 than in 1982-1983. The number of speed-crashes in the urban average rose from a 0.1% increase between 1982-1983 to a 4.8% increase between 1983-1984. The number of local non-speed-crashes declined 2.3%, but this decline was less than the 3.5% reduction in the prior year. Thus, there appeared to be a favorable change in the number of speed-crashes compared to the two controls.

In addition, the comparative ranking of the crash reductions in Petersburg against reductions in 42 other independent Virginia cities was favorable for the SPAR. The city ranked first among the STEP cities in percentage reduction for five crash categories -- including speed-crashes -- and ranked in the top 10 percent among all Virginia cities in the percentage reduction in these five categories (See Appendix E).

Based on the local data, the SPAR also exceeded its stated 1984 goal of maintaining the reduced number of crashes on the four targeted streets. There were 438 total crashes reported on these streets in

1984, 68 fewer than in 1983, for a reduction of 13.4% (See Table 12). Total crashes fell on the other city roads by 19.3%.

It remains troubling, however, that serious crashes increased on the target streets by 11.4% in 1984. This contrasted sharply with the 17.3% decrease on the other city roads. Thus the inverse relationship in changes in the number of serious crashes on the two sets of roads continued into 1984 (See Exhibit 15). The contrast was even greater when comparing changes in the number of property damage crashes on the two sets of roads, where the number of crashes of each type fell over 15% in 1984. The third year of SPAR activity, 1984, also marked the first year in which the number of serious crashes increased on the targeted streets since the SPAR began, suggesting that local drivers had become acclimated to the heightened level of speed law enforcement on these roads.

The continued rise in the crash severity percentage and the greater percentage of crashes occurring on the targeted roads was also disconcerting. Although the number of property damage crashes fell each year since SPAR was initiated, the number of serious crashes seemed resistant to enforcement efforts. Too much emphasis should not be placed on this, however, because the relatively constant number of serious crashes in Petersburg compared very well to the continually increasing number in the urban average. The percentage share of city crashes occurring on the target streets, which the SPAR designers hoped to reduce, rose in 1984 despite reductions in totals. This resulted from relatively greater reductions on other city roads than on the targeted streets.

Conclusions

According to the objective criteria employed in this report, and using state maintained crash data, the 1984 SPAR addressed the speed-crash problem in Petersburg. The project exceeded its stated goals, reported crashes were fewer than projected, and changes in the city's crashes compared favorably against controls and against other Virginia cities. Unfortunately, however, it was not possible to determine whether or not there was a decline in the number of speed-crashes on the roads targeted for SPAR activity, because the state maintained data was not available by street and the locally maintained data did not include speed involvement information. Thus, it was not possible to state that the SPAR had reduced the speed-crash problem on the targeted roads.

Additionally, close analysis of both state and local data provided a more in-depth picture of the effectiveness of the SPAR project. First, serious crashes on the targeted streets -- crashes which impose

the greatest societal cost -- seemed more resistant to the SPAR than property damage crashes. Second, a certain amount of crash "shifting" may have resulted from the SPAR. There was an inverse relationship between gains and losses in serious crashes on the streets with selective enforcement and those without, indicating that what one gained the other may have lost. Third, the effectiveness of the SPAR may have been conditioned by its duration. Taking local and state data together, there is evidence which indicates that more than one year of selective enforcement activity was necessary to produce salutary results, and that these results may have been short-lived as drivers adjusted their behavior to the new patterns of enforcement.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	YES
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	YES
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	YES
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	YES

TABLE 10

BASELINE CRASH DATA: PETERSBURG

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	378	375	385	395	398	383
Fatal	5	7	6	6	4	6
Injury	373	368	379	389	394	377
TOTAL	1,122	1,105	1,025	963	914	1,054
SPEED-CRASHES						
SERIOUS	94	84	87	96	95	90
Fatal	2	4	3	3	2	3
Injury	92	80	84	93	93	87
TOTAL	219	209	207	174	143	202
NON-SPEED-CRASHES						
SERIOUS	284	291	298	299	303	293
Fatal	3	3	3	3	2	3
Injury	281	288	295	296	301	290
TOTAL	903	896	818	789	771	852
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	19.5	18.9	20.2	18.1	15.6	19.2
Serious Crashes	24.9	22.4	22.6	24.3	23.9	23.5
CRASH SEVERITY PERCENTAGES						
All Crashes	33.7	33.9	37.6	41.0	43.5	36.4
Speed-Related	42.9	40.2	42.0	55.2	66.4	44.6

TABLE 11

CHANGES IN CRASH DATA: PETERSBURG

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	-17	-80	-62	-49	-140
Percentage Change	-1.5	-7.2	-6.0	-5.1	-13.3
SERIOUS CRASHES					
Numeric Change	-3	10	10	3	15
Percentage Change	-0.8	2.7	2.6	0.8	3.8
ALL SPEED-CRASHES					
Numeric Change	-10	-2	-33	-31	-59
Percentage Change	-4.6	-1.0	-15.9	-17.8	-29.3
SERIOUS SPEED-CRASHES					
Numeric Change	-10	3	9	-1	5
Percentage Change	-10.6	3.6	10.3	-1.0	5.3
ALL NON-SPEED-CRASHES					
Numeric Change	-7	-78	-29	-18	-81
Percentage Change	-0.8	-8.7	-3.5	-2.3	-9.5
SERIOUS NON-SPEED-CRASHES					
Numeric Change	7	7	1	4	10
Percentage Change	2.5	2.4	0.3	1.3	3.4

NOTE: Negative numbers reflect a reduction in the number of crashes.

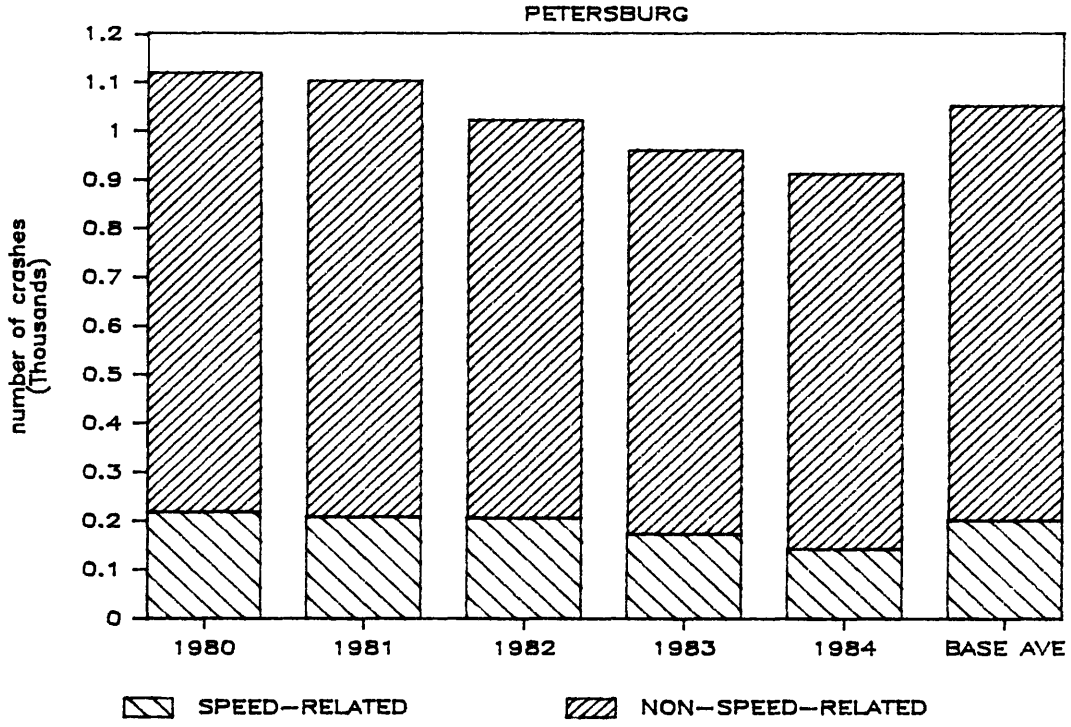
TABLE 12

CITYWIDE CRASHES AND CRASHES ON TARGETED STREETS IN PETERSBURG

BASELINE DATA	1979	1980	1981	1982	1983	1984
TARGETED STREETS						
SERIOUS	131	159	169	168	158	176
Fatal	0	1	4	2	1	1
Injury	131	158	165	166	157	175
TOTAL	740	616	620	618	506	438
NON-TARGETED STREETS						
SERIOUS	249	202	176	190	225	186
Fatal	1	5	3	4	6	4
Injury	248	197	173	186	219	182
TOTAL	1,233	1,202	1,184	1,044	888	687
CITYWIDE TOTAL						
SERIOUS	380	361	345	358	383	362
Fatal	1	6	7	6	7	5
Injury	379	355	338	352	376	357
TOTAL	1,973	1,818	1,804	1,662	1,394	1,125
PERCENTAGE OF CITYWIDE CRASHES ON TARGETED STREETS						
Serious Crashes	34.5	44.0	49.0	46.9	41.3	48.6
Total Crashes	37.5	33.9	34.4	37.2	36.3	38.9
CRASH SEVERITY PERCENTAGES						
Targeted Street	17.7	25.8	27.3	27.2	31.2	40.2
Non-Targeted Streets	20.2	16.8	14.9	18.2	25.3	27.1
Citywide	19.3	19.9	19.1	21.5	27.5	32.2
PERCENT CHANGE IN NUMBER OF CRASHES						
TOTAL CRASHES						
Targeted Street	NA	-16.8	0.6	-0.3	-18.1	-13.4
Non-Targeted Streets	NA	-2.5	-1.5	-11.8	-14.9	-22.6
Citywide	NA	-7.9	-0.8	-7.9	-16.1	-19.3
SERIOUS CRASHES						
Targeted Street	NA	21.4	6.3	-0.6	-6.0	11.4
Non-Targeted Streets	NA	-18.9	-12.9	8.0	18.4	-17.3
Citywide	NA	-5.0	-4.4	3.8	7.0	-5.5

EXHIBIT 12

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

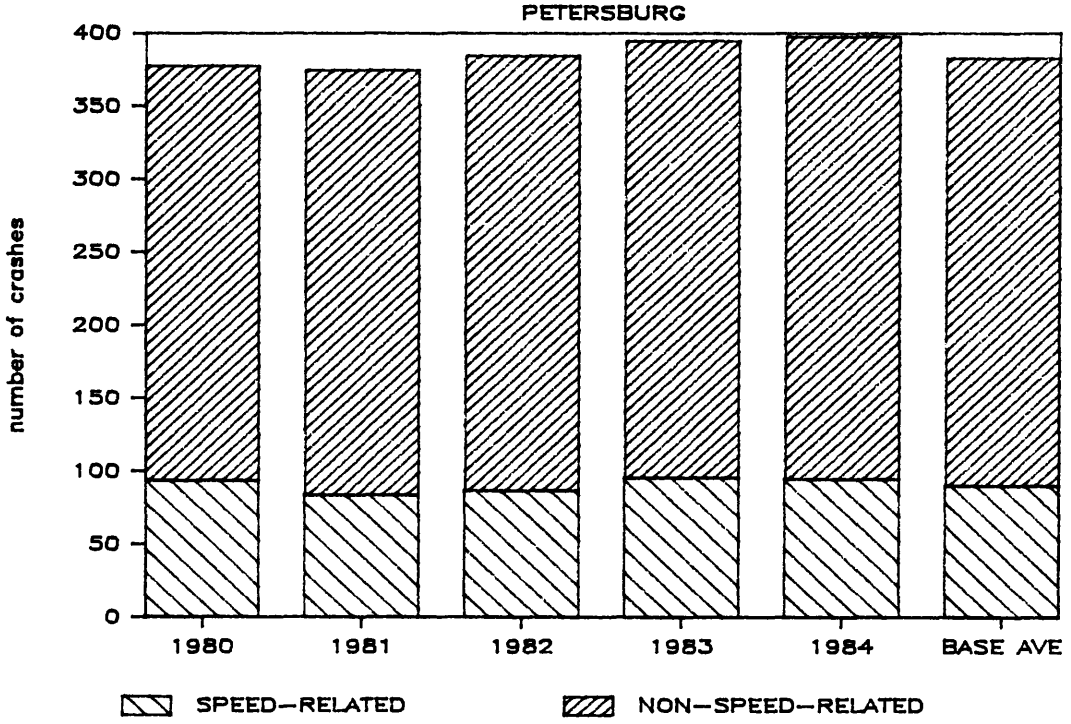
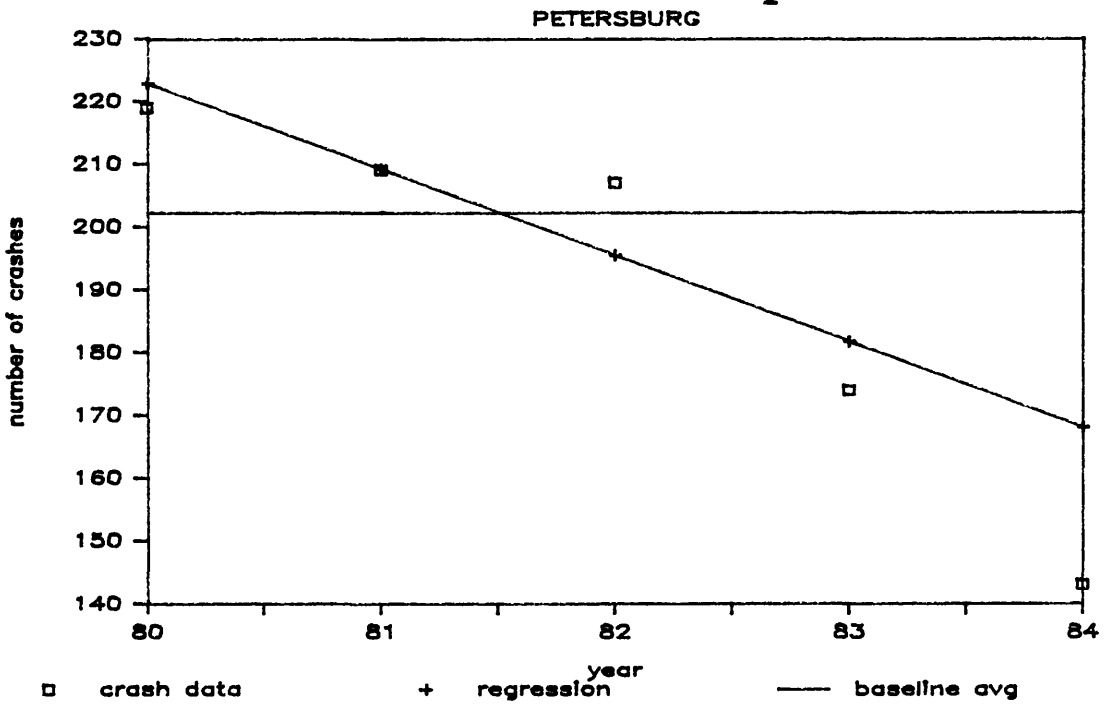


EXHIBIT 13

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

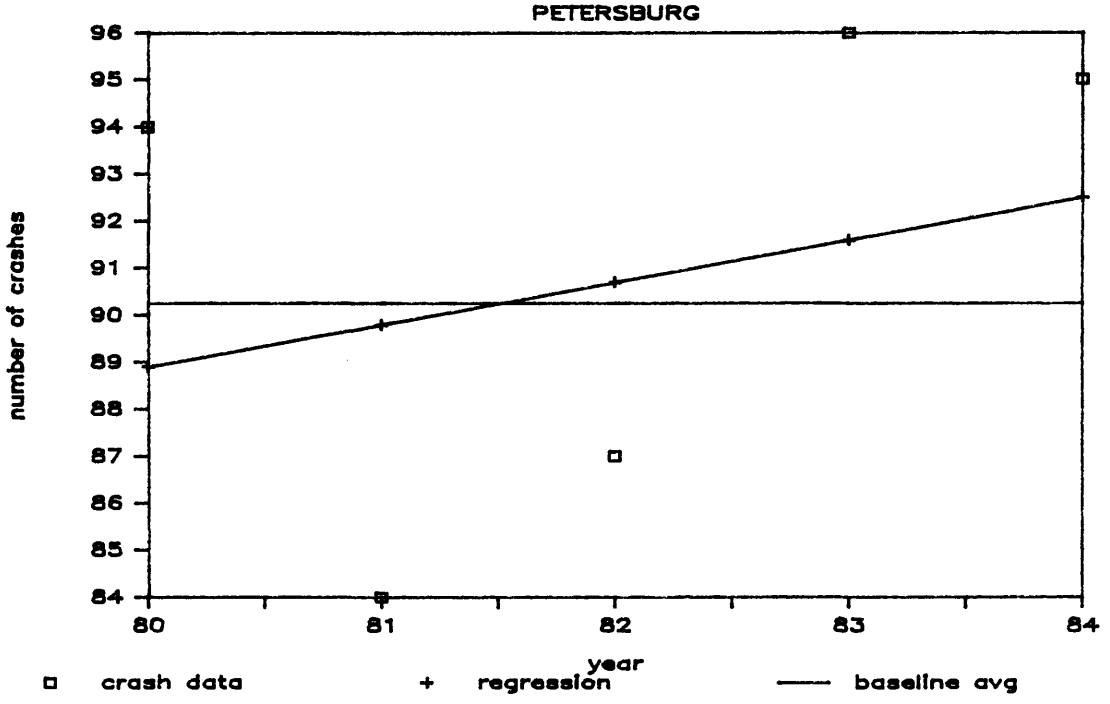


EXHIBIT 14

% CHANGE IN SPEED & CONTROL CRASHES

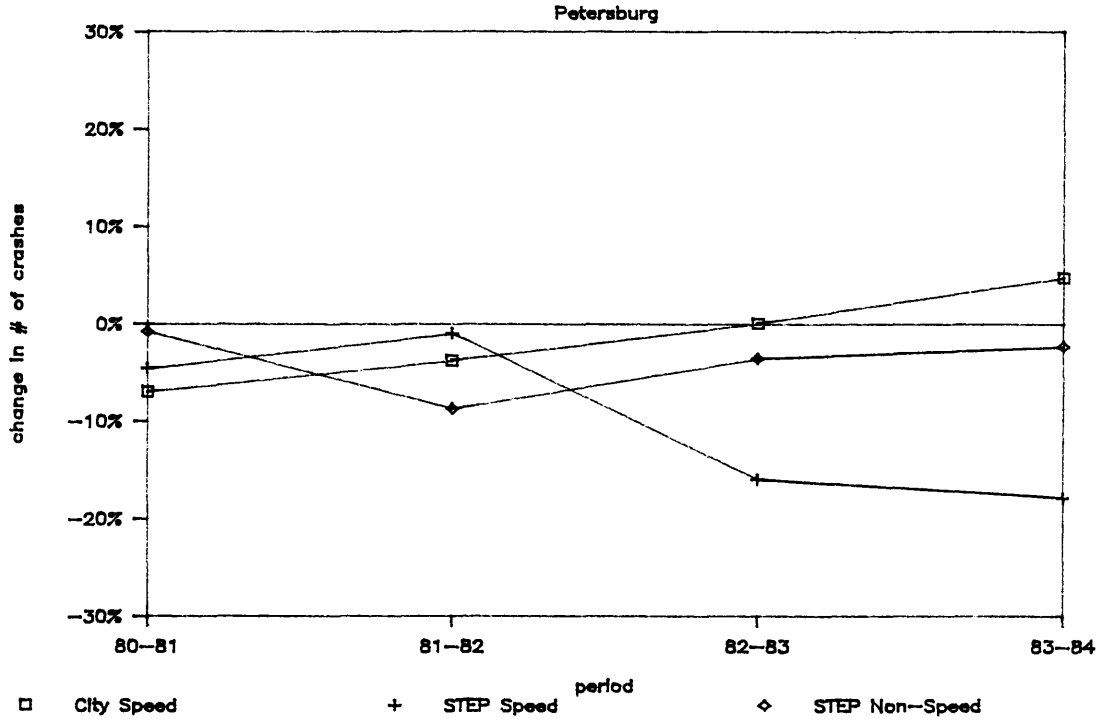
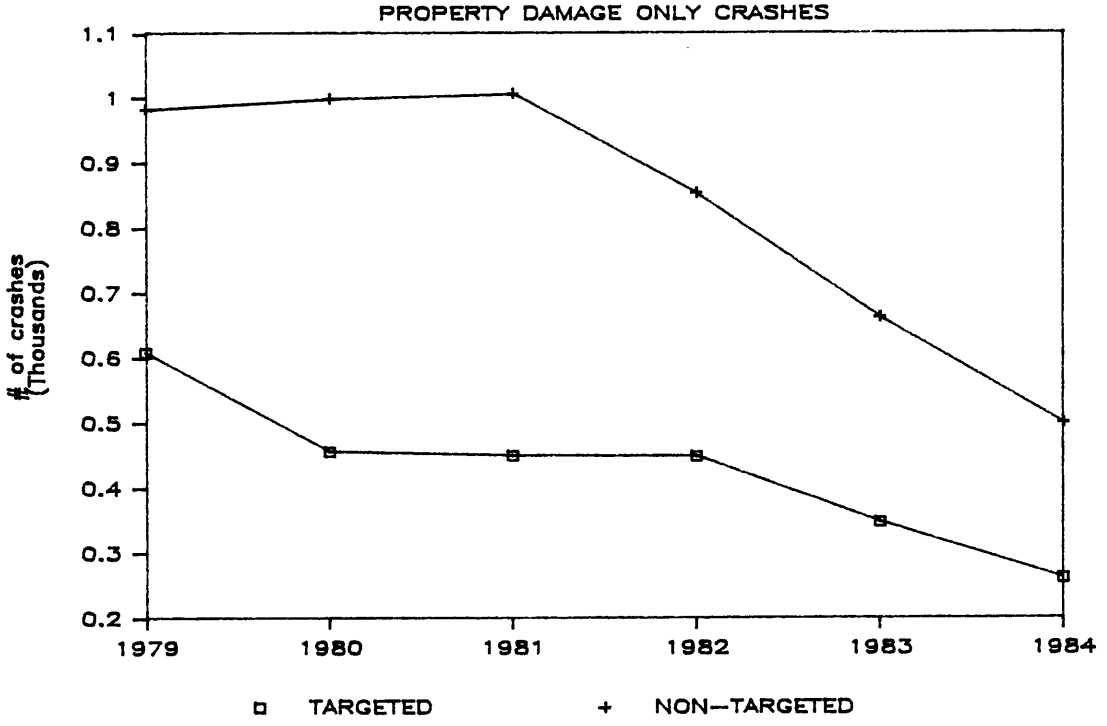


EXHIBIT 15

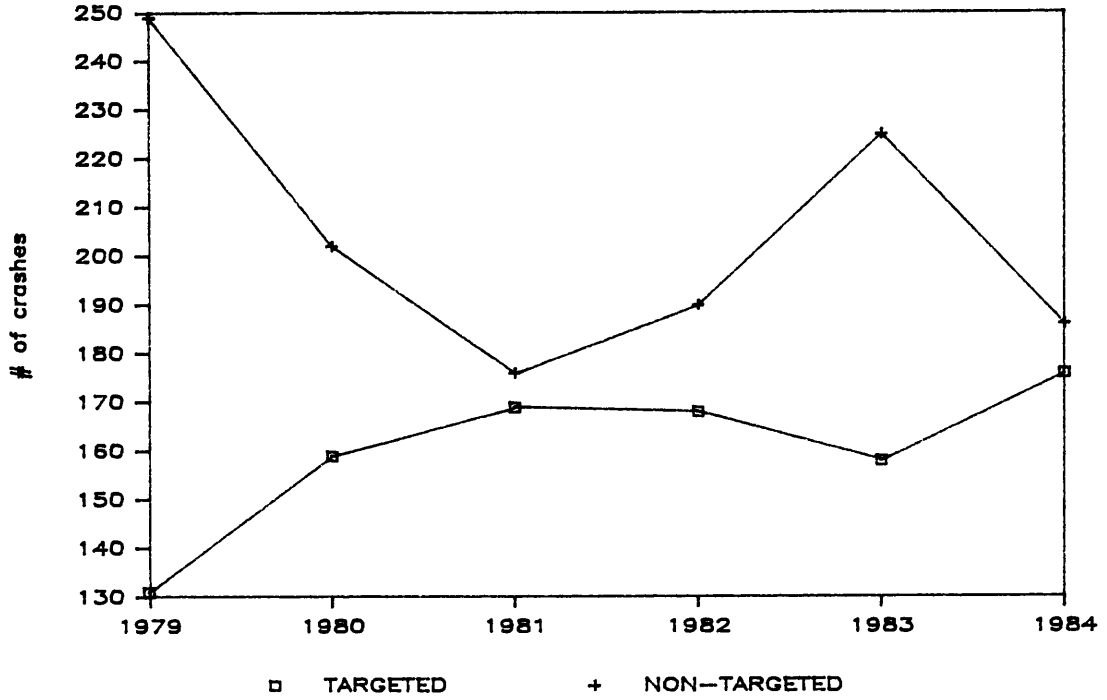
CRASHES ON STEP & NON-STEP STREETS

PROPERTY DAMAGE ONLY CRASHES



CRASHES ON STEP & NON-STEP STREETS

SERIOUS CRASHES



City of Portsmouth

Problem Statement

The Portsmouth Police Department identified two types of roads contributing disproportionately to the local speed-crash problem. First, major traffic arteries into the city accounted for about 40% of the city's crashes in 1982 according to local data. Local data also indicated that 46.5% of the crashes on these roads were speed-related. Second, the high number of school zones in the city -- over 30 according to the police department -- generated highway safety problems.

Unfortunately, the data employed in this report were not street-specific so that it was not possible to analyze the number of crashes in school zones or on the highways into the city. Therefore, citywide data were used to describe the local speed-crash problem and to evaluate project results. The use of citywide data was justified if the above noted percentage of crashes occurring on the major highways were accurate. If the major highways accounted for 40% of all city crashes and 46% of these crashes were speed-related, then there should have been approximately 338 speed-crashes in 1982 (338 equals 2,107 speed-crashes from Table 13 times 40% times 46.5%). The estimated 338 speed-crashes on the major highways was greater than the 299 speed-crashes actually reported for the entire city in the same year (See Table 13). Thus, it was apparent that the problem streets accounted for a major portion of citywide speed-crashes, in the figures provided by the Portsmouth Police Department.

Over the baseline years there was no clear trend in total, serious, or non-speed-crashes. The number of total crashes and non-speed-crashes rose in 1981 and 1982, but fell in 1983 (See Tables 13 and 14, and Exhibit 16). Serious crashes and serious non-speed crashes showed no change in 1981, rose in 1982, and fell in 1983. A declining trend was apparent in both speed-crash categories, however. The number of speed-crashes dropped in 1982 while the number of all other types of crashes increased. Also, the two speed-crash categories led the six categories in percentage reduction for 1983. The regression analysis presented in Exhibit 17 confirmed this declining trend in speed-crashes. However, the data points in these analyses did not lie close to the regression line, so both the descriptive and predictive functions of the regression analysis were questionable. The speed involvement percentages in Table 13 followed the changes in the number of speed-crashes, reaching a high in 1981 of 15.0%, and falling each succeeding year to a low of 12.5% in 1983. No conclusion could be drawn from the changes in crash severity percentages over the same period.

Exhibit 18 presents a graph of the percentage change in the number of local speed-crashes, the number of local non-speed-crashes, and the number of speed-crashes in the urban average. The graph shows that while the percentage change in speed-crashes for the urban average was steadily rising over the baseline years, the percentage change for Portsmouth was falling, reflecting the decline in the number of Portsmouth's speed-crashes. Between 1980 and 1981, speed-crashes in the urban average decreased 7.0%; between 1982 and 1983, these crashes increased 0.1%. The Portsmouth reduction percentages fell from a 16.1% increase between 1980 and 1981 to a 17.7% decrease between 1982 and 1983. Thus, the two groups of data appeared to be changing in opposite directions over the baseline. Changes in the number of local non-speed-crashes loosely followed those in speed-crashes over the baseline. Neither the data for speed-crashes in the urban average nor the data for non-speed-crashes in Portsmouth appeared to be a good control group for the city's speed-crash data.

Portsmouth ranked as a medium priority community among Virginia cities both in the number of local speed-crashes and in the speed involvement percentages (See Appendix F). Note that although the speed involvement percentages were less for Portsmouth than for the urban average (13.8% of Portsmouth crashes were speed-related, compared to 15.4% of urban average crashes), crash severity indicators for the city were much higher than the urban average. Portsmouth's baseline average crash severity percentage of 40.2% was the highest such average percentage for a Virginia city.

Summary of Speed-Crash Problem

1.	OVERALL TRENDS IN NUMBER OF CRASHES	none
2.	PERCENTAGE INDICATORS --	
	Speed Involvement	decreasing
	Crash Severity	no conclusion
3.	REGRESSION ANALYSIS --	
	Speed-Crashes	decreasing
	Serious Speed-Crashes	decreasing
4.	RANK ORDERING PROCESS --	
	Number of Speed-Crashes	medium priority
	Percentage Indicators	medium priority

Proposed Activities and Project Goals

The Portsmouth Police Department applied for and received $22,620 to pay two officers 24 hours of overtime per week for a year and to purchase two new radar units. The primary duty of the officers working the project was to enforce moving traffic violations, including speeding. In addition to intensified enforcement, the department planned to continue talks on traffic safety and driving under the influence of alcohol.

The goal of the 1984 project stated in the grant application was to reduce by 10% the number of accidents occurring in high accident locations.

Project Results

Since street-specific crash data was not available, it was not possible to assess the performance of the 1984 Portsmouth STEP against its stated goal. However, the number of crashes in all six categories increased 10% or more in 1984, making it unlikely that project goals were achieved. Had the project completely met its crash reduction goal on the targeted streets and had crashes on other city roads not changed in number, a 4% citywide reduction in the number of total crashes would have resulted. In fact, the total number of crashes in 1984 was 11.1% higher than in 1983 and 7.5% higher than the baseline average number.

More importantly, the number of speed-crashes rose for the first time in three years, increasing by 46 such crashes or 18.7% over the 1983 number. Although the magnitude of the 18.7% increase may have been exaggerated by an unusually low number of speed-crashes in 1983, the number of speed-crashes in 1984 was the highest over the five-year period examined here. The number of speed-crashes reported in 1984 were significantly higher than projected under the regression analysis, for both speed-related crash categories (See Exhibit 17).

In addition, the change in the number of Portsmouth's speed-crashes compared unfavorably to the changes in the two control groups. The urban average number of speed-crashes in 1984 was 4.8% higher than the number reported in 1983, and 1.0% above the baseline average. The number of speed-crashes in Portsmouth were 18.7% higher in 1984 than 1983, and 4.1% higher than the baseline average number. Like the number of speed-crashes, the number of non-speed-crashes moved from decreases between 1982-1983 to increases between 1983-1984; the 1984 percentage increase for non-speed-crashes was smaller than the percentage increase for speed-crashes.

Finally, changes in the number of speed-crashes in the city were not better than changes in other Virginia cities. Portsmouth ranked below the urban average in its crash reduction percentages for all six crash categories in the comparative ranking of Virginia cities. Portsmouth placed among the lower third of Virginia cities in reduction percentages in the number of speed-crashes and serious speed-crashes (See Appendix G).

Conclusions

The 1984 Portsmouth STEP targeted certain highways and school zones for intensified enforcement of traffic laws. The crash data used here did not specify street locations of city crashes. Thus, it was not possible to determine whether the project achieved its goals. All indications from citywide data are that the project did not succeed in reducing the number of total crashes and speed-crashes on the targeted streets.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	unknown
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	NO
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	NO
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY SIGNIFICANTLY BETTER THAN FOR OTHER VA COMMUNITIES	NO

TABLE 13

BASELINE CRASH DATA: PORTSMOUTH

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	787	784	856	841	1,002	817
Fatal	10	5	6	10	2	8
Injury	777	779	850	831	1,000	809
TOTAL	1,985	2,066	2,107	1,965	2,184	2,031
SPEED-CRASHES						
SERIOUS	124	125	120	112	150	120
Fatal	4	0	1	1	1	2
Injury	120	125	119	111	149	119
TOTAL	267	310	299	246	292	281
NON-SPEED-CRASHES						
SERIOUS	663	659	736	729	852	697
Fatal	6	5	5	9	1	6
Injury	657	654	731	720	851	691
TOTAL	1,718	1,756	1,808	1,719	1,892	1,750
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	13.5	15.0	14.2	12.5	13.4	13.8
Serious Crashes	15.8	15.9	14.0	13.3	15.0	14.7
CRASH SEVERITY PERCENTAGES						
All Crashes	39.6	37.9	40.6	42.8	45.9	40.2
Speed-Related	46.4	40.3	40.1	45.5	51.4	42.9

TABLE 14

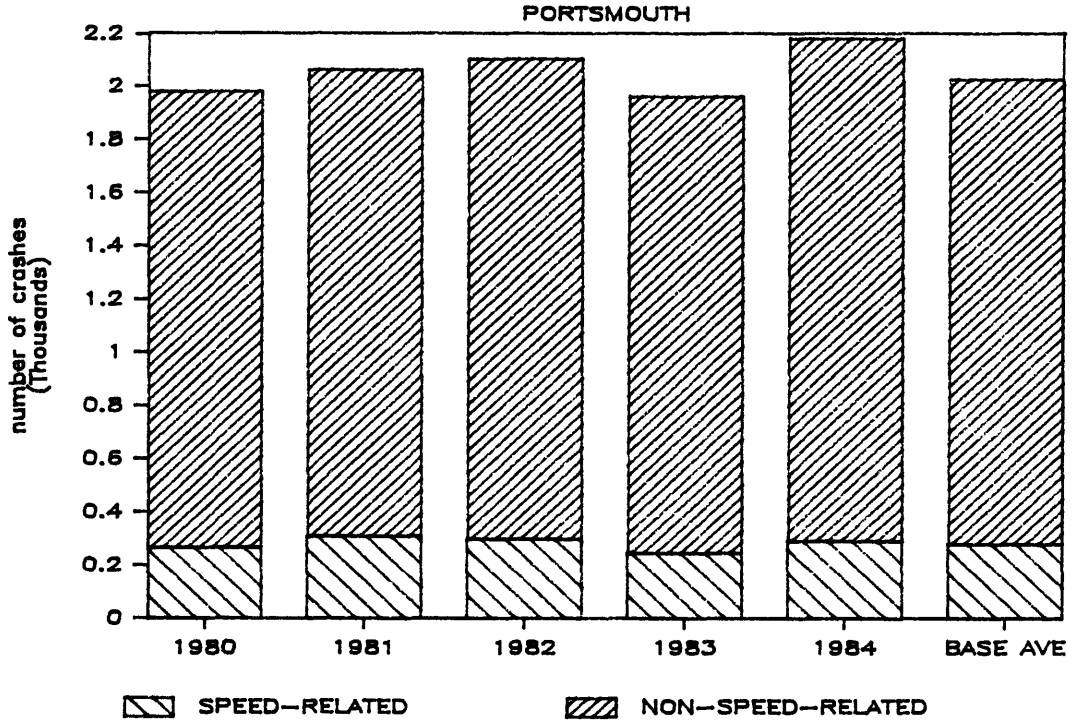
CHANGES IN CRASH DATA: PORTSMOUTH

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	81	41	-142	219	153
Percentage Change	4.1	2.0	-6.7	11.1	7.5
SERIOUS CRASHES					
Numeric Change	-3	72	-15	161	185
Percentage Change	-0.4	9.2	-1.8	19.1	22.6
ALL SPEED-CRASHES					
Numeric Change	43	-11	-53	46	12
Percentage Change	16.1	-3.5	-17.7	18.7	4.1
SERIOUS SPEED-CRASHES					
Numeric Change	1	-5	-8	38	30
Percentage Change	0.8	-4.0	-6.7	33.9	24.7
ALL NON-SPEED-CRASHES					
Numeric Change	38	52	-89	173	142
Percentage Change	2.2	3.0	-4.9	10.1	8.1
SERIOUS NON-SPEED-CRASHES					
Numeric Change	-4	77	-7	123	155
Percentage Change	-0.6	11.7	-1.0	16.9	22.3

NOTE: Negative numbers reflect a reduction in the number of crashes.

EXHIBIT 16

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

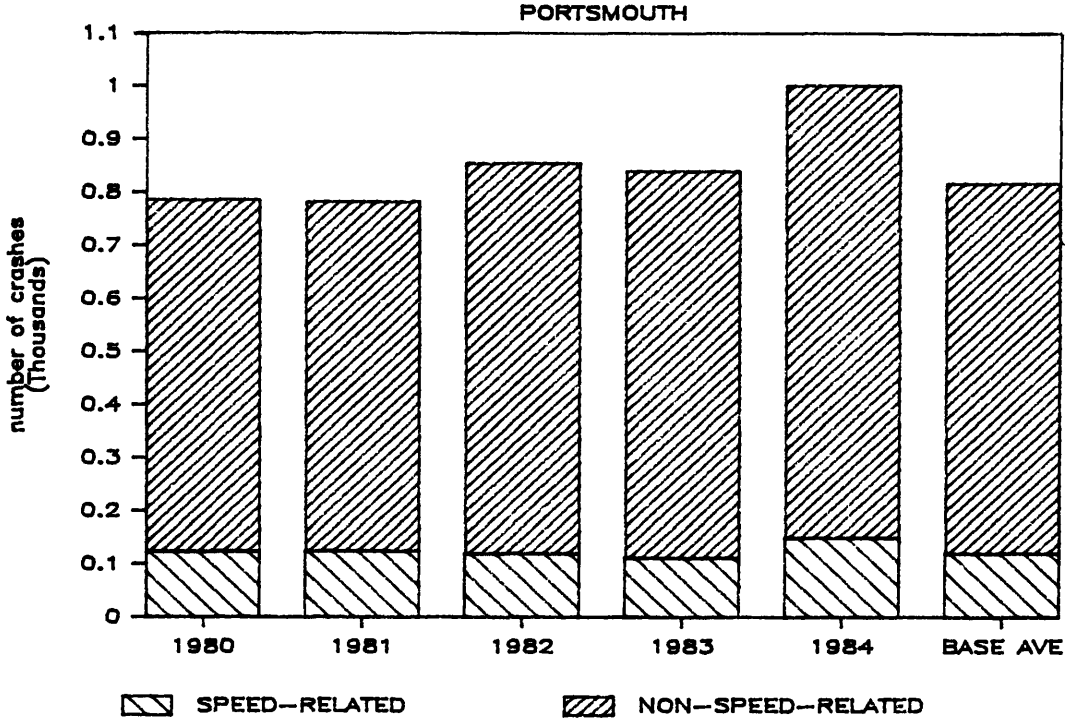
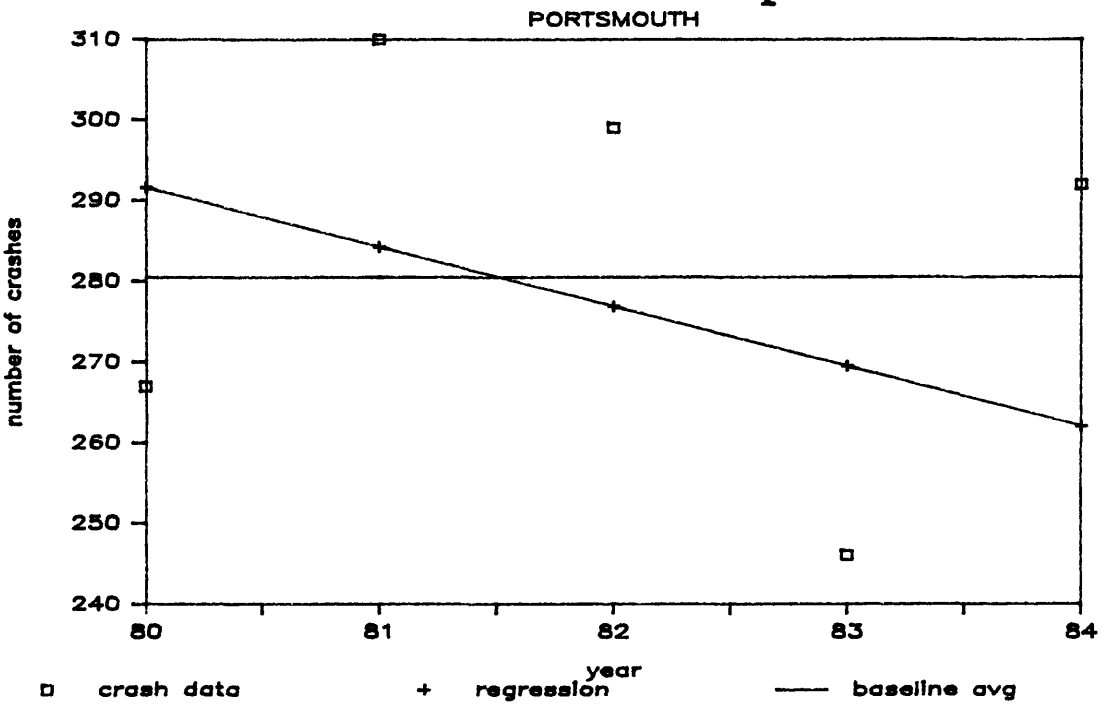


EXHIBIT 17

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

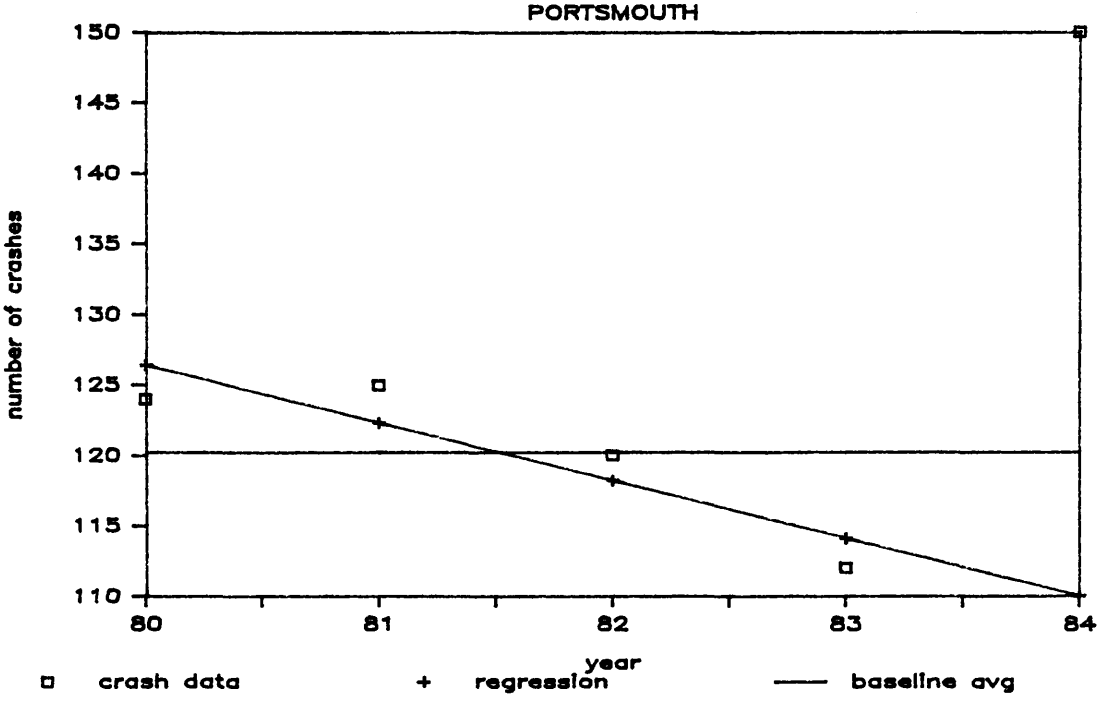
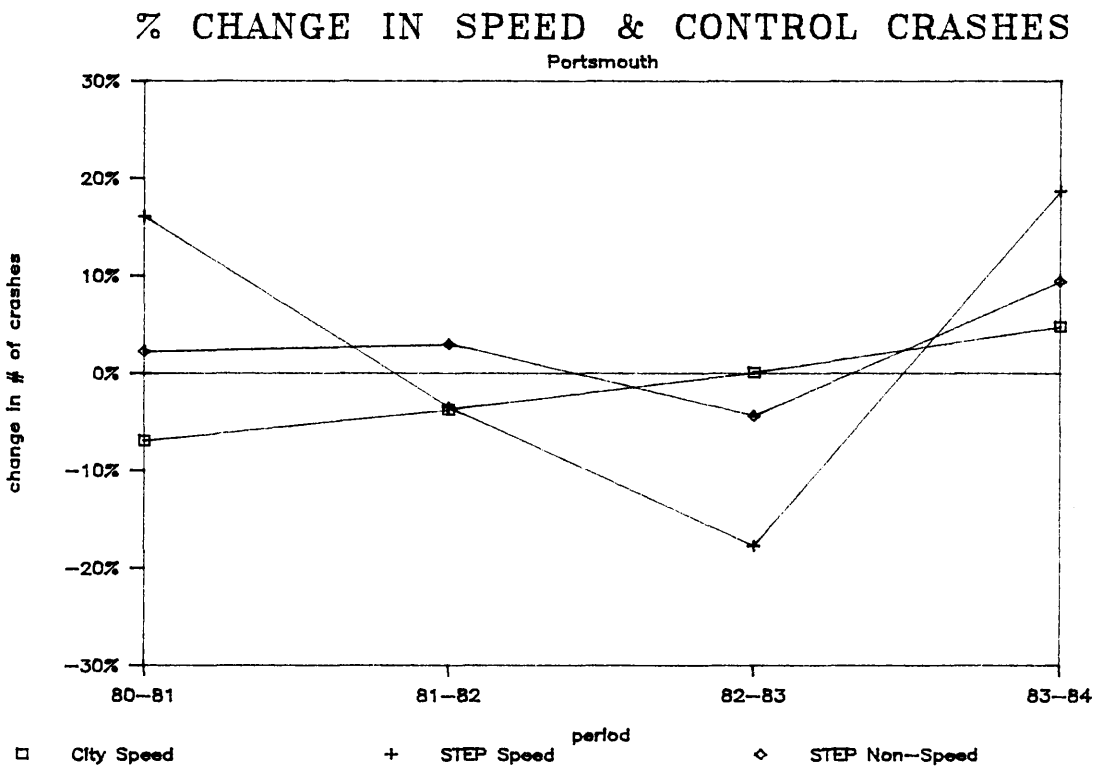


EXHIBIT 18


% CHANGE IN SPEED & CONTROL CRASHES
Portsmouth
30%
20%
10%
0%
-10%
-20%
-30%
change in # of crashes
80-81
81-82
82-83
83-84
period
City Speed
STEP Speed
STEP Non-Speed

City of Richmond

Problem Statement

Richmond led Virginia's independent cities with the highest number of crashes in each of the six categories measured in this report. According to data maintained by the Department of State Police, there were an average of 7,080 auto accidents reported in Richmond between 1980 and 1983, representing 13.5% of all crashes within Virginia cities and 6.1% of all crashes within the state. Of the 7,080 crashes, an average of 1,196 were speed-related; this represents 14.8% of speed-crashes in all Virginia cities and 5.6% of speed-crashes throughout the state.

In its grant application, the Richmond Bureau of Police described the local speed-crash problem as a higher than usual accident rate between the hours of 10:00 PM and 6:00 AM. According to information provided in the application, approximately 18% of all city crashes occurred between these hours. The application also emphasized that most of these accidents occurred on weekends and were a result of speeding violations and other hazardous moving violations. Moreover, the problem was aggravated by the city having no officers available for exclusive traffic patrol duties during these hours. Since the Bureau defined its speed-crash problem in terms of specific times of day, crash data by time of day were extracted from the state data source to confirm the problem and to examine project results.

There was no clearly defined trend in the overall number of crashes through the baseline period. The data in Table 15, Table 16, and Exhibit 19 show two years of decreases followed by one year of increase. Between 1980 and 1981, the number of total crashes, non-speed-crashes, and serious non-speed-crashes fell. Between 1981 and 1982, the number of crashes in all six categories fell. Between 1982 and 1983, however, the number of crashes in all six categories rose, with serious crashes leading in percentage increase. Hence, at the end of the baseline period, it was unclear whether the number of crashes overall were on the rise or on the decline.

The two percentage indicators in Table 15 suggest that the city's speed-crash problem was not growing worse, but its crash severity problem was. The speed-involvement percentages remained relatively stable over the baseline period, with an average of 16.9% of all crashes being speed-related. The crash severity percentages indicated an increasing proportion of serious crashes. In 1980, 34.5% of all crashes in the city were serious; by 1983, 40.0% of all crashes were serious. Note that the data in this report revealed a crash severity percentage one and one-half times greater than that stated in the grant application.

A regression analysis of the number of speed-crashes in Richmond showed an increasing trend over the baseline (See Exhibit 20). This contrasts with an observed decreasing trend in the number of these crashes in the urban average (See Appendix D). Generally, the number of speed-crashes changed at about the same rate as non-speed-crashes over the baseline period. Between 1980 and 1981, the number of speed-crashes in the city increased against a pattern of decreases in the overall number of city crashes. Changes in the number of speed-crashes over the next two years were about the same as changes in non-speed-crashes on a percentage basis (See Exhibit 21). Changes in the number of Richmond's speed-crashes also were loosely associated with changes in the urban average number of speed-crashes (the other control).

In the comparative ranking of Virginia cities, Richmond was rated as having the worst speed-crash problem in the number of speed-crashes in the city. Richmond had the highest number of speed-crashes of any Virginia city and the second-highest number of speed-crashes per registered vehicle. Hence, the city was within the high priority group (See Appendix F). The city fell in the medium priority group, however, when ranked by speed involvement percentages. It was 9th among 43 in the percentage of crashes that were speed-related and 24th in the percentage of speed-crashes that were serious. Although the placement of Richmond among the medium priority group is somewhat arbitrary, the speed-involvement percentages do show that the city speed-crash problem is one of large numbers and not of disproportionality.

Richmond crash data was divided into problem times of day identified by the Bureau (the "targeted hours") and other times of day (the "non-targeted hours") (See Table 17). Also presented in Table 17 are two sets of percentages computed from the crash data roughly corresponding to the percentages used above to evaluate STEPs. The first set is the percentage of crashes occurring during the targeted hours. These percentages, also presented in graphic form in Exhibit 22, declined between 1981 and 1983. In 1981, 18.7% of all crashes occurred during the targeted hour, while in 1983, 16.7% occurred during these hours. Over the baseline period, an average of 18.0% of all crashes and 20.3% of all serious crashes were reported in the targeted hours. It was not possible to determine the relation of these percentages to those in other communities; that is, whether the frequency of crashes during these hours was higher or lower than the frequency in other Virginia cities. Ultimately, such a determination was irrelevant since the local authorities perceived the incidence of crashes during these hours to be the problem that needed to be addressed.

The second set of percentages presented is the percentage change in the number of crashes during targeted and non-targeted hours. The

results of these computations are presented in Exhibit 23. These figures showed that between 1980 and 1982, the percentage change in the number of crashes during targeted hours was within five percentage points of the change in the number of crashes during non-targeted hours. Between 1982 and 1983, however, the percentage change for targeted hours and for non-targeted hours sharply diverged as the the number of crashes during non-targeted hours increased, but the number during targeted hours decreased.

This divergence coincided with the initiation of a federally funded STEP in 1983. Although $15,000 was expended on that project, it was limited to patrolling West Broad Street on weekend nights. Given the limited scope of that project, its effectiveness was not reviewed in the 1983 report. It is noted here because of the similar focus of the two projects: speed-crashes during weekend nights.

Summary of Speed-Crash Problem

1.	OVERALL TRENDS IN NUMBER OF CRASHES	none
2.	PERCENTAGE INDICATORS --	
	Speed Involvement	steady
	Crash Severity	increasing
3.	REGRESSION ANALYSIS --	
	Speed-Crashes	increasing
	Serious Speed-Crashes	increasing
4.	RANK ORDERING PROCESS --	
	Number of Speed-Crashes	high priority
	Percentage Indicators	medium priority

Proposed Activities and Project Goals

The Richmond Bureau of Police requested $50,000 in its 1984 grant application to pay five officers for overtime patrol duty on Friday and Saturday nights. The city received half the amount it requested. This represented $ 0.18 per vehicle registered in the city, the second lowest such figure among the seven STEP cities.

The three project goals stated in the 1984 grant application were:

(1) to reduce the number of accidents in the city by 5%,
(2) to reduce the percentage of accidents occurring during the targeted hours from 18% to 14%, and
(3) to reduce the percentage of accidents resulting in an injury from 24% to 20%.

Project Results

None of the three stated goals of the 1984 Richmond STEP were met. First, the number of all crashes in 1984 increased by 3.4% over the number in 1983, 9.4% over the number in 1982, and 2.7% over the baseline average number. Second, while the percentage of crashes occurring during the targeted hours dropped from 18.7% in 1982 to 16.0% in 1984, the project missed its 14% goal. Third, the percentage of crashes resulting in injury showed no significant decline.

The STEP also failed the effectiveness tests employed using state maintained, citywide data. Although analysis of these data is not entirely appropriate given the limited scope of the Richmond project, they do provide insight into the impact of the project on the city's speed-crash problem as a whole. The number of speed-crashes rose by 8.7% between 1983 and 1984; serious speed-crashes rose by 8.9%. Although all six crash categories reflected increases in 1984, the changes in the speed-crash categories were higher than any other category in the Richmond data. Changes from baseline averages to 1984 data showed a similar pattern: an 11.8% increase in speed-crashes and an 18.6% increase in serious speed-crashes.

More crashes of both speed-related categories were reported in 1984 than projected by the regression analysis in Exhibit 20, and the increase in speed-crashes was greater than that in either of the two controls. The 2.3% increase in the number of non-speed-crashes between 1983 and 1984 was down from a 6.0% increase between 1982 and 1983. The 8.7% increase in speed-crashes between 1983 and 1984 was up from a 4.7% increase between 1982 and 1983.

The percent changes in the number of speed-crashes in Richmond did not compare favorably with those for other Virginia cities. Although Richmond ranked at or above the urban average in crash reduction percentages for total crashes, serious crashes, and non-speed-crashes, it fell below the urban average in both speed-crash categories (See Appendix G).

Crash data for the targeted hours was more favorable. First, the percentage of all city crashes occurring during the target hours fell in both years of STEP activity, from 18.7% prior to STEP activity in 1982, to 16.7% in 1983, and 16.0% in 1984 (See Table 17). Second, although the number of total crashes during non-targeted hours increased between 1982 and 1983, and between 1983 and 1984, the number of crashes during targeted hours decreased over these years (See Exhibit 22 and Exhibit 23). Between 1983 and 1984, crashes during targeted hours decreased 1.2% while crashes during non-targeted hours increased 4.4%. Similarly,

changes in the number of serious crashes were smaller during the targeted hours than the non-targeted ones. The reductions in crashes during targeted hours over the two years of STEP activity was emphasized by relatively close association of the percentage change in the number crashes prior to the STEP.

The positive interpretation of the time-specific data must be tempered, since even if it is assumed that the 1984 Richmond STEP contributed to the decline in the crash problem during targeted hours, there were no data available from which to gauge the effect of the project on the number of speed-crashes during targeted hours. Selective speed enforcement projects are intended to address local speed-crash problems, not local crash problems in general. Since the effect of the 1984 STEP in reducing the number of speed-crashes during the targeted hours is unknown, the project cannot be determined to have been a success.

Conclusions

The 1984 Richmond STEP identified a time-specific crash problem and designed a project to address the problem. The project did not meet any of the tests of effectiveness used in this report. These tests, however, employ citywide data for all hours of the day, whereas the STEP was designed for activity during late night hours. By gathering additional data on the times of day of crashes and comparing crash data for targeted and non-targeted hours, some evidence of effectiveness emerged. This evidence was not conclusive because of lack of controls and lack of speed involvement indicators in the time-specific crash data.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	NO
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	NO
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	YES
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	NO

TABLE 15

BASELINE CRASH DATA: RICHMOND

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	2,587	2,588	2,446	2,810	2,866	2,608
Fatal	10	23	29	23	17	21
Injury	2,577	2,565	2,417	2,787	2,849	2,587
TOTAL	7,503	7,145	6,643	7,027	7,269	7,080
SPEED-CRASHES						
SERIOUS	455	507	425	519	565	477
Fatal	4	9	7	7	7	7
Injury	451	498	418	512	558	470
TOTAL	1,121	1,258	1,174	1,229	1,336	1,196
NON-SPEED-CRASHES						
SERIOUS	2,132	2,081	2,021	2,291	2,301	2,131
Fatal	6	14	22	16	10	15
Injury	2,126	2,067	1,999	2,275	2,291	2,117
TOTAL	6,382	5,887	5,469	5,798	5,933	5,884
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	14.9	17.6	17.7	17.5	18.4	16.9
Serious Crashes	17.6	19.6	17.4	18.5	19.7	18.3
CRASH SEVERITY PERCENTAGES						
All Crashes	34.5	36.2	36.8	40.0	39.4	36.8
Speed-Related	40.6	40.3	36.2	42.2	42.3	39.9

TABLE 16

CHANGES IN CRASH DATA: RICHMOND

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	-358	-502	384	242	190
Percentage Change	-4.8	-7.0	5.8	3.4	2.7
SERIOUS CRASHES					
Numeric Change	1	-142	364	56	258
Percentage Change	.0	-5.5	14.9	2.0	9.9
ALL SPEED-CRASHES					
Numeric Change	137	-84	55	107	141
Percentage Change	12.2	-6.7	4.7	8.7	11.8
SERIOUS SPEED-CRASHES					
Numeric Change	52	-82	94	46	89
Percentage Change	11.4	-16.2	22.1	8.9	18.6
ALL NON-SPEED-CRASHES					
Numeric Change	-495	-418	329	135	49
Percentage Change	-7.8	-7.1	6.0	2.3	0.8
SERIOUS NON-SPEED-CRASHES					
Numeric Change	-51	-60	270	10	170
Percentage Change	-2.4	-2.9	13.4	0.4	8.0

NOTE: Negative numbers reflect a reduction in the number of crashes.

TABLE 17

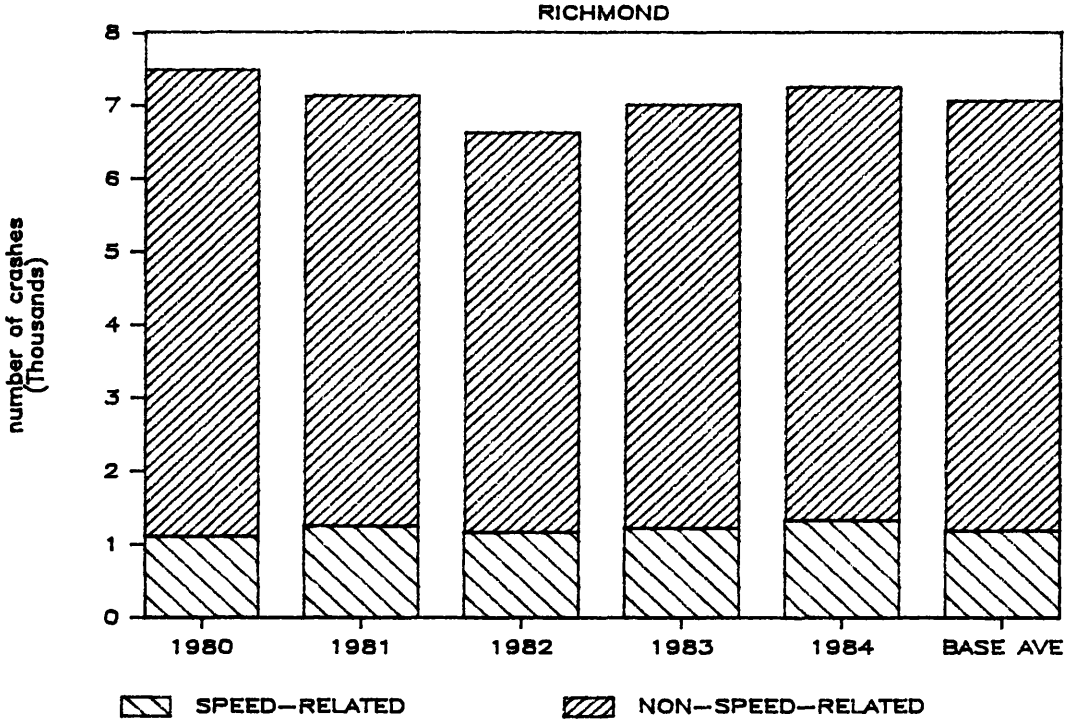
CRASH DATA DURING TARGETED & NON-TARGETED HOURS

CRASHES DURING BY TIME OF DAY	1980	1981	1982	1983	1984	BASELINE AVERAGE
ALL HOURS						
All Crashes	7,503	7,145	6,643	7,027	7,269	7,080
Serious Crashes	2,587	2,588	2,446	2,810	2,866	2,608
TARGETED HOURS						
All Crashes	1,357	1,334	1,240	1,174	1,160	1,276
Serious Crashes	536	555	505	513	501	527
NON-TARGETED HOURS						
All Crashes	6,146	5,811	5,403	5,853	6,109	5,803
Serious Crashes	2,051	2,033	1,941	2,297	2,365	2,081
PERCENT OF CRASHES DURING TARGETED HOURS						
All Crashes	18.1	18.7	18.7	16.7	16.0	18.0
Serious Crashes	20.7	21.4	20.6	18.3	17.5	20.3

PERCENT INCREASE IN THE NUMBER OF CRASHES		1980 -1981	1981 -1982	1982 -1983	1983 -1984	BASELINE AVG -1984
ALL HOURS						
All Crashes	NA	-4.8	-7.0	5.8	3.4	2.7
Serious Crashes	NA	.0	-5.5	14.9	2.0	9.9
TARGETED HOURS						
All Crashes	NA	-1.7	-7.0	-5.3	-1.2	-9.1
Serious Crashes	NA	3.5	-9.0	1.6	-2.3	-5.0
NON-TARGETED HOURS						
All Crashes	NA	-5.5	-7.0	8.3	4.4	5.3
Serious Crashes	NA	-0.9	-4.5	18.3	3.0	13.7

EXHIBIT 19

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

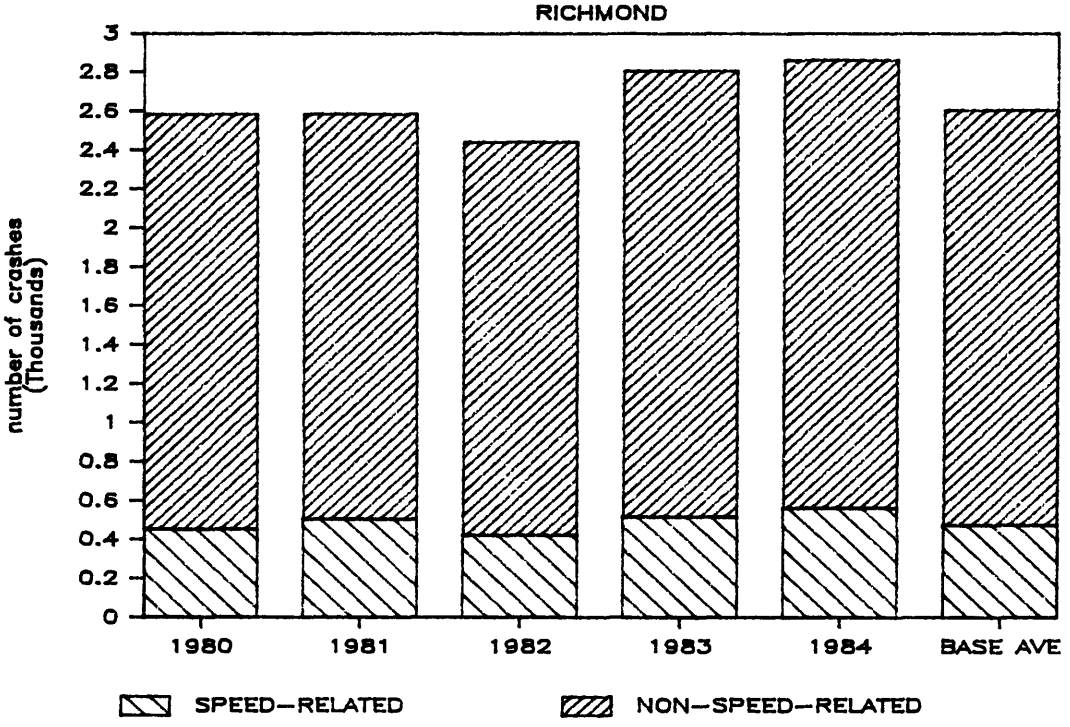
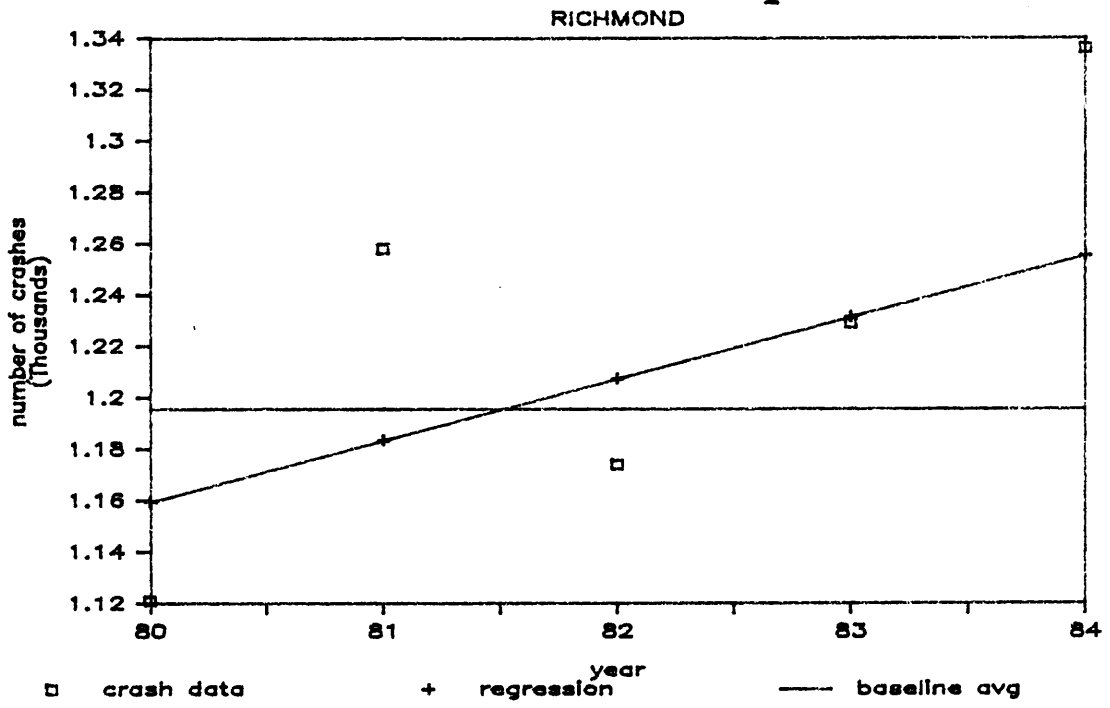


EXHIBIT 20

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

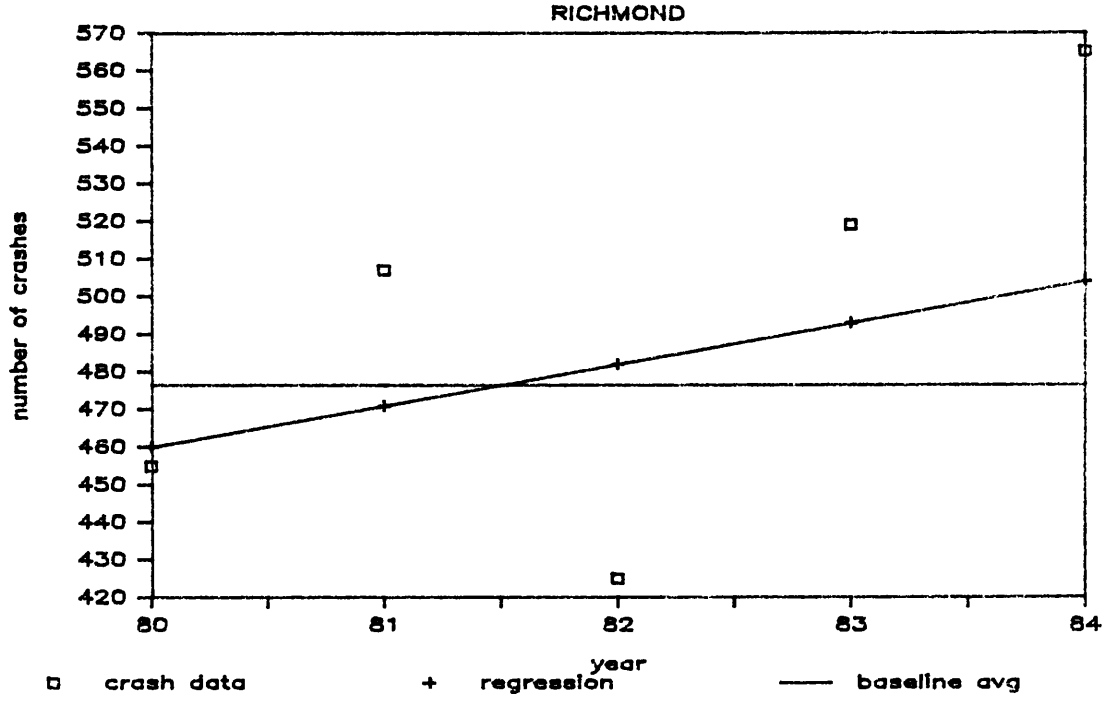


EXHIBIT 21

% CHANGE IN SPEED & CONTROL CRASHES

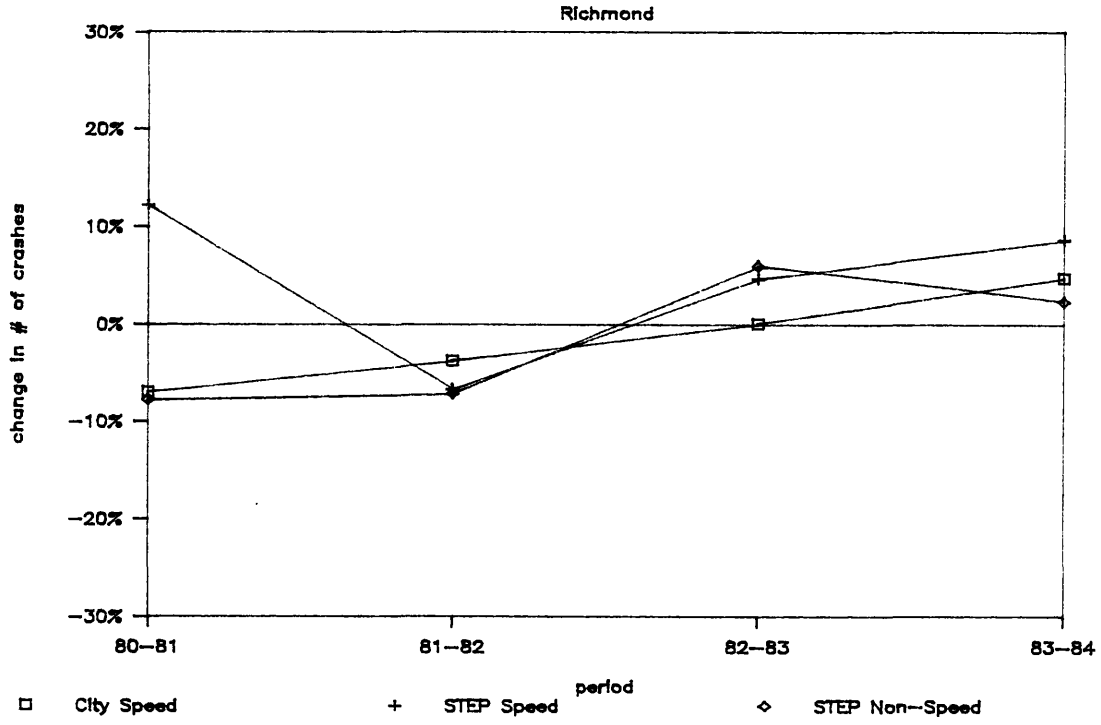


EXHIBIT 22

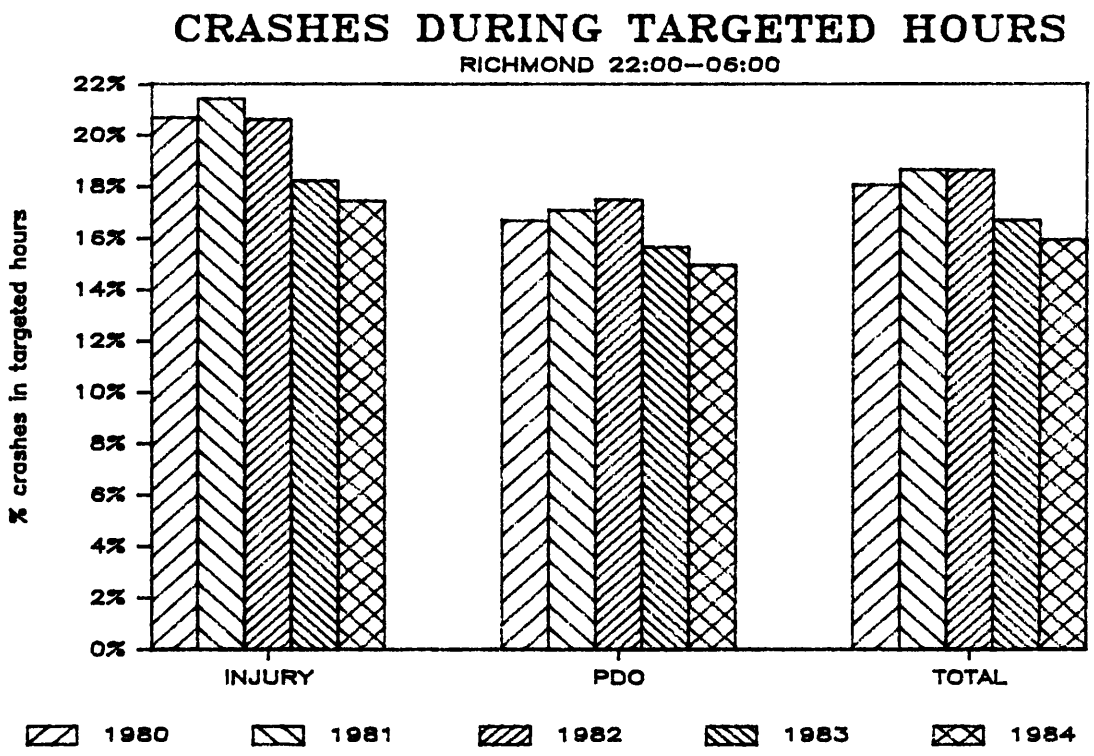
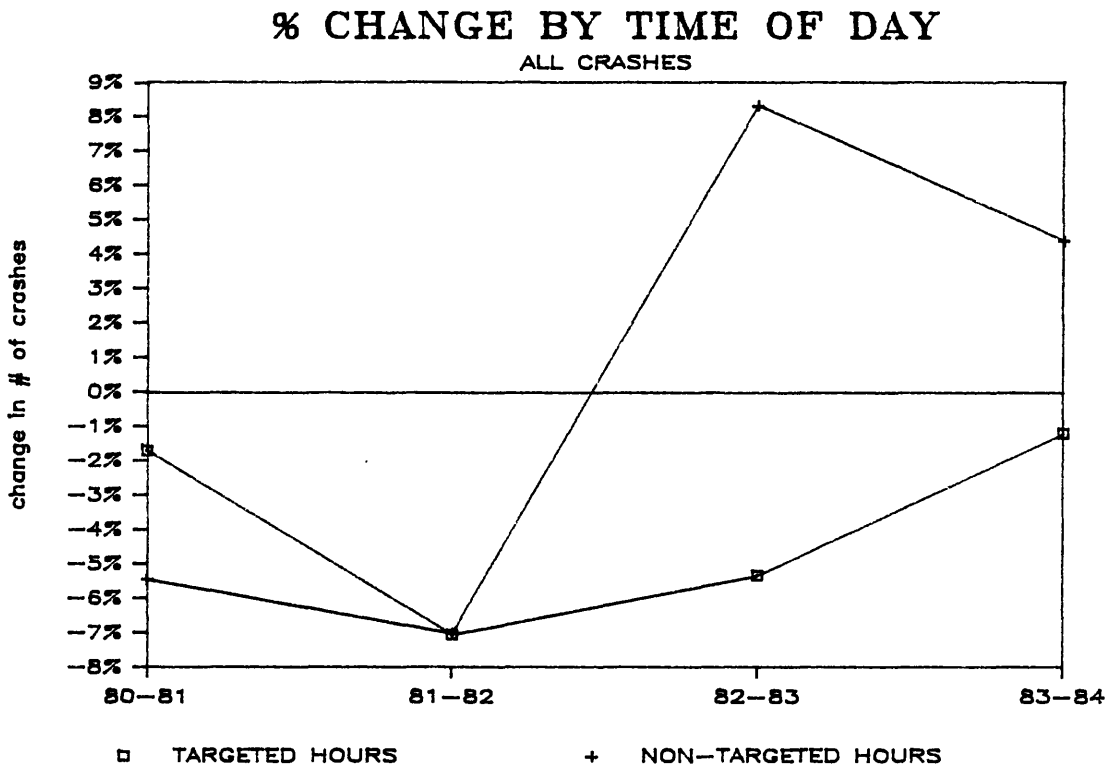
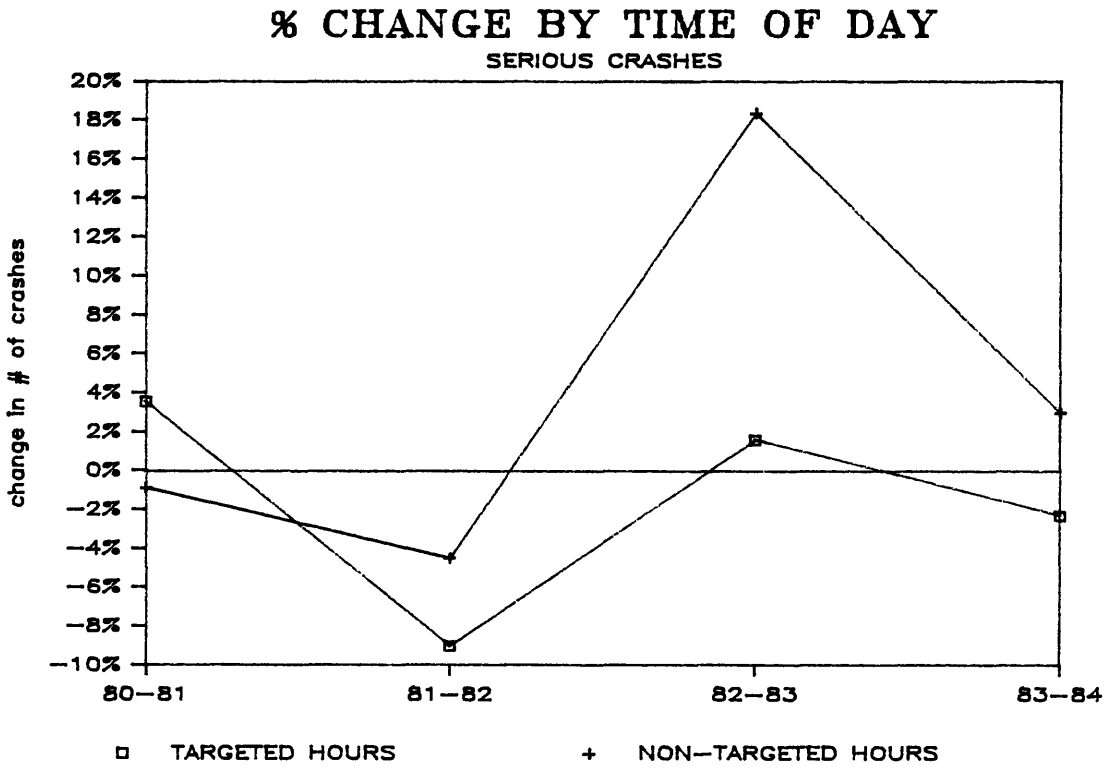

CRASHES DURING TARGETED HOURS
RICHMOND 22:00–06:00
% crashes in targeted hours
22%
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
INJURY
PDO
TOTAL
1980
1981
1982
1983
1984

EXHIBIT 23


% CHANGE BY TIME OF DAY
ALL CRASHES
change in # of crashes
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
-8%
80-81
81-82
82-83
83-84
TARGETED HOURS
NON-TARGETED HOURS


% CHANGE BY TIME OF DAY
SERIOUS CRASHES
change in # of crashes
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
-10%
80-81
81-82
82-83
83-84
TARGETED HOURS
NON-TARGETED HOURS

Department of State Police

Problem Statement

The Department of State Police conducts highway safety activities throughout the state. It has the primary responsibility for patrolling the seven interstate systems which cross Virginia. Its officers also patrol the primary state highways concurrently with local enforcement authorities. Among the duties of the state police is the enforcement of the national 55 mph speed limit on interstate and primary highways.

The Department has been conducting federally funded STEPs since 1979. Over this period, there has been a significant change in the number of highway crashes, injuries, and fatalities. Between 1979 and 1984, the number of crashes and traffic fatalities fell to a ten year low. Traffic injuries did not decline to the same extent, but neither did they increase. The contribution of the State Police STEPs to these highway safety improvements is difficult to quantify. Patrol activity was spread throughout the state, making comparisons of crashes on highways with STEPs with crashes on those without virtually impossible. Reductions in the number of crashes attributable to the projects would be very hard to detect in the statewide crash data because the many factors affecting the number and severity of highway accidents mask the impact of the scattered one-day projects. For example, the Department set the goal of its 1982 projects to be a 2% reduction in both total crashes and injury crashes across the state. However, for the 1973-1981 period, the number of total crashes statewide changed by an average of 6.6% (increase or decrease) per year. The change in injury crashes averaged 5.2%. Thus, even if the 1982 program had completely met its crash reduction goal, the effect would have been hard to distinguish from changes due to other factors.

Because these projects were carried out over several years and throughout the state, it was necessary to adopt an evaluation methodology different from that used to assess the effectiveness of the county and city STEPs. First, because enforcement was scattered over the state for several years, the baseline period was extended from the four years used for city and county projects to nine years. Second, no crash data were readily available to serve as a control for highways with State Police STEPs. Project activity was not restricted to clearly identifiable times of day, sites, or days of week. Thus, no comparison could be made of crash reductions in treatment areas against reductions in non-treatment areas. In an attempt to make some evaluation of the effectiveness of the Department projects, crash data were manipulated to create two surrogate comparison groups. One of these divided crashes into those occurring on highways patrolled primarily by state troopers

(interstate highways and primary state highways), and those on roads patrolled mainly by local law enforcement officers (secondary state highways) (See Table 18 and Exhibits 24 through 26). The other surrogate compared rural crashes against urban crashes on the similar assumption that state troopers patrol rural highways more than city streets. These data are presented in Table 19 and Exhibits 27 - 28. Note that the data source used here is not statewide crash data from Mini-Crash Facts, but data from the Department's own publication of crash statistics, Virginia Traffic Crash Facts (13). Unfortunately, no data source could reasonably provide a cross-tabulation of crashes by road system and speed involvement in crashes. Thus, the most helpful information was not available. Therefore, serious crashes were used exclusively in these analyses since speed is often a factor contributing to injury accidents.

If crash data are divided by road system, two measures of the speed-crash problem and the effectiveness of the projects are: (1) the annual percentage change in the number of serious crashes by road system, and (2) the death rates by road system. The crash data by road system are presented in Table 18 and in Exhibit 24. The percentage change computations are presented in Table 18 and Exhibit 25, and the death rate figures in Table 18 and Exhibit 26.

If the data are divided into rural and urban crashes, two problem and effectiveness measures are: (1) the percentage of serious crashes that were speed-related, and (2) the annual percentage change in the number of serious speed-crashes. The rural and urban crash data are presented in Table 19. The percentage measures are presented in Table 19 and Exhibits 27 and 28. The crash data and the effectiveness measures were examined for signs of improvement since the introduction of federally funded STEP activity in 1979, rather than focusing on one-year changes in crash data as in the evaluation of city and county STEPs.

Proposed Activities and Project Goals

The Department of State Police requested $500,000 in federal grant funds to operate 576 projects, for an average cost of $868 per project. Of this amount, approximately 50% was to pay salary and benefits of state troopers working the projects, 44% was to pay operating costs, and the remaining 6% was to pay the necessary overtime created by the projects. The Department was granted $272,276, which represents 67% of the total selective speed enforcement funds received by the state in 1984. This amount would have funded 313 one-day projects.

Each of the Department's seven field division commanders selected and scheduled the projects within the geographic area of his responsi-

bility. The Department defined one project as selective enforcement activity conducted on one day on one highway or in one general area. Thus, activity on the same highway for two consecutive days was considered two projects. Project sites were selected on the basis of the professional opinion of the sergeant who worked an area and were submitted to headquarters in Richmond for approval. However, each division had complete discretion to change the assignments at any time. Similar projects had been conducted in previous years, beginning in 1979. Under a series of projects named Operation C.A.R.E, special attention was given to operating projects during the holiday weekends of Memorial Day, Independence Day, and Labor Day.

The federally funded selective enforcement program was only one component of the Department's comprehensive traffic safety program. In addition, funding for the State Police STEP came from both federal and state sources.

The goals of the 1984 projects stated in the grant application were:

(1) to reduce the number of motor vehicle crashes occurring on the highways patrolled by the Department by 1%, and

(2) to reduce the percentage of motorists exceeding the national 55 mph speed limit from 30.5% to 30.0%.

The performance indicators at the requested funding level of $500,000 were:

(1) to increase citations for speeding, DUI, and other hazardous violations from 44,039 in 1983 to 88,100 in 1984,

(2) to increase the number of motorists assisted from 17,500 in 1983 to 35,000 in 1984, and

(3) to increase patrol mileage from 988,000 in 1983 to 1,977,000 in 1984.

Project Results

The effectiveness measures used in this section did not indicate that the 1984 STEPs conducted by the Department of State Police affected the number or severity of crashes. First, the projects did not achieve their goal of reducing the number of crashes by 1%. Statewide, total crashes were 8.5% higher in 1984 than in 1983, serious crashes 9.1%, and speed-crashes 6.1% (See Appendix A). According to Department data, total crashes on primary and interstate highways increased 8.9%.

A comparison of crash data for interstate highways with data for primary state highways failed to provide evidence of effectiveness. Between 1977 and 1978, 1979 and 1980, 1981 and 1982, and 1982 and 1983, the number of serious crashes occurring on interstate highways increased more on a percentage basis than did the number on other highways (See Exhibit 25).

Favorable evidence can be gleaned from higher percentage increases in the number of serious crashes on secondary state highways than in the number on primary highways. In 1980, one year after the projects were initiated, the number of serious crashes on primary highways fell 3.3% from the prior year's figure, whereas the number on secondary highways increased 7.1% (See Table 18 and Exhibit 25). There were similar, but smaller, differences in changes on the two road systems in both 1983 and 1984. Also, the percentage increase for serious crashes on primary roads was less than the change for secondary roads in only one year between 1976 and 1979, but was less three times between 1980 and 1984. Also, for the first time since 1980, the percentage increase in 1984 in serious crashes on interstate and primary highways was less than the increase on secondary highways.

No clear difference emerged between road systems if their respective death rates were compared. Death rates generally declined on the primary and interstate road systems after the STEPs began, but the decline in the death rates for these highways was not significantly different from changes in the death rates for the secondary road system (See Exhibit 26). One exception to this was the noticeable increase in the death rate on secondary highways between 1979 and 1980, and the minimal corresponding increase on interstate and primary highways. In 1979, the death rate on secondary highways was 3.4 deaths per million vehicle miles of travel (MVMT). In 1980, the death rate for these highways jumped to 4.3 deaths per MVMT. In contrast, death rates on interstate and primary highways increased from 2.5 deaths per MVMT to 2.7. After 1980, however, changes in the death rates on the two systems were very nearly the same. Over the 1984 grant year, the death rate on interstate and primary highways increased nominally from the 1983 death rate, whereas the death rate for secondary highways remained about the same as in 1983.

Thus, the comparisons of crash data by road system offer some evidence of effectiveness and some evidence to the contrary. The association of the data before the STEPs were initiated and the divergence after 1979 were not so strong as to warrant the conclusion that the projects had affected crash severity or the number of speed-crashes.

Neither of the effectiveness indicators for rural and urban crash data produced evidence of reductions in the number of speed-crashes attributable to the STEPs. The speed involvement percentages in Table 19 fell for both urban and rural areas between 1979 and 1981. These percentages continued to fall for urban Virginia between 1982 and 1984, but rose for rural Virginia (See Exhibit 27). Also, from 1980 through 1983, the annual percentage increase in the number of serious speed-crashes in the rural average was greater than in the urban average (See Table 19 and Exhibit 28). The higher percentage change in serious speed-crashes for rural Virginia implies that the STEPs did not reduce the rural speed-crash problem.

In summary, there was no clear evidence of effectiveness from either set of measures used here. The severe limitations on these analyses in evaluating such widespread activity must be emphasized, however. The effectiveness measures were only surrogates for crash data on the actual roads patrolled by the state troopers. No data linked speed involvement to the roads or areas likely to have been worked during the projects. In addition, even if such data were available, it is unlikely that positive results would show up on a statewide basis. The factors affecting the number and severity of speed-crashes are too many and too complex for an additional $250,000 per year of selective enforcement over six years to affect crash data noticeably.

Indeed, effectiveness evaluations may be fruitless given the nature of the projects themselves. Enforcement activity was spread throughout the state and the grant funds amounted to $0.11 per registered vehicle. In addition, it would be difficult for projects conducted for only one day at a time per site throughout the state to deter significant numbers of drivers from speeding, because the projects are not in place long enough for drivers to learn about them. Rather than a specific effort to which motorists respond out of fear of apprehension, the spreading of efforts is more akin to an increase in the Department's general enforcement funds. This statement is in no way meant to slight the efforts of the Department; the design and implementation of their projects should be left to them. It is only to recognize the difficulty, perhaps impossibility, of evaluating the effectiveness of such projects in reducing the number of highway accidents.

Conclusions

The State Police conducted a series of individual projects in 1984. These projects were highly selective in that they generally lasted only one day at a location. There were no limitations on the days of week, hours of day, or the locations of road segments that could be selected for STEP activity. Thus, it was difficult to assess the impact of these

projects on either statewide or locality specific crashes. In the absence of site specific data gathered over a long term, several surrogate measures were used to evaluate the effectiveness of the projects. It was not possible to come to any conclusions concerning the effectiveness of the projects.

TABLE 18

CRASH DATA AND ANALYSIS OF INTERSTATE, PRIMARY, AND SECONDARY HIGHWAY SYSTEMS

	NUMBER OF SERIOUS CRASHES			ANNUAL CHANGE IN SERIOUS CRASHES			DEATH RATES	
YEAR	INTERSTATE	PRIMARY	SECONDARY	INTERSTATE	PRIMARY	SECONDARY	COMBINED PRIMARY & INTERSTATE	SECONDARY
1975	1,884	9,701	7,603	NA	NA	NA	2.8	4.5
1976	2,002	10,658	7,850	6.3%	9.9%	3.2%	2.9	4.2
1977	2,147	11,480	8,735	7.2%	7.7%	11.3%	3.2	4.5
1978	2,469	12,255	9,153	15.0%	6.8%	4.8%	2.8	4.0
1979	2,328	11,726	8,767	-5.7%	-4.3%	-4.2%	2.5	3.4
1980	2,328	11,342	9,389	0.0%	-3.3%	7.1%	2.7	4.3
1981	2,479	11,800	9,606	6.5%	4.0%	2.3%	2.4	3.9
1982	2,670	11,536	9,402	7.7%	-2.2%	-2.1%	2.0	3.3
1983	2,945	12,113	10,039	10.3%	5.0%	6.8%	2.0	3.2
1984	3,207	13,254	11,302	8.9%	9.4%	12.6%	2.2	3.3

SOURCE: Department of Highways & Transportation Summary of Accident Data for years 1975-1984.

TABLE 19

CRASH DATA AND ANALYSIS OF RURAL AND URBAN CRASHES

YEAR	ALL SERIOUS CRASHES		SERIOUS SPEED-CRASHES		SPEED INVOLVEMENT		ANNUAL CHANGE IN SERIOUS SPEED-CRASHES	
	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN
1975	19,094	17,069	5,114	1,759	26.8%	10.3%		
1976	20,054	17,812	5,150	2,245	25.7%	12.6%	0.7%	27.6%
1977	21,745	19,055	5,457	2,195	25.1%	11.5%	6.0%	-2.2%
1978	22,980	19,425	6,587	2,810	28.7%	14.5%	20.7%	28.0%
1979	22,133	19,115	6,250	2,647	28.2%	13.8%	-5.1%	-5.8%
1980	22,403	17,990	5,842	2,230	26.1%	12.4%	-6.5%	-15.8%
1981	23,048	18,644	5,860	2,180	25.4%	11.7%	0.3%	-2.2%
1982	22,482	18,780	5,980	2,188	26.6%	11.7%	2.0%	0.4%
1983	24,099	20,062	6,677	2,165	27.7%	10.8%	11.7%	-1.1%
1984	26,371	21,824	7,378	2,474	28.0%	11.3%	10.5%	14.3%

SOURCE: Department of State Police, Virginia Traffic Crash Facts, 1975-1984.

EXHIBIT 24

NUMBER OF SERIOUS CRASHES

BY ROAD SYSTEM

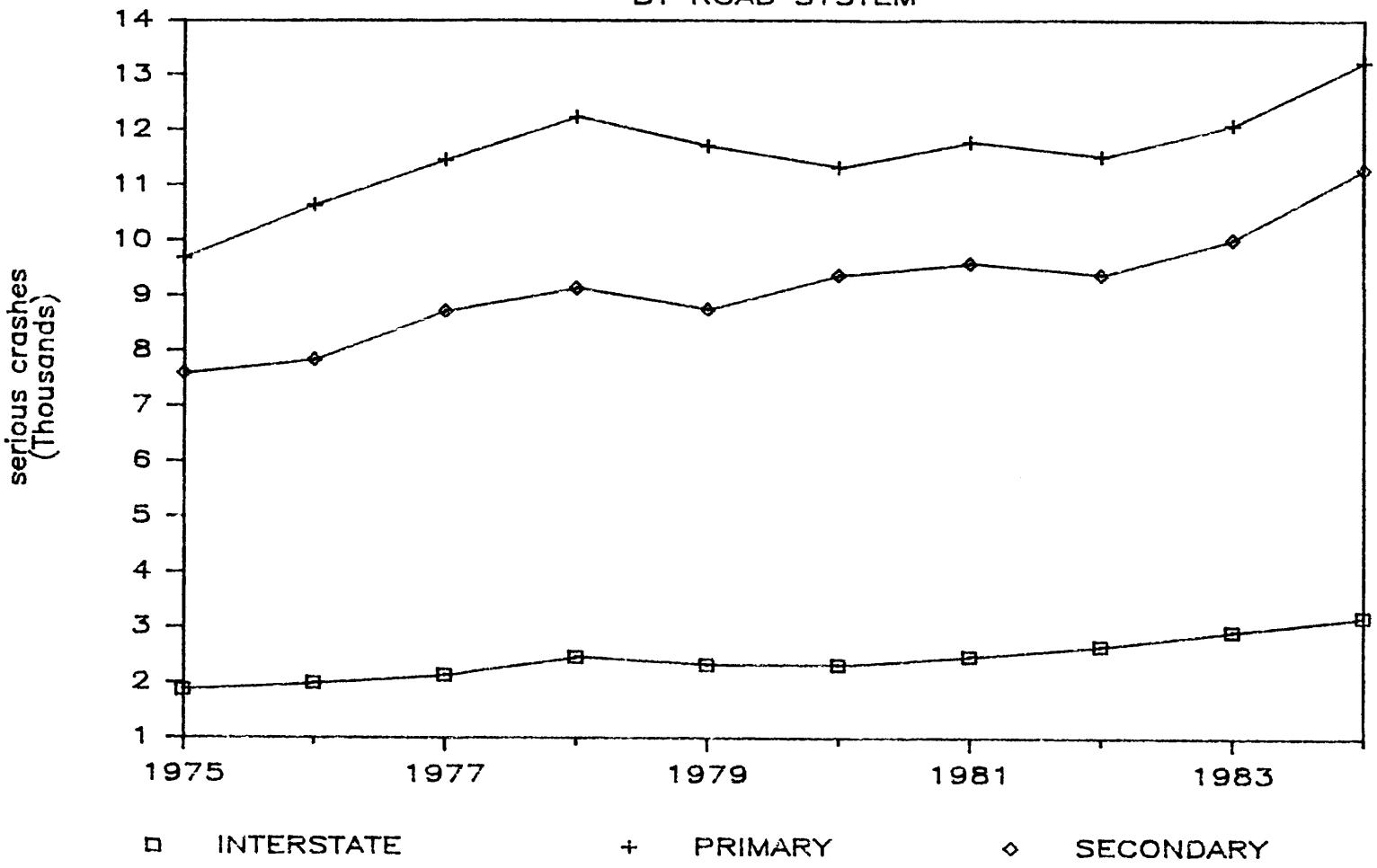


EXHIBIT 25

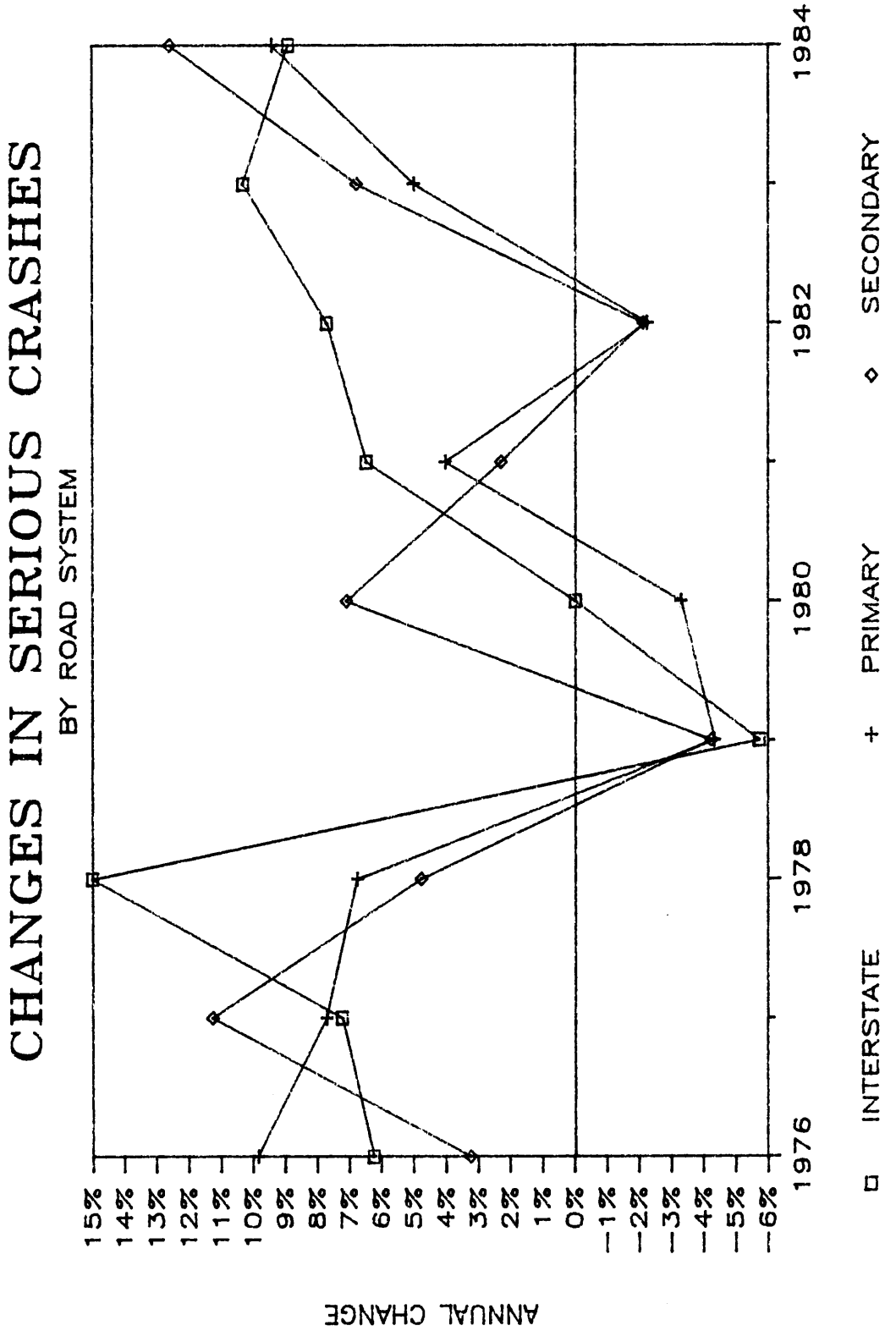

CHANGES IN SERIOUS CRASHES
BY ROAD SYSTEM
ANNUAL CHANGE
15%
14%
13%
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
-1%
-2%
-3%
-4%
-5%
-6%
1976
1978
1980
1982
1984
□ INTERSTATE
+ PRIMARY
◇ SECONDARY

EXHIBIT 26

DEATH RATES

BY ROADWAY SYSTEM

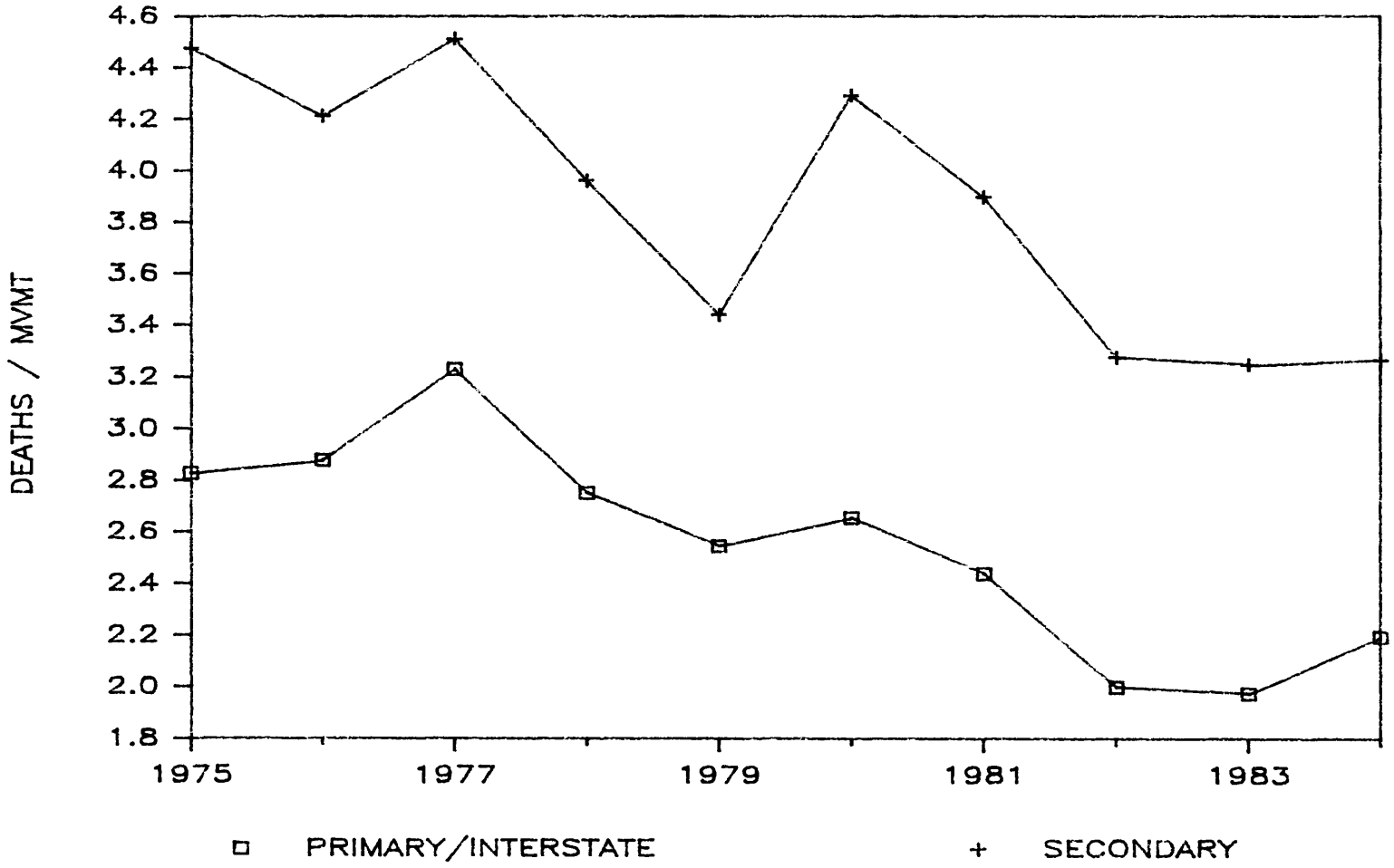


EXHIBIT 27

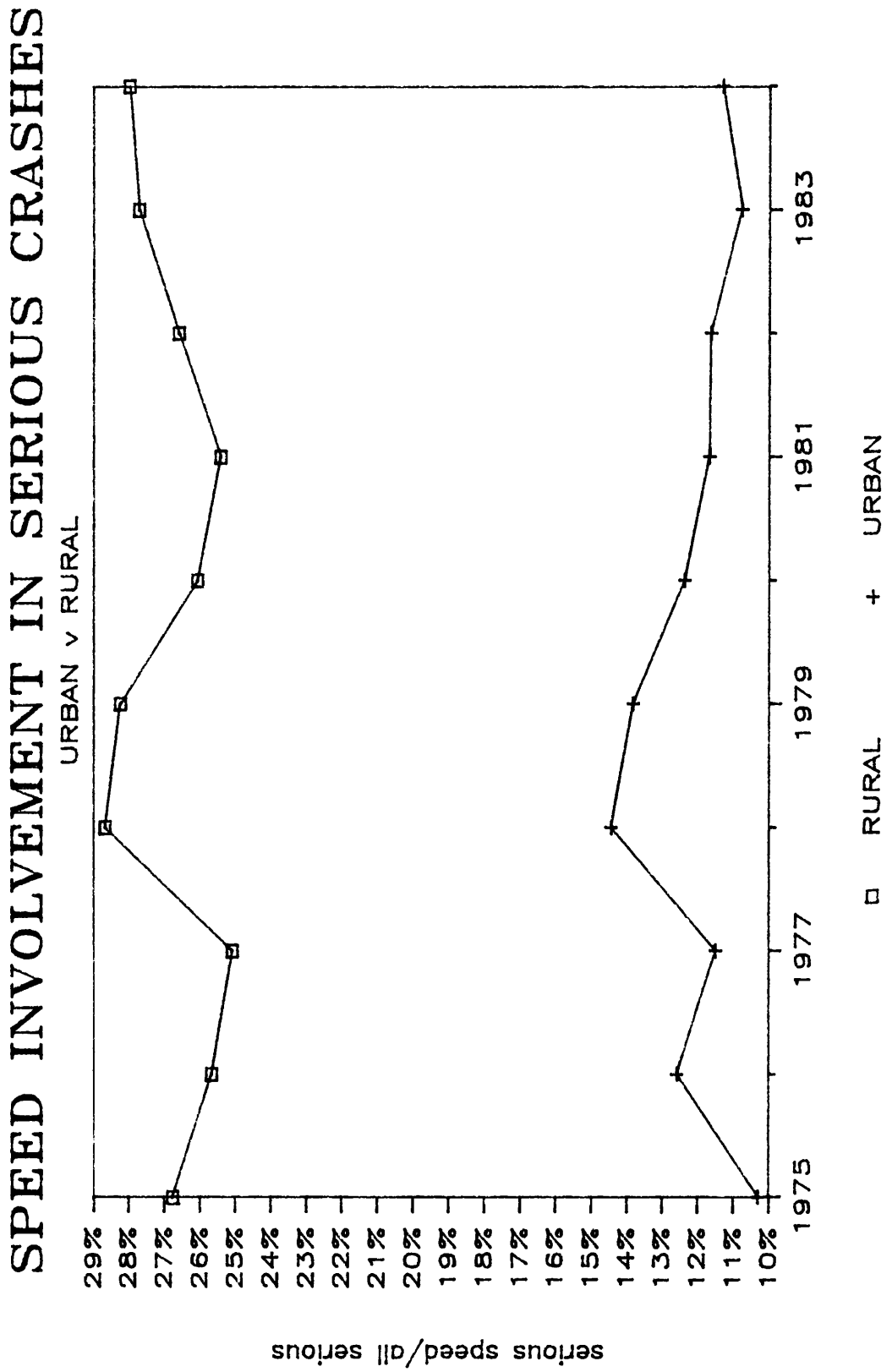
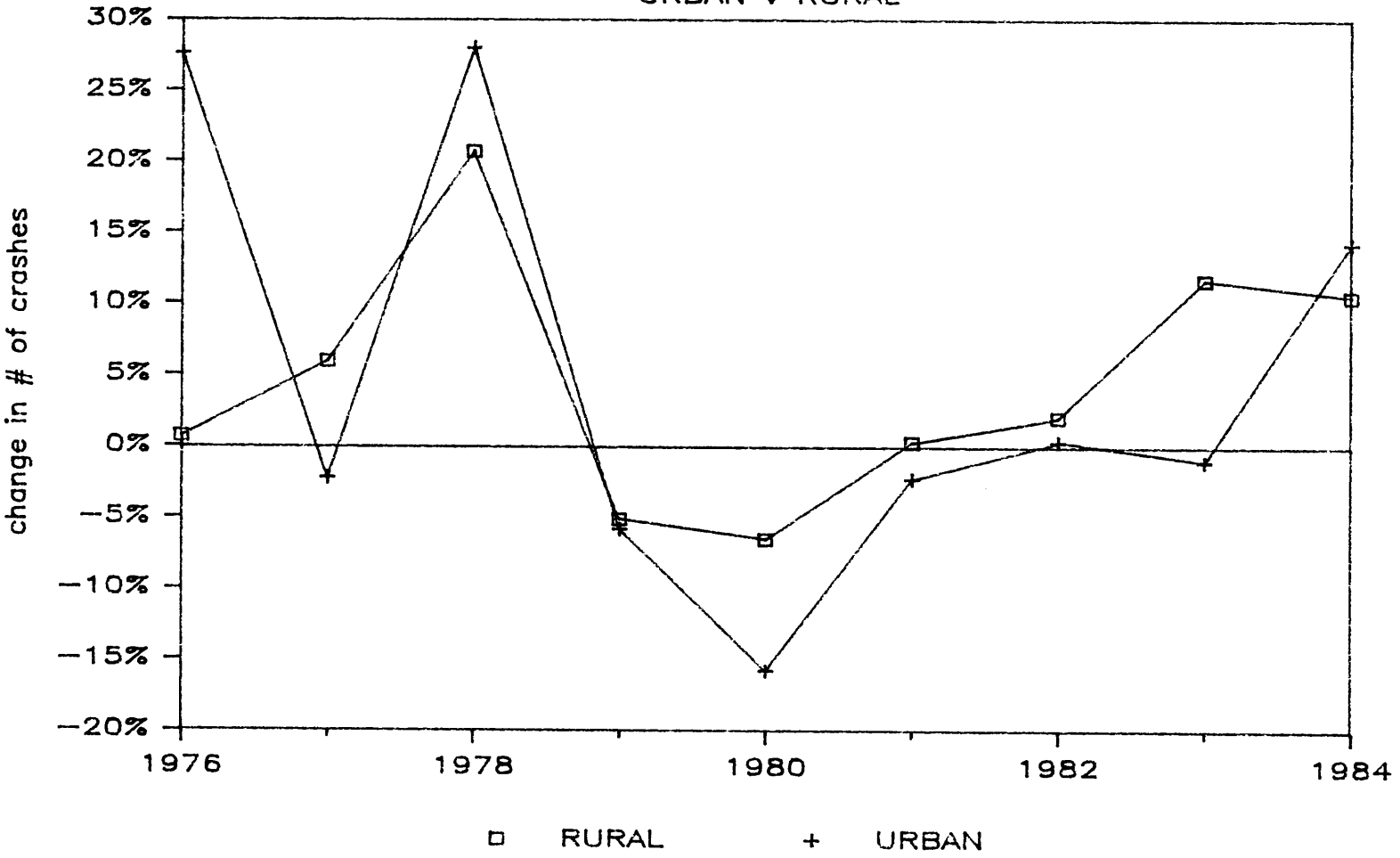

SPEED INVOLVEMENT IN SERIOUS CRASHES
URBAN v RURAL
serious speed/all serious
29%
28%
27%
26%
25%
24%
23%
22%
21%
20%
19%
18%
17%
16%
15%
14%
13%
12%
11%
10%
1975
1977
1979
1981
1983
□ RURAL
+ URBAN

EXHIBIT 28

CHANGE IN SERIOUS SPEED–CRASHES

URBAN v RURAL



INDIVIDUAL EVALUATIONS OF EQUIPMENT PROJECTS

Town of Herndon

The town of Herndon applied for and received $2,500 in federal funds to purchase an additional radar unit. The radar was to be employed in a comprehensive local selective enforcement effort with one full-time officer assigned to patrol activity. The program goal was to reduce the total number of auto injuries from 86 to 70 (an 18.6% reduction) and to reduce the number of all crashes below the 1982 level.

Despite the small number of crashes occurring in the town, the second lowest number of crashes of any STEP community, all categories of crashes were increasing rapidly (See Tables 20 and 21, Exhibit 29). The regression analysis in Exhibit 30 presented an increasing trend in both categories of speed-crashes. The town was not included in the ranking of local speed-crash problems in Appendix F because the number of registered vehicles in the town was not available. (Because Herndon is not an independent city in Virginia, data on registered vehicles were not listed by the DMV data source.) Therefore, the comparison of changes in local speed-crashes against controls was dispensed with since the small base number of crashes made such an analysis meaningless.

The program did not meet its crash reduction goals. The numbers of crashes reported for five categories were higher in 1984 than in 1983, and much higher than those in 1982. Total crashes increased 11.4%, serious crashes 24.3%, and non-speed-crashes 15.3% (See Table 21). There were two fewer speed-crashes, a 4.3% reduction. However, even this number was 21.6% higher than the baseline average, and there were eight more serious speed-crashes, a 44.4% increase in this category. Speed-crashes reported in 1984 were below the number projected under the regression analysis, but serious speed-crashes were above. Finally, the comparison of percentage change among Virignia cities in Appendix G showed that the increases in the number of crashes of all categories in Herndon were noticeably greater than increases in most other cities.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	NO
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	NO
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	n/a
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	NO

TABLE 20

BASELINE CRASH DATA: HERNDON

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	55	56	61	70	87	61
Fatal	1	0	1	0	2	1
Injury	54	56	60	70	85	60
TOTAL	159	195	211	237	264	201
SPEED-CRASHES						
SERIOUS	8	14	17	18	26	14
Fatal	1	0	1	0	2	1
Injury	7	14	16	18	24	14
TOTAL	20	44	37	47	45	37
NON-SPEED-CRASHES						
SERIOUS	47	42	44	52	61	46
Fatal	0	0	0	0	0	0
Injury	47	42	44	52	61	46
TOTAL	139	151	174	190	219	164
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	12.6	22.6	17.5	19.8	17.0	18.5
Serious Crashes	14.5	25.0	27.9	25.7	29.9	23.6
CRASH SEVERITY PERCENTAGES						
All Crashes	34.6	28.7	28.9	29.5	33.0	30.2
Speed-Related	40.0	31.8	45.9	38.3	57.8	38.5

TABLE 21

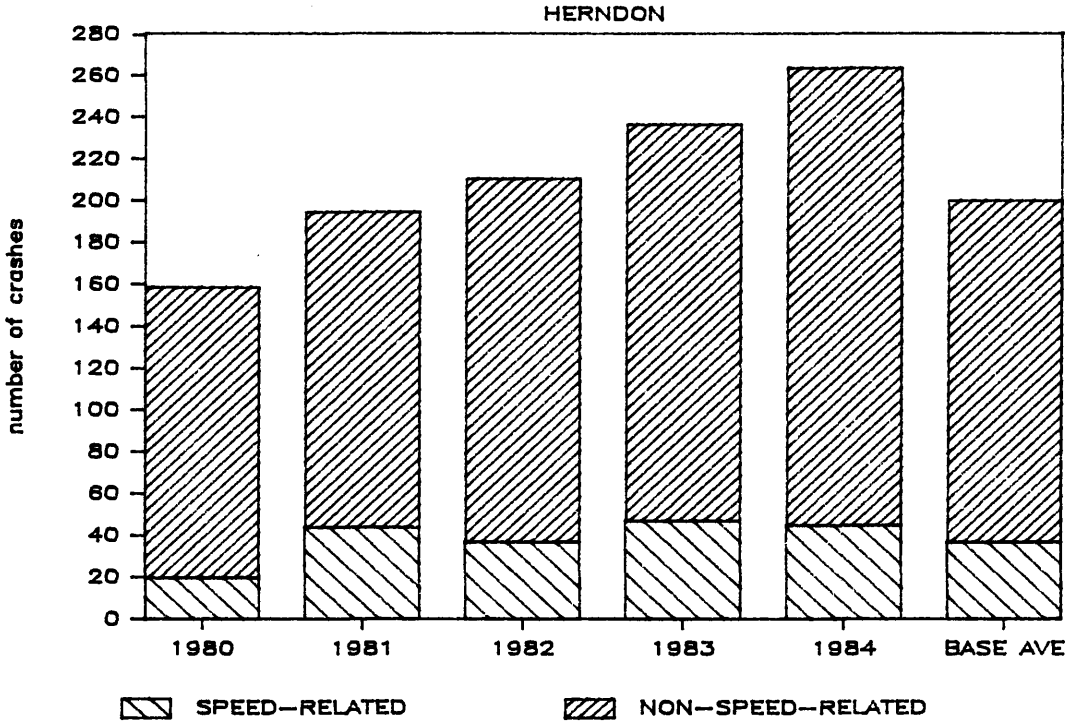
CHANGES IN CRASH DATA: HERNDON

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	36	16	26	27	64
Percentage Change	22.6	8.2	12.3	11.4	31.7
SERIOUS CRASHES					
Numeric Change	1	5	9	17	27
Percentage Change	1.8	8.9	14.8	24.3	43.8
ALL SPEED-CRASHES					
Numeric Change	24	-7	10	-2	8
Percentage Change	120.0	-15.9	27.0	-4.3	21.6
SERIOUS SPEED-CRASHES					
Numeric Change	6	3	1	8	12
Percentage Change	75.0	21.4	5.9	44.4	82.5
ALL NON-SPEED-CRASHES					
Numeric Change	12	23	16	29	56
Percentage Change	8.6	15.2	9.2	15.3	33.9
SERIOUS NON-SPEED-CRASHES					
Numeric Change	-5	2	8	9	15
Percentage Change	-10.6	4.8	18.2	17.3	31.9

NOTE: Negative numbers reflect a reduction in the number of crashes.

EXHIBIT 29

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

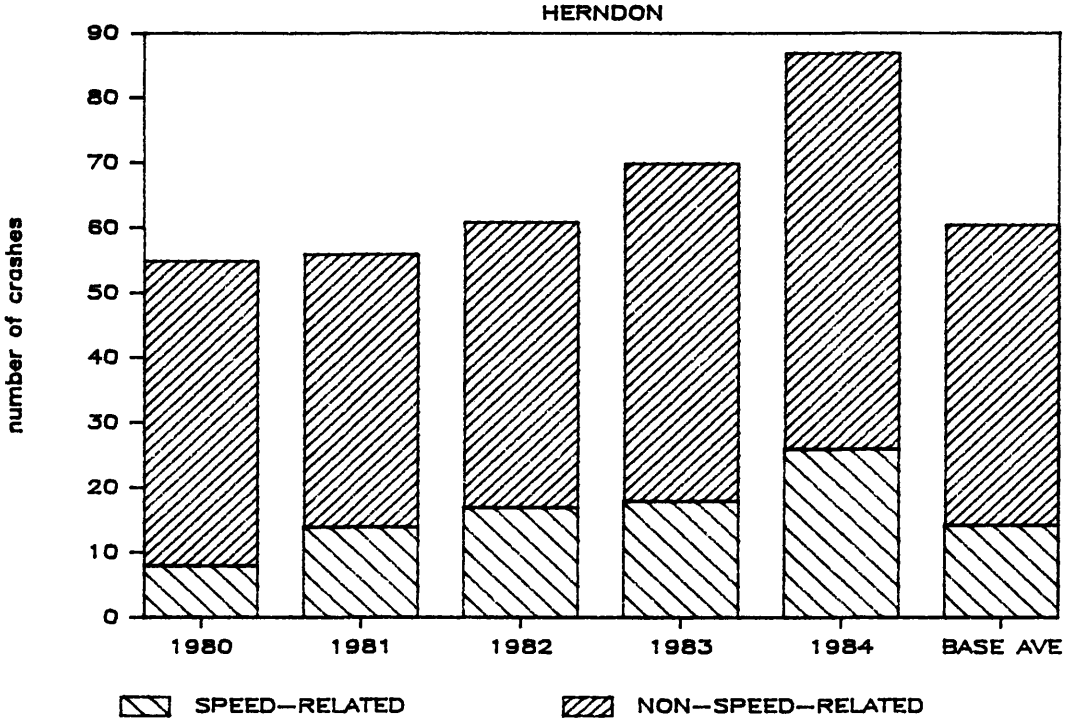
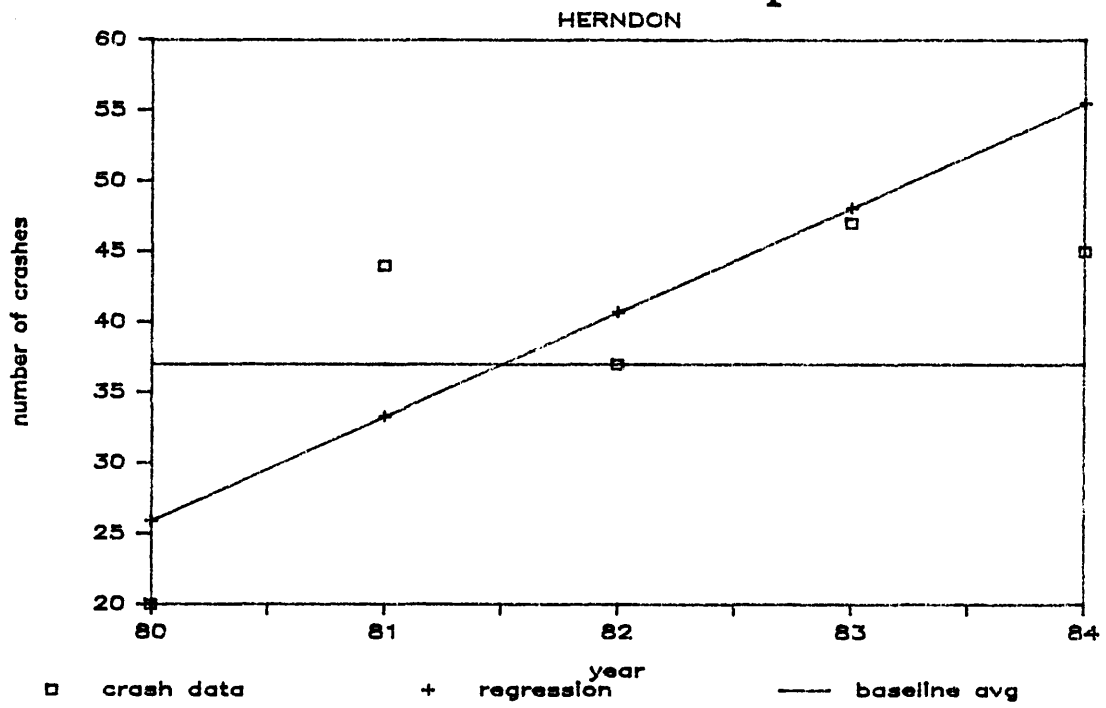
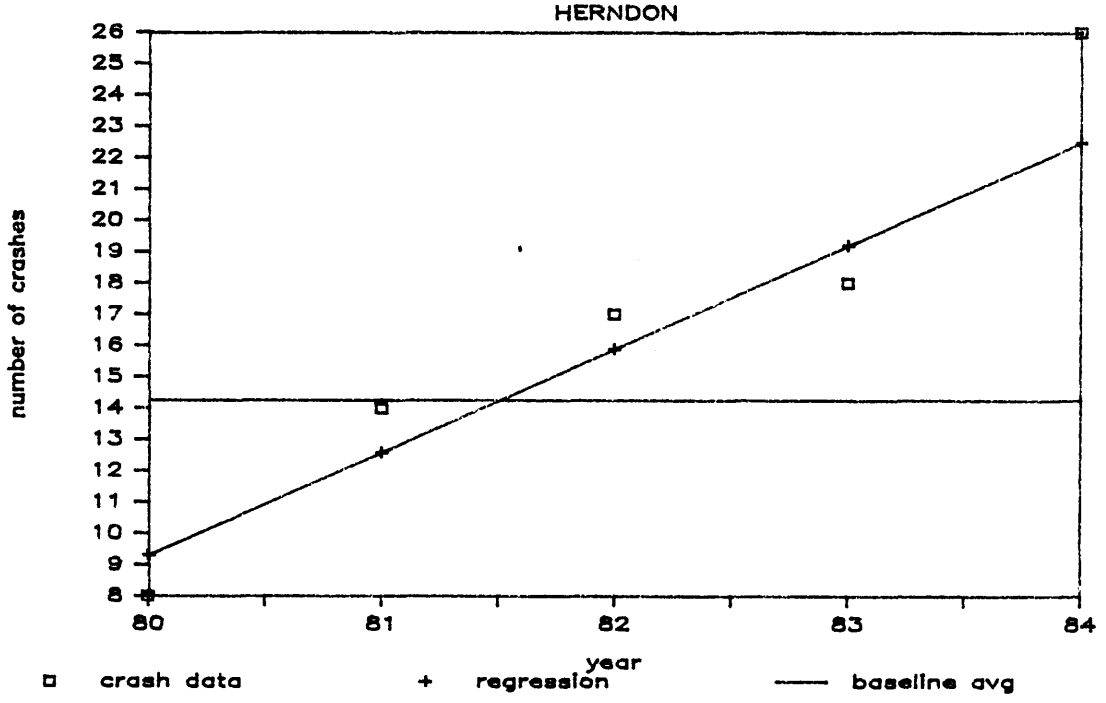


EXHIBIT 30

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes



City of Manassas Park

The Manassas Park Police Department received $2,000 towards the purchase of radar equipment to be used in its efforts to deter speeding motorists. The number of crashes in all categories for this city were the lowest for any community receiving grant funds. In the ranking processes used, Manassas Park placed as a high priority in the speed involvement percentages but a (very) low priority in the number of speed-crashes (See Appendix F). No clear trends in the crash data were discernible (See Table 22 and Exhibit 31). The small number of crashes produced such volatility in the measures used here that generalizations about trends in the crash data were difficult (See Table 23). The regression analysis pointed in opposite directions for the two different speed-crash categories: more crashes were predicted for speed-crashes and fewer for serious speed-crashes (See Exhibit 32).

The numbers of crashes in each of the six categories increased in 1984, but four of these categories increased by fewer than five crashes. Speed-crashes rose from 9 in 1983 to 12 in 1984, and serious speed-crashes from 3 to 4. Given these small numbers, no conclusions on effectiveness could be made.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	n/a
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	n/a
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	n/a
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	n/a

TABLE 22

BASELINE CRASH DATA: MANASSAS PARK

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	24	22	15	19	23	20
Fatal	0	1	0	0	0	0
Injury	24	21	15	19	23	20
TOTAL	74	69	71	62	77	69
SPEED-CRASHES						
SERIOUS	7	2	5	3	4	4
Fatal	0	1	0	0	0	0
Injury	7	1	5	3	4	4
TOTAL	11	6	17	9	12	11
NON-SPEED-CRASHES						
SERIOUS	17	20	10	16	19	16
Fatal	0	0	0	0	0	0
Injury	17	20	10	16	19	16
TOTAL	63	63	54	53	65	58
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	14.9	8.7	23.9	14.5	15.6	15.6
Serious Crashes	29.2	9.1	33.3	15.8	17.4	21.3
CRASH SEVERITY PERCENTAGES						
All Crashes	32.4	31.9	21.1	30.6	29.9	29.0
Speed-Related	63.6	33.3	29.4	33.3	33.3	39.5

TABLE 23

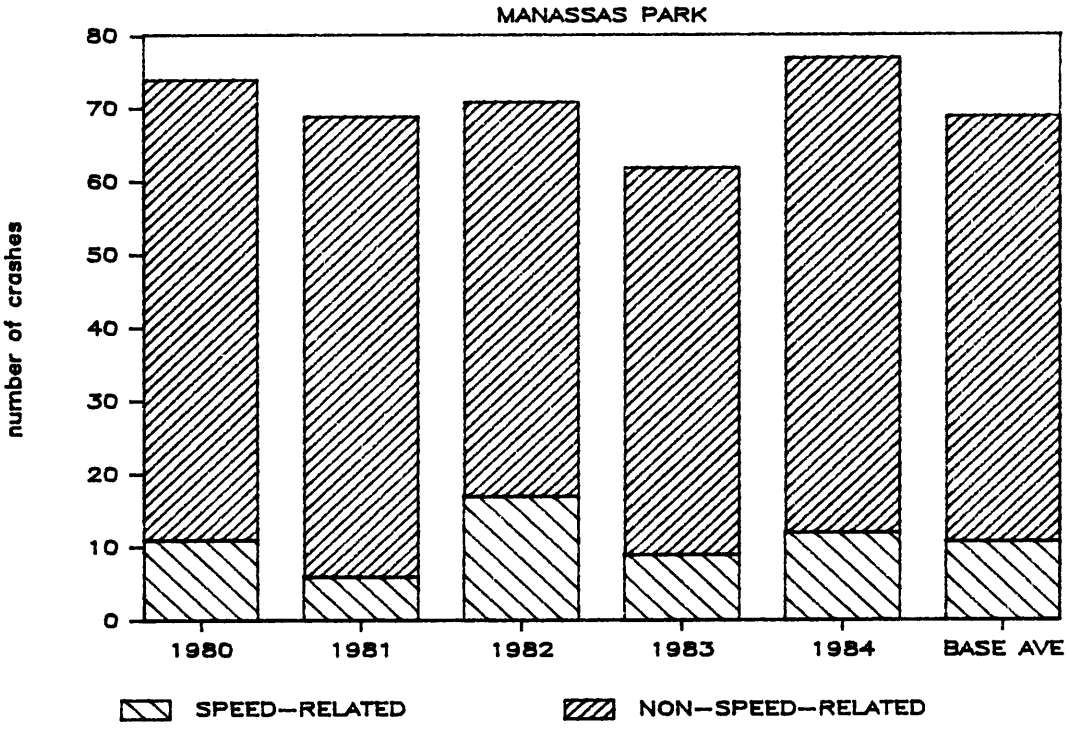
CHANGES IN CRASH DATA: MANASSAS PARK

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	-5	2	-9	15	8
Percentage Change	-6.8	2.9	-12.7	24.2	11.6
SERIOUS CRASHES					
Numeric Change	-2	-7	4	4	3
Percentage Change	-8.3	-31.8	26.7	21.1	15.0
ALL SPEED-CRASHES					
Numeric Change	-5	11	-8	3	1
Percentage Change	-45.5	183.3	-47.1	33.3	11.6
SERIOUS SPEED-CRASHES					
Numeric Change	-5	3	-2	1	0
Percentage Change	-71.4	150.0	-40.0	33.3	-5.9
ALL NON-SPEED-CRASHES					
Numeric Change	0	-9	-1	12	7
Percentage Change	0.0	-14.3	-1.9	22.6	11.6
SERIOUS NON-SPEED-CRASHES					
Numeric Change	3	-10	6	3	3
Percentage Change	17.6	-50.0	60.0	18.8	20.6

NOTE: Negative numbers reflect a reduction in the number of crashes.

EXHIBIT 31

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

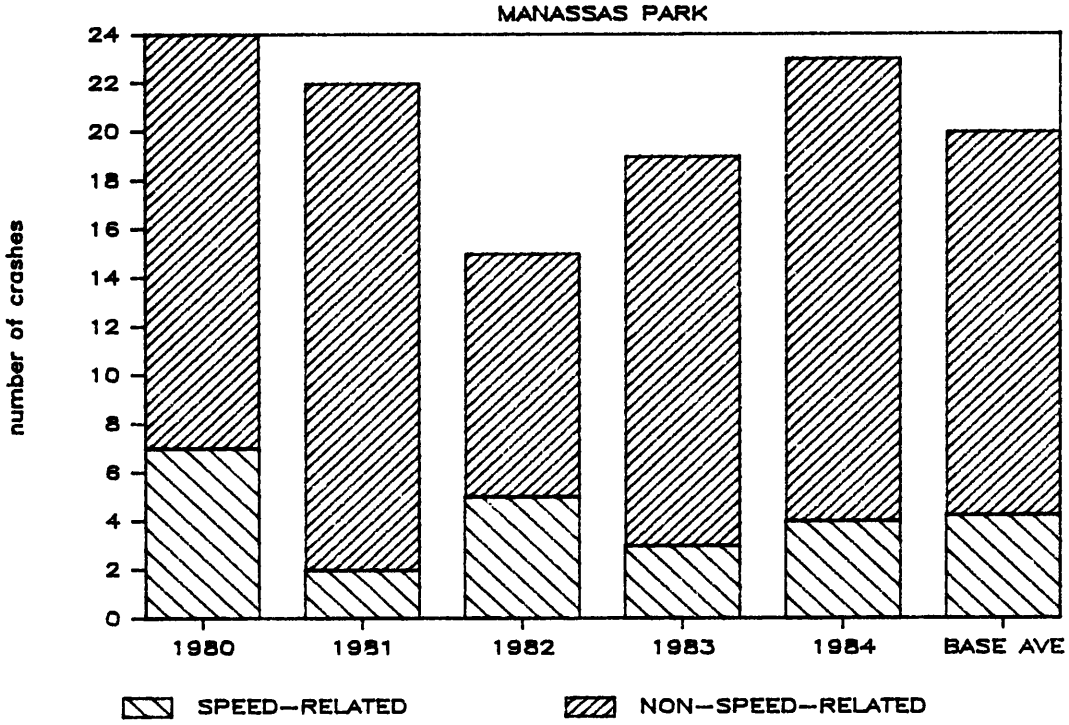
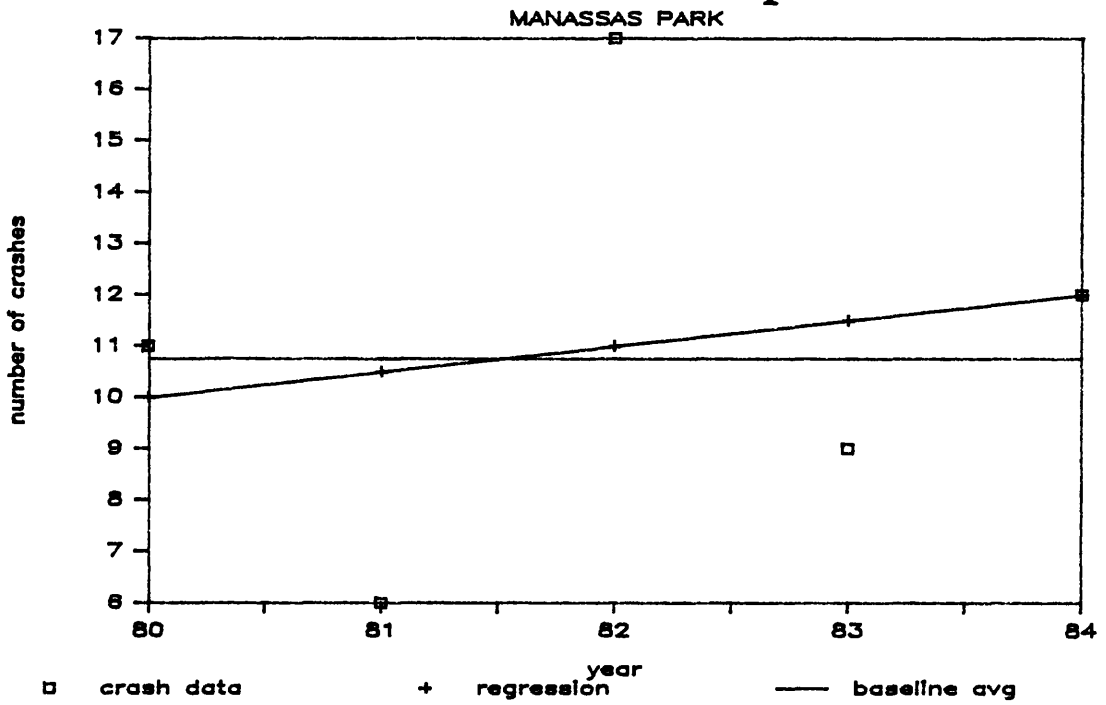
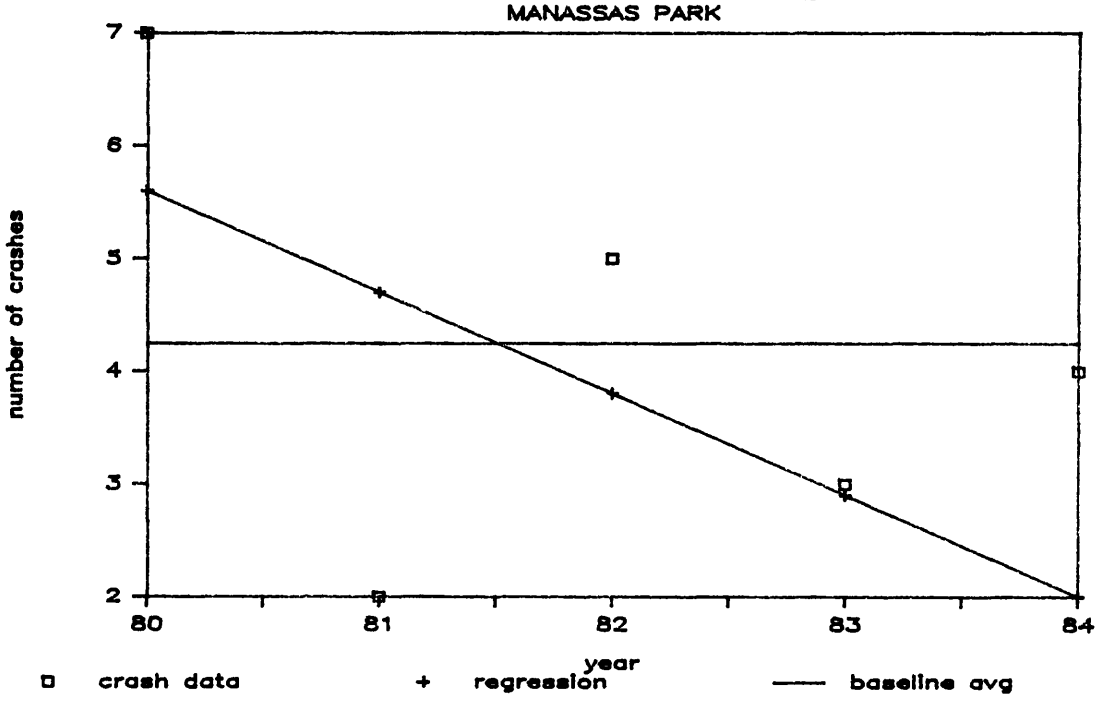


EXHIBIT 32

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes



City of Norfolk

The Norfolk Police Department received $4,000 in federal funds to purchase two additional radar units and accessories. No crash reduction goal was stated by the Department in its grant application for this equipment project.

The number of crashes in the city increased for all crash categories in the baseline years (See Tables 24 & 25, and Exhibit 33). The regression analysis for speed-crashes confirmed the increasing trend in both categories of speed-crashes (See Exhibit 34). Under both ranking processes used in this report, Norfolk had a high priority speed-crash problem during the baseline years (See Appendix F).

The number of crashes in four of the six categories increased in 1984 over 1983 levels. All crashes were up 0.8%, serious crashes 4.7%, non-speed-crashes 2.2%, and serious non-speed-crashes 6.9% (See Table 25). Fewer speed-crashes of both categories were reported in 1984 than in 1983, and fewer speed-crashes were reported than projected under the regression analysis. The percentage reduction in speed-crashes compared favorably against both controls (See Exhibit 35). The number of local speed-crashes dropped 7.5%, while the number of local non-speed-crashes rose 2.2% and the urban average number of speed-crashes rose 4.8%. Finally, while Norfolk placed at or below the urban average in the percentage increase in four categories of crashes, its percentage reduction in the number of speed-crashes was noticeably better than for other Virginia cities (See Appendix G).

Thus, under three of the four tests employed here, Norfolk is judged to have effectively reduced the number of its speed-crashes.

Summary of Results

1.	ACHIEVE CRASH REDUCTION GOALS	n/a
2.	1984 SPEED-CRASHES BELOW PROJECTIONS	YES
3.	POSITIVE ANNUAL CHANGE IN SPEED-CRASHES COMPARED TO CONTROLS	YES
4.	1984 CHANGE IN SPEED-CRASHES FOR STEP COMMUNITY NOTICEABLY BETTER THAN FOR OTHER VA COMMUNITIES	YES

TABLE 24

BASELINE CRASH DATA: NORFOLK

BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	2,106	2,468	2,601	2,779	2,911	2,489
Fatal	36	26	35	24	39	30
Injury	2,070	2,442	2,566	2,755	2,872	2,458
TOTAL	6,687	7,023	7,286	7,438	7,496	7,109
SPEED-CRASHES						
SERIOUS	400	491	485	514	489	473
Fatal	16	15	13	6	13	13
Injury	384	476	472	508	476	460
TOTAL	951	1,099	1,072	1,105	1,022	1,057
NON-SPEED-CRASHES						
SERIOUS	1,706	1,977	2,116	2,265	2,422	2,016
Fatal	20	11	22	18	26	18
Injury	1,686	1,966	2,094	2,247	2,396	1,998
TOTAL	5,736	5,924	6,214	6,333	6,474	6,052
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	14.2	15.6	14.7	14.9	13.6	14.9
Serious Crashes	19.0	19.9	18.6	18.5	16.8	19.0
CRASH SEVERITY PERCENTAGES						
All Crashes	31.5	35.1	35.7	37.4	38.8	35.0
Speed-Related	42.1	44.7	45.2	46.5	47.8	44.7

TABLE 25

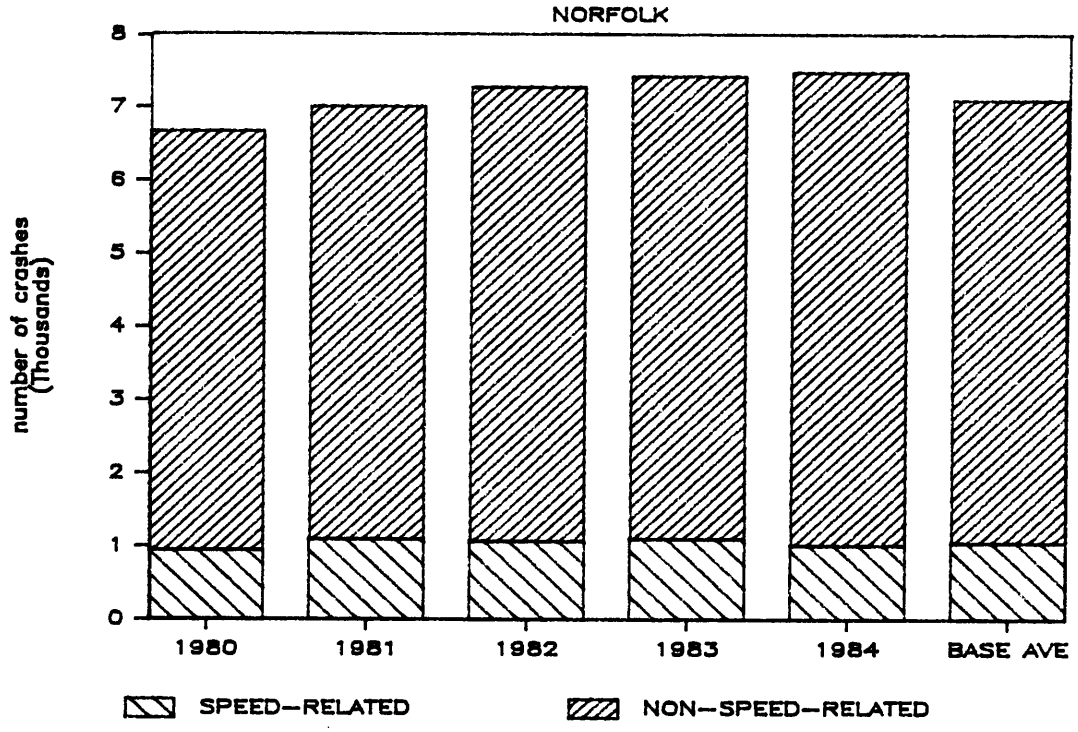
CHANGES IN CRASH DATA: NORFOLK

CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	336	263	152	58	388
Percentage Change	5.0	3.7	2.1	0.8	5.5
SERIOUS CRASHES					
Numeric Change	362	133	178	132	423
Percentage Change	17.2	5.4	6.8	4.7	17.0
ALL SPEED-CRASHES					
Numeric Change	148	-27	33	-83	-35
Percentage Change	15.6	-2.5	3.1	-7.5	-3.3
SERIOUS SPEED-CRASHES					
Numeric Change	91	-6	29	-25	17
Percentage Change	22.8	-1.2	6.0	-4.9	3.5
ALL NON-SPEED-CRASHES					
Numeric Change	188	290	119	141	422
Percentage Change	3.3	4.9	1.9	2.2	7.0
SERIOUS NON-SPEED-CRASHES					
Numeric Change	271	139	149	157	406
Percentage Change	15.9	7.0	7.0	6.9	20.1

NOTE: Negative numbers reflect a reduction in the number of crashes.

EXHIBIT 33

SPEED INVOLVEMENT – ALL CRASHES



SPEED INVOLVEMENT – SERIOUS CRASHES

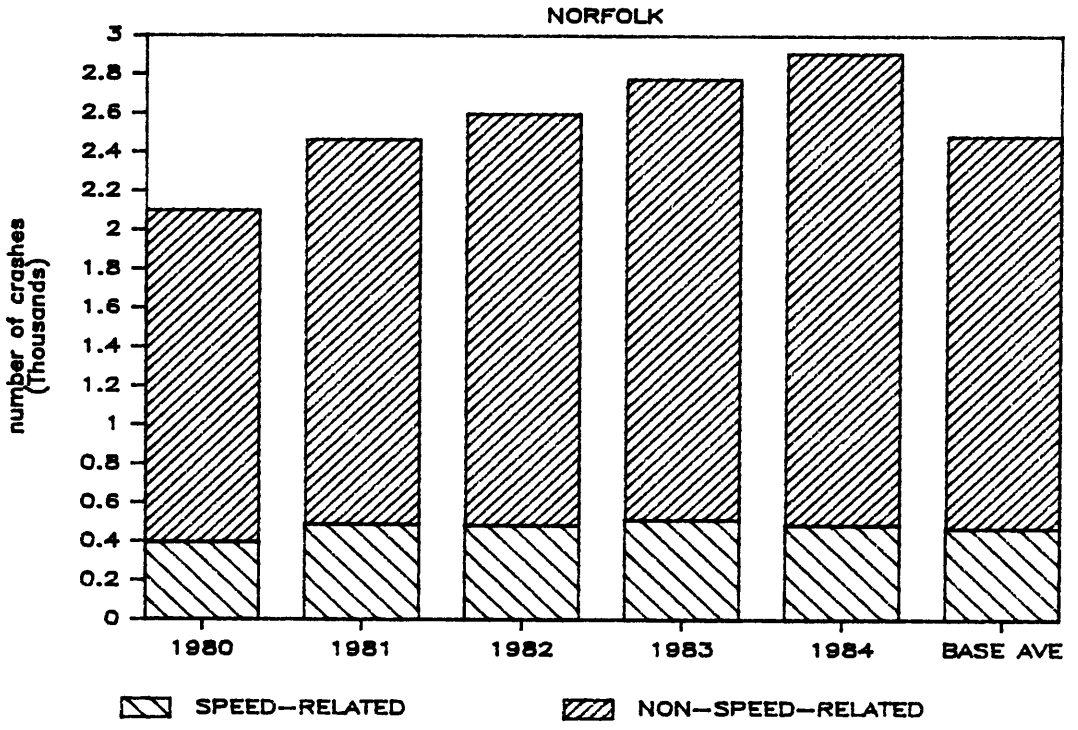
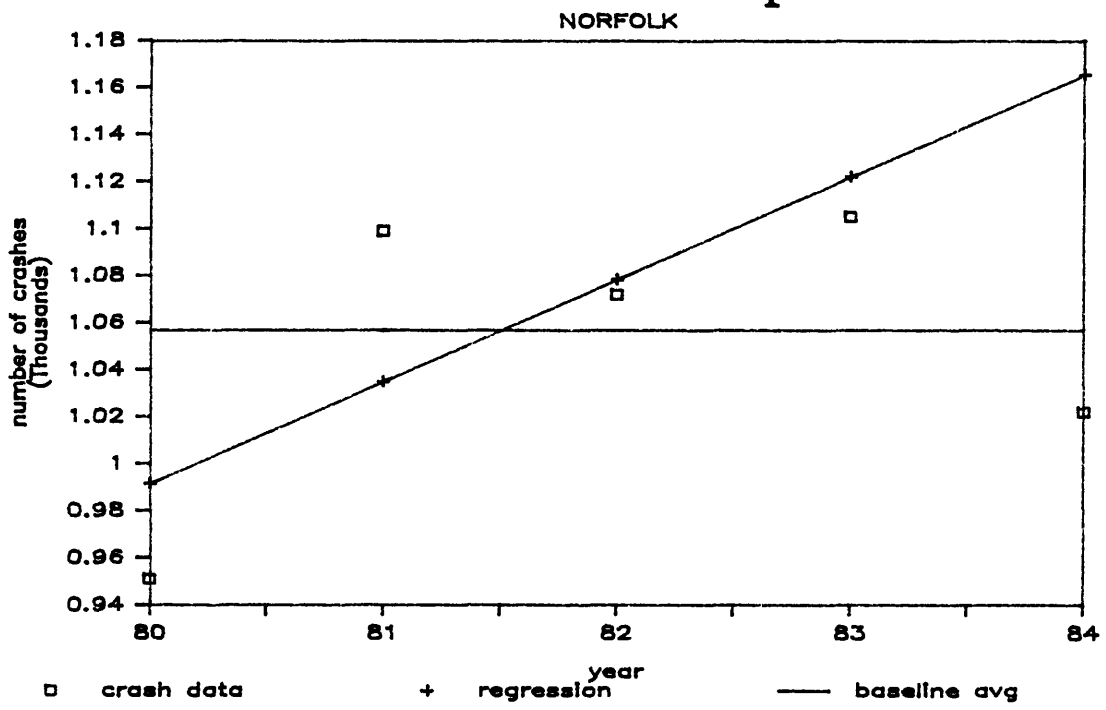


EXHIBIT 34

REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes

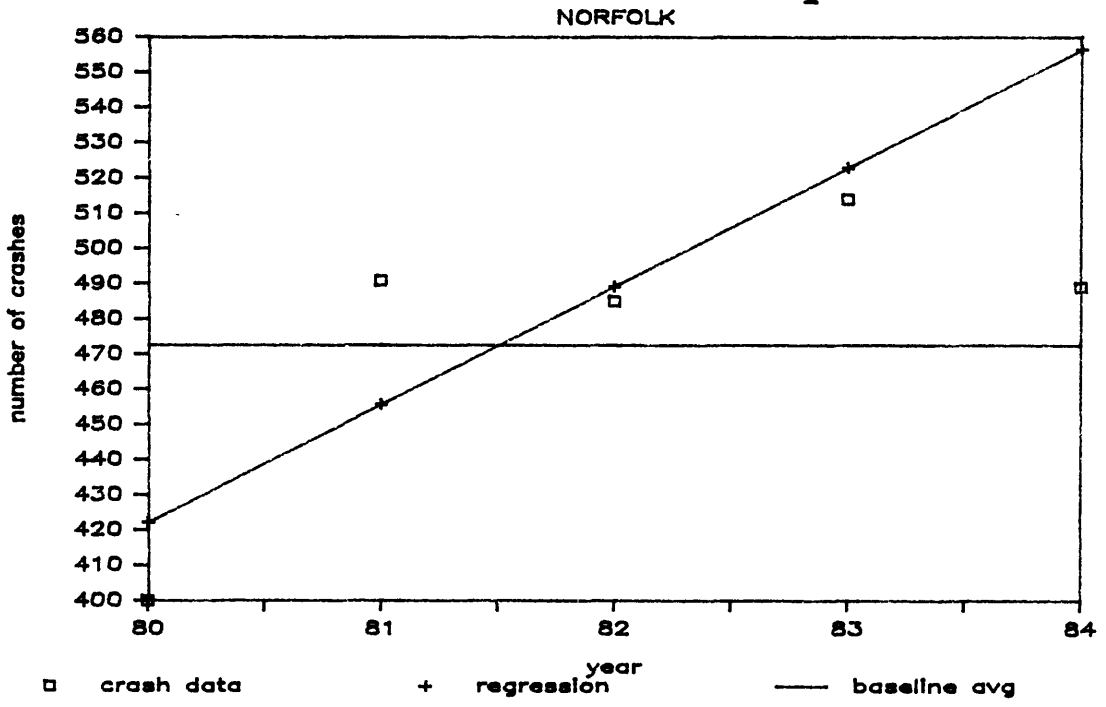
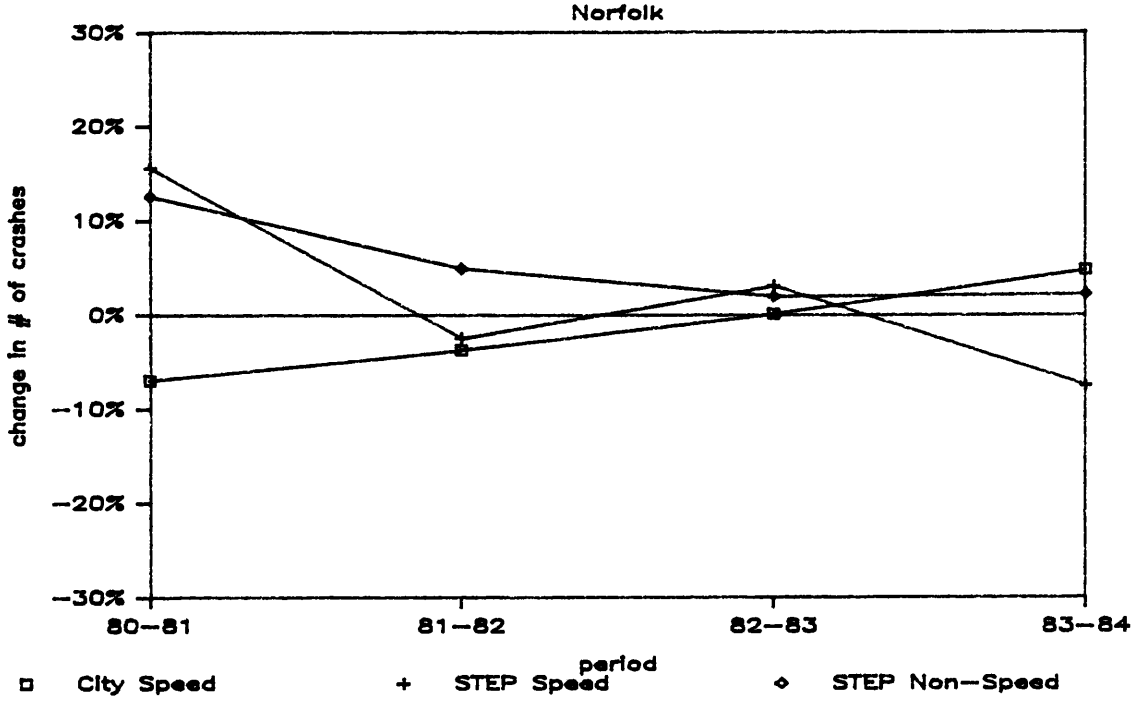


EXHIBIT 35

% CHANGE IN SPEED & CONTROL CRASHES



REFERENCES

1. Pub. L. No. 89-564, 80 Stat. 731.

2. 23 U.S.C. §402(a) (1985).

3. Id.

4. 23 C.F.R. §1204.4, Highway Safety Program No. 15, II. (1985).

5. Under the powers and duties of the Commissioner of the Department of Motor Vehicles enumerated in Va. Code Ann. §46.1-40.4 (Supp. 1985).

6. 23 U.S.C. §402(b)(1)(C) (1985).

7. 23 U.S.C. §1204.4, Supplement B (1985).

8. Daniel John Regan, Jr., and Alden 1. Atkins, Estimates of the Economic and Human Consequences of Motor Vehicle Accidents in Virginia During 1980, Virginia Highway & Transportation Council, Charlottesville, VA., October 1985.

9. 23 C.F.R. §1204.4, Supplement A, Chapter IV.5 (1985).

10. 23 C.F.R. §1204.4, Supplement B, Chapter II.3 (1985).

11. Charles B. Stoke, Alden L. Atkins, and Alan K. Caudell, Evaluation of 1982 Selective Speed Enforcement Projects in Virginia, Virginia Highway & Transportation Council, Charlottesville, VA. (1985),

    Stephen M. Sharkey and Charles B. Stoke, Evaluation of 1983 Selective Speed Enforcement Projects in Virginia, Virginia Highway & Transportation Council, Charlottesville, VA., 1985.

12. Virginia Department of State Police, Virginia Traffic Crash Facts, Richmond, VA., 1976-1984.

13. Jack D. Jernigan, The Comprehensive Community Based Traffic Safety Program Phase I: Problem Identification for District 2 and District 7, Virginia Highway & Transportation Research Council, Charlottesville, VA., 1986

APPENDIX A

TABLES AND EXHIBITS FOR STATE OF VIRGINIA CRASH DATA

BASELINE CRASH DATA: STATE OF VIRGINIA

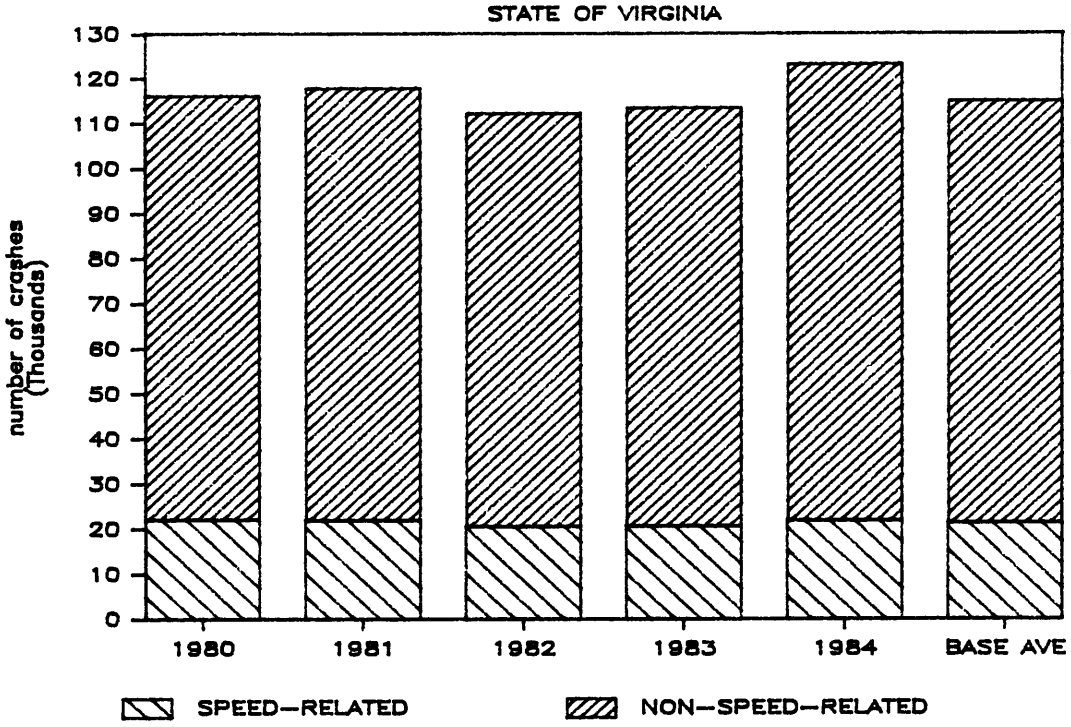
BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	40,392	41,686	41,262	44,161	48,196	41,875
Fatal	938	908	782	802	923	858
Injury	39,454	40,778	40,480	43,359	47,273	41,018
TOTAL	116,382	117,981	112,474	113,672	123,356	115,127
SPEED-CRASHES						
SERIOUS	9,797	9,828	9,344	9,869	10,591	9,710
Fatal	386	408	334	321	364	362
Injury	9,411	9,420	9,010	9,548	10,227	9,347
TOTAL	22,237	21,969	20,576	20,682	21,941	21,366
NON-SPEED-CRASHES						
SERIOUS	30,595	31,858	31,918	34,292	37,605	32,166
Fatal	552	500	448	481	559	495
Injury	30,043	31,358	31,470	33,811	37,046	31,671
TOTAL	94,145	96,012	91,898	92,990	101,415	93,761
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	19.1	18.6	18.3	18.2	17.8	18.6
Serious Crashes	24.3	23.6	22.6	22.3	22.0	23.2
CRASH SEVERITY PERCENTAGES						
All Crashes	34.7	35.3	36.7	38.8	39.1	36.4
Speed-Related	44.1	44.7	45.4	47.7	48.3	45.4

CHANGES IN CRASH DATA: STATE OF VIRGINIA

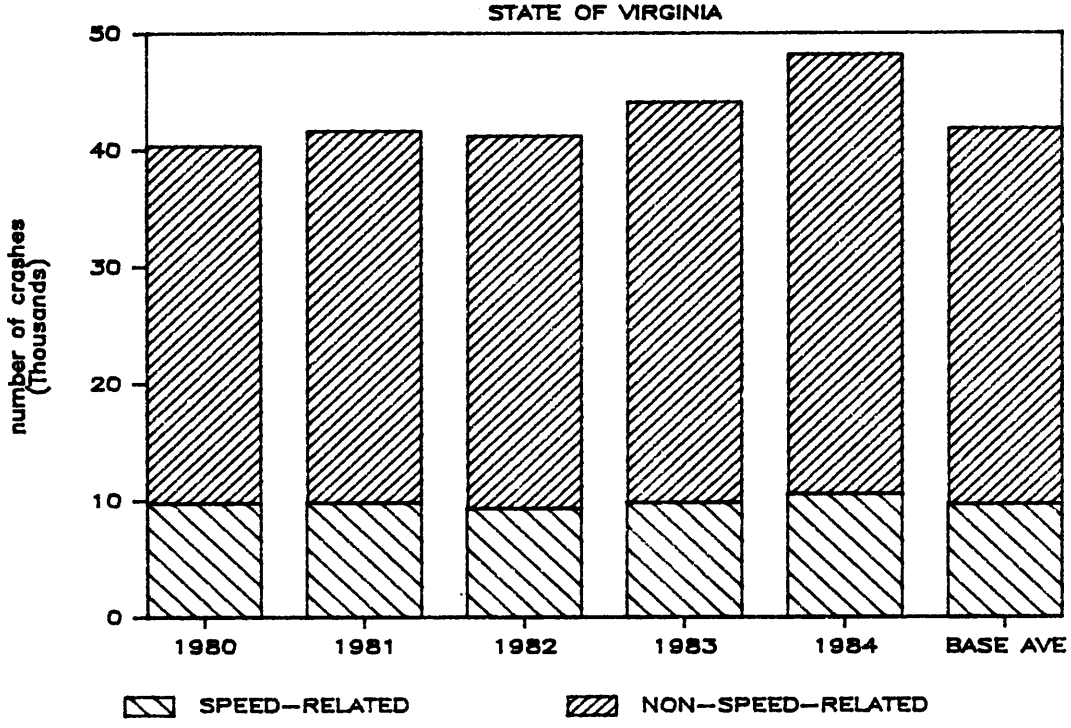
CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	1,599	-5,507	1,198	9,684	8,229
Percentage Change	1.4	-4.7	1.1	8.5	7.1
SERIOUS CRASHES					
Numeric Change	1,294	-424	2,899	4,035	6,321
Percentage Change	3.2	-1.0	7.0	9.1	15.1
ALL SPEED-CRASHES					
Numeric Change	-268	-1,393	106	1,259	575
Percentage Change	-1.2	-6.3	0.5	6.1	2.7
SERIOUS SPEED-CRASHES					
Numeric Change	31	-484	525	722	882
Percentage Change	0.3	-4.9	5.6	7.3	9.1
ALL NON-SPEED-CRASHES					
Numeric Change	1,867	-4,114	1,092	8,425	7,654
Percentage Change	2.0	-4.3	1.2	9.1	8.2
SERIOUS NON-SPEED-CRASHES					
Numeric Change	1,263	60	2,374	3,313	5,439
Percentage Change	4.1	0.2	7.4	9.7	16.9

NOTE: Negative numbers reflect a reduction in the number of crashes.

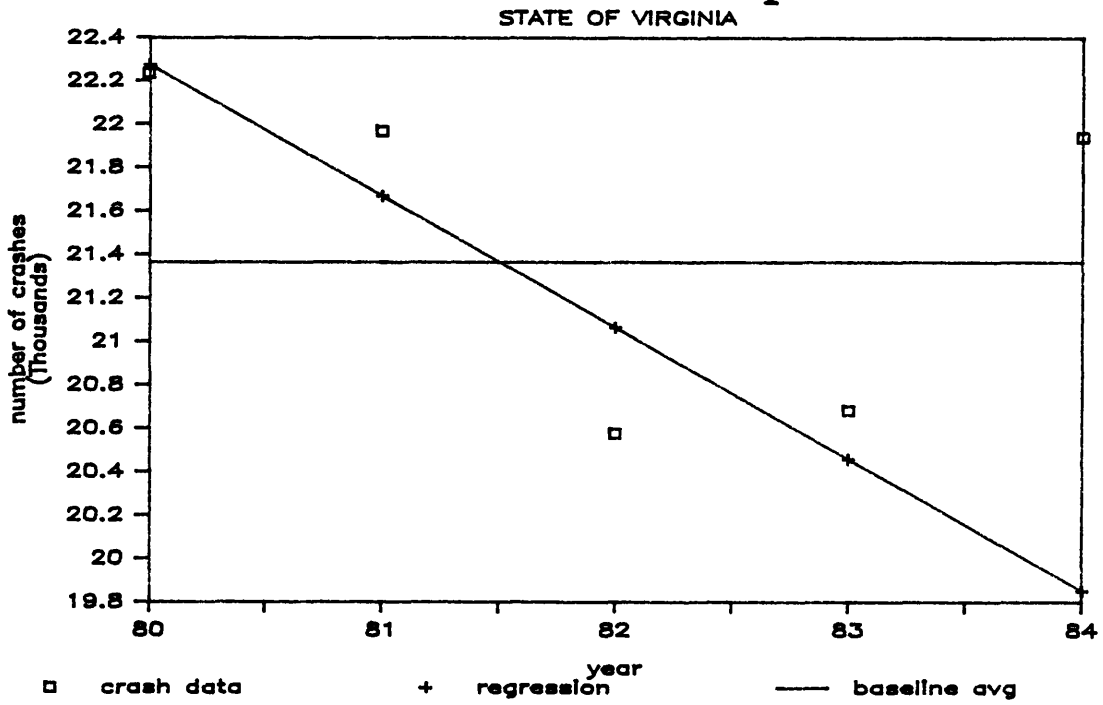
SPEED INVOLVEMENT – ALL CRASHES



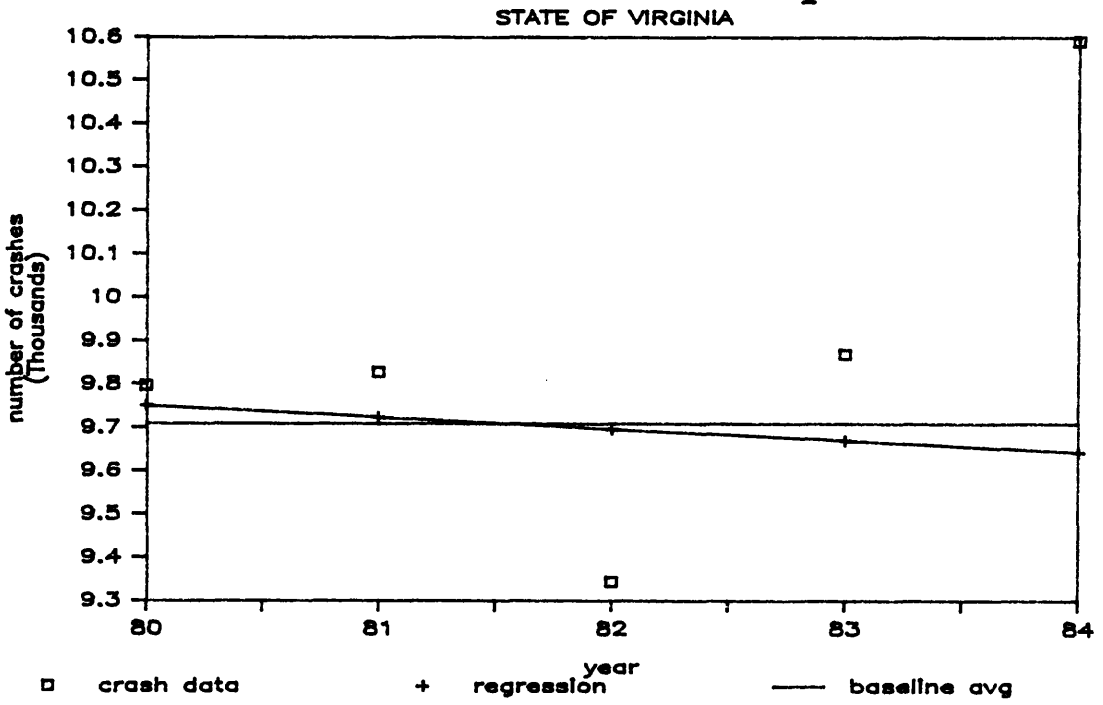
SPEED INVOLVEMENT – SERIOUS CRASHES



REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes



APPENDIX B

TABLES AND EXHIBITS FOR VIRGINIA COUNTIES CRASH DATA

BASELINE CRASH DATA: VIRGINIA COUNTIES

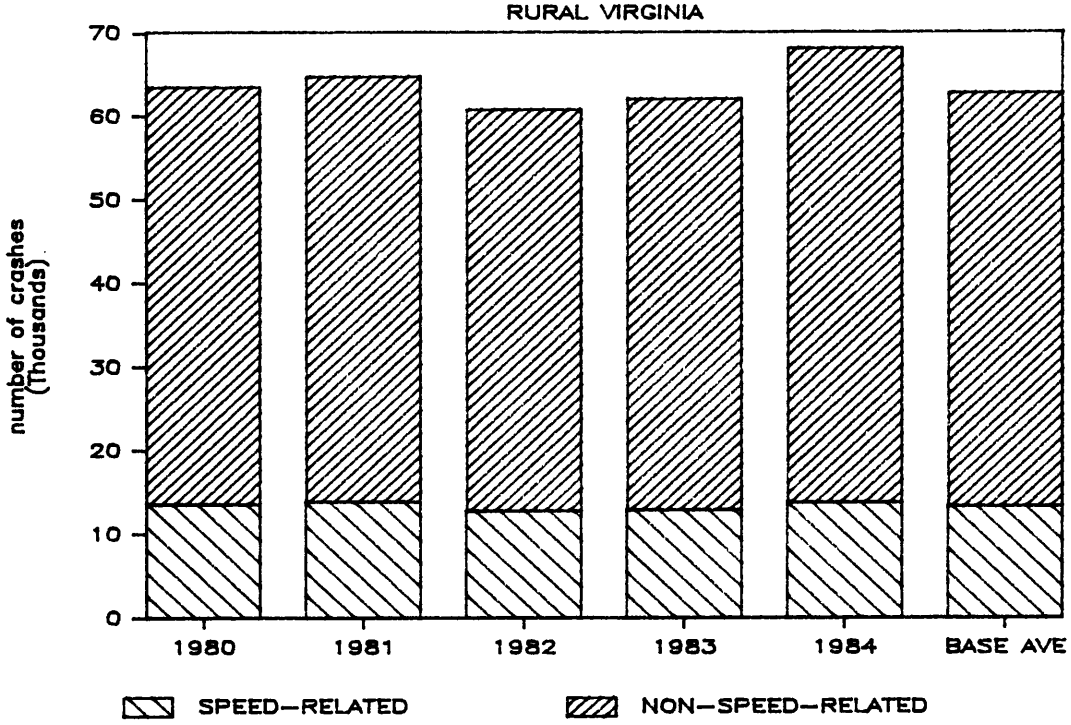
BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	23,896	24,349	23,708	25,289	27,818	24,311
Fatal	737	713	579	597	700	657
Injury	23,159	23,636	23,129	24,692	27,118	23,654
TOTAL	63,572	64,791	60,870	62,128	68,200	62,840
SPEED-CRASHES						
SERIOUS	6,282	6,498	6,125	6,468	6,930	6,343
Fatal	302	326	261	253	288	286
Injury	5,980	6,172	5,864	6,215	6,642	6,058
TOTAL	13,590	13,923	12,826	12,926	13,813	13,316
NON-SPEED-CRASHES						
SERIOUS	17,614	17,851	17,583	18,821	20,888	17,967
Fatal	435	387	318	344	412	371
Injury	17,179	17,464	17,265	18,477	20,476	17,596
TOTAL	49,982	50,868	48,044	49,202	54,387	49,524
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	21.4	21.5	21.1	20.8	20.3	21.2
Serious Crashes	26.3	26.7	25.8	25.6	24.9	26.1
CRASH SEVERITY PERCENTAGES						
All Crashes	37.6	37.6	38.9	40.7	40.8	38.7
Speed-Related	46.2	46.7	47.8	50.0	50.2	47.6

CHANGES IN CRASH DATA: VIRGINIA COUNTIES

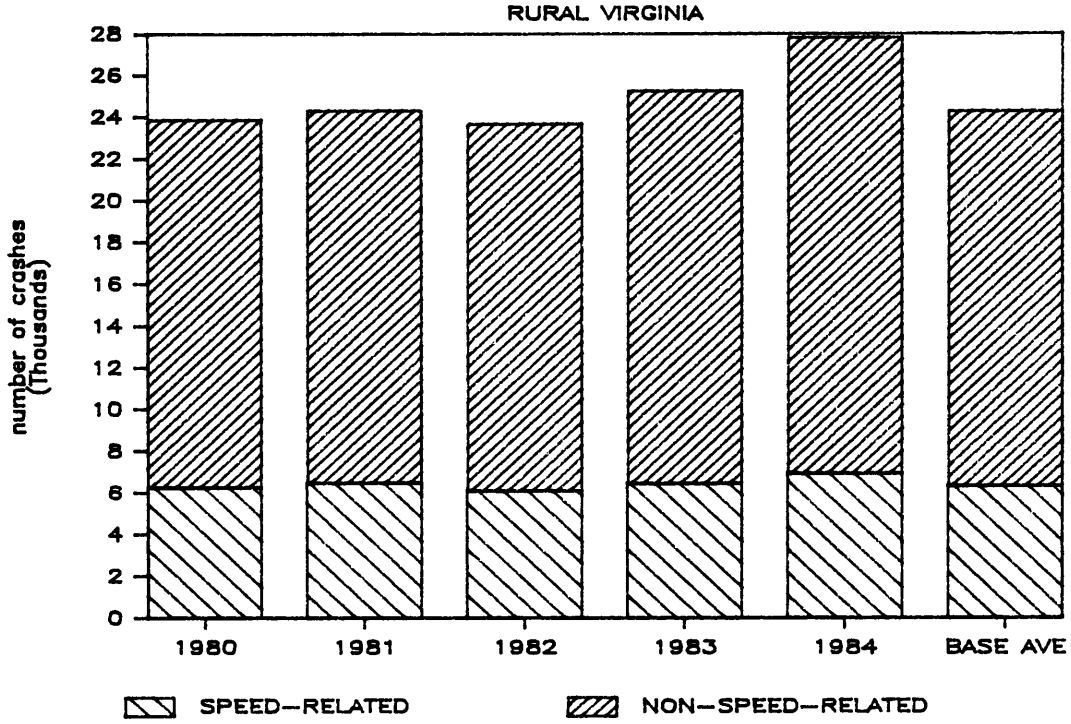
CRASH CATEGORIES	Changes over Baseline Period			Changes over Grant Period	
	1980 to 1981	1981 to 1982	1982 to 1983	1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	1,219	-3,921	1,258	6,072	5,360
Percentage Change	1.9	-6.1	2.1	9.8	8.5
SERIOUS CRASHES					
Numeric Change	453	-641	1,581	2,529	3,508
Percentage Change	1.9	-2.6	6.7	10.0	14.4
ALL SPEED-CRASHES					
Numeric Change	333	-1,097	100	887	497
Percentage Change	2.5	-7.9	0.8	6.9	3.7
SERIOUS SPEED-CRASHES					
Numeric Change	216	-373	343	462	587
Percentage Change	3.4	-5.7	5.6	7.1	9.2
ALL NON-SPEED-CRASHES					
Numeric Change	886	-2,824	1,158	5,185	4,863
Percentage Change	1.8	-5.6	2.4	10.5	9.8
SERIOUS NON-SPEED-CRASHES					
Numeric Change	237	-268	1,238	2,067	2,921
Percentage Change	1.3	-1.5	7.0	11.0	16.3

NOTE: Negative numbers reflect a reduction in the number of crashes.

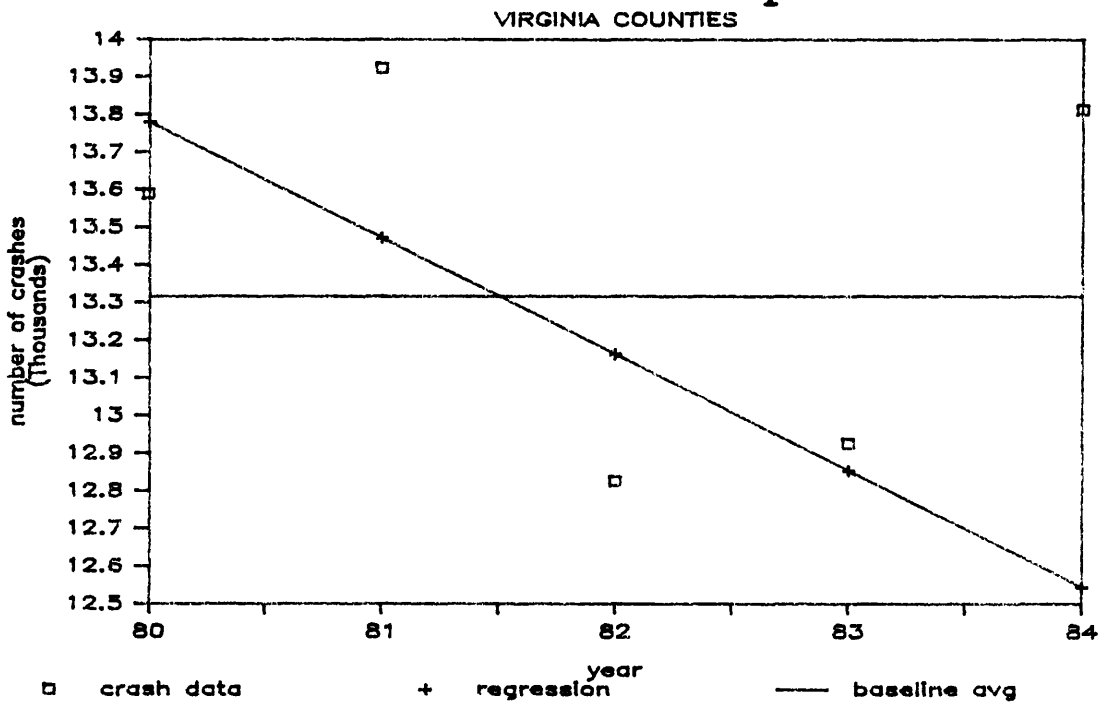
SPEED INVOLVEMENT – ALL CRASHES



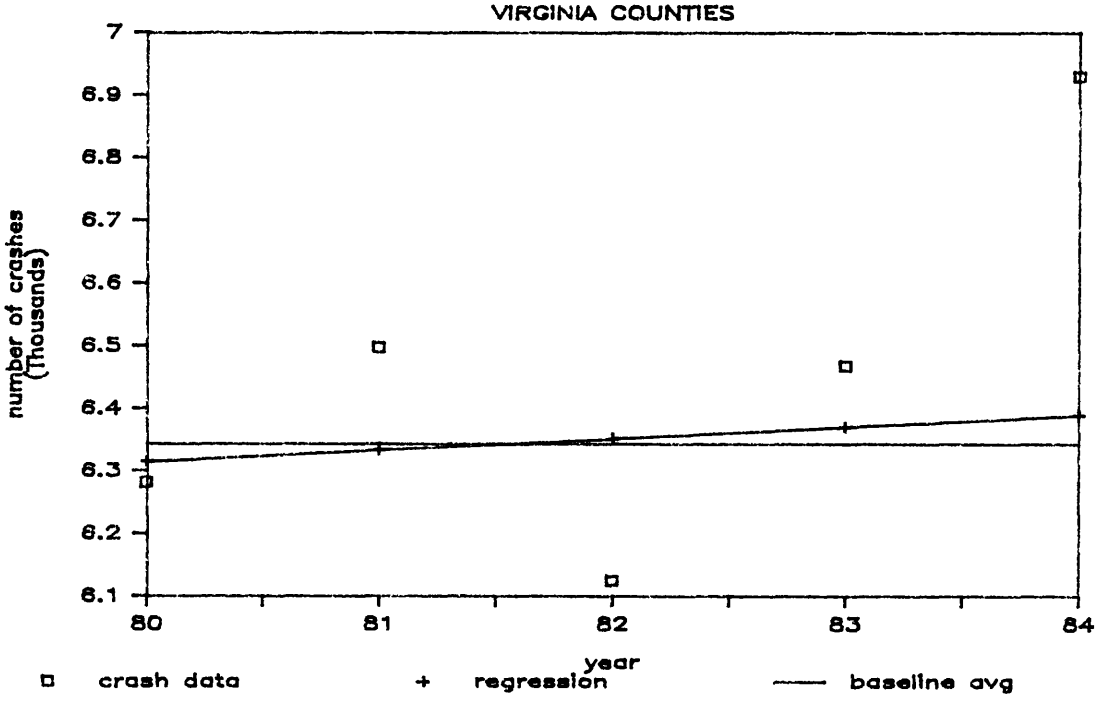
SPEED INVOLVEMENT – SERIOUS CRASHES



REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes



APPENDIX C

TABLES AND EXHIBITS FOR VIRGINIA CITIES CRASH DATA

BASELINE CRASH DATA: VIRGINIA CITIES

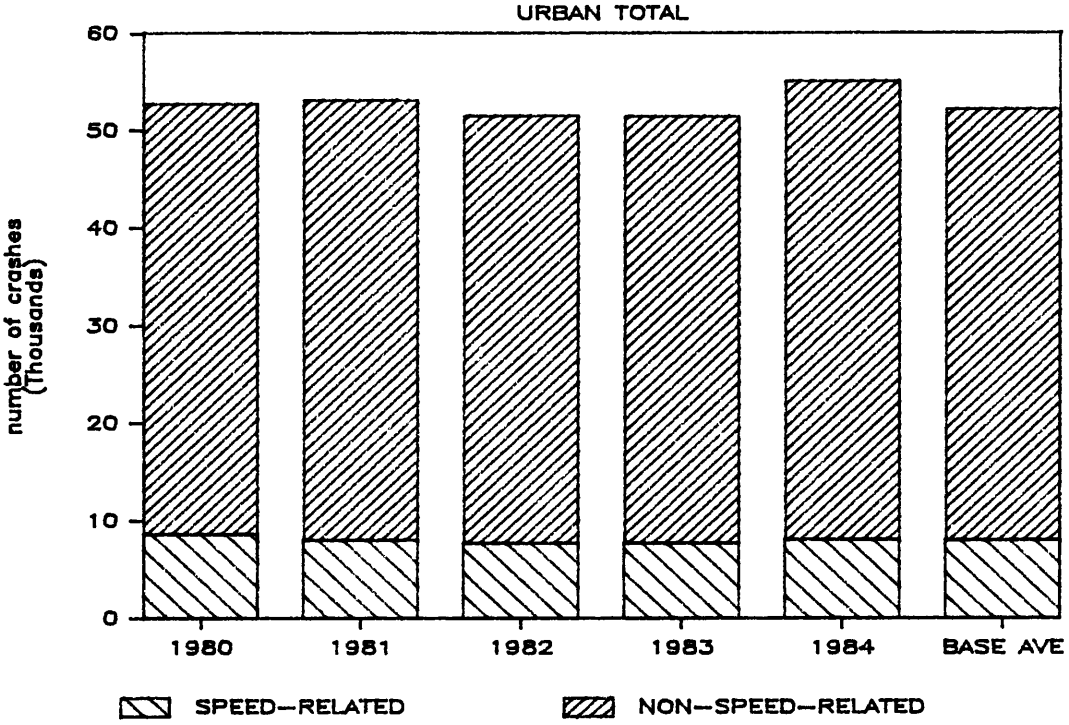
BASELINE DATA	1980	1981	1982	1983	1984	1980-1983 AVERAGE
ALL CRASHES						
SERIOUS	16,496	17,337	17,554	18,872	20,378	17,565
Fatal	201	195	203	205	223	201
Injury	16,295	17,142	17,351	18,667	20,155	17,364
TOTAL	52,810	53,190	51,604	51,544	55,156	52,287
SPEED-CRASHES						
SERIOUS	3,515	3,330	3,219	3,401	3,661	3,366
Fatal	84	82	73	68	76	77
Injury	3,431	3,248	3,146	3,333	3,585	3,290
TOTAL	8,647	8,046	7,750	7,756	8,128	8,050
NON-SPEED-CRASHES						
SERIOUS	12,981	14,007	14,335	15,471	16,717	14,199
Fatal	117	113	130	137	147	124
Injury	12,864	13,894	14,205	15,334	16,570	14,074
TOTAL	44,163	45,144	43,854	43,788	47,028	44,237
SPEED INVOLVEMENT PERCENTAGES						
All Crashes	16.4	15.1	15.0	15.0	14.7	15.4
Serious Crashes	21.3	19.2	18.3	18.0	18.0	19.2
CRASH SEVERITY PERCENTAGES						
All Crashes	31.2	32.6	34.0	36.6	36.9	33.6
Speed-Related	40.6	41.4	41.5	43.8	45.0	41.8

CHANGES IN CRASH DATA: VIRGINIA CITIES

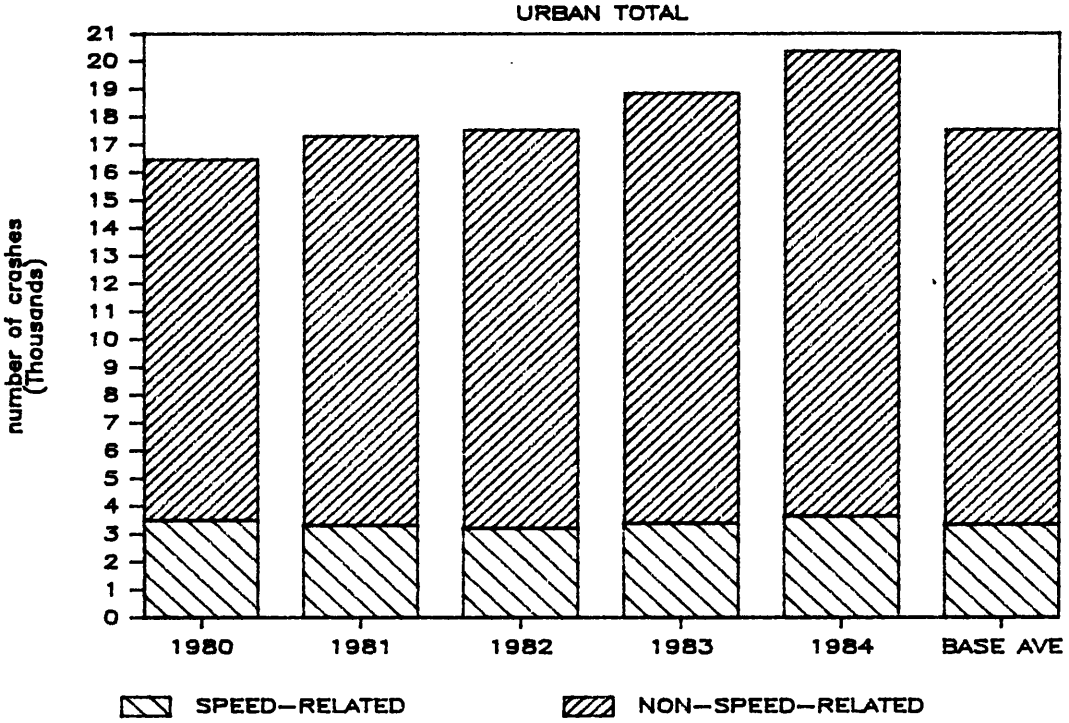
CRASH CATEGORIES	Changes over Baseline Period: 1980 to 1981	1981 to 1982	1982 to 1983	Changes over Grant Period: 1983 to 1984	BASELINE AVG to 1984
ALL CRASHES					
Numeric Change	380	-1,586	-60	3,612	2,869
Percentage Change	0.7	-3.0	-0.1	7.0	5.5
SERIOUS CRASHES					
Numeric Change	841	217	1,318	1,506	2,813
Percentage Change	5.1	1.3	7.5	8.0	16.0
ALL SPEED-CRASHES					
Numeric Change	-601	-296	6	372	78
Percentage Change	-7.0	-3.7	0.1	4.8	1.0
SERIOUS SPEED-CRASHES					
Numeric Change	-185	-111	182	260	295
Percentage Change	-5.3	-3.3	5.7	7.6	8.8
ALL NON-SPEED-CRASHES					
Numeric Change	981	-1,290	-66	3,240	2,791
Percentage Change	2.2	-2.9	-0.2	7.4	6.3
SERIOUS NON-SPEED-CRASHES					
Numeric Change	1,026	328	1,136	1,246	2,519
Percentage Change	7.9	2.3	7.9	8.1	17.7

NOTE: Negative numbers reflect a reduction in the number of crashes.

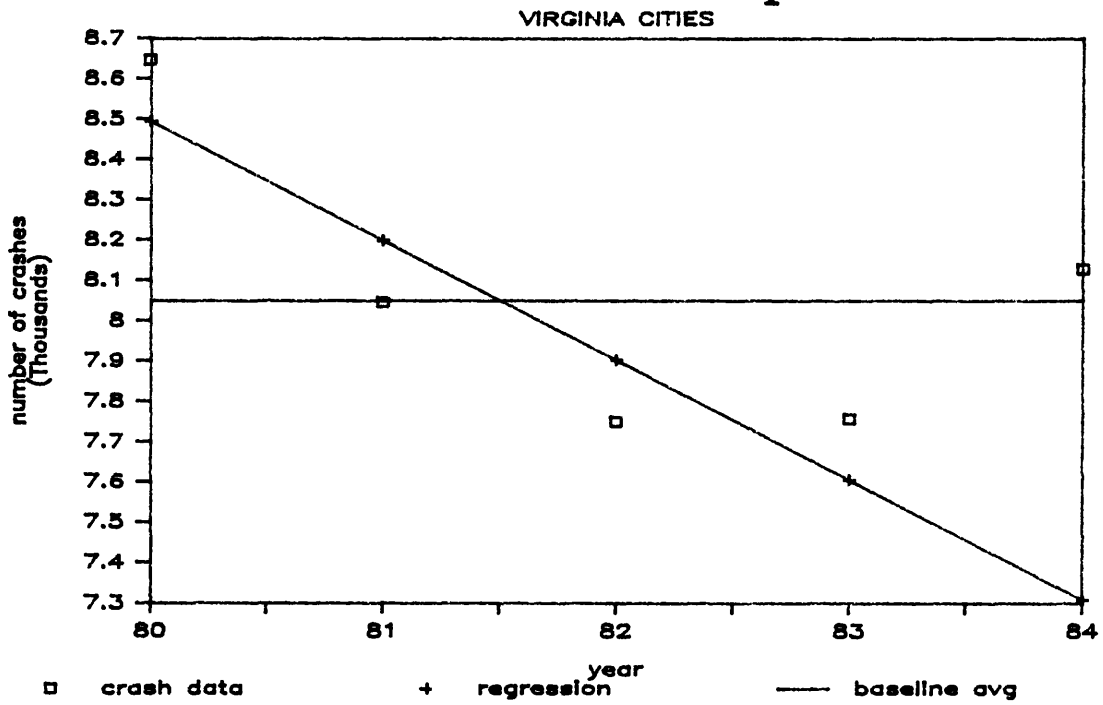
SPEED INVOLVEMENT – ALL CRASHES



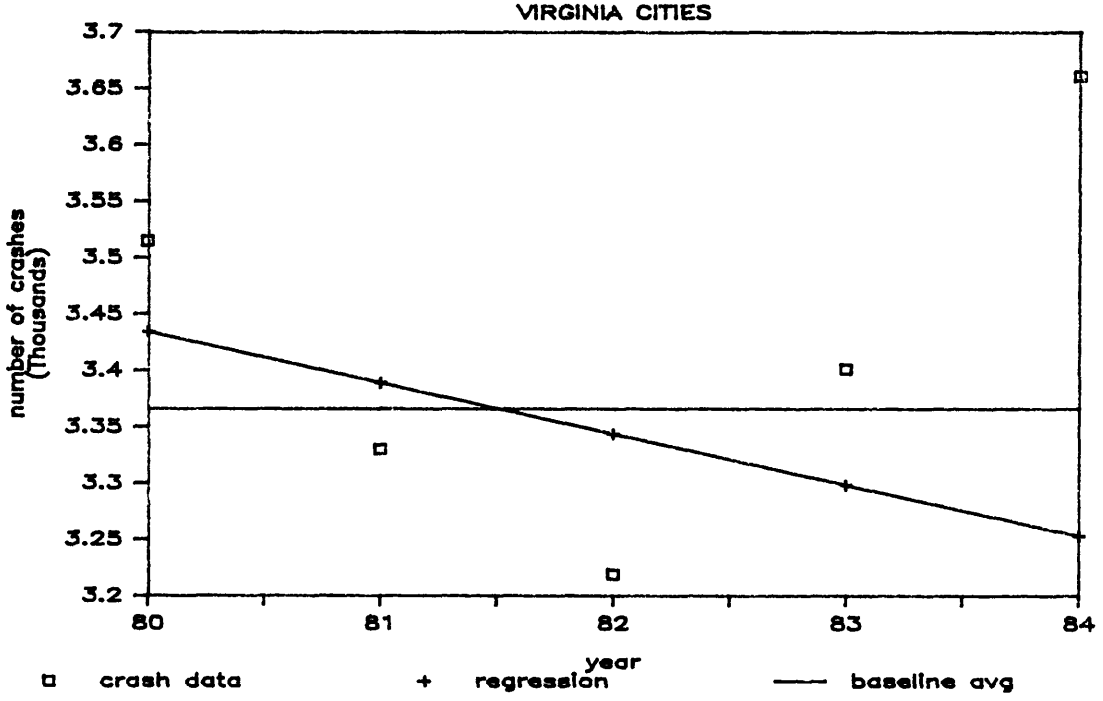
SPEED INVOLVEMENT – SERIOUS CRASHES



REGRESSION ANALYSIS: Speed Crashes



REGRESSION ANALYSIS: Ser. Speed Crashes



APPENDIX D

DEMOGRAPHIC INFORMATION ON STEP COMMUNITIES

DEMOGRAPHIC INFORMATION ON STEP COMMUNITIES

COMMUNITY	1984 POPULATION	RANK IN POPULATION	VEHICLES REGISTERED IN 1984	AREA IN SQUARE MILES	POPULATION DENSITY	INTERSTATE & PRIMARY ROAD MILEAGE	SECONDARY ROAD MILEAGE
COUNTIES							
ALBEMARLE	58,600	10	43,787	740	79	178	748
GOOCHLAND	12,500	64	10,797	295	42	103	275
CITIES							
HERNDON	na	na	na	4	na	3	32
LYNCHBURG	67,300	10	45,149	50	1,346	47	258
MANASSAS PARK	6,300	37	1,497	2	3,150	2	12
NORFOLK	279,800	2	151,097	64	4,372	106	627
PETERSBURG	40,800	13	23,704	23	1,774	27	150
PORTSMOUTH	107,900	7	63,033	45	2,398	34	361
RICHMOND	219,100	3	137,103	63	3,478	88	697
STATE							
COUNTIES	3,507,400					1,706	42,965
CITIES	2,128,100					8,176	1,379
* TOTAL	5,635,500		4,099,966	40,767	138	10,006	44,511

* Note: Total Road Mileage figures are not equal to the sum of county and city figures because the totals include mileage for state property, such as state parks and school roads.

SOURCE:

1) Population data were taken from Estimates of the Population of Virginia Counties and Cities, The Tayloe Murphy Institute (1985). Population rank based on separate rankings of 41 cities and 95 counties in Virginia in the same report.

2) Road mileage data were extracted from Mileage Tables, Virginia Dept. of Highways & Transportation (1984).

APPENDIX E

RANK ORDERING METHODOLOGY

The classification of STEP communities into high, medium, and low priority communities was accomplished through the use of rank-sums of two sets of measures: (1) the number of speed-crashes in each community and (2) the percentage of crashes that were speed-related. The first step in the ranking process was to collect data. Crash data were compiled from Mini-Crash Facts for the years 1980 through 1983 for all Virginia cities. Crash data were compiled for all Virginia counties for the years 1981 through 1983. The shorter period for counties was necessary because of difficulties in obtaining the data. Registration data for the communities were obtained from the Department of Motor Vehicles.

The second step in the process was to rank the communities on each of four criteria: (1) the raw number of crashes in the community, (2) the number of crashes per registered vehicle in the community, (3) the percentage of crashes in the community that were speed-related, and (4) the percentage of speed-related crashes in the community that were serious. The rankings were from high to low, so that the community with the highest number of crashes was ranked 1, the next 2, etc.

The third step was to graph the rankings produced in the second step using the rankings based on the number of speed-crashes as axes for one graph and the rankings based on the speed involvement percentages as axes for the other. The approach of using two rankings as the axes of the graph is mathematically equivalent to summing the separate rankings; thus, the position of any one community is its rank-sum of the two individual rankings.

Finally, the communities were divided into three priority groups: high, medium, and low. The divisions were made by looking for groups or clusters of communities with approximately the same rank-sums and for breaks in the clusters. The clusters closest to the origin were classified as high priority communities; the succeeding set of clusters as medium priority communities; and the farthest set as low priority communities.

Urban and rural communities were ranked separately because of the difference in the nature of the respective speed-crash problems. The positions of the STEP communities were labelled in the graphs with the

first letter of the name of the community (the first and second for cases in which the name of more than one STEP community began with the same letter). The final graphs and the underlying numerical rankings are included in Appendix F.

Any attempt to classify Virginia's communities into priority groups will be somewhat arbitrary. The rank-sum process used here is not immune from this criticism, especially in the line-drawing step (step 4 above). It does, however, have specific advantages:

- The ranking process does not attempt to discern whether a community suffered from a speed-crash problem at all; rather the process compares the relative severity of the local speed-crash problem with that of other Virginia communities.

- The rankings are based on data accumulated over a period of time, reducing inconsistencies from annual fluctuations in the number of crashes.

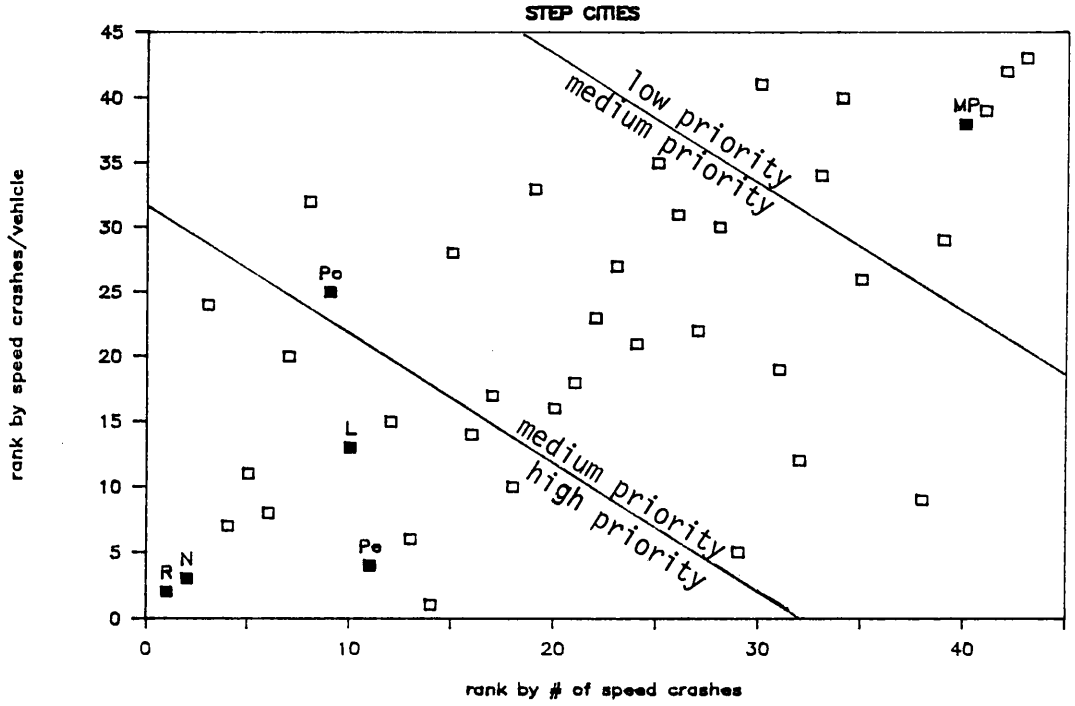
- The numerical rankings are based both on absolute numbers of crashes and normalized numbers of crashes, both of which are relevant to determining the priority of a local crash problem relative to the problems of other communities.

The priority ranking process described above was developed by Jack Jernigan for the Highway and Transportation Research Council. For further information and examples of its application, see Jack D. Jernigan, The Comprehensive Community Based Traffic Safety Program Phase I: Problem Identification for District 2 andDistrict 7, Virginia Highway & Transportation Research Council, Charlottesville, VA (June 1986).

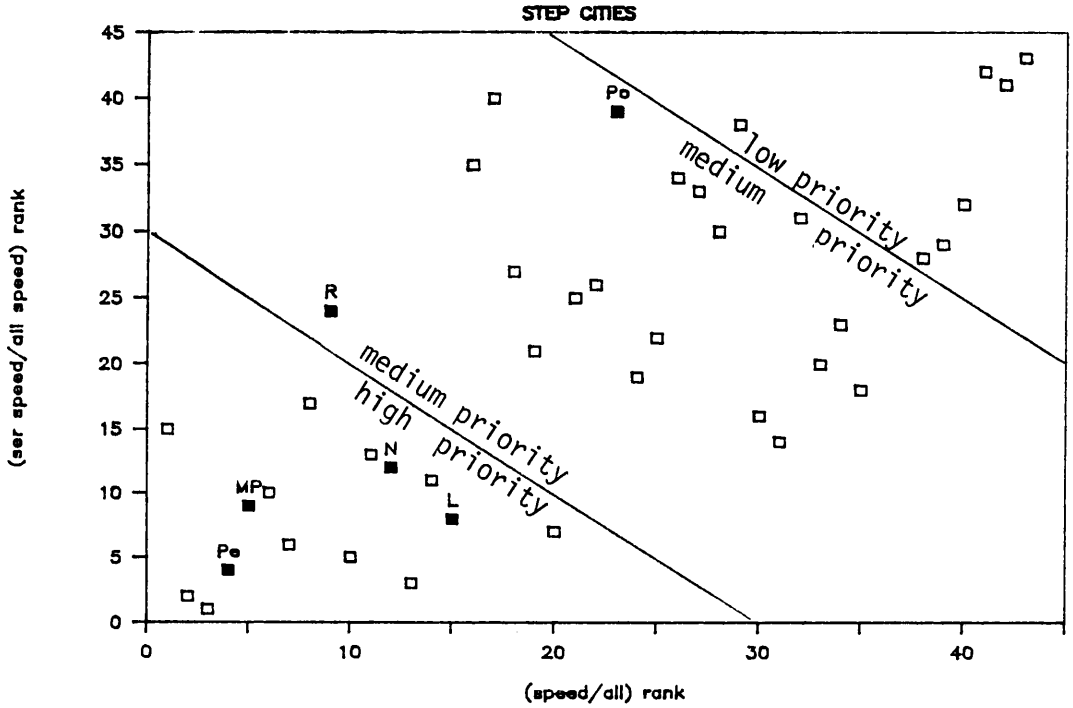
APPENDIX F

RANK ORDERING OF VIRGINIA COMMUNITIES

RANKING BY # OF SPEED–CRASHES

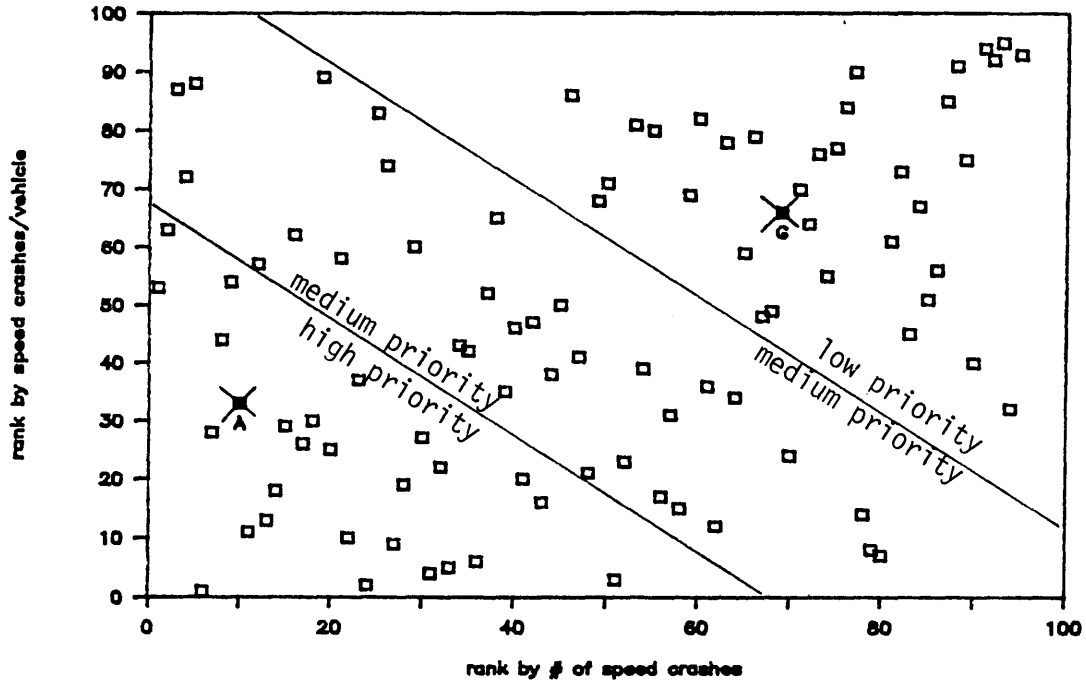


RANKING BY SPEED INVOLVEMENT %



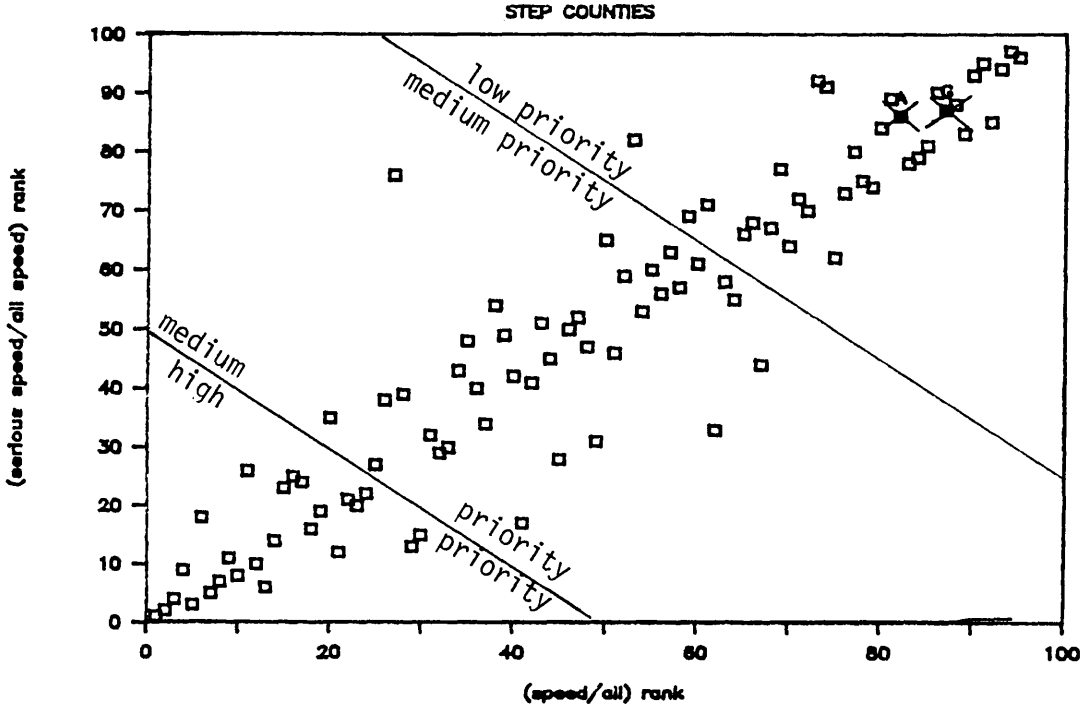
RANKING BY # OF SPEED–CRASHES

STEP COUNTIES



RANKING BY SPEED INVOLVEMENT %

STEP COUNTIES



SPEED-CRASH PROBLEM RANKING
OF VIRGINIA COUNTIES

	RANKING BY			
county	raw # of speed-crashes	speed-crashes per registered vehicle	% of all crashes that are speed-related	% of serious crashes that are speed-related
ALBEMARLE	10	33	82	86
GOOCHLAND	69	66	87	87
ACCOMACK	46	86	79	74
ALLEGHANY	54	39	65	66
AMELIA	70	24	24	22
AMHERST	32	22	42	41
APPOMATTOX	65	59	40	42
ARLINGTON	2	63	91	95
AUGUSTA	16	62	55	60
BATH	79	8	20	35
BEDFORD	29	60	37	34
BLAND	80	7	17	24
BOTETOURT	40	46	71	72
BRUNSWICK	52	23	36	40
BUCHANAN	6	1	2	2
BUCKINGHAM	68	49	48	47
CAMPBELL	21	58	52	59
CAROLINE	36	6	43	51
CARROLL	27	9	10	8
CHARLES CITY	85	51	54	53
CHARLOTTE	72	64	49	31
CHESTERFIELD	5	88	94	97
CLARKE	56	17	19	19
CRAIG	90	40	53	82
CULPEPER	39	35	28	39
CUMBERLAND	83	45	62	33
DICKENSON	24	2	1	1
DINWIDDIE	41	20	30	15
ESSEX	87	85	92	85
FAIRFAX	1	53	89	83
FAUQUIER	17	26	31	32
FLOYD	57	31	13	6
FLUVANA	58	15	7	5
FRANKLIN	20	25	21	12
FREDERICK	18	30	18	16
GILES	59	69	23	20

county	RANKING BY raw # of speed-crashes	speed-crashes per registered vehicle	% of all crashes that are speed-related	% of serious crashes that are speed-related
GLOUCESTER	50	71	76	73
GRAYSON	48	21	4	9
GREENE	84	67	83	78
GREENESVILLE	51	3	9	11
HALIFAX	28	19	33	30
HANOVER	25	83	88	88
HENRICO	3	87	93	94
HENRY	7	28	26	38
HIGHLAND	94	32	27	76
ISLE OF WIGHT	44	38	61	71
JAMES CITY	53	81	80	84
KING GEORGE	89	75	64	55
KING WILLIAM	64	34	60	61
KING and QUEEN	93	95	67	44
LANCASTER	91	94	81	89
LEE	33	5	6	18
LOUDOUN	9	54	44	45
LOUISA	47	41	46	50
LUNENBURG	67	48	14	14
MADISON	81	61	73	92
MATHEWS	92	92	58	57
MECKLENBURG	37	52	32	29
MIDDLESEX	82	73	39	49
MONTGOMERY	26	74	57	63
NELSON	61	36	63	58
NEW KENT	62	12	66	68
NORTHAMPTON	75	77	75	62
NORTHUMBERLAND	88	91	56	56
NOTTOWAY	76	84	41	17
ORANGE	60	82	72	70
PAGE	55	80	34	43
PATRICK	43	16	5	3
PITTSYLVANIA	12	57	50	65
POWHATAN	71	70	70	64
PRINCE EDWARD	73	76	74	91
PRINCE GEORGE	77	90	95	96
PRINCE WILLIAM	4	72	86	90
PULASKI	38	65	59	69

	RANKING BY			
county	raw # of speed-crashes	speed-crashes per registered vehicle	% of all crashes that are speed-related	% of serious crashes that are speed-related
RAPPAHANNOCK	78	14	29	13
RICHMOND	95	93	84	79
ROANOKE	19	89	85	81
ROCKBRIDGE	31	4	22	21
ROCKINGHAM	8	44	25	27
RUSSELL	22	10	8	7
SCOTT	45	50	35	48
SHENANDOAH	34	43	12	10
SMYTH	35	42	11	26
SOUTHHAMPTON	63	78	90	93
SPOTSYLVANIA	23	37	77	80
STAFFORD	14	18	38	54
SURRY	86	56	69	77
SUSSEX	74	55	78	75
TAZEWELL	15	29	15	23
WARREN	49	68	45	28
WASHINGTON	13	13	16	25
WESTMORELAND	66	79	51	46
WISE	11	11	3	4
WYTHE	42	47	47	52
YORK	30	27	68	67

SPEED-CRASH PROBLEM RANKING
OF VIRGINIA INDEPENDENT CITIES

	RANKING BY			
county	raw # of speed-crashes	speed-crashes per registered vehicle	% of all crashes that are speed-related	% of serious crashes that are speed-related
Alexandria	7	20	28	30
Bedford	32	12	2	2
Bristol	23	27	22	26
Buena Vista	41	39	35	18
Charlottesville	13	6	24	19
Chesapeake	8	32	32	31
Clifton Forge	42	42	42	41
Colonial Heights	30	41	41	42
Covington	43	43	31	14
Danville	12	15	18	27
Emporia	35	26	38	28
Fairfax	14	1	14	11
Falls Church	24	21	6	10
Franklin	33	34	16	35
Fredericksburg	18	10	39	29
Galax	31	19	30	16
Hampton	4	7	8	17
Harrisonburg	21	18	33	20
Hopewell	19	33	29	38
Lexington	39	29	27	33
Lynchburg	10	13	15	8
Manassas	20	16	10	5
Manassas Park	40	38	5	9
Martinsville	22	23	34	23
Newport News	5	11	11	13
Norfolk	2	3	12	12
Norton	38	9	43	43
Petersburg	11	4	4	4
Poquoson	34	40	1	15
Portsmouth	9	25	23	39
Radford	28	30	26	34
Richmond	1	2	9	24
Roanoke	6	8	13	3
Salem	16	14	7	6
South Boston	29	5	3	1
Staunton	25	35	25	22

	RANKING BY			
county	raw # of speed-crashes	speed-crashes per registered vehicle	% of all crashes that are speed-related	% of serious crashes that are speed-related
Suffolk	15	28	40	32
Virginia Beach	3	24	19	21
Waynesboro	26	31	21	25
Williamsburg	27	22	17	40
Winchester	17	17	20	7

APPENDIX G

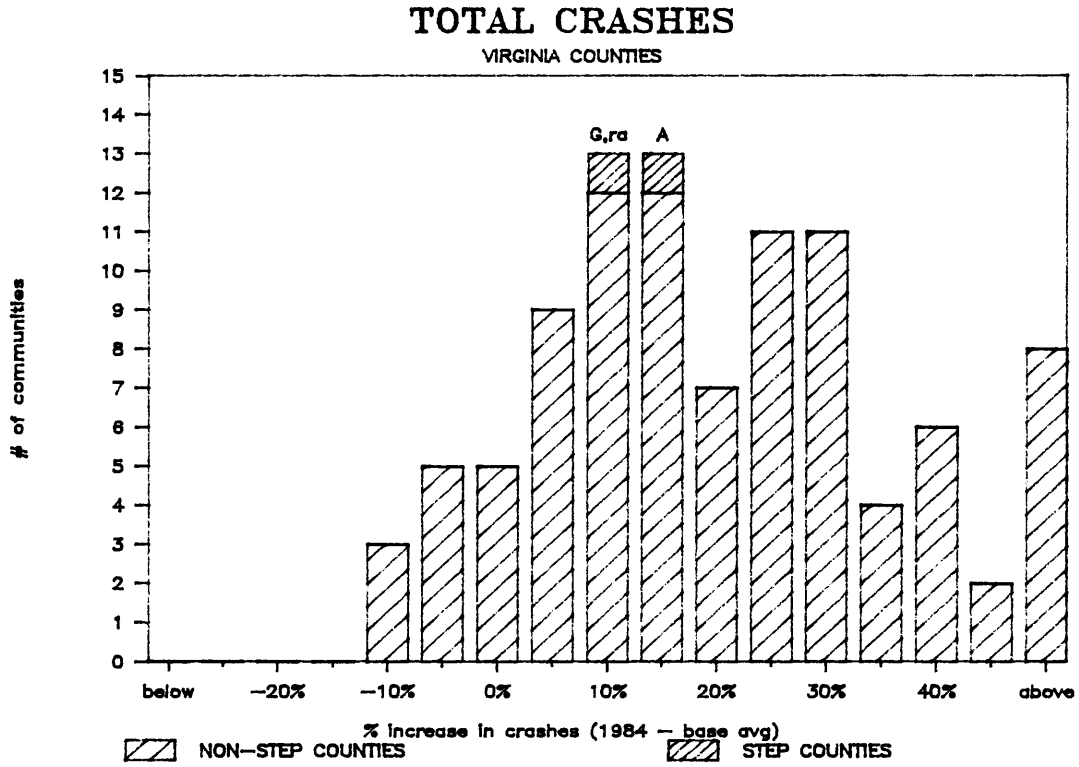
COMPARISON OF CHANGES IN CRASH DATA FOR VIRGINIA COMMUNITIES

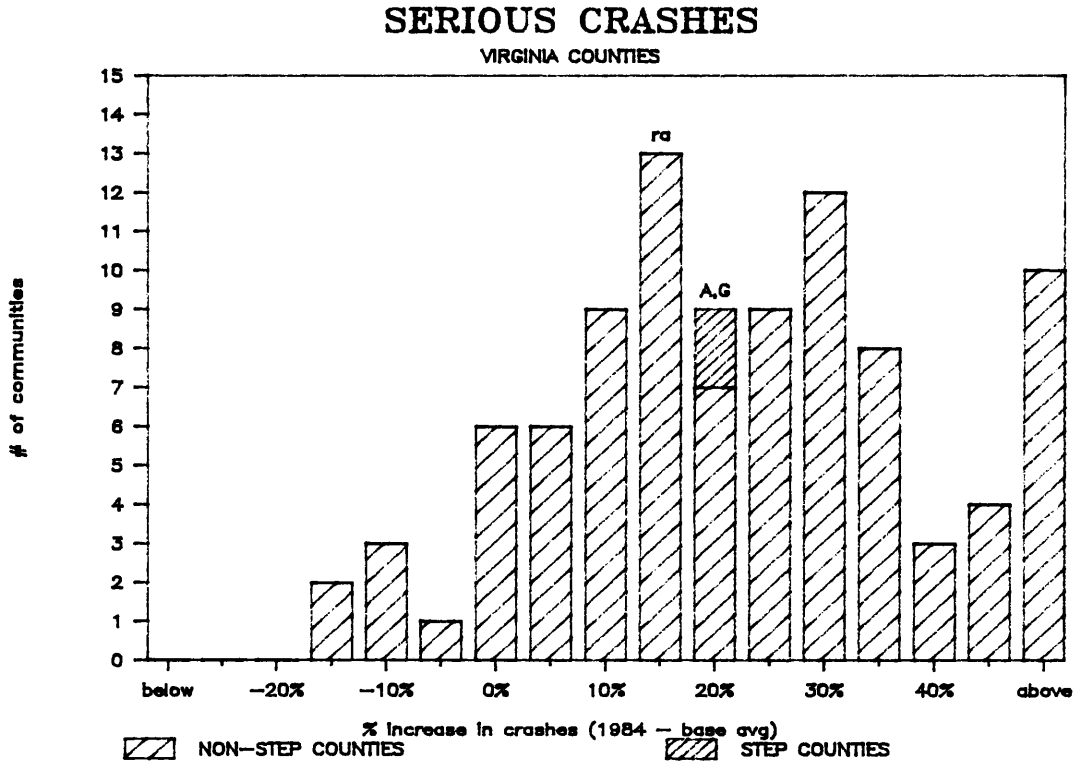
This appendix graphically presents the percentage change in the number of crashes between the baseline average and 1984 for all Virginia communities. These graphs allow the reader to compare the percentage change in the number of crashes for each STEP community against the percentage change for all other Virginia communities.

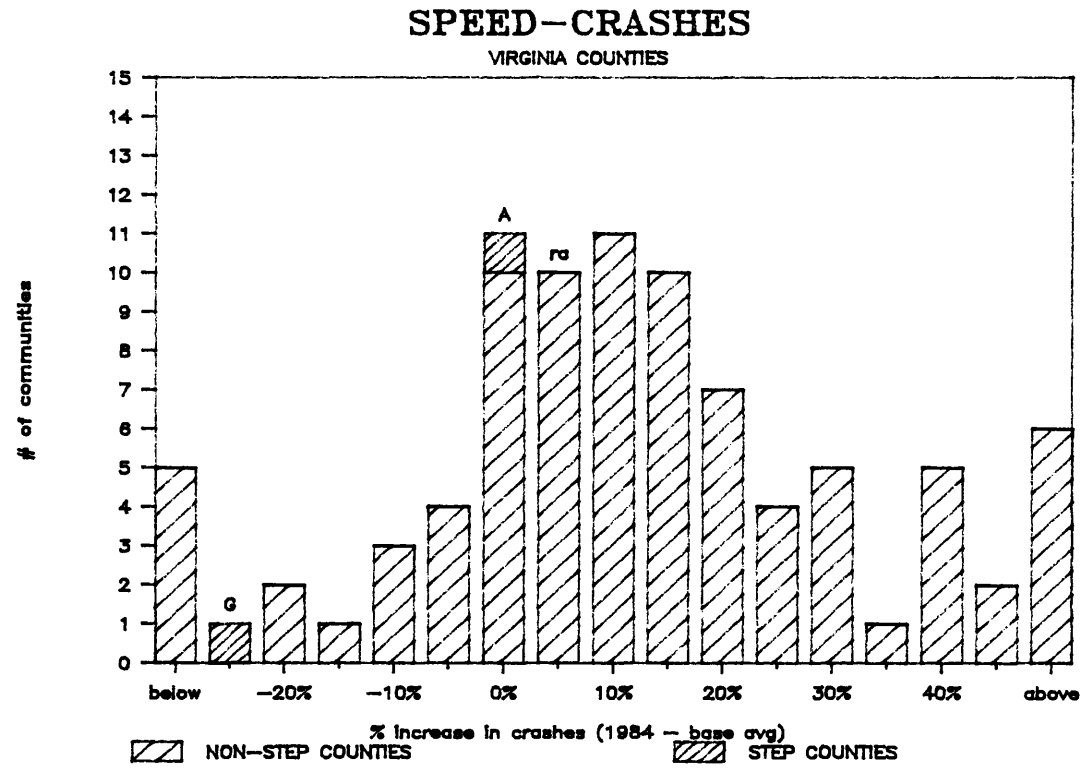
The graphs were prepared separately for Virginia cities as a set and counties as another set in the following manner. The percentage change in the number of crashes for each category was calculated for each Virginia community having at least 20 such crashes. Those communities with 20 or fewer crashes of any particular type were not included, since a numeric difference of a single crash would amount to a 5% or greater change under these circumstances. Then communities were grouped together in by changes of 5% increments and counted. For example, 13 communities were counted in which total crashes were between 5% and 10% higher in 1984 than in the four-year baseline average. The number of communities in each 5% increment was represented in a bar graph, with the STEP communities highlighted and labelled for identification. The labels used were -

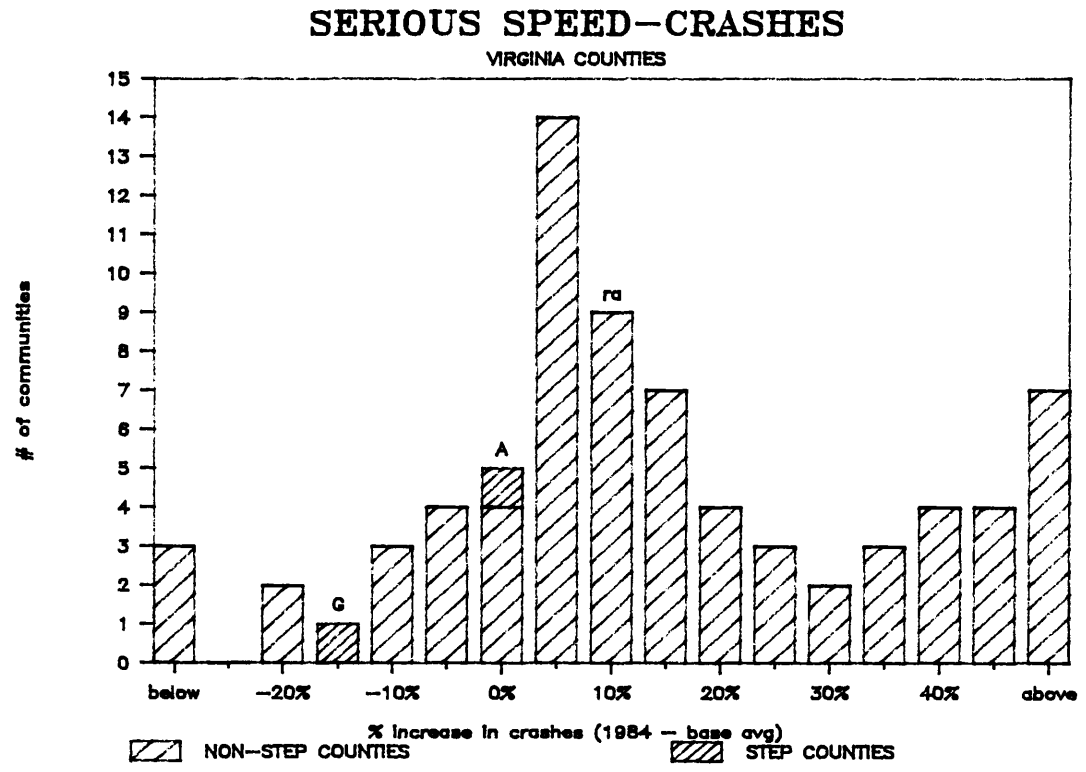
A	Albemarle County
G	Goochland County
ra	Rural Average (average of Virginia counties)
H	Herndon
L	Lynchburg
Mp	Manassas Park
N	Norfolk
Pe	Petersburg
Po	Portsmouth
R	Richmond
ua	Urban Average (average of Virginia cities)

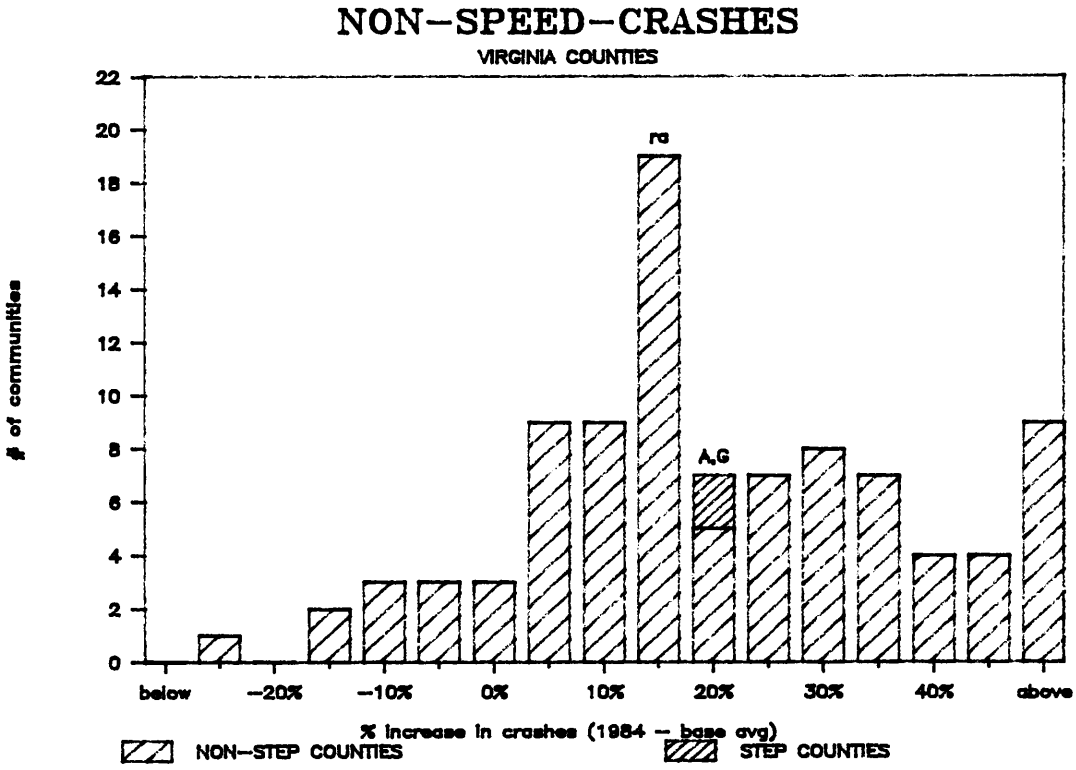
Note that negative percentages in the graph represent crash reductions between the baseline average and 1984 numbers. Therefore, negative percentages reflect favorable changes in the number of crashes.

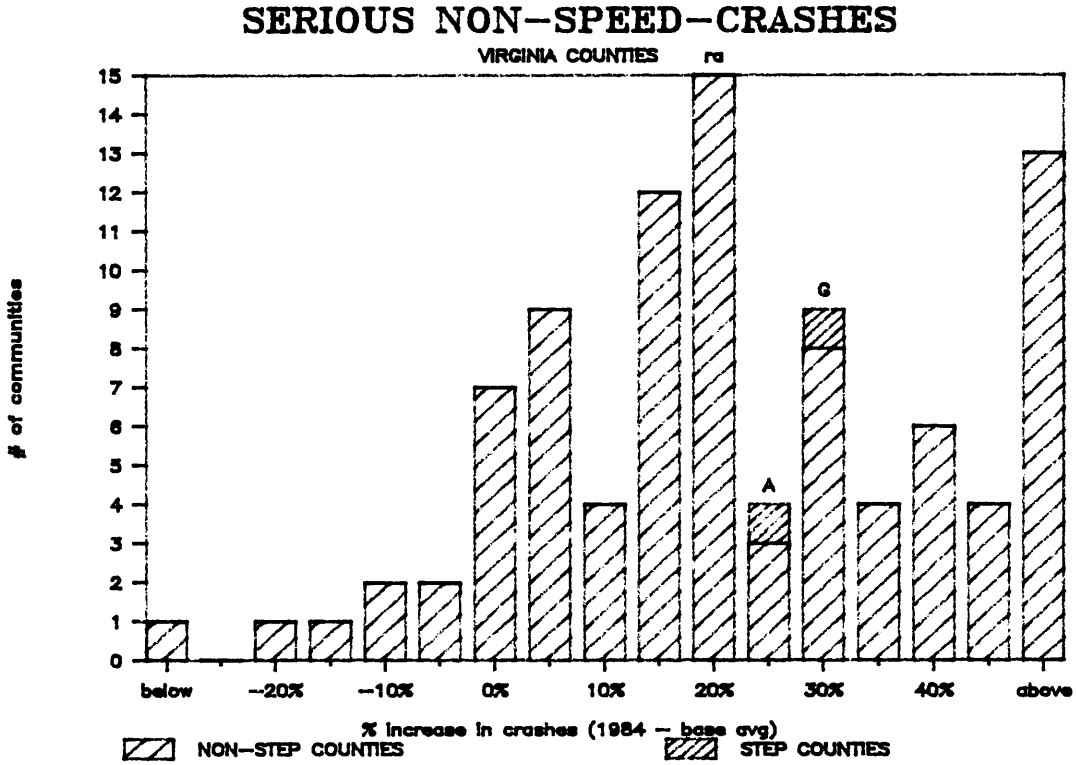

TOTAL CRASHES
VIRGINIA COUNTIES
# of communities
G,ra
A
below
-20%
-10%
0%
10%
20%
30%
40%
above
% increase in crashes (1984 - base avg)
NON-STEP COUNTIES
STEP COUNTIES


SERIOUS CRASHES
VIRGINIA COUNTIES
# of communities
ra
A,G
below
-20%
-10%
0%
10%
20%
30%
40%
above
% increase in crashes (1984 - base avg)
NON-STEP COUNTIES
STEP COUNTIES


SPEED–CRASHES
VIRGINIA COUNTIES
# of communities
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
A
G
ra
below
–20%
–10%
0%
10%
20%
30%
40%
above
% increase in crashes (1984 – base avg)
NON–STEP COUNTIES
STEP COUNTIES

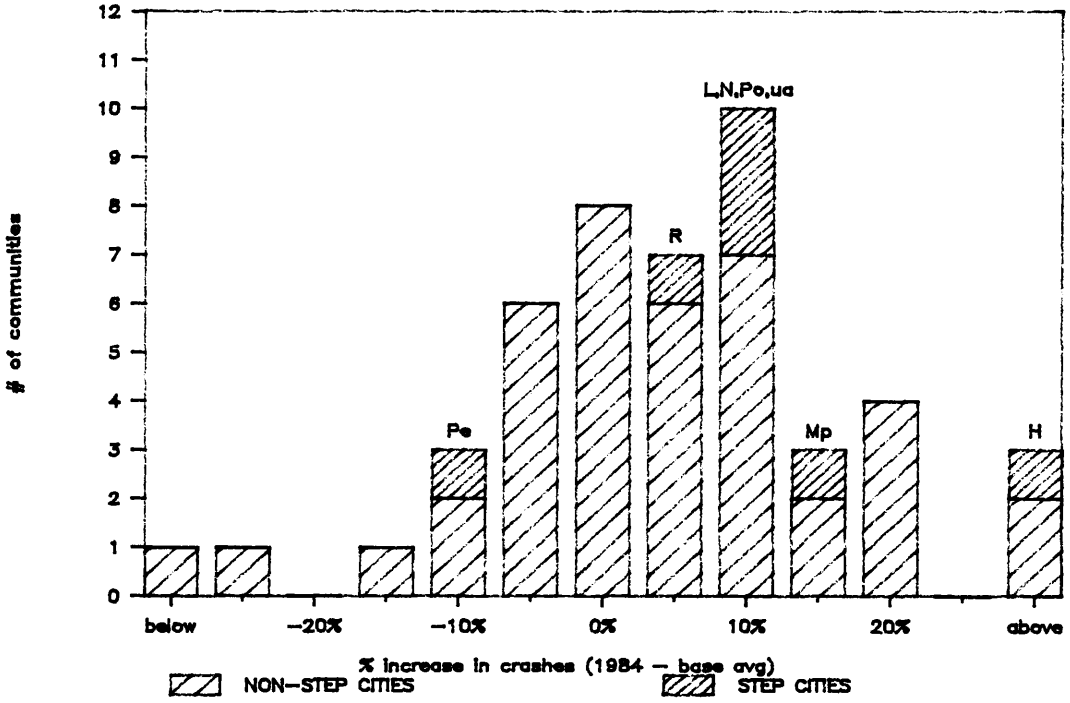

SERIOUS SPEED–CRASHES
VIRGINIA COUNTIES
# of communities
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
A
G
ra
below
–20%
–10%
0%
10%
20%
30%
40%
above
% increase in crashes (1984 – base avg)
NON–STEP COUNTIES
STEP COUNTIES


NON–SPEED–CRASHES
VIRGINIA COUNTIES
# of communities
0
2
4
6
8
10
12
14
16
18
20
22
ra
A,G
below
–20%
–10%
0%
10%
20%
30%
40%
above
% increase in crashes (1984 – base avg)
NON–STEP COUNTIES
STEP COUNTIES


SERIOUS NON–SPEED–CRASHES
VIRGINIA COUNTIES
ra
# of communities
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
A
G
below
–20%
–10%
0%
10%
20%
30%
40%
above
% increase in crashes (1984 – base avg)
NON–STEP COUNTIES
STEP COUNTIES

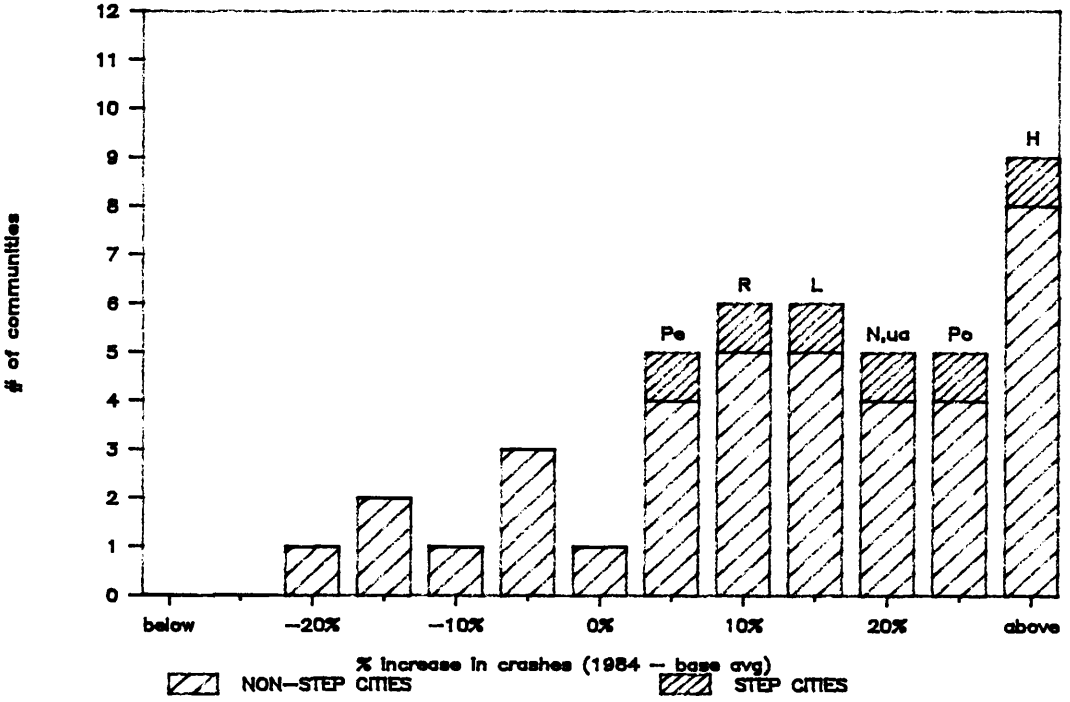
TOTAL CRASHES

VIRGINIA CITIES

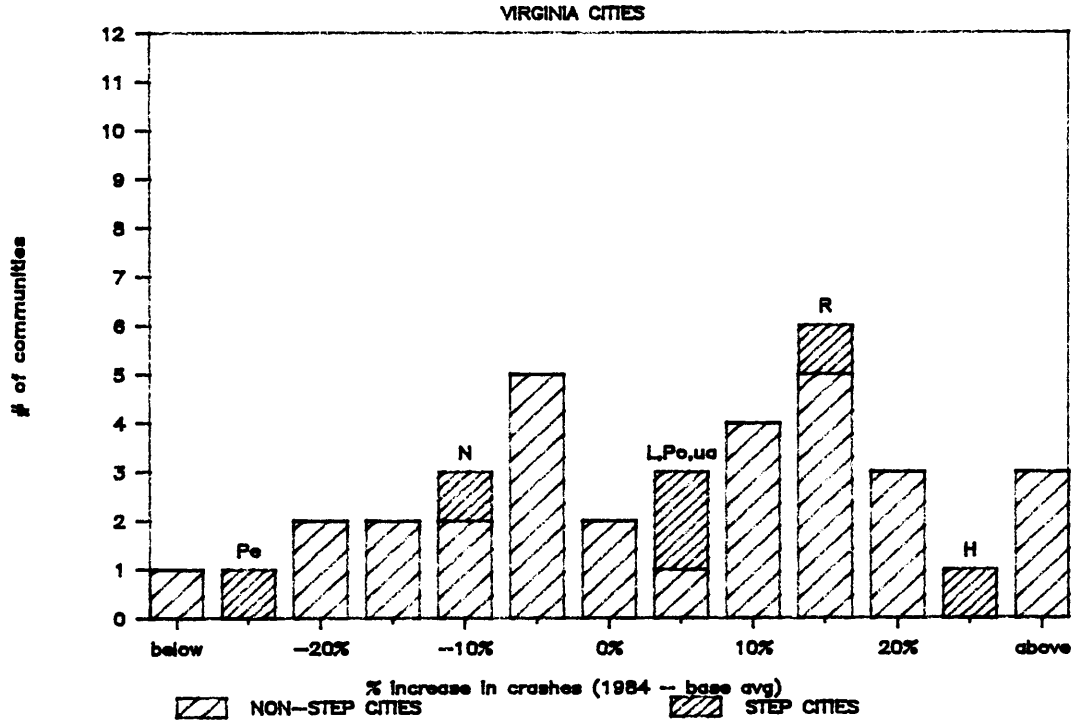


SERIOUS CRASHES

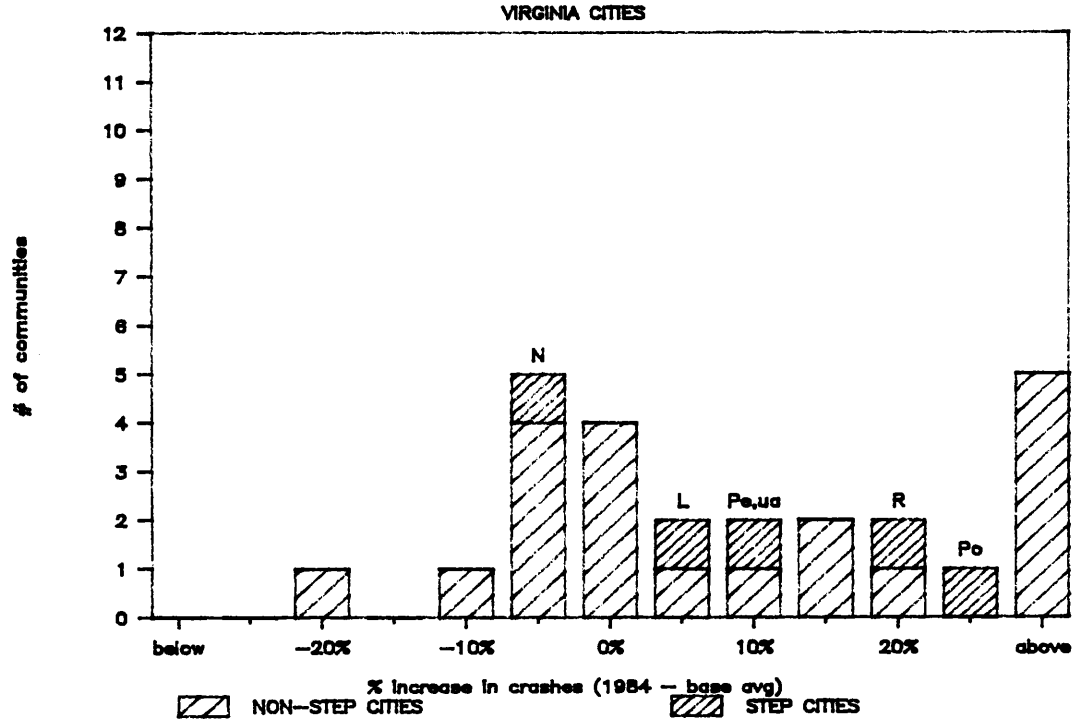
VIRGINIA CITIES

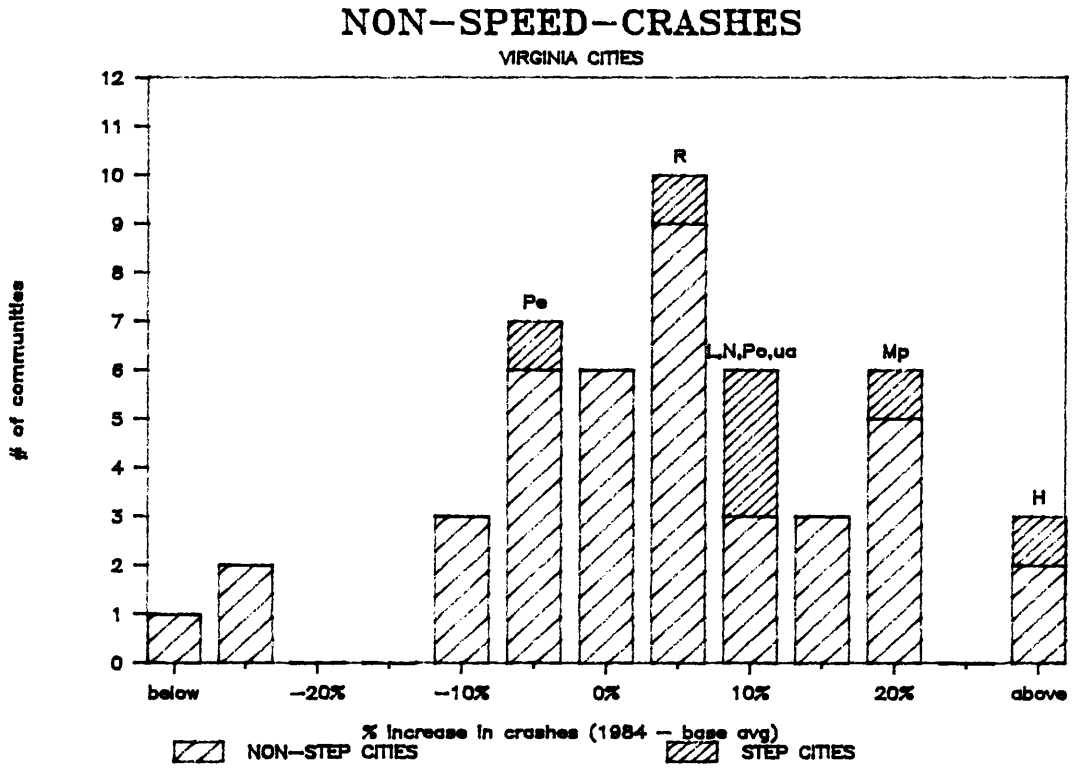


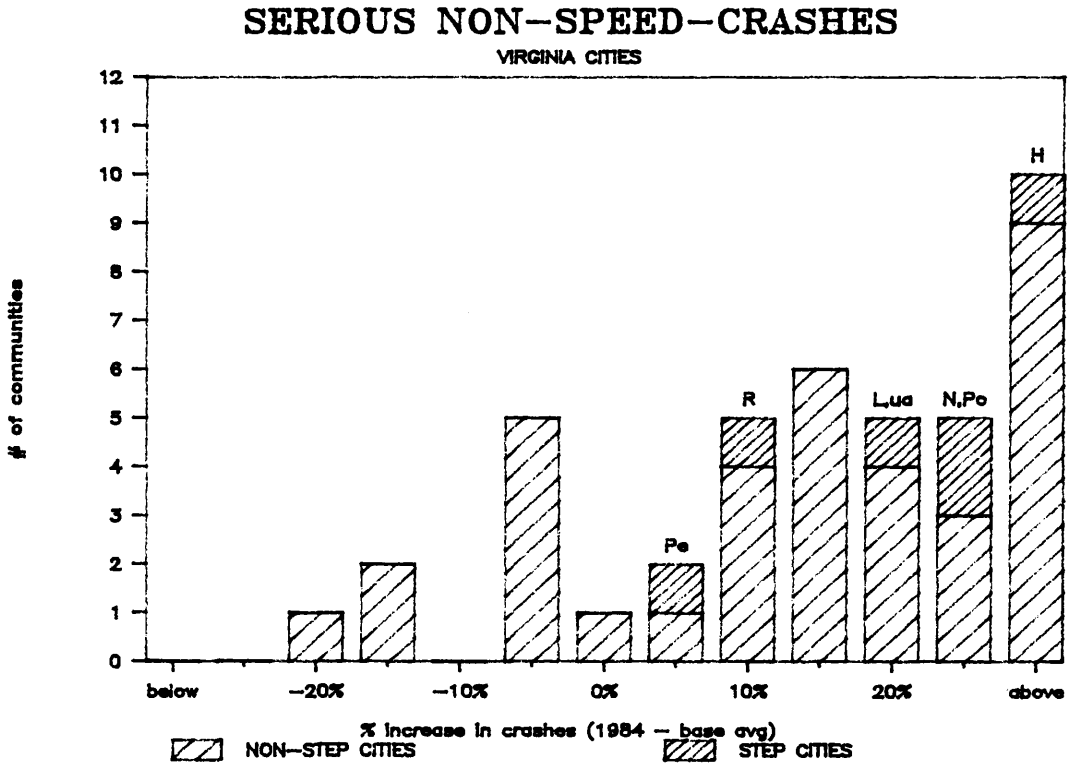
SPEED–CRASHES



SERIOUS SPEED–CRASHES




NON–SPEED–CRASHES
VIRGINIA CITIES
# of communities
12
11
10
9
8
7
6
5
4
3
2
1
0
R
Pe
L,N,Po,ua
Mp
H
below
–20%
–10%
0%
10%
20%
above
% increase in crashes (1984 – base avg)
NON–STEP CITIES
STEP CITIES


SERIOUS NON–SPEED–CRASHES
VIRGINIA CITIES
# of communities
12
11
10
9
8
7
6
5
4
3
2
1
0
H
R
L,ua
N,Po
Pe
below
–20%
–10%
0%
10%
20%
above
% increase in crashes (1984 – base avg)
NON–STEP CITIES
STEP CITIES