AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES TO DETERMINE TOTAL PROJECT IMPACT OF THE FAIRFAX ALCOHOL SAFETY ACTION PROJECT

PROGRESS REPORT # 3
January 1, 1974 - December 31, 1974

by

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ABSTRACT

The Fairfax ASAP project, one of 35 federally funded alcohol countermeasure projects designed to attack the problem of drunken drivers on the highways, was implemented at the community level in January 1972. This report summarizes the results of data obtained to measure project impact on selected ultimate performance indicators at the end of the third year of project operations, 1974

Data indicate a significant change in trend in the Fairfax ASAP area during the 1972-1974 period in several of the ultimate performance measures. There was a definite reduction in the number of personal injuries, fatal injuries, and fatal crashes from what would have been predicted by linear regression analysis based on trends established over the past fifteen years, and the change is significant at the 95% level. No such change was evident in the control community, Henrico County, in any of the performance categories. Data on vehicle registrations, vehicle miles of travel, and population did not indicate a reason for any change in trend. The effects of the energy shortage on traffic volumes were compensated for; however, it is important to note that the effects of the lowered speed limit could not be ascertained with any degree of certainty, and therefore could not be considered. The encouraging figures for the period should be considered in this light, though the lowered speed limit applied to the control community as well as to the ASAP area and the figures are not so encouraging in the control county.

Another ultimate performance indicator, the average blood alcohol content (BAC) of drivers in the ASAP area showed little change during the 1972-74 period. The mean BAC of 0.148% for alcohol-related fatalities in 1973 was the lowest of the six-year period reviewed, but the 1974 mean was up to 0.159% and the average for the 3-year ASAP period was almost identical to that of the baseline period. The average number of fatally injured drivers with positive BAC's was higher for the three years of ASAP operations than it was for the baseline period (16.7 to 13.7), while the average number of fatalities with positive BAC's was the same for both periods. It was concluded that the number of fatalities was no small and the data so variable that attempts to ascribe benefits to ASAP at the project level would be meaningless.

The average BAC level for drivers arrested for driving while intoxicated (DWI) but not involved in crashes declined from 0.19% in 1972 to 0.17% in 1973 and 0.18% in 1974. While this decline might be attributed to a reduction in the "pool" of intoxicated drivers, it should be noted that the presumptive BAC level for drunken driving was changed in 1972 from .15% to .10%. Therefore, intuitively, the average BAC should be lower since the pool of drivers subject to arrest for DWI was increased on the lower end of the BAC scale. An analysis of BAC distributions in Quarter 12 versus those in Quarter 1 confirms that a statistically significant change occurred. BAC levels were significantly lower in Quarter 12 than in Quarter 1.

A benefit/cost analysis of the Fairfax ASAP indicates that the project may be returning benefits at a rate of between 1.6 to 1 and 12 to 1 over projected costs at the .95% confidence level. Estimated cost savings after three years of operations appear to be between $4 and $29 million. No such cost savings were evidenced in the control site, Henrico County.

While these data are encouraging, caution should be expressed over two counfounding factors. The year 1971 was an extraordinary one in Fairfax for fatal crashes. Hence the trend line for 1972 through 1974 was influenced by the large number of crashes in 1971. Reductions in fatal crashes and fatalities in 1972 and 1973 may reflect a regression to the mean. To help alleviate this problem new projections using three-year blocs were made to be compared to the total ASAP period rather than to the yearly periods. The second confounding factor was the effects of the energy shortage, which could not be adequately compensated for because all of the effects are not yet known. The impact of the nationwide 55 mph speed limit is especially troublesome for 1974, but it was hoped that the use of three-year blocs of time would lessen the effect on the analysis by combining the pre energy shortage years, 1972 and 1973, with 1974

PURPOSE

The purpose of this report is to review and summarize the results of the Fairfax Alcohol Safety Action Project (ASAP), as indicated by certain "ultimate performance measures" for determining total project impact, at the end of three years of project operations. The ultimate performance measures are indices of those phenomena which the ASAP is ultimately designed to reduce — such phenomena as alcohol related traffic crashes, and especially the fatalities and injuries that accompany them. If the ASAP is a truly successful program, its success should be reflected in reductions in the ultimate performance indicators.

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METHOD

The Highway Safety Division of Virginia, through a special staff in Fairfax, manages the Fairfax ASAP project. The Safety Section of the Virginia Highway and Transportation Research Council in Charlottesville serves as the project evaluator. This report is an evaluation of the Fairfax ASAP as measured by ultimate performance indicators such as alcohol related traffic accidents and related injuries and fatalities. The report is in five sections: (a) changes in levels or distribution of ultimate performance measures, (b) characteristics of fatal crashes and fatally injured drivers, (c) trends in blood alcohol concentration levels of arrested drivers, (d) trends in public information and awareness of ASAP and the drinking driver problem, and (e) benefit/cost analysis of overall project impact.

Because the number of accidents has consistently risen year after year in Fairfax, a linear regression analysis was used to determine whether there had been any change in the level of these ultimate performance measures during the ASAP period. Data on accident related factors were collected for the ten year period prior to the establishment of the ASAP, and from these it was decided that million vehicle miles of travel was linearly related to numbers of accidents. Therefore, this factor was used as the predictor variable in the regression analysis. Using the actual vehicle miles for the ASAP years, projections were made of the number of fatal, injury, and property damage crashes which would have been expected had the ASAP not been in operation. These projections were made first for each year of the project's operation, and then for the three year ASAP period, 1972 though 1974. The three year projection was done exactly as the yearly projections except that vehicle miles driven for three year spans rather for one year periods was used as the predictor. Five such spans, covering the fifteen years prior to the establishment of the ASAP, were used in the projections (data was not available for the period prior to the 15 year span). The same procedures were used to project expected crashes in a control community, Henrico County, to help verify that any changes in Fairfax would be attributable to the ASAP and not to some other phenomena.

The second section of the report deals with characteristics of fatal crashes and fatally injured drivers such as the age, sex, prior driving record and blood alcohol content (BAC) of the driver, and the time of day and day of the week of the accident. Such data can be valuable in determining which groups are more likely to be involved in fatal accidents. Similar data for non-fatal accidents were not included in this report, but have become available in the publication "An Analysis of ASAP Performance Measures for 1972, 1973, and 1974" written by E. Sweeton and K. Costenoble for the Center for the Environment and Man (CEM). This CEM document, based on crash tapes not available for this report, should be used as a companion volume to this one.

The benefit/cost analysis section utilized the predictions from the regression analysis as a basis for determining the potential societal cost for accidents in Fairfax within the range described by the 95% confidence interval. The actual societal costs for the ASAP period were then subtracted from the predicted costs to obtain a benefit figure, and this figure was divided by the three year ASAP cost to obtain a benefit/cost ratio.

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INTRODUCTION

The Fairfax Alcohol Safety Action Project (ASAP) was begun in January 1972 as one of 35 federally funded demonstration projects designed to implement and evaluate a comprehensive community alcohol countermeasures program. The Fairfax ASAP was approved for three years and funded with $2.1 million in an attempt to confront and ameliorate the community's drunken driving problem.

A principal goal of the Fairfax ASAP was to effect a reduction in the number of alcohol-related fatalities, injuries, and property damage crashes. The goal was approached through a systems oriented program providing countermeasures of increased and extensive enforcement of driving while intoxicated (DWI) statutes, a special judicial countermeasure consisting of a probation and review process, programs of rehabilitation and treatment for persons convicted of DWI, and extensive public information and education projects in the community.

The results of the project after the first two years of operations were quite encouraging. Data indicated a statistically significant reduction in injury crashes in both 1972 and 1973, based on a linear regression model using 1962-1972 data. Fatal crashes and fatalities declined, but not significantly, and overall societal costs also declined somewhat.

This report summarizes the data on ultimate performance measures for 1974 and discusses the overall measures for the three-year period, 1972-1974, which comprised the original ASAP operating period in Fairfax.

CHANGES IN LEVELS OR DISTRIBUTIONS OF ULTIMATE PERFORMANCE MEASURES

Fatal, Injury, and Property Damage Crash Trends

Some of the most significant indicators of ASAP project impact are the fatal, personal injury and property damage accident totals, and the percentages of these totals that were alcohol-related in the pre-ASAP and post-ASAP periods. To gauge the influence of ASAP, data from Fairfax County are compared with data collected for a selected control site, Henrico County.

Tables 1 and 2 present comparative crash data for Fairfax and Henrico Counties for the period 1962-1971, and for the ASAP years 1972-1974. Figures 1 and 2 show the same data graphically (utilizing semi-log paper to smooth out flucutations in the trend lines). Additionally data were collected on population, motor vehicle registration, and annual vehicle miles of travel in order to standardize or normalize accident data according to exposure variables. These data are tabulated in Appendix B and shown graphically in Figures 3 and 4.

The population and vehicle registrations have been growing at a rate of close to 10% per year in Fairfax County, while vehicle miles of travel had been increasing at a 20% annual rate until 1974, when they declined slightly, apparently as a result of the energy shortage. A comparison of Figures 1 and 3 shows that crash trends are closely correlated with the growth in these exposure variables. Fatal crashes, relatively infrequent and low probability events, are the most variable of the data and do not correlate well, but injury and property damage crashes demonstrate growth patterns closely associated with exposure variables, especially with vehicle miles driven.

In Henrico, the control site, the rate of growth in the exposure variables has been about half that in Fairfax, 5% in population and vehicle registrations and 10% in miles driven, as shown in Figure 4. The energy shortage did not reverse the growth in miles driven in Henrico though it did apparently slow the rate of growth. As in Fairfax, growth in the number of injury and property damage crashes closely parallel the growth in vehicle miles of travel, while changes in the number of fatal crashes seem to show little or no correlation. It should be noted, however, that 1973 saw a decline in the number of injury crashes from the preceding year. It was the first year in the 11 years for which data had been obtained that injury crashes declined. Hence the phenomenon first observed in Fairfax in 1972, and at first thought to be attributable to ASAP, may also be occurring in the control site. Injury crashes were virtually unchanged in 1974 in both Fairfax and Henrico.

Figure 5 plots Fairfax crash rates per 100 million vehicle miles of travel. These trend lines show that motor vehicle crashes, injuries, and fatalities have not been growing quite as fast as exposure per 100 million vehicle miles. The fatal crash rate dropped from 4.1 in 1963 to 2.4 in 1970. In 1971, the year before ASAP, the rate jumped up to a seven-year high of 3.3. During the three years of ASAP the rate again declined to 2.5 in 1972 and to record lows of 2.1 in 1973 and 1.7 in 1974. It should be noted, however, in conjunction with the figures for 1974, that the energy shortage may very well have had some effect. Attempts were made to compensate for such effects but no satisfactory formula could be devised to cope with the variables, especially the lowered national speed limit. (See Appendix A for further information on the effects of the energy crisis)

TABLE 1

FAIRFAX ASAP CRASH DATA
1962 - 1974

	Fatal Crashes	Fatalities	Injury Crashes	Injuries	Property Damage Crashes	Pedestrians	
						Killed	Injured
1962	36	40	1,444	2,159	4,649	9	N/A
1963	47	56	1,663	2,530	5,354	7	N/A
1964	47	57	1,978	2,984	6,468	9	121
1965	51	59	2,210	3,161	7,360	6	132
1966	56	65	2,359	3,424	7,720	10	196
1967	55	64	2,525	3,457	7,645	14	160
1968	60	65	2,815	4,106	8,834	14	170
1969	59	69	2,916	4,165	10,331	13	161
1970	59	63	3,151	4,465	11,519	17	186
1971	90	100	3,374	4,756	12,501	22	187
1972	76	85	3,405	4,795	13,850	25	192
1973	68	78	3,610	5,032	14,511	11	172
1974	55	63	3,558	4,889	13,904	9	182

TABLE 2

HENRICO COUNTY CRASH DATA
1962 - 1974

	Fatal Crashes	Fatalities	Injury Crashes	Injuries	Property Damage Crashes	Pedestrians	
						Killed	Injured
1962	18	21	469	723	1,634	1	N/A
1963	12	17	527	813	1,704	4	N/A
1964	14	15	623	914	1,946	2	56
1965	17	25	632	977	2,075	4	44
1966	28	31	740	1,090	2,260	10	46
1967	18	19	755	1,157	1,989	1	53
1968	19	24	800	1,230	2,201	4	46
1969	22	26	875	1,301	2,476	9	65
1970	23	26	886	1,313	2,668	3	52
1971	16	17	984	1,395	3,106	4	55
1972	24	24	1,083	1,594	3,445	8	67
1973	19	11	1,070	1,503	3,555	6	64
1974	35	40	1,073	1,545	3,321	7	57

Source: Virginia Department of State Police (both tables)

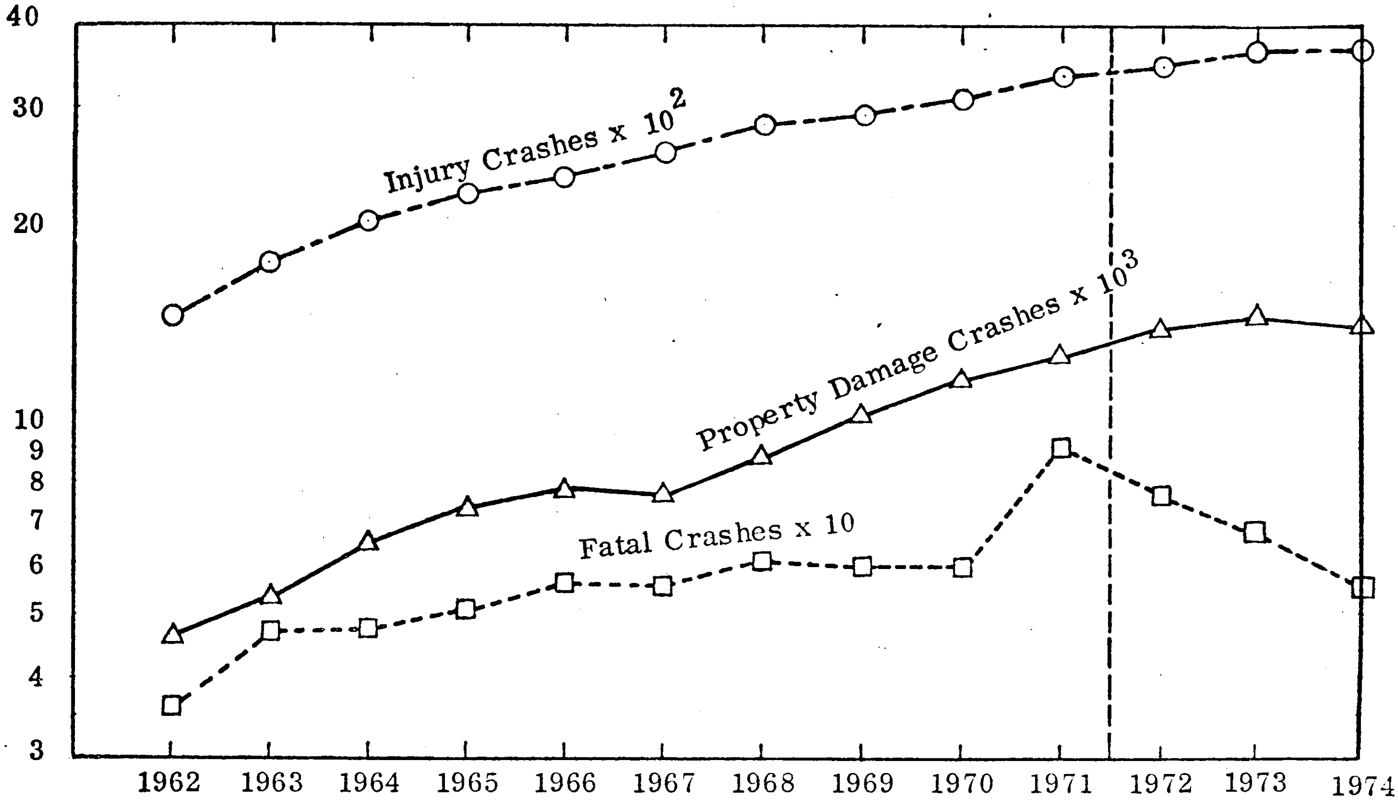

Figure 1. Trends in Fairfax crashes

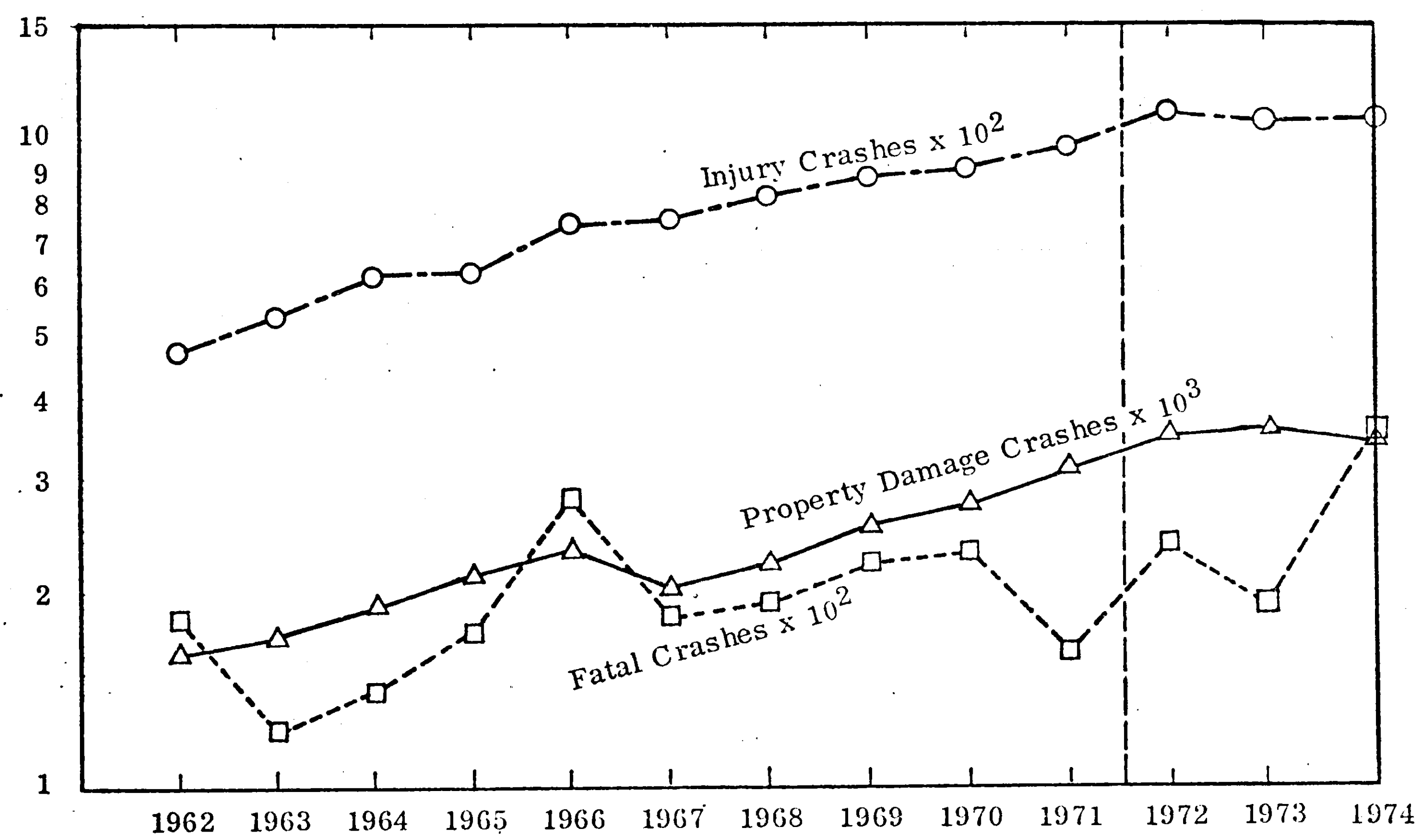

Figure 2. Trends in Henrico crashes

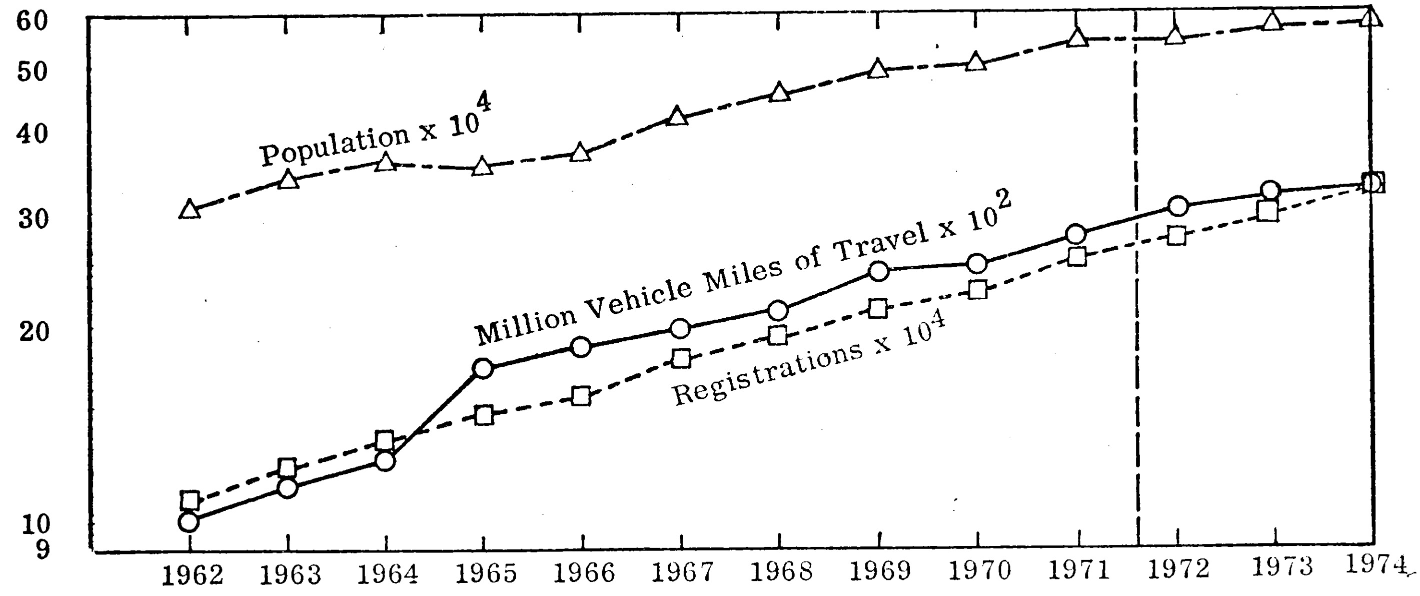

Figure 3. Trends in Fairfax exposure variables

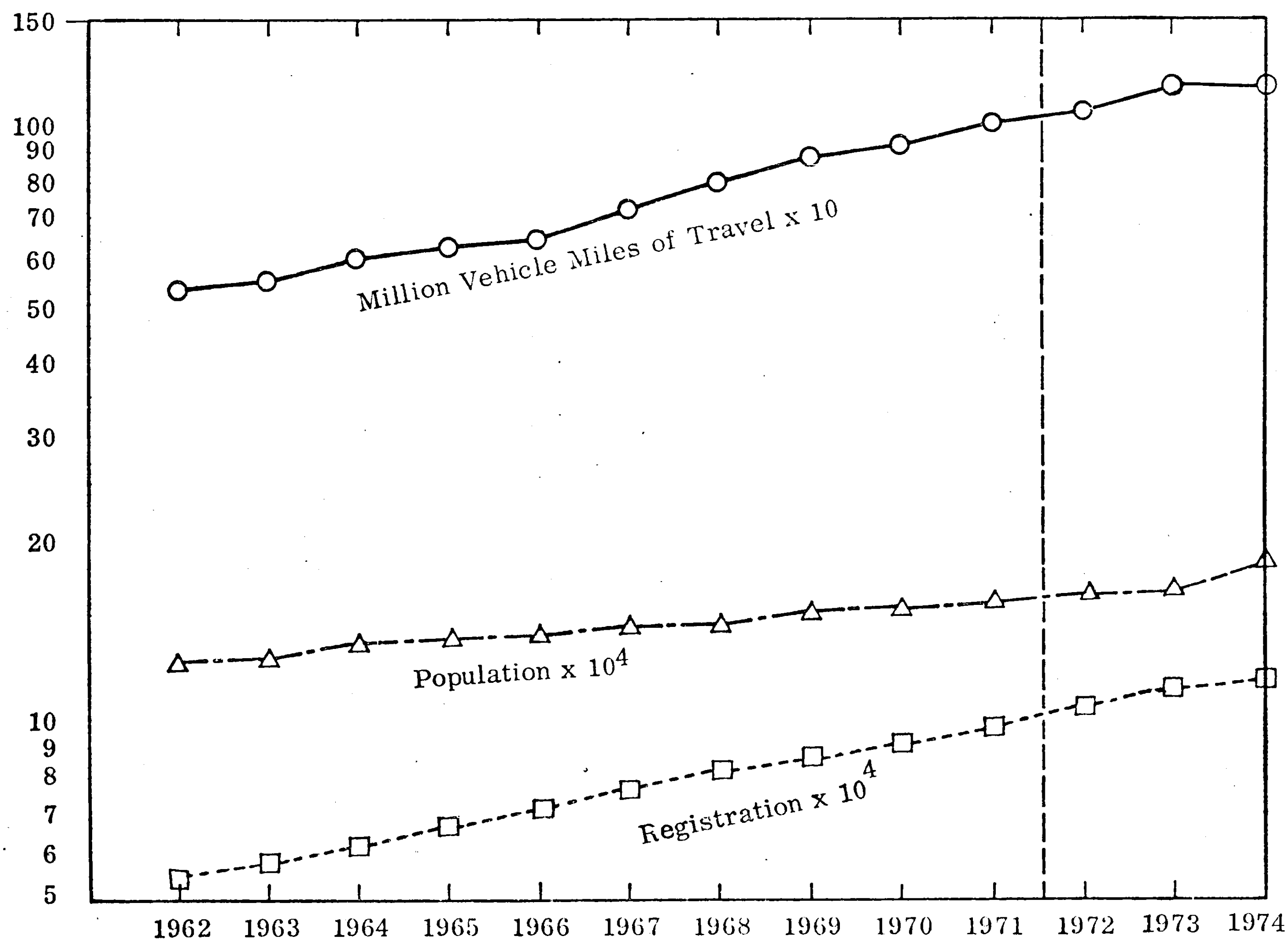

Figure 4. Trends in Henrico exposure variables

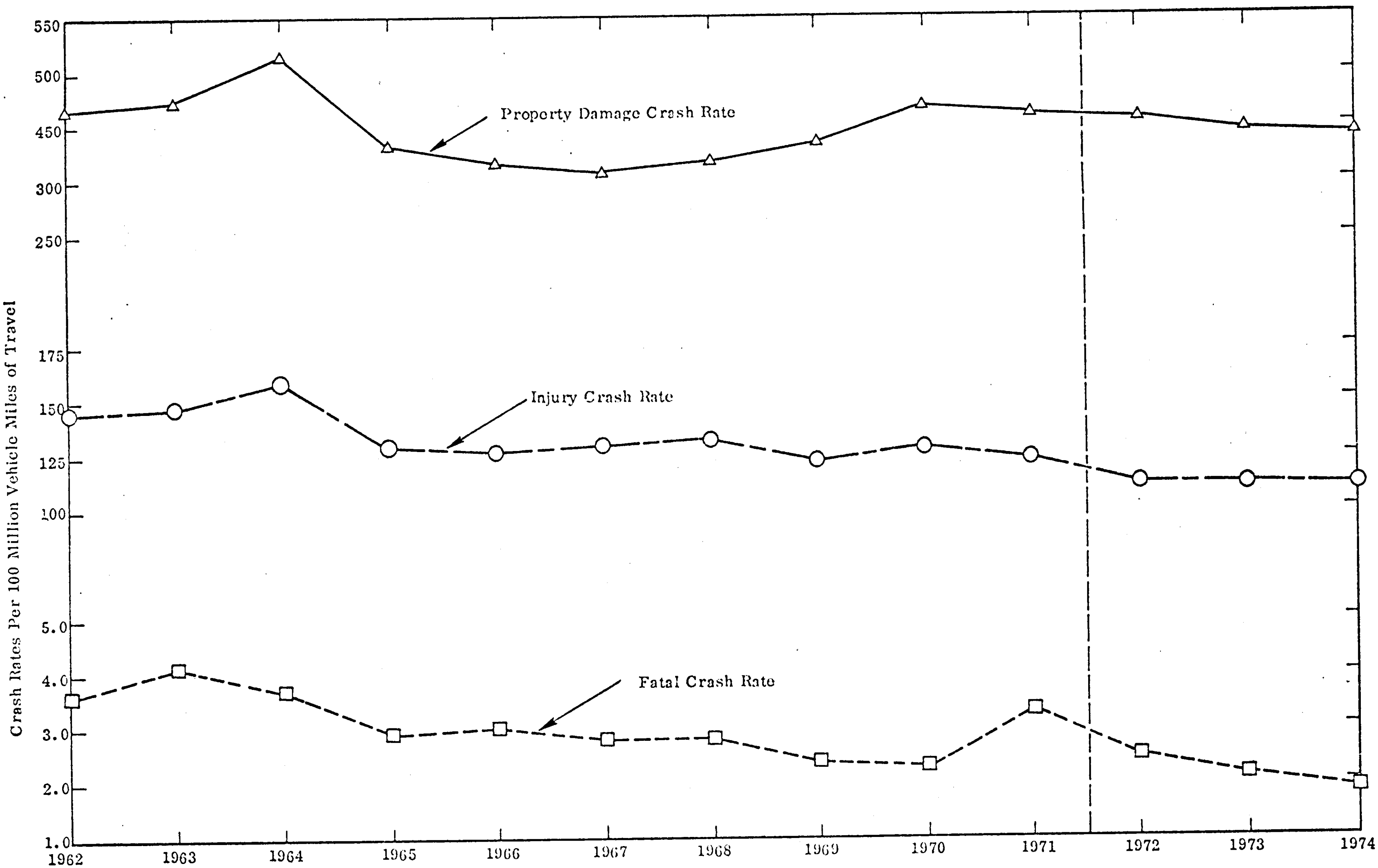

Figure 5. Trends in Fairfax crash rates as a function of miles of travel.

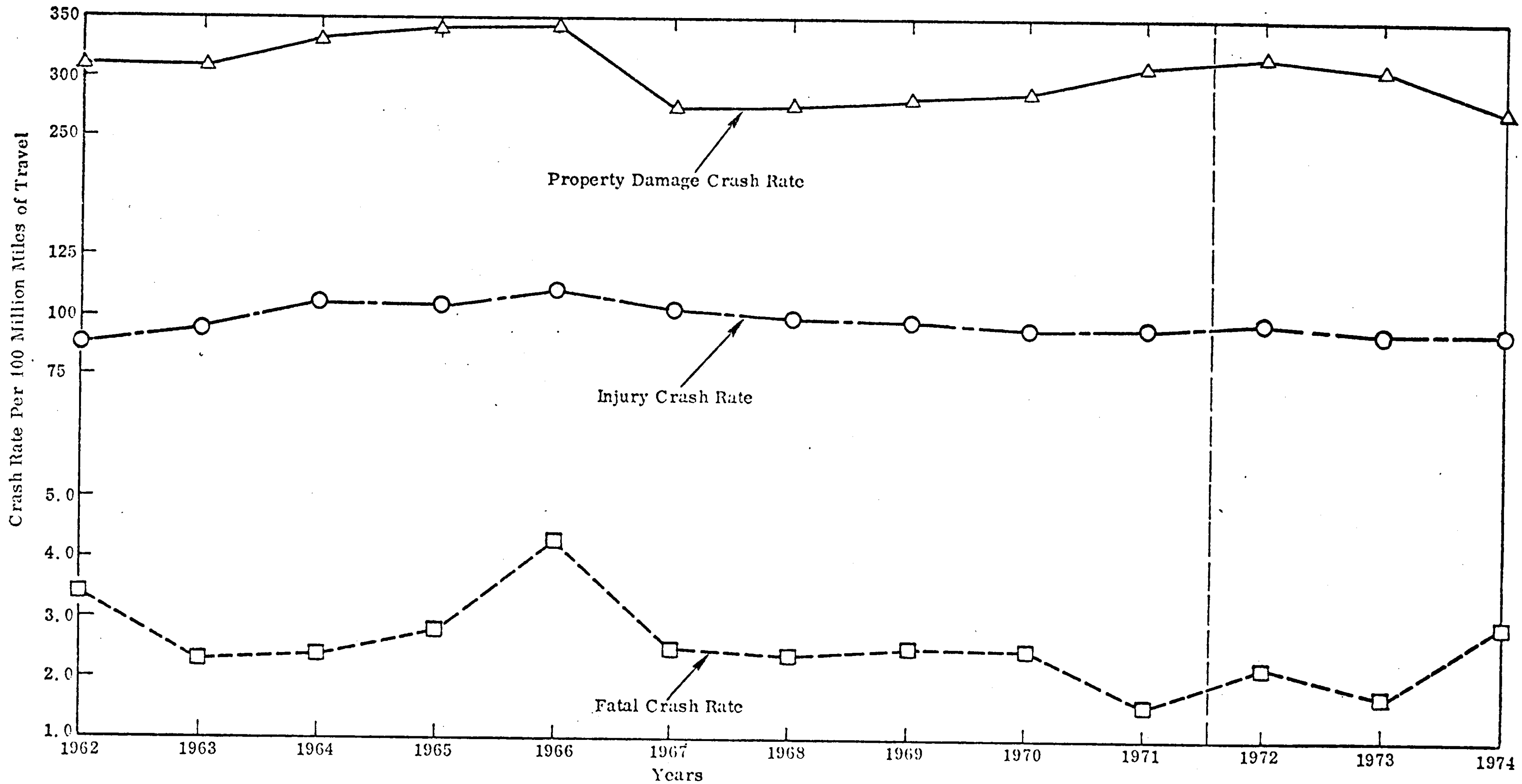

Figure 6. Trends in Henrico crash rates as a function of miles of travel.

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Figure 5 also shows a steady decline in the injury crash rate from 145 per million miles in 1962 to 110 in both 1973 and 1974. Property damage crash rates have likewise declined slightly from 468 in 1962 to 429 in 1974. These figures indicate an established trend toward declines in the crash rates prior to ASAP and little change in these trends during the ASAP period.

Figure 6 shows the trends in Henrico crash rates per 100 million vehicle miles of travel. As in Fairfax, fatal crash rates showed a long-term decline from 3.4 in 1962 to 1.6 in 1973. In 1974, though, there was an abrupt rise to 2.9, which would seem to belie any effects from the energy shortage. The explanation probably lies in the infrequent and variable nature of fatal crashes, however. Injury and property damage crash rates were almost stable between 1962 and 1971, but then showed definite declines in 1973 and 1974. Thus any decline in the ASAP area crash rates would have to be considered in light of similar declines in the control county.

Projections for 1972 - 1974

The data in Tables 1 and 2 and exposure data in Figures 3 and 4 (and in Appendix B) were used to develop projections of fatal, injury, and property damage crashes in Fairfax and Henrico for the 1972-1974 period. In this report actual mileage figures for 1974 were used to update the original projections for 1974 made in 1972. The projections provide values upon which evaluations of ASAP performance may be based. Actual data for 1972-1974 can be compared with these projected estimates for Fairfax, while Henrico data can be reviewed to see if changes in the ten-year trends occur which are independent of any concentrated alcohol countermeasures effort.

Exposure variables in Fairfax and Henrico were projected as a function of time using linear regression analysis. From these projections, million vehicle miles of travel (MVMT) was selected as the independent variable for the projection of expected crash values. Fatal crashes, fatalities, injury crashes, and property damage crashes for each locality were projected as a function of MVMT using linear regression analysis. High coefficients of correlation were obtained from Fairfax injury crashes (.989) and Fairfax property damage crashes (.973). Coefficients of correlation for Fairfax fatal crashes and fatalities were .853 and .756 respectively.

Injury and property damage crash data for Henrico County also correlated closely with projections of MVMT. Injury crashes had a correlation coefficient of .967, and property damage crashes had a correlation coefficient of .934. Correlation coefficients for fatal crashes (.297) and fatalities (.146) were poor. Complete data on the linear regression analyses and projections are given in Appendix C.

Tables 3 and 4 present summary data on the projections for Fairfax and Henrico crashes for the 1972-74 period. These data were used to compare actual data with projections, and in the calculation of estimated project benefits and costs.

TABLE 3

FAIRFAX ASAP

1972, 1973, AND 1974 CRASH PROJECTIONS

	Fatal Crashes	Fatalities	Injury Crashes	Injuries	Property Damage Crashes
1972	80	86	3,699	5,216	13,236
1973	85	90	3,950	5,569	14,237
1974	84	89	3,915	5,481	14,097
Total ASAP Period	249	265	11,564	16,266	41,570

TABLE 4

HENRICO COUNTY

1972, 1973, AND 1974 CRASH PROJECTIONS

	Fatal Crashes	Fatalities	Injury Crashes	Injuries	Property Damage Crashes
1972	22	24	1,058	1,491	3,069
1973	22	24	1,128	1,590	3,253
1974	23	24	1,158	1,633	3,331
Total ASAP Period	67	72	3,344	4,714	9.653

Fairfax Alcohol-Related Fatalities

Several of the most significant measures of overall project impact are to be found in the data on alcohol-related fatalities. It is to be hoped, of course, that ASAP can reduce fatal crashes and fatalities to levels below the predicted values. If alcohol-related fatal crashes can be significantly reduced by ASAP, then the fact should be observed in total crash data.

Data in Table 5 reflect the results of BAC tests on persons killed in motor vehicles accidents in Fairfax in the baseline period 1969-71 and after the three years of ASAP, 1972-1974. These data are at best inconclusive. The percentage of positive BAC's was down in 1972 from the two preceding years, but down only to the 1969 level. The percentage then remained constant in 1973 but jumped significantly to 56% in 1974. Also of significance in 1973 is the fact that the mean positive BAC was down to 0.14%, the lowest level in five years. though 1974 showed an increase. The three-year averages show virtually identical total fatalities and total number with positive BAC, though the percent positive declined. The mean BAC was virtually unchanged.

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TABLE 5

FAIRFAX ALCOHOL-RELATED FATALITIES
(Includes Pedestrians)

Year	Fatalities	Number Tested For BAC	%	Number Positive	%	Number Negative	%	Mean Positive BAC
1969	60	38	63	16	42	22	58	0.152%
1970	63	47	75	23	49	24	51	0.176%
1971	100	71	71	42	59	29	41	0.166%
Avg.	74	52	70	27	52	25	48	0.166%
1972	85	65	76	27	42	38	58	0.183%
1973	78	57	73	24	42	33	58	0.148%
1974	63	52	83	29	56	23	44	0.159%
Avg.	75	58	77	27	46	31	54	0.162%

Data on the BAC's of fatally injured motorists is the subject of a more intensive analysis in a later section of this report.

Differences in Actual and Projected Crashes

To test the impact of the Fairfax ASAP on fatal, injury, and property damage crashes after three years of project operations, it was determined that actual crashes should be compared with projected crashes both in Fairfax and Henrico.

The actual crash data for Fairfax and Henrico was compared with the projections described earlier. The analysis developed 95% confidence intervals for each data category for 1972, 1973, and 1974. Summary data are shown in Tables 6 and 7.

Only one category, Fairfax injury crashes, showed a statistically significant improvement in all three years of the project, though Fairfax fatal crashes declined significantly in 1974. No significant reductions were observed in Henrico.

Because the yearly figures were somewhat inconsistent, a further projection was done based on three-year blocs to compare the overall ASAP period with previous three-year spans. This was done for two reasons: first because the Fairfax ASAP was originally designed to be a three-year project, and therefore a total impact analysis seemed more appropriate than a simple yearly analysis; and second because the larger figures involved in the three-year periods might lend greater accuracy to the projections.

The projections are shown in Appendix D and summary data are shown as the bottom line in Tables 6 and 7. Notice that data for a further five years was used in these projections to allow for a greater degree of accuracy — to give five data points rather than three.

The three-year analysis shows much more encouraging results than do the annual figures. Significant reductions are shown in fatal crashes, fatalities, and injury crashes in Fairfax. Only property damage crashes did not show a significant change overall. In Henrico, by contrast, not one of the four categories showed a significant reduction.

TABLE 6

ACTUAL AND PROJECTED FAIRFAX CRASHES

	Fatal Crashes				Fatalities				Injury Crashes				Property Damage Crashes			
Year	Actual	Projected	95% C.I.	Sig.	Actual	Projected	95% C.I.	Sig.	Actual	Projected	95% C.I.	Sig.	Actual	Projected	95% C.I.	Sig.
1972	76	80	61-99	No	85	86	60-111	No	3,405	3,699	3,459 - 3,938	Yes Lower	13,850	13,236	11,666 - 14,850	No
1973	68	85	64-105	No	78	90	63-117	No	3,610	3,950	3,696- 4,204	Yes Lower	14,511	14,237	12,571 - 15,903	No
1974	55	84	64-104	Yes Lower	63	89	62-117	No	3,558	3,915	3,663 - 4,167	Yes Lower	13,904	14,097	12,445 - 15,749	No
72-74	199	260	223-296	Yes Lower	226	292	238-346	Yes Lower	10,573	12,119	10,825 - 13,413	Yes Lower	42,265	42,904	37,656 - 48,153	No

TABLE 7

ACTUAL AND PROJECTED HENRICO CRASHES

	Fatal Crashes				Fatalities				Injury Crashes				Property Damage Crashes			
Year	Actual	Projected	95% C.I.	Sig.	Actual	Projected	95% C.I.	Sig.	Actual	Projected	95% C.I.	Sig.	Actual	Projected	95% C.I.	Sig.
1972	24	22	10-33	No	25	24	10-37	No	1,083	1,058	946 - 1,170	No	3,445	3,069	2,643 - 3,495	No
1973	19	22	10-35	No	22	24	10-38	No	1,070	1,129	1,009 - 1,248	No	3,555	3,253	2,798 - 3,708	No
1974	35	23	9-35	No	40	24	9-39	Yes Higher	1,073	1,158	1,035 1,281	No	3,321	3,331	2,862 - 3,799	No
72-74	78	74	49-98	No	87	82	52-113	No	3,226	3,612	2,935 - 4,288	No	10,321	10,303	8,572 - 12,034	No

CHARACTERISTICS OF FATAL CRASHES AND FATALLY INJURED DRIVERS IN FAIRFAX IN 1974

Thirty-six drivers were killed as a result of motor vehicle crashes in Fairfax in 1974. The Chief Medical Examiner of Virginia is authorized to perform autopsies on all fatally injured motorists. If the motorist dies within four hours of the crash, the autopsy will normally include a measure of the blood alcohol concentration (BAC). Of the 36 fatally injured drivers in 1974, the Chief Medical Examiner reported BAC test results for 29. Of the 29 drivers who were tested, 10 were negative, 2 had low levels of alcohol, and 17 had BAC's greater than .10%. These data are shown in Table 8.

Sixty-five percent of the driver fatalities tested were alcohol-related (A/R) in terms of the OAC criterion that any positive level of alcohol should count as an alcohol-related fatality. Perhaps more realistically in terms of the alcohol contributing to the cause of the crash, 59% of the fatally injured drivers had BAC's above the presumptive limit of .10%, and their crashes could definitely be considered as being alcohol-related.

The reader is cautioned in comparing fatality data for 1974 to data for the previous ASAP years or to the years prior to ASAP operations. Fortunately, traffic fatalities are extremely rare events, but unfortunately for statistical purposes, they exhibit an extremely unstable nature so that it is almost impossible to make reliable statistical inferences from such small and variable numbers. The instability in the data base for fatally injured drivers can easily be demonstrated by the data in Exhibits 1 and 2.

Exhibit 1 depicts the percentages of fatally injured drivers with positive BAC's for the baseline years of 1969, 1970, and 1971, and for the three ASAP operational years of 1972 through 1974. Note that 1972 and 1973 showed an encouraging trend from the 1971 peak. However, as noted in last year's report, such a drop might indicate only a regression to the mean, an interpretation which seems to be borne out by the large jump in 1974. Thus the average for the three-year ASAP period was 51.5% compared to the baseline period average of 50.6%, hardly a significant change overall.

The data shown in Exhibit 2 suggest that the number of fatally injured drivers with positive BAC's is also extremely variable, and that the drop in 1972 and 1973 probably exhibited only another example of regression to the mean. Note that when the 1974 data are included, the average for the ASAP years is 16.7 (20 in 1972, 11 in 1973, and 19 in 1974), while the average for the baseline period was only 13.7 (6 in 1969, 11 in 1970, and 24 in 1971).

Similarly, the mean BAC for all fatally injured drivers tested was .085% in both the baseline period and the ASAP period, even though the yearly figures were quite variable (.046% in 1969, .079% in 1970, and .111% in 1971, compared to .086% in 1972, .055% in 1973, and .114% in 1974). The mean BAC for all drivers with a positive BAC was more stable, with an average of .168% in the baseline period (1.62% in 1969, .165% in 1970, and .171 in 1971) compared to an ASAP average of .165%.

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EXHIBIT 1

Percent of fatally injured drivers with positive BAC

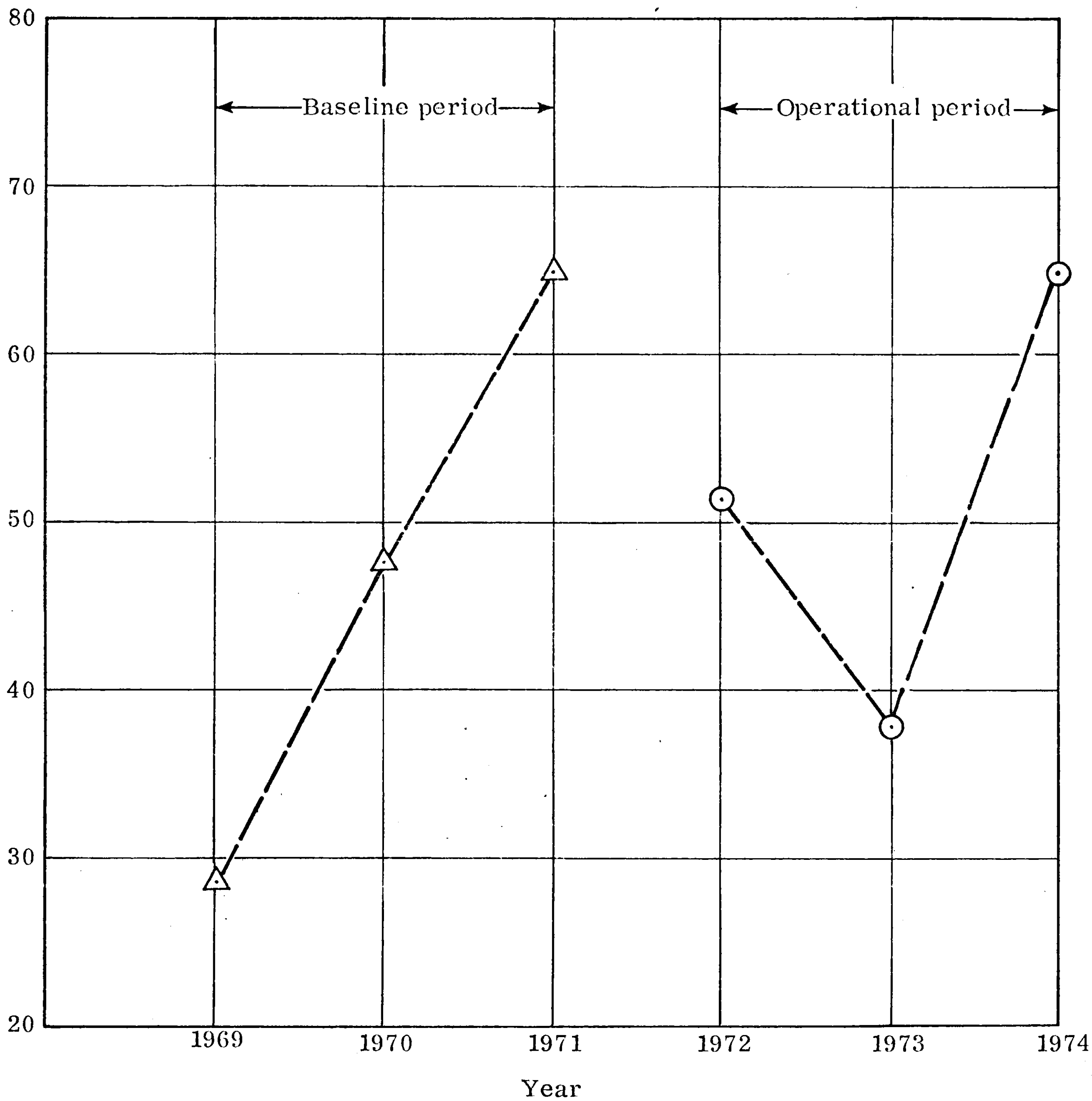
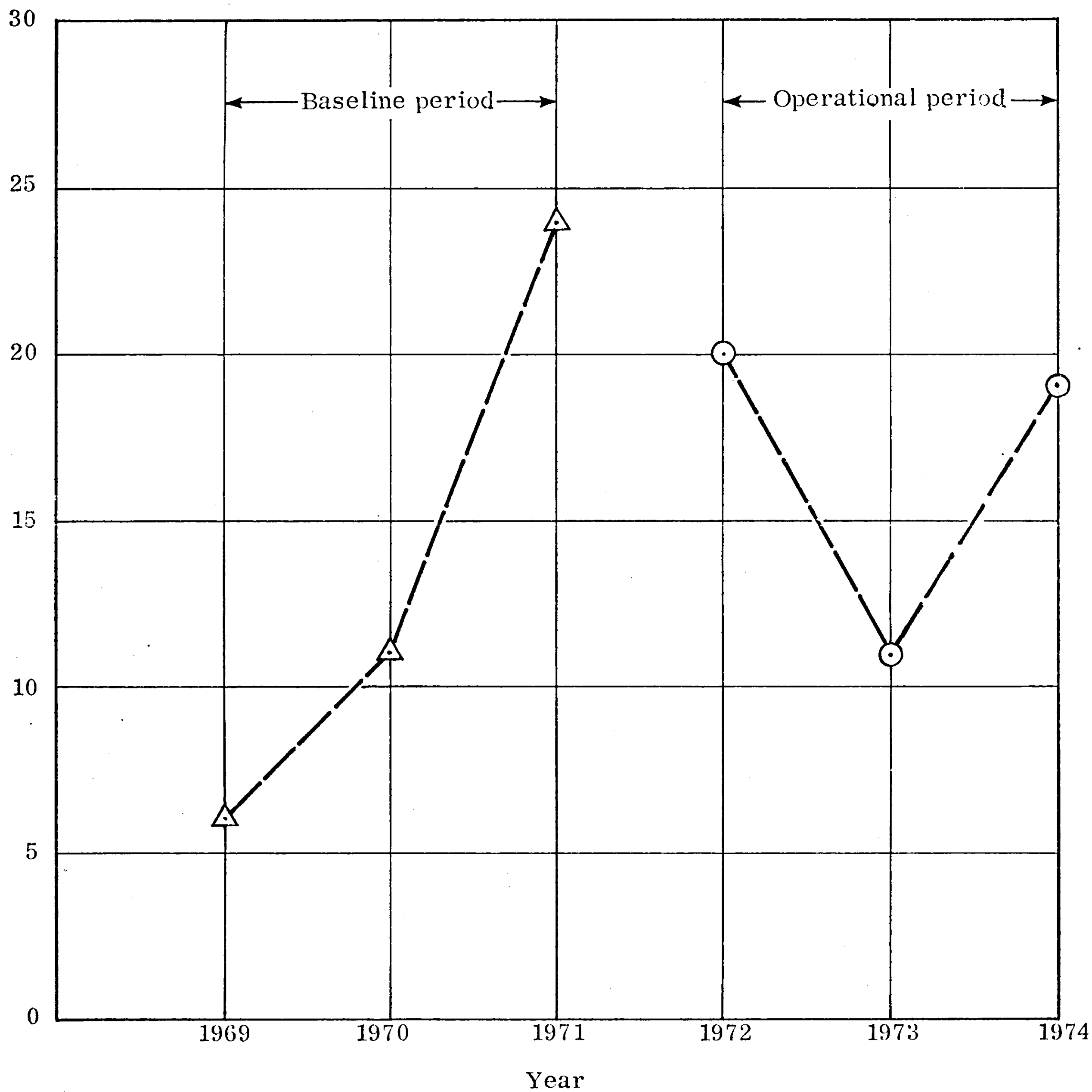


EXHIBIT 2

Number of fatally injured drivers with positive BAC



In examining these data on the fatally injured drivers, the only conclusion that can be supported is that the numbers are so small and the data so variable that any attempts to ascribe any benefits to the Fairfax ASAP are meaningless at project level. It is suggested instead that data on personal injury crashes, which indicate a much more stable pattern, be used for measuring the effectiveness of an ASAP at the project level. Injury crashes in Fairfax have exhibited stable trends and have occurred in large enough numbers to make statistical testing feasible.

Blood Alcohol Concentration of Fatally Injured Drivers By Time Periods

The BAC's for fatally injured drivers were categorized by four-hour time periods as shown in Table 8. For the time periods of most of the ASAP patrols, which were 8 p.m. to 4 a.m., there were 16 fatally injured drivers, of whom 12 had positive BAC's, 1 had a negative BAC, and 3 had unknown alcohol levels. For the other 16 hours of the day, there were 20 fatally injured drivers, with 7 having positive BAC's, 9 having negative BAC's, and 4 having unknown levels. This pattern of positive BAC's occurring most frequently during the late night hours is consistent with earlier findings, both in Fairfax and in other areas with ASAP's. Eight of the 12 positive BAC's occurred in the period from midnight to 4 a.m., a fact which is consistent with roadside survey findings of the greatest incidence of drunken driving occurring after midnight.

Blood Alcohol Concentrations of Fatally Injured Drivers by Day of Week

Table 9 shows the BAC distribution of fatally injured drivers by day of the week. Unlike the findings from past years the data show no discernable trend by day of the week. The weekends appear to have been no worse than any other periods in 1974. The low total for Friday may be explained by the fact that many of those killed on Saturday were killed in the early morning and were actually drinking on Friday night (this of course is true for every day, not just Friday and Saturday).

BAC's of Fatally Injured Drivers by Age Group

The BAC's of fatally injured drivers in Fairfax in 1973 are broken down by age group in Table 10. More than half of the fatalities, 20 of the 36, were in the 16-24 age group. This age group accounted for 9 of the 19 alcohol-related fatalities among drivers. Even when adjustments are made for driving exposure, this age group was clearly overrepresented in both the numbers of fatally injured drivers and alcohol-related fatalities.

TABLE 8

DISTRIBUTION OF BLOOD ALCOHOL CONCENTRATIONS BY TIME OF DAY FOR DRIVERS KILLED IN TRAFFIC CRASHES

Time Interval (Inclusive Hours)	Blood Alcohol Concentration								
	Negative	.01 - .04	.05 - .09	.10 - .14	.15 - .19	.20 - .24	.25+	Unknown	Total
12 M - 4 a.m.	0	0	2	2	1	1	2	2	10
4 - 8 a.m.	0	0	0	2	1	0	0	0	3
12 N - 4 p.m.	2	0	0	0	0	0	0	2	4
8 a.m. - 12 N	4	0	0	0	0	0	0	1	5
4 - 8 p.m.	3	0	0	1	2	1	0	1	8
8 p.m. - 12 M	1	0	0	1	1	2	0	1	6
Total	10	0	2	6	5	4	2	7	36

TABLE 9

DISTRIBUTION OF BLOOD-ALCOHOL CONCENTRATIONS BY THE DAY OF THE WEEK FOR DRIVERS KILLED IN TRAFFIC CRASHES

Time Interval (Day of the Week)	Negative	.01 - .04	.05 - .09	.10 - .14	.15 - .19	.20 - .24	.25+	Unknown	Total
Monday	2	0	0	1	1	2	1	2	9
Tuesday	0	0	1	0	1	0	0	1	3
Wednesday	3	0	0	2	1	0	0	1	7
Thursday	2	0	1	1	1	0	0	1	6
Friday	0	0	0	0	0	0	1	0	1
Saturday	3	0	0	2	0	2	0	2	9
Sunday	0	0	0	0	1	0	0	0	1
Total	10	0	2	6	5	4	2	7	36

TABLE 10

DISTRIBUTION OF BLOOD-ALCOHOL CONCENTRATIONS BY AGE GROUPINGS FOR DRIVERS KILLED IN TRAFFIC CRASHES

Driver Age Grouping	Blood Alcohol Concentration								
	Negative	.01 - .04	.05 - .09	.10 - .14	.15 - .19	.20 - .24	.25+	Unknown	Total
16-24	7	0	1	4	2	2	0	4	20
25-34	1	0	0	1	1	1	0	0	4
35-44	0	0	0	1	1	0	2	1	5
45-54	2	0	0	0	1	1	0	0	4
55-64	0	0	0	0	0	0	0	1	1
65+	0	0	1	0	0	0	0	1	2
Unknown	0	0	0	0	0	0	0	0	0
Total	10	0	2	6	5	4	2	7	36

BAC's of Fatally Injured Drivers by Sex

Of the 36 fatalities which occurred, 29 were males and 7 were females, as shown in Table 11. This result is consistent with the greater driving exposure and risk undertaken by the male. However, only 2 of the 7 females who were tested exhibited a positive BAC while 17 of the 22 males tested had been drinking. Again, this finding is consistent with the roadside survey findings and the arrest experience in Fairfax which show that about 95% of the drunken drivers are males.

Additional Characteristics of Fatal Crashes and Fatally Injured Drivers

Table 12 is a summation of the characteristics of the fatally injured drivers. In addition to some data discussed previously, it also includes information on crash types and on previous traffic convictions of the drivers. As the table shows, 15 of the fatal crashes were multi-vehicle, with 7 of these at night and 8 in the day. The other 21 fatal accidents were single vehicle crashes of which 13 were at night and 8 in the day. This is consistent with the usual finding of more single vehicle accidents at night coincident with the period of increased alcohol usage.

The driving records of the 31 persons whose records were known showed that 11 had no previous traffic convictions while 20 had previous convictions, including 12 with three or more convictions. In contrast, 22 of the 35 fatalities in 1973 had no prior convictions.

TABLE 11

DISTRIBUTION OF BLOOD-ALCOHOL CONCENTRATIONS BY SEX FOR DRIVERS KILLED IN TRAFFIC CRASHES

Sex	Blood Alcohol Concentration							
	Negative	.01 - .04	.05 - .09	.10 - .14	.15 - .19	.20 - .24	.25+	Unknown	Total
Male	5	0	2	5	5	3	2	7	29
Female	5	0	0	1	0	1	0	0	7
Total	10	0	2	6	5	4	2	7	36

TABLE 12

COMPOSITE PROFILE OF FATALLY INJURED DRIVERS, 1974

Vehicle Operator's Age

Age	16-18	19-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
No. of Cases	7	13	3	1	2	3	2	2	0	1	2

Blood Alcohol Concentration

BAC	Neg.	.01 - .04	.05 - .09	.10 - .14	.15 - .19	.20 - .24	.25+	Unknown
No. of Cases	10	0	2	6	5	4	2	7

Driver Sex Classification

Sex	Male	Female
No. of Cases	29	7

Type of Crash

Type	Multi-Vehicle		Single Vehicle	
No. of Cases	15		21	
	Night	Day	Night	Day
No. of Cases	7	8	13	8

Previous Criminal Convictions

Convictions	None	One	Two	Three or More	Unknown
No. of Cases	32	1	0	1	2

Previous Traffic Convictions

Convictions	None	One	Two	Three or More	Unknown
No. of Cases	11	6	2	12	5

TRENDS IN BLOOD ALCOHOL CONCENTRATIONS OF DRIVERS ARRESTED FOR DRIVING WHILE INTOXICATED

The Fairfax Alcohol Safety Action Project initiated its enforcement countermeasures on February 1, 1972. Throughout its first year, the number of drivers arrested for driving while intoxicated increased steadily. During the 11 months 2,976 drivers were arrested for DWI, with the numbers of arrests being 506, 669, 767, and 1,034, respectively, for the four quarters of 1972. During 1973, the number of arrests increased over 1972, but gradually declined each quarter. Of the 3,777 persons arrested, 3,245 had BAC tests. The quarterly totals for arrests were 1,061, 943, 888, and 885, respectively. In 1974 BAC tests were given to 3,051 of the 3,531 drivers arrested. The quarterly arrest figures were 871, 829, 859, and 972. The distribution of BAC's of those arrested for DWI by arrest category is shown in Table 13. It should be noted that almost 90% of the arrests for which BAC's were available were in the non-crash category, and it is this category which is used as the basis for determining any trends in BAC's of arrested drivers.

TABLE 13

DISTRIBUTION OF DRIVER BAC'S BY ARREST CATEGORY

Arrest Category	BAC's - 1972	BAC's - 1973	BAC's 1974
Fatal Crash	1 (0%)	1 (0%)	0 (0%)
Injury Crash	57 (2%)	82 (2%)	114 (4%)
Property Damage	150 (6%)	220 (7%)	289 (9%)
Non-Crash	2,347 (92%)	2,942 (91%)	2,648 (87%)

The average BAC's for the non-crash arrests were determined for each month of the ASAP operations. These monthly averages are shown in Table 14.

The average BAC's for the non-crash arrests were determined for each month of the ASAP operations. These monthly averages are shown in Table 14.

TABLE 14

AVERAGE BAC'S OF NON-CRASH ARRESTS

Month	1972	1973	1974	Month	1972	1973	1974
January	-	.17%	.17%	July	.19%	.17%	.17%
February	.19%	.19%	.18%	August	.20%	.17%	.16%
March	.17%	.18%	.18%	September	.21%	.17%	.17%
April	.20%	.18%	.18%	October	.19%	.17%	.17%
May	.19%	.16%	.19%	November	.20%	.16%	.18%
June	.19%	.17%	.18%	December	.19%	.17%	.19%

1979

The presumptive level for DWI was lowered from 0.15% to 0.10% on July 1, 1972. Even with the lowering of the presumptive level and the increased enforcement contributing to greater numbers of DWI arrests each quarter, the average BAC remained about the same in 1972. In 1972 the average BAC was .19% compared with .17% in 1973, and .18% in 1974. A slight reduction might be expected as the potential "pool" of intoxicated drivers is gradually reduced through arrests. However, in the first six months of 1972, the average BAC was only .04% higher than the presumptive limit compared with a 1974 average that was .08% higher. Thus it appears that the lowering of the presumptive limit increased the pool of potential DWI offenders more than the fear of arrest decreased this pool. Alternatively, it is possible that many drivers in the BAC range of .10% - 14% may not exhibit such deviant driving behavior that a police officer could detect their condition. Obviously the lowering of the presumptive level would increase the number arrested in the .10% - .14% range if they could be detected and such an increase is apparent in Table 15. In any event, it appears that the danger from drunken drivers has been slightly reduced while at the same time a change in laws enlarged the pool of potential DWI offenders without significantly affecting the arrests being made.

The distribution of BAC's for the first and twelfth quarters of ASAP operations are shown in Table 15. The distribution of BAC's for Quarter 1 was compared with that of Quarter 12 through the use of the chi-square technique. The hypothesis that the two distributions did not differ must be rejected since the calculated chi-square of 29.5 greatly exceeded the value necessary for statistical significance at the 99% confidence level. This calculation confirms the previous conclusion that the BAC's of arrested drivers were significantly lower during Quarter 12 than in Quarter 1. However, the lowering of the average BAC of arrested drivers by .01% must be interpreted in the proper perspective, which considers that the presumptive limit for DWI was statutorily lowered .05% during the same period.

TABLE 15

BAC DISTRIBUTION BY QUARTER

BAC Category	Quarter 1	Quarter 12
0% - .14%	61	202
.15% - .19%	149	219
.20% - .24%	128	164
.25% +	55	87

$$X^2 = 29.5$$

$$p < .01$$

TRENDS IN PUBLIC INFORMATION AND AWARENESS OF ASAP AND THE DRINKING DRIVING PROBLEM

One of the countermeasures in the Fairfax ASAP is Public Information and Education. There have been numerous media events specifically dealing with the Fairfax ASAP, but in addition, the national advertising of "Get the Problem Drinker Off The Road" has received broad exposure in the Fairfax area. As a result, there is a confounding factor which makes it difficult to separate the effects of the local ASAP publicity from the national publicity.

The sources of information concerning public information are the ASAP household and roadside surveys. The surveys that were conducted near the end of the third year of ASAP operations (1974) are compared below with the results from the baseline surveys. All of the questions discussed below are contained on the Fairfax Household Survey Questionnaire, and one of the questions is also on the Fairfax Roadside Survey Questionnaire. Comparisons are made using the technique of "differences between two percentages" unless otherwise specified.

Since both the Fairfax ASAP and the national campaign have received good coverage in the Fairfax area, it follows that a greater percentage of the population should have heard of a program to reduce alcohol-related traffic deaths, whether or not they could have specifically recalled the name of the program. Question 9 on the household survey tests this assumption. On the baseline survey 47.2% of the sample had heard of such a program compared with 52.6% on the fourth household survey, as shown in Table 16. The increase is not statistically significant and leaves some doubt that people in the Fairfax area are currently more aware of such a program.

TABLE 16

Have you heard of a campaign or program that would reduce alcohol-related traffic deaths?

	Yes
Baseline Survey (1971)	47.2%
Fourth Survey (1974)	52.6%

Subjects who had heard of such a program were asked to specify its name. This question is directed at finding out how many people could specifically recall the ASAP on an open-ended question. Only 3.0% of the total sample of 500 people could name ASAP on the baseline survey compared with 15.4% of the total on the fourth survey. This increase in the percentage of the total sample who could recall ASAP is significant at the .001% confidence level, as shown in Table 17. Thus it appears that the local ASAP public information program has succeeded in making the Fairfax ASAP better known to the people in the area.

TABLE 17

Do you recall what agency or organization is sponsoring the program?

	ASAP
Baseline Survey (1971)	3.0%
Fourth Survey (1974)	15.4%

$p < .001$

One of the objectives of the Fairfax ASAP is to increase public knowledge regarding the concept of the blood alcohol content, or BAC. More importantly, the objective is to increase the public knowledge regarding the specific presumptive limit in Virginia for driving while intoxicated. The presumptive limit in Virginia in 1971 during the baseline survey was .15% and it was reduced to .10% before the 1974 survey; therefore, the reader is cautioned in interpreting the data to remember this important change. The percentage of the samples who could correctly define blood alcohol content was 86.4% on both the baseline and 1974 surveys as shown in Table 18. The percentage from the household survey who could correctly select the presumptive alcohol limit in Virginia was 11.6% on the baseline survey (.15% presumptive level) and 22.6% on the fourth survey (.10% presumptive level). The percentages of ASAP area residents on the roadside survey who choose the correct answer were 19.0% on the baseline survey and 24.4% on the 1974 roadside survey. The increase was significant in both the roadside and household surveys. It is also interesting to note that the nighttime drivers were more knowledgeable than those persons interviewed in their homes. See Table 19 for a summary of this information.

TABLE 18

What do you think the term blood alcohol concentration or blood alcohol level means?

	Correct
Baseline Survey (1971)	86.4%
Fourth Survey (1974)	86.4%

No significant change

TABLE 19

The blood alcohol concentration is based on a chemical test, such as a breath test, and is used to determine if a person is legally drunk or intoxicated. Which of these do you understand is the legal definition of being drunk in this state?

(Hand Respondent Card "A")

1. Any Trace
2. .05%
3. .08%
4. .10% (1974)
5. .12%
6. .15% (1971)
7. .20%
8. Don't Know

	Correct (Household Survey)
Baseline Survey (1971)	11.6%
Fourth Survey (1974)	22.6%
	$p < .001$

	Correct (Roadside Survey)
Baseline Survey (Jan. 72)	19.0%
Fourth Survey (Oct. 74)	24.4%
	$p < .05$

Another objective of both the local ASAP and national public information campaigns is to increase public support for getting the problem drinker off the road. On the baseline survey, 38.6% of the sample thought the problem drinker to be more responsible than social drinkers for fatal accidents. This percentage rose to 44.2% on the fourth survey, an increase which is not statistically significant, as shown in Table 20.

TABLE 20

Would you guess that more fatal accidents are caused by the many social drinkers or by the smaller number of problem drinkers?

	Problem Drinkers
Baseline Survey (1971)	38.6%
Fourth Survey (1974)	44.2%

There are a number of myths and misconceptions concerning alcoholic beverages and their effects on a person. In the areas of general alcohol information, there has been some slight change since the baseline survey. Table 21 lists a number of questions about alcohol which were asked on the household surveys. There were five which changed significantly. The respondents scored significantly poorer on question "b" ($p < .01$) but they did improve significantly on questions "d", "f", "g", and "i". Note, however, that even with the improvement, less than half were able to correctly answer "g" and "i". Thus more than half still believe (mistakenly) that black coffee will sober a person and that a person used to drinking can drink more without becoming drunk.

A series of questions dealing with a variety of methods for reducing the drinking driving problem were asked. These eight questions are shown in Table 22 with the results of the baseline and the 1974 surveys. Note that in the first four questions there was very little change in the "not effective" column though there was some shifting between "fairly effective" and "very effective." In the last four questions however, a more pronounced change is visible with alcohol education courses, random road checks, and sickness pills gaining popularity while anti-starting devices lost favor.

The best liked methods in both surveys were greater police enforcement of drunk driving laws and more severe penalties for drunken drivers, followed by special education courses, random police checks, improved treatment services, and public information campaign. The least popular methods were the sickness pill and the anti-starting device.

The respondents were asked to describe how often they drive after having anything to drink. In 1971, 24.8% said often or occasionally compared with 19.0% in 1974, which is a significant reduction at the .05% confidence level. This is an encouraging sign that people are becoming more aware of the risks of driving after drinking, whether they feel the risks to be risks of accidents or risks of arrests, though, of course, "self reporting" replies can be misleading. Table 23 shows the distribution of answers to this question.

Table 24 lists four questions dealing with the perceived risks of certain things happening to the respondents after drinking too much. There of the questions deal with the chances of committing a moving traffic violation, being involved in an automobile accident, and being involved in a serious or fatal automobile accident. All three show significant increases in the perceived risks associated with the three events. The fourth question deals with the chances of being stopped by the police. The perceived risk was higher on the fourth survey but not significantly so. It appears that in general the respondents think that if they drive after drinking too much, the chance of being involved in accidents or committing moving traffic violations is much greater than the chance of being stopped by the police. Apparently the perceived risk of apprehension hasn't gone up among the general population, though the perceived risk of committing a driver "error" or being involved in an accident has increased.

TABLE 21

			Baseline Survey Correct	Fourth Survey Correct	Significance
True	a.	A younger person just starting to drink will get drunk faster than an older person on the same amount of liquor.	68.0%	62.8%	No
True	b.	A person drinking on an empty stomach will get drunk faster on the same number of drinks than a person who has eaten something.	93.6%	89.0%	$p < .01$
False	c.	If a person uses a mixer, like soda water, w/liquor, he can drink more without getting drunk than if he drank liquor straight.	52.4%	53.2%	No
True	d.	A small person will get drunk faster than a large person on the same number of drinks.	44.0%	55.8%	$p < .01$
False	e.	A person who has had one drink should not be allowed to drive an automobile.	76.0%	77.4%	No
False	f.	If a person sticks to the same kind of drink he is less likely to get drunk than if he mixes different kinds of drinks like beer, whiskey, etc.	45.4%	51.6%	$p < .05$
False	g.	A person who is used to drinking can drink more and not become drunk than a person who drinks only once in a while.	30.8%	43.6%	$p < .01$
True	h.	Alcohol will affect a person faster if he's under medication like a tranquilizer or antidepressant.	92.0%	92.8%	No
False	i.	Strong black coffee is helpful in sobering a person up before he drives.	39.6%	46.0%	$p < .05$
False	j.	Beer is pretty much like a soft drink as far as making a person drunk is concerned.	95.8%	95.8%	No

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TABLE 22

SURVEY OPINION ON THE EFFECTIVENESS OF METHODS OF REDUCING DRUNK DRIVING

	1971			1974		
	Very	Fairly	Not Effective	Very	Fairly	Not Effective
a. Greater police enforcement of drunk driving laws	52%	40%	8%	50%	42%	8%
b. Large scale public information and education campaign	37%	45%	18%	27%	55%	18%
c. Improved treatment services for problem drinkers	42%	40%	18%	40%	44%	16%
d. Move severe penalties for convicted drunken drivers	58%	30%	12%	60%	28%	12%
e. Having convicted drunken drivers use a sickness pill	20%	18%	62%	19%	26%	55%
f. Special alcohol education courses for convicted drunk drivers	30%	52%	18%	34%	54%	12%
g. Police using random road checks to find drinking drivers	30%	44%	26%	35%	51%	14%
h. A device that would prevent a drunken person from starting a car	52%	22%	26%	40%	25%	35%

TABLE 23

How often do you drive after having anything to drink? Would you say often, occasionally, hardly ever, or never?

	Often + Ocassionally	Hardly Ever or Never
Baseline Survey (1971)	24.8%	75.2%
Fourth Survey (1974)	19.0%	81.0%

$p < .05$

TABLE 24

a. If you drive after drinking too much, what do you think the chances are of your committing a moving traffic violation?

	Better Than Even Chance
Baseline Survey (1971)	64.8%
Fourth Survey (1974)	74.5%

$p < .01$

b. If you drive after drinking too much, what are your chances of being stopped by the police?

	Better Than Even Chance
Baseline Survey (1971)	28.6%
Fourth Survey (1974)	32.2%

Not significant

c. If you drive after drinking too much, what are your chances of being involved in an automobile accident?

	Better Than Even Chance
Baseline Survey (1971)	58.2%
Fourth Survey (1974)	66.8%

$p < .01$

d. If you drive after drinking too much, what are your chances of being involved in a serious or fatal automobile accident?

	Better Than Even Chance
Baseline Survey (1971)	49.0%
Fourth Survey (1974)	59.0%

$p < .01$

BENEFIT/COST ANALYSIS

Societal Costs in Fairfax

In order to qualify as a completely successful undertaking, the Fairfax ASAP project will not only have to produce a measurable improvement in traffic crash data but such quantified benefits will have to outweigh the cost of producing them. Since the ASAP is a new and completely federally funded project, its costs are easily identified. (The 1971 start-up costs are evenly distributed over the three-year period.)

CY 1972 = $796,243.
CY 1973 = 858,119.
CY 1974 = 880,496

Total 3 Year Cost = $2,534,858.

Societal costs of motor vehicle crashes computed for the baseline period and for the three years of project operations are shown in Table 25.

TABLE 25

FAIRFAX ASAP SOCIETAL COSTS OF AUTO CRASHES

Year	Fatalities	Injuries	Property Damage Crashes
1969	60	4,165	10,331
1970	63	4,465	11,519
1971	100	4,756	12,501
1972	85	4,795	13,850
1973	78	5,032	14,511
1974	63	4,899	13,904

SOCIETAL COSTS FOR EACH YEAR

1969_{L1} = 60 x ($201,000) + 4,165 x ($7,300) + 10,331 x ($300) = $45,563,800

1970_{L2} = 63 x ($201,000) + 4,465 x ($7,300) + 11,519 x ($300) = $48,713,200

1971_{L3} = 100 x ($201,000) + 4,765 x ($7,300) + 12,501 x ($300) = $58,569,100

1972_{L4} = 85 x ($201,000) + 4,795 x ($7,300) + 13,850 x ($300) = $56,243,000

1973_{L5} = 78 x ($201,000) + 5,032 x ($7,300) + 14,511 x ($300) = $56,764,900

1974_{L6} = 63 x ($201,000) + 4,899 x (7,300) + 13,904 x ($300) = $52,596,900

One of the most simple methods of benefit/cost analysis is a calculation of the "break-even" rate. The break-even rate is computed as the ratio of benefits to costs necessary to effect a "break-even" point. Using 1969, 1970, and 1971 data (which reduces the signficance of the extraordinary high fatality figure of 1971) to estimate the break-even point for 1972, 1973, and 1974 yields the following figures:

$$\text{Approximate ASAP Costs} = \frac{2,534,858}{152,846,100} = 0.0166$$

Thus the ASAP in the three-year (1972-1974) period would have to achieve a reduction in total accident costs of 1.66% to "break-even" in the business sense. In fact, however, it was found that total accident costs increased slightly in 1972-1974 over the 1969-1971 period. Costs for the latter were $153 million while the total 1972-1974 costs were $166 million; a cost increase of some $13 million.

Break-even analysis, however, does not account for the increases in accident exposure that occurred in the 1972-1974 period. Hence, even though overall costs were greater during the ASAP period than during the baseline period, it is possible that accident costs were less than otherwise would have been expected. Hence projections of expected accident figures based on the 1962-1971 crash trends, shown in the first section of this report, should be used in estimating accident costs and program benefits, if any, from the Fairfax ASAP.

Table 26 shows estimated societal costs of traffic crashes in Fairfax based upon projections made from the linear regression model of section one.

TABLE 26

ESTIMATED FAIRFAX SOCIETAL COSTS BASED ON LINEAR REGRESSION MODEL

1972_{L4} = 86 x ($201,000) + 5,216 ($7,300) + 13,236 x ($300) = $59,333,600

1973_{L5} = 90 x ($201,000) + 5,569 ($7,300) + 14,237 x ($300) = $63,914,800

1974_{L6} = 89 x ($201,000) + 5,481 ($7,300) + 14,097 x ($300) = 62,129,400

It can be seen from the data in Table 26 that projected 1972-1974 costs in Fairfax, based on the ten-year trend, would be over $185 million if that trend were uninterrupted.

If, in fact, it can be demonstrated that reductions in traffic crashes are attributable to the Fairfax ASAP project, then savings in societal costs to the community are approximately $19 million. Unfortunately, it is not possible to attribute the full $19 million to ASAP. Since few of the reductions in crashes were statistically significant it is not possible to demonstrate a positive benefit/ cost ratio for any year except 1974. For example, the figure $59,333,600 for 1972 was based on a projection at the 95% confidence interval; that projection of course covered a range of possible results, not just a single point. Using the same calculations shown in Table 26 for the lower and upper limits of the projected range shows that the 1972 projected cost could have fallen anywhere between $50,913,700 and $67,010,900 at the 95% level. Thus no definite benefit can be demonstrated even though the actual cost of $56 million was in the lower end of the range. The 1973 actual costs of $56 million also fell within the projected range of $54 million to $71 million. Only in 1974 did the actual cost fall below the projected range at $52,596,900 actual compared to $53,629,900 at the lower end of the range. Thus at least a $1 million decrease was seen in 1974 through the decrease in previous years is not significant.

When the three-year analysis figures are used rather than the annual projections the benefit/cost analysis is much more promising. The three-year total societal cost in the ASAP area was $165,605,000. The projected cost based on the three-year period projections was $195,422,300 with a range at the 95% confidence interval of $169,766,300 to $221,071,300. Clearly then there was a significant benefit from the program of at least $4,161,300 at the 95% level and as much as $29,817,300 if the actual projection is used. With actual project costs of $2.53 million the benefits would exceed the costs of the program by at least 1.6 to 1 and by as much as 12 to 1.

Societal Costs in Control Community

Societal costs of motor vehicle crashes in Fairfax must be tested against trends in societal costs of crashes in a matched control community to provide indications of the impact of ASAP on the overall crash picture.

Societal costs of auto crashes in Henrico County are shown in Table 27.

TABLE 27

HENRICO COUNTY SOCIETAL COSTS OF AUTO CRASHES

Year	Fatalities	Injuries	Property Damage Crashes
1969	26	1,301	2,476
1970	26	1,313	2,668
1971	17	1,395	3,106
1972	25	1,594	3,445
1973	22	1,503	3,555
1974	40	1,545	3,321

SOCIETAL COSTS FOR EACH YEAR

1969_{L1} = 26 x ($201,000) + 1,301 x ($7,300) + 2,476 ($300) = $15,466,100

1970_{L2} = 26 x ($201,000) + 1,313 x ($7,300) + 2,668 ($300) = $15,611,300

1971_{L3} = 17 x ($201,000) + 1,395 x ($7,300) + 3,106 ($300) = $14,532,300

1972_{L4} = 25 x ($201,000) + 1,594 ($7,300) + 3,445 ($300) = $17,694,700

1973_{L5} = 22 x ($201,000) + 1,503 x ($7,300) + 3,555 ($300) = $16,460,400

1974_{L6} = 40 x ($201,000) + 1,545 x ($7,300) + 3,321 ($300) = $20,314,800

It can be seen from Table 27 that while the trend in societal costs of crashes in Henrico is upward, the rate of increase is much more modest than in Fairfax, and it may be seen that in two years of the five for which data were obtained, costs actually declined over year earlier levels. Total societal costs for the years 1972 to 1974 were over $54 million.

Table 28, again using the linear regression model of section one, shows the estimated societal costs of motor vehicle crashes in Henrico for 1972 - 1974 based on prior crash trends.

TABLE 28

ESTIMATED HENRICO COUNTY SOCIETAL COSTS BASED ON LINEAR REGRESSION MODEL

1972_{L4} = 24 x ($201,000) + 1,491 x ($7,300) + 3,069 ($300) = $16,629,000

1973_{L5} = 24 x ($201,000) + 1,590 x ($7,300) + 3,253 ($300) = $17,406,900

1974_{L6} = 24 x ($201,000) + 1,633 x ($7,300) = 3,331 ($300) = $17,744,200

The actual costs of $54 million exceeded the $51.7 million total annual projections and far exceeded the $43 million lower end of the three-year projection. Thus no significant cost benefit was evident at the control site.

Figures 7 and 8 show the yearly actual and projected costs graphically.

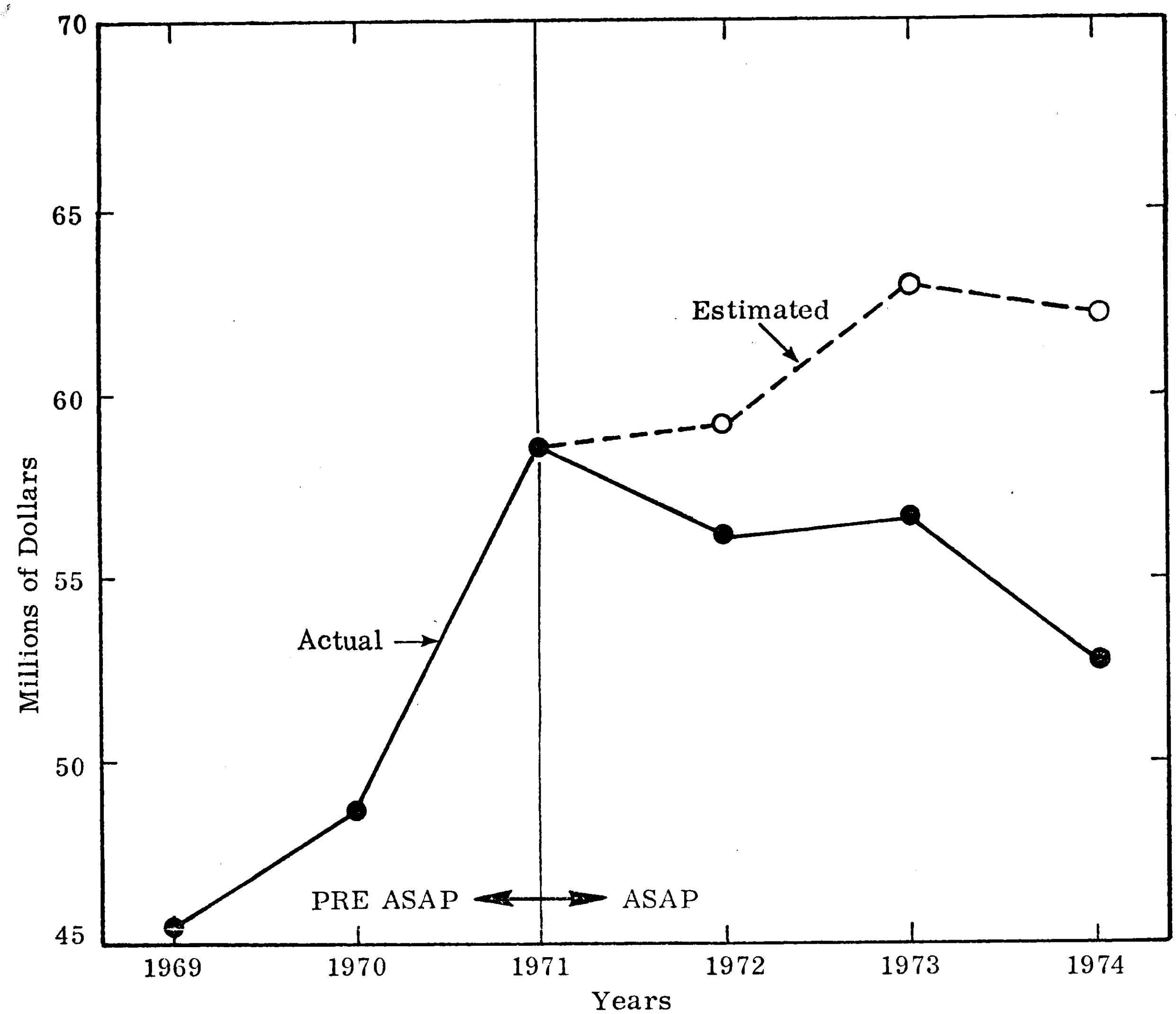

Figure 7. Actual and estimated societal cost of auto crashes in the Fairfax ASAP area.

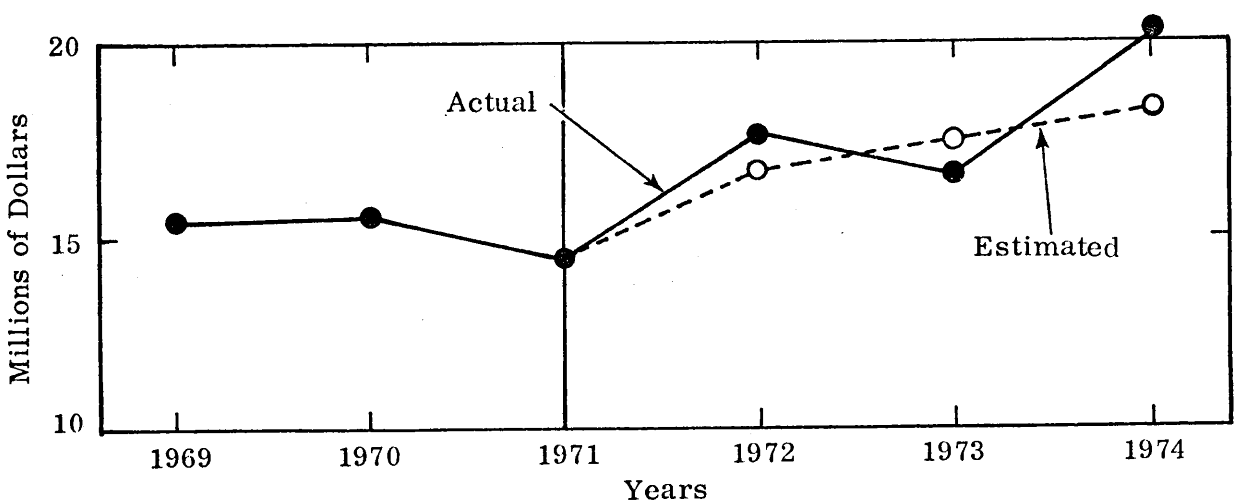

Figure 8. Actual and estimated societal cost of auto crashes in the Henrico area.

APPENDIX

APPENDIX A

EFFECTS OF THE ENERGY SHORTAGE ON 1974 CRASH DATA

One of the most troublesome confounding factors in evaluating the ASAP program in 1974 is the effect that the energy shortage might have had on the crash rates. Unfortunately no compensation could be made for these effects in the Fairfax area simply because no justifiable formula could be devised.

The most obvious effect — a reduction in the number of miles driven — is compensated for automatically by the statistics in the report which use vehicle miles traveled as the variable. However, the other obvious factor, the national 55 mph speed limit, has not been compensated for. Though the lowered speed limit would obviously have an effect on crash rates, and especially on the severity of accidents, no formula could be devised to quantify that effect so that it could be considered in the data.

It was thought at one time that a less obvious result of the energy shortage, a shift in day/night driving patterns, might be a factor in the ASAP area. However, further checking indicated that the apparent shift was only an aberration at one traffic count station while most of the ASAP area showed no significant change. Though revised crash projections were made to compensate for this apparent shift, these were abandoned when the shift was found to be unique in the one count station. It is possible that the shift was nevertheless significant, but it was not quantifiable, and thus could not be used.

APPENDIX B

FAIRFAX ASAP AREA POPULATION

(Fairfax County, Fairfax City, Falls Church, Vienna, Herndon)

1962	304,021
1963	340,766
1964	360,587
1965	356,146
1966	376,149
1967	419,446
1968	453,396
1969	475,074
1970	487,763
1971	530,527
1972	535,872
1973	567,172
1974	589,011

Sources:

1960-64 Statistical Abstract of Va. 1966

1965-69 Bureau of Population and Ecnomic Research, U. Va.

1970 1970 Census; Commonwealth of Virginia; Virginia Department of Highways

1971-73 Planning Departments, Fairfax County and Fairfax City. Falls Church 1971 data are same as 1970 census.

1974 Statistics Department, Fairfax County. Planning Departments Fairfax City and Falls Church.

FAIRFAX ASAP AREA MOTOR VEHICLE REGISTRATIONS

1962	109,463
1963	121,682
1964	132,776
1965	146,092
1966	156,353
1967	177,359
1968	191,649
1969	211,478
1970	224,016
1971	250,010
1972	277,339
1973	294,098
1974	322,624

Sources:

Fairfax County; Mr. Ray Birch, Division of Finance Fairfax County, 1962-1973. 1974 Miss Ann Davis, Div. of Finance.

Fairfax City; Mrs. Frances Cox, City of Fairfax, 1968-1974; 1962-1967 estimated by VH&TRC.

Falls Church; Mr. Eckert, city of Falls Church, 1962-1971; 1972 data estimated by VH&TRC, 1974 Falls Church Treasurers Office.

FAIRFAX ASAP AREA ANNUAL VEHICLE MILES OF TRAVEL
(000,000)

1957	688.7
1958	703.9
1959	789.1
1960	785.8
1961	859.3
1962	993.7
1963	1,134.1
1964	1,254.5
1965	1,710.5
1966	1,859.4
1967	1,954.0
1968	2,117.1
1969	2,392.7
1970	2,461.6
1971	2,716.6
1972	3,036.8
1973	3,272.8
1974	3,239.9

Source:

Traffic and Safety Division, Virginia Department of Highways

HENRICO COUNTY POPULATION

1962	124,743
1963	128,445
1964	132,147
1965	135,849
1966	139,551
1967	143,253
1968	146,955
1969	150,651
1970	154,364
1971	158,066
1972	161,768
1973	165,470
1974	183,118

Source:

1960-1970 Census Data. 1962-69 data are interpolated from the Census data; 1971-73 are extrapolated from 1970. 1974 Mr. Winter, Office of Advanced Planning, Henrico County.

HENRICO COUNTY ANNUAL VEHICLE MILES OF TRAVEL
(000,000)

1957	428.1
1958	447.0
1959	472.8
1960	487.9
1961	508.1
1962	530.2
1963	556.4
1964	585.4
1965	606.7
1966	659.1
1967	733.6
1968	800.9
1969	881.8
1970	932.4
1971	1,022.7
1972	1,085.0
1973	1,160.5
1974	1,192.3

Source:

Traffic and Safety Division, Virginia Department of Highways

HENRICO COUNTY MOTOR VEHICLE REGISTRATIONS
(Rounded to Nearest 100)

1962	54,000
1963	57,000
1964	60,000
1965	65,000
1966	70,000
1967	75,000
1968	81,000
1969	85,000
1970	90,000
1971	96,000
1972	104,000
1973	111,000
1974	118,500

Source:

Mr. Dotson, County of Henrico, 1962-1971. 1972 data estimated by VH&TRC. Mr. Carroll, County of Henrico, 1974.

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APPENDIX C

FAIRFAX FATAL CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = 18.1492 + 2.03569E-02 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .852767

THERE IS A -

0.05 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .727212
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 7.78629

UNASSOC SUM OF SQUARES= 485.013
TOTAL SUM OF SQUARES= 1778
T-STATISTIC= 4.61369   DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1859.36
STANDARD DEVIATION = 588.796

DEPENDENT VARIABLE (Y) DATA:
MEAN = 56
STANDARD DEVIATION = 14.0554

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
993.7	36	38.3779	-.062	1.06605	4.5413
1134.1	47	41.236	.1397	.877361	4.03525
1254.5	47	43.6869	.0758	.929509	3.62925
1710.5	51	52.9697	-.0372	1.03862	2.54317
1859.4	56	56.0008	-.0001	1.00001	2.46224
1954	55	57.9266	-.0506	1.05321	2.49733
2117.1	60	61.2463	-.0204	1.02078	2.71172
2392.1	59	66.8449	-.1174	1.13296	3.40254
2461.6	59	68.2597	-.1357	1.15694	3.60077
2716.6	90	73.4597	.2253	.816119	4.51015

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
3036.3	79.969	60.6168	--	99.3212
3272.8	84.7732	64.2298	--	105.317
3239.9	84.1035	63.7347	--	104.472

FAIRFAX FATALITIES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:
Y = 27.1795 + 1.92112E-Ø2 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .755612

THERE IS A -

Ø.Ø5 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

Ø.Ø1 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .57Ø95
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 1Ø.4ØØ4

UNASSOC SUM OF SQUARES= 365.355
TOTAL SUM OF SQUARES= 2Ø16.9
T-STATISTIC= 3.26279 DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, Ø=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1359.36
STANDARD DEVIATION = 533.796

DEPENDENT VARIABLE (Y) DATA:
MEAN = 62.9
STANDARD DEVIATION = 14.97

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
993.7	4Ø	46.2697	-.1356	1.15674	6.Ø6593
1134.1	56	48.9669	.1436	.874439	5.39Ø93
1254.5	57	51.2799	.1115	.899643	4.34773
1710.5	59	6Ø.Ø4Ø2	-.Ø174	1.Ø1763	3.4Ø369
1859.4	65	62.9ØØ8	.Ø333	.967704	3.23391
1954	64	64.7182	-.Ø111	1.Ø1122	3.33573
2117.1	65	67.8515	-.Ø421	1.Ø4387	3.62214
2392.1	6Ø	73.1346	-.1796	1.21891	4.5449
2461.6	63	74.4697	-.1541	1.18206	4.3364
2716.6	1ØØ	79.3686	.2599	.793686	6.Ø2433

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
3Ø36.8	85.52	59.67Ø5	--	111.369
3272.8	9Ø.Ø538	62.6132	--	117.494
3239.9	89.4218	62.2144	--	116.629

FAIRFAX INJURY CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:
Y = 461.141 + 1.Ø6615 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .989694

THERE IS A -

Ø.Ø5 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

Ø.Ø1 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .979494
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 96.3396

UNASSOC SUM OF SQUARES= 74232.3
TOTAL SUM OF SQUARES= 3.62084E+06
T-STATISTIC= 19.543 DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, Ø=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1859.36
STANDARD DEVIATION = 583.796

DEPENDENT VARIABLE (Y) DATA:
MEAN = 2443.5
STANDARD DEVIATION = 634.234

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
993.7	1444	1520.58	-.0504	1.05303	56.1894
1134.1	1663	1670.26	-.0044	1.00437	49.983
1254.5	1973	1798.63	.0997	.909316	44.9046
1710.5	2213	2284.79	-.0323	1.03384	31.5235
1859.4	2359	2443.54	-.0346	1.03584	30.4659
1954	2525	2544.4	-.0077	1.00763	30.3994
2117.1	2815	2718.29	.0355	.965645	33.559
2392.1	2916	3011.43	-.0318	1.03274	42.0996
2461.6	3151	3085.53	.0212	.979238	44.7993
2716.6	3374	3357.45	.0049	.995094	55.304

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
3Ø36.8	3698.83	3459.38	--	3938.27
3272.8	395Ø.44	3696.26	--	42Ø4.62
3239.9	3915.36	3663.34	--	4167.39

FAIRFAX PROPERTY DAMAGE CRASHES AS A FUNCTION OF MILLION MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = 346.5 + 4.24426 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .972766

THERE IS A -

0.05 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .946274
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 631.573

UNASSOC SUM OF SQUARES= 3.19034E+06
TOTAL SUM OF SQUARES= 5.93964E+07
T-STATISTIC= 11.3703   DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1859.36
STANDARD DEVIATION = 538.726

DEPENDENT VARIABLE (Y) DATA:
MEAN = 8233.1
STANDARD DEVIATION = 2568.97

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
993.7	4649	4564.02	.0186	.98172	362.363
1134.1	5354	5159.91	.0376	.963749	327.316
1254.5	6468	5673.92	.1435	.876765	294.334
1710.5	7360	7606.3	-.0324	1.03346	236.693
1859.4	7720	8238.27	-.063	1.06713	199.723
1954	7645	8639.78	-.1152	1.13012	202.569
2117.1	8334	9332.02	-.0534	1.05637	210.959
2392.1	10331	10499.2	-.0161	1.01628	275.994
2461.6	11519	10794.2	.0671	.937074	293.696
2716.6	12501	11876.4	.0525	.95074	365.337

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
3036.8	13235.5	11665.7	--	14805.2
3272.8	14237.1	12570.7	--	15903.5
3239.9	14097.5	12445.3	--	15749.7

HENRICO FATAL CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:
Y = 12.8381 + 8.01988E-03 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .296837

THERE IS A -

0.05 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = 8.81121E-02
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 4.70369

UNASSOC SUM OF SQUARES= 176.997
TOTAL SUM OF SQUARES= 194.1
T-STATISTIC= .879209 DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 730.92
STANDARD DEVIATION = 171.888

DEPENDENT VARIABLE (Y) DATA:
MEAN = 18.7
STANDARD DEVIATION = 4.64399

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
530.2	18	17.0903	.0532	.949458	2.35895
556.4	12	17.3004	-.3064	1.4417	2.17868
585.4	14	17.5329	-.2016	1.25235	1.99359
606.7	17	17.7038	-.0398	1.0414	1.86986
659.1	28	18.124	.5449	.647286	1.62531
733.6	18	18.7215	-.0386	1.04008	1.48764
800.9	19	19.2612	-.0136	1.01375	1.61862
881.8	22	19.91	.1049	.905002	2.02647
932.4	23	20.3158	.1321	.883298	2.36433
1022.7	16	21.04	-.2396	1.315	3.04895

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
1085	21.5397	9.74668	--	33.3327
1160.5	22.1452	9.54493	--	34.7454
1193.2	22.4074	9.42774	--	35.3871

HENRICO FATALITIES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:
Y = 18.9241 + 4.34502E-03 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .14619

THERE IS A -

0.05 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = 2.13714E-02
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 5.36051

UNASSOC SUM OF SQUARES= 229.88
TOTAL SUM OF SQUARES= 234.9
T-STATISTIC= .417977 DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?
??D1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 730.92
STANDARD DEVIATION = 171.888

DEPENDENT VARIABLE (Y) DATA:
MEAN = 22.1
STANDARD DEVIATION = 5.10882

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
530.2	21	21.2279	-.0108	1.01085	2.68835
556.4	17	21.3417	-.2035	1.25539	2.48291
585.4	15	21.4677	-.3013	1.43118	2.27198
606.7	25	21.5603	.1595	.862411	2.13096
659.1	31	21.7879	.4228	.702837	1.85227
733.6	19	22.1116	-.1408	1.16377	1.69537
800.9	24	22.4041	.0712	.933503	1.84464
881.8	26	22.7556	.1425	.875214	2.30945
932.4	26	22.9754	.1316	.883671	2.69449
1022.7	17	23.3678	-.2726	1.37458	3.4747

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
1085	23.6385	10.1987	--	37.0782
1160.5	23.9665	9.6068	--	38.3263
1192.3	24.1047	9.32469	--	38.8847

HENRICO INJURY CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:
Y = 49.527 + .92975 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .966883

THERE IS A -

Ø.Ø5 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

Ø.Ø1 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .934862
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 44.7448

UNASSOC SUM OF SQUARES= 16Ø18.5
TOTAL SUM OF SQUARES= 245877.
T-STATISTIC= 1Ø.7153 DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, Ø=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 73Ø.92
STANDARD DEVIATION = 171.888

DEPENDENT VARIABLE (Y) DATA:
MEAN = 729.1
STANDARD DEVIATION = 165.287

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
53Ø.2	469	542.48	-.1355	1.15667	22.44
556.4	527	566.84	-.Ø7Ø3	1.Ø756	2Ø.7251
585.4	623	593.8Ø3	.Ø491	.953134	18.9644
6Ø6.7	632	613.6Ø6	.Ø299	.97Ø896	17.7874
659.1	74Ø	662.325	.1172	.895Ø34	15.4611
733.6	755	731.592	.Ø319	.968996	14.1514
8ØØ.9	8ØØ	794.164	.ØØ73	.9927Ø5	15.3975
881.8	875	869.381	.ØØ64	.993578	19.2772
932.4	886	916.426	-.Ø333	1.Ø3434	22.4912
1Ø22.7	984	1ØØØ.38	-.Ø164	1.Ø1665	29.ØØ37

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
1Ø85	1Ø58.31	946.122	--	117Ø.49
116Ø.5	1128.5	1ØØ8.64	--	1248.36
1192.3	1158.Ø7	1Ø34.7	--	1281.44

[illegible] PROPERTY DAMAGE CRASHES AS A FUNCTION OF MILLION MILES OF TRAVEL

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = 424.301 + 2.43747 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .934173

THERE IS A -

0.05 PROBABILITY THAN AN R OF .63 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .76 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .872678
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 169.74

UNASSOC SUM OF SQUARES= 230504.
TOTAL SUM OF SQUARES= 1.81033E+06
T-STATISTIC= 7.40492   DEG. OF FREEDOM= 8

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 738.92
STANDARD DEVIATION = 171.838

DEPENDENT VARIABLE (Y) DATA:
MEAN = 2205.9
STANDARD DEVIATION = 448.495

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
530.2	1634	1716.65	-.0482	1.05058	85.1265
556.4	1704	1780.51	-.043	1.0449	78.6211
585.4	1946	1851.2	.0512	.951234	71.942
606.7	2075	1903.12	.0903	.917165	67.4768
659.1	2260	2030.84	.1128	.898602	58.6521
733.6	1989	2212.43	-.101	1.11233	53.6538
800.9	2201	2376.47	-.0739	1.07973	58.4105
881.8	2476	2573.67	-.038	1.03945	73.1285
932.4	2668	2697.	-.0108	1.01087	85.3208
1022.7	3106	2917.11	.0647	.939184	110.026

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
1085	3068.96	2643.39	--	3494.53
1160.5	3252.99	2798.29	--	3707.69
1192.3	3330.5	2862.49	--	3798.51

DONE

APPENDIX D

FAIRFAX FATAL CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = 3Ø.9594 + 2.39598E-Ø2 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .983279

THERE IS A -

Ø.Ø5 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

Ø.Ø1 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .966838
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 11.5926

UNASSOC SUM OF SQUARES= 4Ø3.154
TOTAL SUM OF SQUARES= 12157.2
T-STATISTIC= 9.35222 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, Ø=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 4474.2
STANDARD DEVIATION = 2262.46

DEPENDENT VARIABLE (Y) DATA:
MEAN = 138.4
STANDARD DEVIATION = 55.1299

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
2131.7	72	83.2325	-.135	1.156Ø1	7.85331
2638.8	96	94.1846	.Ø192	.981Ø89	7.Ø164
4Ø99.1	145	129.173	.1225	.89Ø849	5.2774
593Ø.5	171	173.Ø53	-.Ø119	1.Ø12Ø1	6.37233
757Ø.9	2Ø8	212.357	-.Ø2Ø6	1.Ø2Ø95	9.45587

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
9549.5	259.764	223.45	--	296.Ø77

FAIRFAX FATALITIES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:
Y = 38.2152 + 2.65788E-02 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .97093

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .942706
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 17.118

UNASSOC SUM OF SQUARES= 879.089
TOTAL SUM OF SQUARES= 15343.2
T-STATISTIC= 7.02577 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 4484.2
STANDARD DEVIATION = 2262.46

DEPENDENT VARIABLE (Y) DATA:
MEAN = 157.4
STANDARD DEVIATION = 61.9338

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
2181.7	82	96.2922	-.1477	1.1732	11.5965
2638.8	107	108.351	-.0125	1.01263	10.3607
4099.1	172	147.164	.1687	.855608	7.7923
5938.5	194	195.841	-.0095	1.00949	9.40968
7579.9	232	239.441	-.0311	1.03207	13.9629

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL	
9549.5	292.03	238.403 --	345.652

1990

FAIRFAX INJURY CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = 290.095 + 1.23868 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .991954

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .983972
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 413.012

UNASSOC SUM OF SQUARES= 511741.
TOTAL SUM OF SQUARES= 3.19273E+07
T-STATISTIC= 13.5759 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 4484.2
STANDARD DEVIATION = 2262.46

DEPENDENT VARIABLE (Y) DATA:
MEAN = 5844.6
STANDARD DEVIATION = 2825.2

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
2181.7	2540	2992.53	-.1513	1.17816	279.792
2638.8	3692	3558.73	.0374	.963904	249.975
4099.1	5851	5367.58	.09	.917379	188.019
5933.5	7699	7636.11	.0032	.991831	227.03
7570.9	9441	9668.04	-.0235	1.02405	336.387

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL	
9549.5	12118.9	10825.2 --	13412.7

FAIRFAX PROPERTY DAMAGE CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = -1531.74 + 4.65326 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .990635

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .981358
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 1675.44

UNASSOC SUM OF SQUARES= 8.42163E+06
TOTAL SUM OF SQUARES= 4.51759E+08
T-STATISTIC= 12.567 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 4484.2
STANDARD DEVIATION = 2262.46

DEPENDENT VARIABLE (Y) DATA:
MEAN = 19334.4
STANDARD DEVIATION = 10627.3

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
2181.7	7475	8620.27	-.1329	1.15321	1135.91
2638.8	11465	10747.3	.0667	.937399	1014.06
4099.1	19182	17542.4	.0934	.914525	762.724
5930.5	24199	26064.4	-.0716	1.07709	920.977
7570.9	34351.	33697.6	.0193	.980979	1366.62

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL	
9549.5	42904.5	37656.3 --	48152.8

1703

HENRICO FATAL CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = 24.3514 + 1.43211E-02 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .801074

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .641719
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 7.37962

UNASSOC SUM OF SQUARES= 163.377
TOTAL SUM OF SQUARES= 456
T-STATISTIC= 2.31804 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1930.62
STANDARD DEVIATION = 597.24

DEPENDENT VARIABLE (Y) DATA:
MEAN = 52
STANDARD DEVIATION = 10.6771

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
1347.9	41	43.6548	-.0609	1.06475	4.8339
1526.2	50	46.2883	.082	.924165	4.13933
1748.5	43	49.3918	-.1295	1.14865	3.48679
2193.6	65	55.7662	.1655	.857941	3.67351
2836.9	61	64.9789	-.0613	1.06523	6.49935

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJICTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL	
3437.8	73.5845	48.9224	-- 98.2466

HENRICO FATALITIES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

LINEAR REGRESSION ANALYSIS

THE REGRESSION EQUATION IS:
Y = 35.4037 + 1.36724E-02 X

STATISTICS OF THE SAMPLE

COEFFICIENT OF CORRELATION = .722599

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .522149
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 9.02009

UNASSOC SUM OF SQUARES= 244.031
TOTAL SUM OF SQUARES= 510.801
T-STATISTIC= 1.81056 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1930.62
STANDARD DEVIATION = 597.24

DEPENDENT VARIABLE (Y) DATA:
MEAN = 61.8
STANDARD DEVIATION = 11.3005

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
1347.9	45	53.8328	-.1641	1.19628	5.96953
1526.2	64	56.2706	.1373	.879228	5.05956
1748.5	57	59.31	-.039	1.04053	4.2619
2193.6	74	65.3956	.1315	.883724	4.49623
2836.9	69	74.191	-.07	1.07523	7.94413

PROJECTIONS

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL
3437.8	82.4068	52.2624 -- 112.551

17[illegible]

HENRICO INJURY CRASHES AS A FUNCTION OF MILLION VEHICLE
MILES OF TRAVEL FOR THREE YEAR PERIODS

L I N E A R   R E G R E S S I O N   A N A L Y S I S

THE REGRESSION EQUATION IS:

Y = -523.812 + 1.20294 X

S T A T I S T I C S   O F   T H E   S A M P L E

COEFFICIENT OF CORRELATION = .971518

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .943847
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 202.351

UNASSOC SUM OF SQUARES= 122844.
TOTAL SUM OF SQUARES= 2.18747E+06
T-STATISTIC= 7.10168 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1930.62
STANDARD DEVIATION = 597.24

DEPENDENT VARIABLE (Y) DATA:
MEAN = 1798.6
STANDARD DEVIATION = 739.505

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
1347.9	967	1097.62	-.1191	1.13508	133.918
1526.2	1204	1312.11	-.0824	1.08979	113.503
1748.5	1782	1579.52	.1281	.886375	95.6087
2193.6	2295	2114.95	.0851	.921546	100.866
2836.9	2745	2888.8	-.0498	1.05233	178.213

P R O J E C T I O N S

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL		
3437.8	3611.64	2935.4	--	4287.88

HENRICO PROPERTY DAMAGE CRASHES AS A FUNCTION OF MILLION VEHICLE MILES OF TRAVEL FOR THREE YEAR PERIODS

LINEAR REGRESSION ANALYSIS

THE REGRESSION EQUATION IS:

Y = -351.291 + 3.09915 X

STATISTICS OF THE SAMPLE

COEFFICIENT OF CORRELATION = .971863

THERE IS A -

0.05 PROBABILITY THAN AN R OF .88 WILL OCCUR RANDOMLY

0.01 PROBABILITY THAT AN R OF .96 WILL OCCUR RANDOMLY

COEFFICIENT OF DETERMINATION = .944517
STANDARD ERROR OF ESTIMATE OF THE POPULATION = 518.023

UNASSOC SUM OF SQUARES= 804957.
TOTAL SUM OF SQUARES= 1.45090E+07
T-STATISTIC= 7.14636 DEG. OF FREEDOM= 3

DO YOU WANT A FULL PRINTOUT OR PROJECTIONS ONLY
1=FULL PRINT, 0=PROJECTIONS, 2=STOP PROGRAM
?1
INDEPENDENT VARIABLE (X) DATA:
MEAN = 1930.62
STANDARD DEVIATION = 597.24

DEPENDENT VARIABLE (Y) DATA:
MEAN = 5632
STANDARD DEVIATION = 1904.53

S.E.P. = STANDARD ERROR OF ANY POINT ON REGRESSION LINE

X-ACTUAL	Y-ACTUAL	Y-FOR	(A-F)/F	FOR/ACT	S.E.P.
1347.9	3255	3826.06	-.1493	1.17544	342.833
1526.2	4480	4378.64	.0231	.977375	290.57
1748.5	5725	5067.58	.1297	.885167	244.761
2193.6	6450	6447.01	.0004	.999537	258.219
2836.9	8250	8440.7	-.0226	1.02312	456.231

PROJECTIONS

95 PCT. CONFIDENCE INTERVAL = PROJECTION + OR - 2 STANDARD ERRORS

INDEPENDENT VARIABLE	PROJECTION	95 PCT. CONFIDENCE INTERVAL	
3437.8	10303.	8571.79 --	12034.2