

Evaluation Report
Target Hardening
Grant Award Contract #1479
July 1, 1974, through February 29, 1976

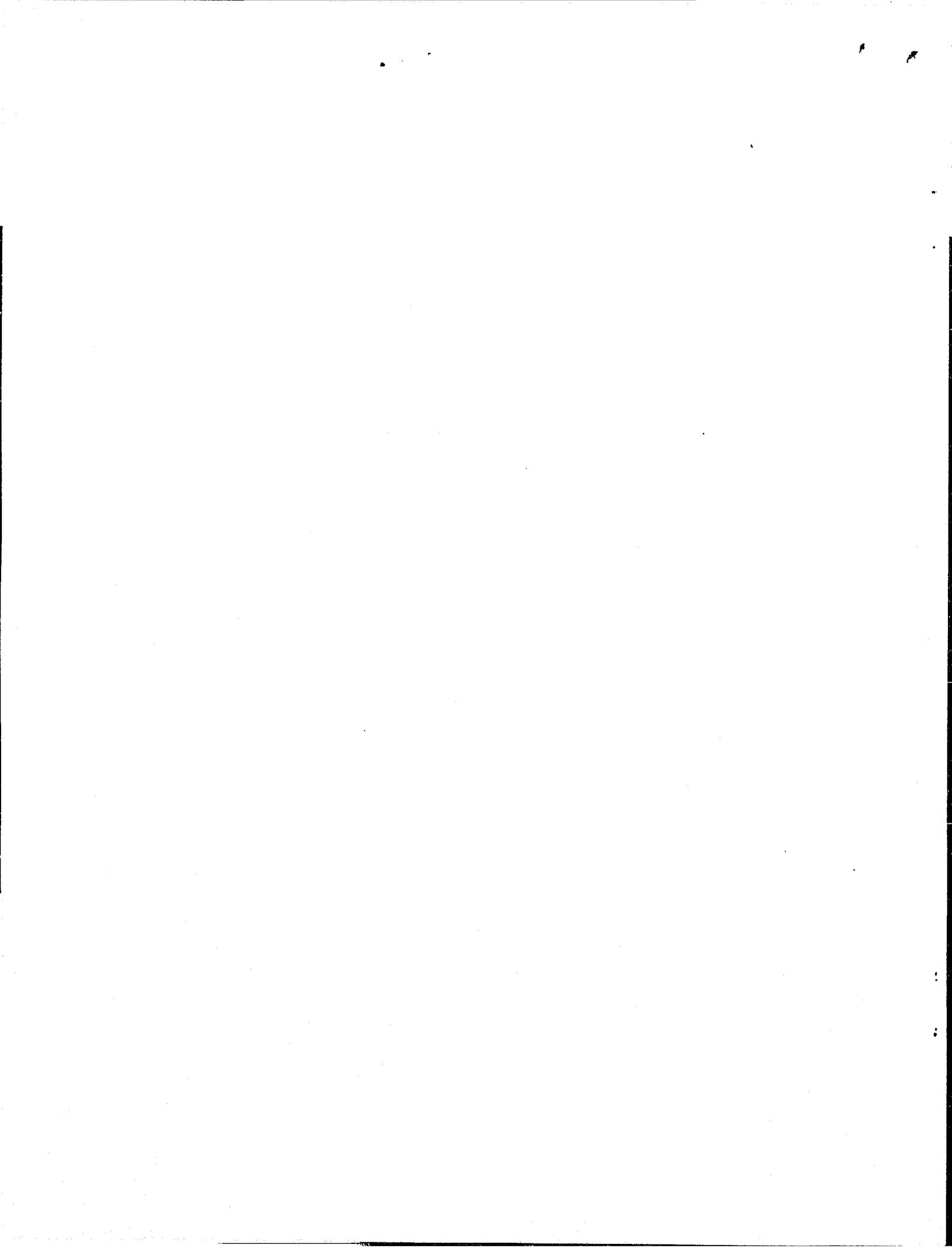
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Target Hardening Evaluation
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The Target Hardening Project attempted to reduce burglary rates in four Seattle Housing Authority housing projects by making housing units more difficult for burglars to penetrate.

Specific hardening measures employed were:

1. installation of exterior solid-core doors or reinforcement of existing doors;
2. installation of one-inch dead-bolt locks on all exterior doors;
3. pinning of sliding glass windows to limit opening to less than nine inches;
4. construction of stub walls to prevent exterior access to interior door latches.

The goal of this project was to reduce, through target hardening, the incidence of burglaries committed in Seattle Housing Authority housing projects. This was to be achieved through deterrence by making forced entry physically more difficult and time-consuming, and, in cases of attempted or committed burglary, by leading to increased time for suspect observation.

Four specific objectives of the project were:

1. to effect significant reduction in the number of burglaries involving forced entry within the following Seattle Housing Authority housing projects: High Point, Holly Park, Rainier Vista, and Yesler Terrace;
2. to increase significantly the arrest-per-burglary rate within Seattle Housing Authority housing projects;
3. to increase significantly the proportion of witnessed burglaries involving forced entry into "hardened" housing units; (Rationale: The installation of solid core doors, one-inch dead-bolt locks, and the construction of walls or replacement with nonshattering material for all existing glass windows within a 32-inch radius of door latches will lead to increased noise and longer time periods required to make forced entry. This will result in increased exposure for offenders and a higher likelihood of being observed);
4. to increase significantly the proportion of witness-and/or victim-identified suspects of forced-entry burglaries into "hardened" housing units. (Rationale: Increased offender exposure time would enable witnesses to observe more and subsequently describe suspects in more detail.)

The total Law Enforcement Assistance Administration cost for this project, including matching funds from the city and state, was \$42,222. Of this amount, \$35,111 was spent on materials and labor for the hardening measures described above. These LEAA funds were supplemented by Housing and Urban Development Modernization funds, amounting to \$405,868.14.

In all, 3,082 living units were hardened. This total includes all permanent residential units in the High Point, Holly Park, Yesler Terrace, and Rainier Vista housing projects. The locations of these projects are shown on Map 1.

Hardening began in July, 1974, and was completed in May, 1975. For individual housing projects, hardening construction occurred as follows: High Point, December, 1974, through May, 1975; Holly Park, July, 1974, through May, 1975; Yesler Terrace, July, 1974, through November, 1974; Rainier Vista, July, 1974, through September, 1974.

For evaluation purposes, data on actual or attempted residential burglaries (hereafter referred to as "burglaries") were collected from three sources: reports to the Seattle Police Department (SPD data), reports to Seattle Housing Authority project managers (SHA data), and responses to crime victimization surveys conducted on random samples* of residents in late 1974 and again in late 1975 (victimization data). Also, data on robberies, thefts, and incidents of vandalism or arson were collected from SHA reports and victimization surveys.

To discover whether displacement of burglary to nearby areas would occur after hardening, SPD data on burglary and victimization data on burglary, robbery, theft, vandalism, and arson were collected for census tracts containing these four housing projects.** These data were subdivided according to type of housing within these census tracts: SHA project housing vs. non-SHA housing. Throughout this report, therefore, "non-SHA" housing refers to housing within the same census tracts as SHA housing but outside of the housing projects themselves. Crime rates in non-SHA housing in these census tracts and for Seattle as a whole provided comparison data for crime rates within the SHA projects being hardened.

Why use three different sources of data to find out burglary rates? Each data source has strengths and weaknesses. Seattle Police Department records show only those burglaries reported to police, not all which occur. SHA records exist only for SHA housing, and also require victims to take the initiative in reporting crimes. Residents vary in their tendencies to report to the SPD, to the SHA, to both, or to neither. Victimization data require the least effort on the part of the crime victim; he has only to answer the interviewer's questions. For this reason, victimization surveys usually show higher rates of crime than do statistics based on other crime reports. For example, a 1975 victimization survey of 13 American cities done by the Law Enforcement Assistance Administration found that only 52% of the burglaries had been reported to the police.***

* In 1974, residents of 228 SHA households and of 194 non-SHA households were interviewed. In 1975, residents of 303 SHA households and of 224 non-SHA households were interviewed.

** From Map 1 one can see that High Point Project lies in tract #107; Holly Park Project in tract #110; Yesler Terrace Project in tracts #85, 86, and 91; Rainier Vista Project in tracts #100 and 101.

*** Criminal Victimization Surveys in 13 American Cities, U.S. Department of Justice, LEAA, U.S. Government Printing Office, Washington, D.C., 1975.

A number of problems occurred with the victimization surveys for this evaluation, however. First, because target hardening took longer to complete than originally expected, the survey in 1975 provided data on only three months of post-hardening events. Such a short period of time can be unduly influenced by seasonal or chance events. Second, the victimization data were inconsistent with data from SPD and SHA sources, with victimization showing lower rates of burglary than had been reported to SPD and SHA in more than half of the comparisons of the rates. Third, the victimization survey asked respondents about crimes by which they had been victimized during the past year. Since SHA project residents are a mobile group, some respondents were reporting crimes which had occurred before they had moved to the project, while other potential respondents (who may have experienced crimes while in the project) had moved out before the survey. Fourth, the interviewers were residents of the SHA projects who did not have previous interviewing experience and showed some misunderstandings involving the purpose and content of the survey. Although a sample of interviews was verified, disclosing some falsified data, it was not financially possible to verify all interviews. A completely verified survey done by well-trained interviewers would probably have yielded more consistent results. Finally, the availability of data from two other sources made the victimization data supplementary but not essential for evaluation purposes.

Because of all the problems detailed above, the victimization data will not be presented in the main body of this report. For those interested, Appendix A provides a discussion of the data inconsistencies and summary statistics from these surveys.

Therefore, data from two sources, SPD and SHA, were used in evaluating the project's success in reaching the overall goal of burglary reduction and the first two of the four objectives outlined on page 1. Unfortunately, data regarding the last two objectives were not available from the SPD computer, so data could not be obtained without great effort and expense. Data from SPD and SHA sources were used to answer the following questions:

1. Did target hardening significantly reduce burglary rates in the four SHA housing projects? (This is related to Objective #1.)
2. Were there significant changes in burglary rates for non-SHA housing in these same census tracts for these time periods? (This question was asked to determine whether significant displacement of burglary from SHA housing to nearby non-SHA housing occurred as a result of target hardening within the SHA projects.)
3. How did burglary rate trends for SHA housing compare with trends for Seattle as a whole, and with trends for non-SHA housing?
4. How did the mode of entry used by burglars in entering SHA housing change after hardening was completed? (This question is relevant to Objective #3, but cannot be definitive for that objective.)
5. Did the proportion of burglaries cleared by police arrest change for SHA housing after hardening? How did the changes in SHA clearance rates compare with changes for Seattle as a whole and for non-SHA housing?

6. Did robbery and vandalism show any changes in rate during these time periods in SHA housing? (Was there displacement to other crimes within the housing projects?)
7. What was the overall result of target hardening?

To answer these questions, statistical tests were applied to differences in rates of occurrence before and after hardening. A difference or change was considered to be statistically significant if it showed a probability level below .05. This standard of significance is conventional for social science research; it implies that observed differences or changes could be due to chance occurrences less than five percent of the time.

Two time periods were used in comparing crime rates: pre-hardening vs. post-hardening time periods. The "pre-hardening" time period includes months prior to complete hardening of any single living unit; the "post-hardening" time period includes months following 67% completion of hardening (67% of the living units completely hardened.*) The number of months on which pre- and post-hardening averages are based differs by the source of the data. The number of months in each time period for which data were available is listed in Table 1.

DATA BASE FOR BURGLARY RATES BY DATA SOURCE AND TIME PERIOD

TABLE 1

	PRE-HARDENING	POST-HARDENING
	Months for which pre-hardening data were available	Months for which post-hardening data were available
SPD Data	January 1973 - June 1974 (18 months)	April 1975 - September 1976 (18 months)
SHA Data	July 1973 - June 1974 (12 months)	April 1975 - June 1976 (15 months)

* This definition of "post-hardening" was used because hardening of 67% of units was thought to have considerable impact on burglary; also, the use of 67% rather than 100% as a cut-off point provided a longer post-hardening period for data comparison.

Question 1: Did target hardening significantly reduce burglary rates in the four SHA housing projects?

Table 2 shows the rates of burglary per 100 households per year for SHA housing according to both SPD and SHA data. Reductions in burglary rates range from a decrease of 44.4% (SPD data) to 59.2% (SHA data).

The last column in Table 2 gives the mean or average difference in monthly burglaries across the compared time periods. This number was determined by pairing the same months in the two time periods (for example, April, 1974, with April, 1975) and subtracting the number of burglaries in the later month from the number of burglaries in the earlier month. (See Appendix B for an example of this process.) These differences were averaged to determine \bar{D} , the mean difference in monthly burglaries. If \bar{D} is positive, that implies burglary rates have decreased; if \bar{D} is negative, that implies burglary rates have increased during the time periods compared.

To see whether this mean change was significantly different from no change or not, an estimate of confidence limits for that specific \bar{D} was made. The starred \bar{D} numbers are different from zero with a less than 5 percent chance of error. For positive starred \bar{D} numbers, this means that a significant decrease in burglary rates occurred.

According to SPD and SHA data, burglary rates in hardened SHA housing projects were significantly reduced from pre-hardening to post-hardening time periods.

In sum, burglary rates for the hardened SHA housing projects were significantly reduced after hardening was completed.

Table 3 provides a breakdown of these burglary rates by individual housing project, using both SPD and SHA data sources. The third column of this table shows decreases in burglary rates for all projects and data sources except for Yesler Terrace. Excluding Yesler Terrace, reductions in burglary rates range from 37.6 percent to 76.9 percent.

The fourth column shows the mean monthly differences scores and the results of confidence interval tests used to demonstrate the significance of these differences in relation to zero difference. These numbers were computed in the same way as the numbers in Table 2. Three of the eight mean difference scores are significantly greater than zero, indicating a significant decrease in burglary rate with a 5 percent level of chance error. Four more mean differences show decreases approaching significance, with a less than 10 percent level of chance error.

Why do SHA mean differences in High Point and Rainier Vista show significant reductions in burglary rates while SPD mean differences do not? Comparing SPD and SHA reported burglary rates, one sees that SHA rates are higher for seven of the eight projects and time periods. Only for the post-hardening time period at High Point does the SPD rate exceed the SHA rate. Thus it appears that a lower percentage of the burglaries are reported to the SPD than to the SHA. When reporting rates to the SPD are so low, it is difficult to measure change in burglary rates because the changes must affect those few people who will report

TABLE 2

AVERAGE RATES FOR BURGLARY - ALL SHA HOUSING

(Rates per 100 households per year)

	PRE	POST	(PRE TO POST) % CHANGE	MEAN DIFFERENCE
SPD Data	$\bar{X} = 5.88$ $S = 4.42$ $N = 18$	$\bar{X} = 3.27$ $S = 1.27$ $N = 18$	- 44.4%	$\bar{D} = 3.17^*$ $S_D = 4.86$ $\bar{D} > 0$ $P < .05$ $N = 15$
SHA Data	$\bar{X} = 11.13$ $S = 4.07$ $N = 12$	$\bar{X} = 4.54$ $S = 1.48$ $N = 15$	- 59.2%	$\bar{D} = 6.46^*$ $S_D = 4.09$ $\bar{D} > 0$ $P < .05$ $N = 12$

\bar{X} = average rate per 100 households per year

N = number of months for which data were collected

S = standard deviation of the monthly averages

* significant at the .05 level

TABLE 3

AVERAGE RATES FOR BURGLARY BY HOUSING PROJECT - SHA HOUSING

(Rates per 100 households per year)

		PRE	POST	(PRE TO POST) % Change	MEAN DIFFERENCE
High Point	SPD Data	$\bar{X} = 7.15$ $S = 7.69$ $N = 24$	$\bar{X} = 3.56$ $S = 2.09$ $N = 16$	- 50.2%	$\bar{D} = 5.06$ $S_D = 9.37$ $\bar{D} > 0$ $P < .10$
	SHA Data	$\bar{X} = 10.42$ $S = 6.80$ $N = 17$	$\bar{X} = 2.41$ $S = 1.10$ $N = 15$	- 76.9%	$\bar{D} = 9.66^*$ $S_D = 8.05$ $\bar{D} > 0$ $P < .05$
Holly Park	SPD Data	$\bar{X} = 6.71$ $S = 3.96$ $N = 18$	$\bar{X} = 4.19$ $S = 2.24$ $N = 16$	- 37.6%	$\bar{D} = 3.05$ $S_D = 4.46$ $\bar{D} > 0$ $P < .10$
	SHA Data	$\bar{X} = 11.85$ $S = 7.91$ $N = 12$	$\bar{X} = 4.83$ $S = 2.86$ $N = 15$	- 59.2%	$\bar{D} = 7.15^*$ $S_D = 8.08$ $\bar{D} > 0$ $P < .05$
Yesler Terrace	SPD Data	$\bar{X} = 1.56$ $S = 2.12$ $N = 18$	$\bar{X} = 1.90$ $S = 2.04$ $N = 21$	+ 21.8%	$\bar{D} = -0.11$ $S_D = 3.10$ $\bar{D} < 0$ n.s.
	SHA Data	$\bar{X} = 5.33$ $S = 3.33$ $N = 12$	$\bar{X} = 5.36$ $S = 5.28$ $N = 19$	+ 0.6%	$\bar{D} = 2.50$ $S_D = 3.91$ $\bar{D} > 0$ $P < .10$
Rainier Vista	SPD Data	$\bar{X} = 4.90$ $S = 3.75$ $N = 18$	$\bar{X} = 2.64$ $S = 2.60$ $N = 24$	- 46.1%	$\bar{D} = 2.04$ $S_D = 4.04$ $\bar{D} > 0$ $P < .10$
	SHA Data	$\bar{X} = 14.69$ $S = 8.47$ $N = 12$	$\bar{X} = 5.24$ $S = 3.48$ $N = 21$	- 64.3%	$\bar{D} = 10.21^*$ $S_D = 9.50$ $\bar{D} > 0$ $P < .05$
TOTALS	SPD Data	$\bar{X} = 5.88$ $S = 4.42$ $N = 18$	$\bar{X} = 3.27$ $S = 1.27$ $N = 18$	- 44.4%	$\bar{D} = 3.17^*$ $S_D = 4.86$ $\bar{D} > 0$ $P < .05$
	SHA Data	$\bar{X} = 11.13$ $S = 4.07$ $N = 12$	$\bar{X} = 4.54$ $S = 1.48$ $N = 15$	- 59.2%	$\bar{D} = 6.46^*$ $S_D = 4.09$ $\bar{D} > 0$ $P < .05$

* significant at the .05 level

to SPD. Also, when reporting rates are lower, there is more chance for changes in reporting rates to affect data, and these reporting rate changes would not necessarily reflect true changes in actual burglary rates.

To sum it up, High Point, Holly Park, and Rainier Vista showed significant reductions in burglary rates after hardening was completed, as measured by one or both of SHA and SPD reports. Yesler Terrace showed no significant change on the basis of either data source.

Question 2: Were there significant changes in burglary rates for non-SHA housing in these same census tracts for these time periods?

Table 4 gives SPD burglary rates for all non-SHA housing in these census tracts for the same time periods used in the SHA housing statistics (see Table 1.) There are no SHA rates given because SHA does not compile statistics for non-SHA housing.

There is a small but significant decrease (8.9%) in the burglary rates for non-SHA housing from pre- to post-hardening. Thus burglary is not being displaced from the hardened SHA housing to nearby areas to any measurable degree. This conclusion is strengthened by comparing this 8.9% decrease in burglary rates for non-SHA housing with the city-wide trend in burglary rates for these time periods. City-wide, burglary rates were reduced by 5.8% during this time, so non-SHA areas had a somewhat greater reduction in burglary rates than did the city as a whole, providing more evidence that burglaries were not simply displaced to nearby areas by hardening.

TABLE 4

AVERAGE RATES FOR BURGLARY - ALL NON-SHA HOUSING

(Rates per 100 households per year)

	PRE	POST	(PRE TO POST) % Change	MEAN DIFFERENCE
SPD Data	$\bar{X} = 9.18$ $S = 1.22$ $N = 18$	$\bar{X} = 8.36$ $S = 1.10$ $N = 18$	- 8.9%	$\bar{D} = 1.08^*$ $S_D = 1.34$ $\bar{D} > 0$ $p < .05$ $N = 15$

Table 5 shows the burglary rates in non-SHA housing, subdivided by project area. Housing near High Point and Holly Park shows a reduction in burglary rates; housing near Yesler Terrace and Rainier Vista shows an increase. The changes in non-SHA housing burglary rates for the areas surrounding Holly Park (a decrease) and Rainier Vista (an increase) are significantly different from no change, using a .05 level of confidence.

TABLE 5

AVERAGE RATES FOR BURGLARY IN NON-SHA HOUSING, SEPARATELY BY PROJECT AREA
(Rates per 100 households per year)

		PRE	POST	(PRE TO POST) % Change	MEAN DIFFERENCE
High Point Census Tract non-SHA housing	SPD Data	$\bar{X} = 19.24$ $S = 11.35$ $N = 24$	$\bar{X} = 12.59$ $S = 7.55$ $N = 16$	- 34.6%	$\bar{D} = 7.12$ $S_D = 14.04$ $\bar{D} > 0$ $p < .10$
Holly Park Census Tract non-SHA housing	SPD Data	$\bar{X} = 30.58$ $S = 5.95$ $N = 18$	$\bar{X} = 19.60$ $S = 5.44$ $N = 16$	- 35.9%	$\bar{D} = 12.59^*$ $S_D = 10.36$ $\bar{D} > 0$ $p < .05$
Yesler Terrace Census Tracts non-SHA housing	SPD Data	$\bar{X} = 5.50$ $S = 1.11$ $N = 18$	$\bar{X} = 5.78$ $S = 1.62$ $N = 21$	+ 5.1%	$\bar{D} = -0.32$ $S_D = 2.21$ $\bar{D} < 0$ n.s.
Rainier Vista Census Tracts non-SHA housing	SPD Data	$\bar{X} = 6.70$ $S = 1.43$ $N = 18$	$\bar{X} = 8.63$ $S = 1.86$ $N = 24$	+ 28.8%	$\bar{D} = -1.75^*$ $S_D = 2.52$ $\bar{D} < 0$ $p < .05$
TOTALS non-SHA housing	SPD Data	$\bar{X} = 9.18$ $S = 1.22$ $N = 18$	$\bar{X} = 8.36$ $S = 1.10$ $N = 18$	- 8.9%	$\bar{D} = 1.08^*$ $S_D = 1.34$ $\bar{D} > 0$ $p < .05$

* significant at the .05 level

In summary, non-SHA housing shows a somewhat mixed picture of burglary rate changes, with the overall trend showing a small reduction in rates. While SPD burglary rates show a significant decrease in burglaries in the post hardening period for total non-SHA housing and the area around Holly Park shows a significant decrease in burglary rates, the Rainier Vista area shows a significant increase in burglaries, while the High Point and Yesler Terrace areas show no significant change.

Question 3: How did burglary rate trends for SHA housing compare with trends for Seattle as a whole and with trends for non-SHA housing?

Table 6 shows the averages, percentage changes, and mean differences for pre- and post-hardening burglary rates in SHA housing, non-SHA housing, and for Seattle as a whole.

Hardened SHA housing shows large and significant reductions in burglary rates after hardening, ranging from a 44.4% reduction (SPD data) to a 59.2% reduction (SHA data). Non-SHA housing shows a smaller but still significant reduction of 8.9%, while the city-wide reduction of 5.8% did not represent a significant change.

In conclusion, burglary rates for SHA housing showed more favorable trends than did rates for non-SHA housing or for Seattle as a whole during these time periods.

TABLE 6

COMPARISON OF BURGLARY RATES FOR SHA HOUSING, NON-SHA HOUSING,
AND ALL OF SEATTLE

	AVERAGE RATES PER 100 HOUSEHOLDS PER YEAR		(PRE TO POST) % CHANGE		MEAN DIFFERENCE	
	SHA	non-SHA	SHA	non-SHA	SHA	non-SHA
SPD Data	Pre: 5.88 Post: 3.27	Pre: 9.18 Post: 8.36	-44.4%	- 8.9%	$\bar{D} = 3.17^*$ $S_D = 4.86$ $\bar{D} > 0$ $p < .05$ $N = 15$	$\bar{D} = 1.08^*$ $S_D = 1.34$ $\bar{D} > 0$ $p < .05$ $N = 15$
SHA Data	Pre: 11.13 Post: 4.54		-59.2%		$\bar{D} = 6.46^*$ $S_D = 4.09$ $\bar{D} > 0$ $p < .05$ $N = 12$	

	Average Rates	% Change	Mean Difference
All Seattle (SPD Data)	Pre: 4.84 Post: 4.56	- 5.8%	$\bar{D} = 0.28$ $S_D = 0.61$ $\bar{D} > 0$ n.s. $N = 12$

* significant at the .05 level

Table 7 shows the significance of these differences between burglary rate trends in SHA housing as compared with trends for Seattle and as compared with trends for non-SHA housing. These differences in trends were compared by performing a paired t-test on monthly differences in rates for SHA housing as compared with Seattle, and for SHA housing as compared with non-SHA housing; (see Appendix C for an example of these calculations.)

Table 7 shows that SHA housing had a significantly greater decrease in burglary rates than did Seattle as a whole. However, the decrease for SHA housing was not significantly greater than the decrease for non-SHA housing, as measured by SPD data. This SHA vs. non-SHA comparison approached significance, however, reaching a significance level of .10.

To sum it up, SHA housing showed a significantly greater reduction in burglary as compared with total Seattle rates, while the comparison between SHA and non-SHA housing approached significance.

TABLE 7

SHA vs. Seattle Burglary Rate Changes;
SHA vs. non-SHA Burglary Rate Changes;
Statistical Comparisons of Hardening Effects

	SHA Mean Difference	SEATTLE Mean Difference	Which housing had more favorable % change?	Was this SHA vs. Seattle difference significant?
SHA Housing vs. SEATTLE	$\bar{D} = 3.17^*$ $S_D = 4.86$ $\bar{D} > 0$ $p < .05$ $N = 15$	$\bar{D} = 0.28$ $S_D = 0.61$ $\bar{D} > 0$ n.s. $N = 12$	SHA	YES $\bar{D} = 3.48^*$ $S_D = 5.04$ $p < .05$ $N = 12$

	SHA Mean Difference	NON-SHA Mean Difference	Which housing had more favorable % change?	Was this SHA vs. NON-SHA difference significant?
SHA Housing vs. Non-SHA Housing	$\bar{D} = 3.17^*$ $S_D = 4.86$ $\bar{D} > 0$ $p < .05$ $N = 15$	$\bar{D} = 1.08^*$ $S_D = 1.34$ $\bar{D} > 0$ $p < .05$ $N = 15$	SHA	NO $\bar{D} = 2.09$ $S_D = 4.52$ $p < .10$ $N = 15$

* significant at the .05 level

Burglary rate changes for SHA and non-SHA housing, subdivided by project area, are given in Table 8. For comparison, figures for Seattle as a whole are provided at the bottom of Table 8. In the High Point, Holly Park, and Rainier Vista areas, SHA housing showed greater percentage decreases in burglary rates than did non-SHA housing. For the Yesler Terrace area, SHA housing showed a greater increase in burglary rate than did non-SHA housing. The reported burglary rates for the Yesler Terrace project are only one-third the lowest reported rates for any other area, however, leading one to suspect that under-reporting of burglary in this project may make these rates undependable.

Thus three of the four housing projects showed greater percentage decreases in burglary rates than did the corresponding surrounding non-SHA housing in each of these three areas.

In Table 8, the mean differences for non-SHA housing are greater than the corresponding differences for SHA housing, except in the case of Rainier Vista where the mean differences are approximately equal for both types of housing. This is true in spite of the fact that for each of the four areas, SHA housing shows greater percentage change than does non-SHA housing. The absolute value of the mean difference appears to be positively correlated with the value of the pre-hardening burglary rate; that is, initially higher burglary rates are likely to be changed by a larger amount than are initially lower burglary rates. A correlation between pre-hardening burglary rates and mean differences (all mean differences treated as positive) for the 12 measures in Table 8 yields a correlation coefficient of +.80, significant at the .001 level (for 10 degrees of freedom). This means that there is a highly significant correlation between the size of the pre-hardening burglary rate and the size of the mean difference found for that set of data.

Why should higher burglary rates pre-hardening be related to greater changes in burglary rates? Possible explanations include differential reporting rates and floor effects. When a smaller percentage of burglaries is reported, it is harder to document actual change because the change in burglary rates may not affect the small group of people who do the reporting. Floor effects upon change occur when a rate of occurrence is so low that increased effort is needed to lower it further. For example, it is easier to reduce the percentage of people lacking swine flu immunity when 55 percent of people lack immunity than when 5 percent of the people lack immunity. Similarly, if the initial burglary rate is 1.56 per 100 households per year (as reported in Yesler Terrace SPD data), it would be impossible to reduce this rate by 2 burglaries per 100 households per year unless you invent negative burglaries.

Support for both of the above hypotheses can be found in Table 8. SHA project residents appear to under-report burglaries to the SPD, because pre-hardening burglary rates from SHA data are higher than rates from SPD data for each project. Also according to SPD data, SHA burglary rates are markedly lower than such rates in immediately surrounding non-SHA housing for each project, also indicating under-reporting. While under-reporting apparently occurs for each housing project, floor effects seem to be involved as well because the correlation between pre-hardening burglary rates and mean differences remains significant (+.74, $p < .05$, $df=6$) when non-SHA housing is excluded from this correlation.

TABLE 8

COMPARISON OF SHA AND NON-SHA BURGLARY RATES BY PROJECT AREA

	Rates per 100 households per year		(Pre to Post) % Change		Mean Difference	
	SHA	non-SHA	SHA	non-SHA	SHA	non-SHA
<u>HIGH POINT AREA</u>						
SPD Data	Pre: 7.15 Post: 3.56	Pre: 19.24 Post: 12.59	-50.2%	-34.6%	$\bar{D} = 5.06$ $S_D = 9.37$ $\bar{D} > 0$ $p < .10$	$\bar{D} = 7.12$ $S_D = 14.04$ $\bar{D} > 0$ $p < .10$
SHA Data	Pre: 10.42 Post: 2.41		-76.9%		$\bar{D} = 9.66^*$ $S_D = 8.05$ $\bar{D} > 0$ $p < .05$	
<u>HOLLY PARK AREA</u>						
SPD Data	Pre: 6.71 Post: 4.19	Pre: 30.58 Post: 19.60	-37.6%	-35.9%	$\bar{D} = 3.05$ $S_D = 4.46$ $\bar{D} > 0$ $p < .10$	$\bar{D} = 12.59^*$ $S_D = 10.36$ $\bar{D} > 0$ $p < .05$
SHA Data	Pre: 11.85 Post: 4.83		-59.2%		$\bar{D} = 7.15^*$ $S_D = 8.08$ $\bar{D} > 0$ $p < .05$	
<u>YESLER TERRACE AREA</u>						
SPD Data	Pre: 1.56 Post: 1.90	Pre: 5.50 Post: 5.78	+21.8%	+ 5.1%	$\bar{D} = -0.11$ $S_D = 3.10$ $\bar{D} < 0$ n.s.	$\bar{D} = -0.32$ $S_D = 2.21$ $\bar{D} < 0$ n.s.
SHA Data	Pre: 5.33 Post: 5.55		+4.1%		$\bar{D} = 2.50$ $S_D = 3.91$ $\bar{D} > 0$ $p < .10$	

* significant at the .05 level

TABLE 8 (continued)

Comparison of SHA and non-SHA Burglary Rates by Project Area

	Rates per 100 households per year		(Pre to Post) % Change		Mean Difference	
	SHA	non-SHA	SHA	non-SHA	SHA	non-SHA
<u>RAINIER VISTA AREA</u> SPD Data	Pre: 4.90 Post: 2.64	Pre: 6.70 Post: 8.63	-46.1%	+28.8%	$\bar{D} = 2.04$ $S_D = 4.04$ $\bar{D} > 0$ $p < .10$	$\bar{D} = -1.75^*$ $S_D = 2.52$ $\bar{D} < 0$ $p < .05$
SHA Data	Pre: 14.69 Post: 5.24		-64.3%		$\bar{D} = 10.21^*$ $S_D = 9.50$ $\bar{D} > 0$ $p < .05$	

(14)

	Rates per 100 households per year SEATTLE	(Pre to Post) % Change SEATTLE	Mean Difference SEATTLE
All Seattle SPD Data	Pre: 4.84 Post: 4.56	- 5.8%	$\bar{D} = 0.28$ $S_D = 0.61$ $\bar{D} > 0$ n.s. $N = 12$

* significant at the .05 level

Table 9 shows the significance of the differences between SHA and non-SHA housing burglary rate trends. This was measured by a paired t-test of differences, as was done in Table 7 above.

For High Point SHA and non-SHA areas, for example, Table 9 shows a mean decrease in burglary rates of 5.06 for SHA housing and of 7.61 for non-SHA housing. In both cases, these rate decreases are based on 16 pre-hardening months matched with 16 post-hardening months by month name, so N = 16. Although SHA housing showed a greater percentage decrease in burglary rates, there was no significant difference found between SHA and non-SHA rate changes. Thus, decreases in burglary in the High Point project could be a reflection of an area trend towards fewer burglaries, as well as an effect of target hardening.

In the Holly Park area, SHA housing and non-SHA housing both showed significant decreases in burglary rates, with percentage reductions nearly equal but slightly favoring SHA housing. The average decrease in burglary rate for SHA housing was 3.05; for non-SHA housing, it was 12.59*. A test for difference between these trends showed the non-SHA housing to have a significantly greater reduction than the SHA housing. Thus in the Holly Park area, SHA housing showed less of a decrease than did non-SHA housing.

In the Yesler Terrace area, there were no significant changes in the burglary rates for either SHA or non-SHA housing, and also no significant difference between the rate changes for the two types of housing.

For the Rainier Vista area, SHA housing showed a nearly significant decrease in burglary rates, while non-SHA housing showed a significant increase. The difference between these trends was significant, showing that the Rainier Vista project was not following the upward trend for burglary rates in non-SHA housing in the census tracts in which the project is located.

To sum it up, the High Point and Yesler Terrace areas showed no difference in burglary rate trends between SHA and non-SHA housing. The Holly Park and Rainier Vista areas showed significant differences in burglary rate trends for SHA versus non-SHA housing. For Holly Park, non-SHA housing had a greater decrease in burglary rates than did SHA housing; for Rainier Vista, non-SHA housing had a greater increase in burglary than did SHA housing in that area.

* The percentage reduction is greater for SHA housing even though the absolute change in numbers is less for SHA housing. The reason for this seeming contradiction is that the initial burglary rates for non-SHA housing in the Holly Park area is much higher than for SHA housing in this area.

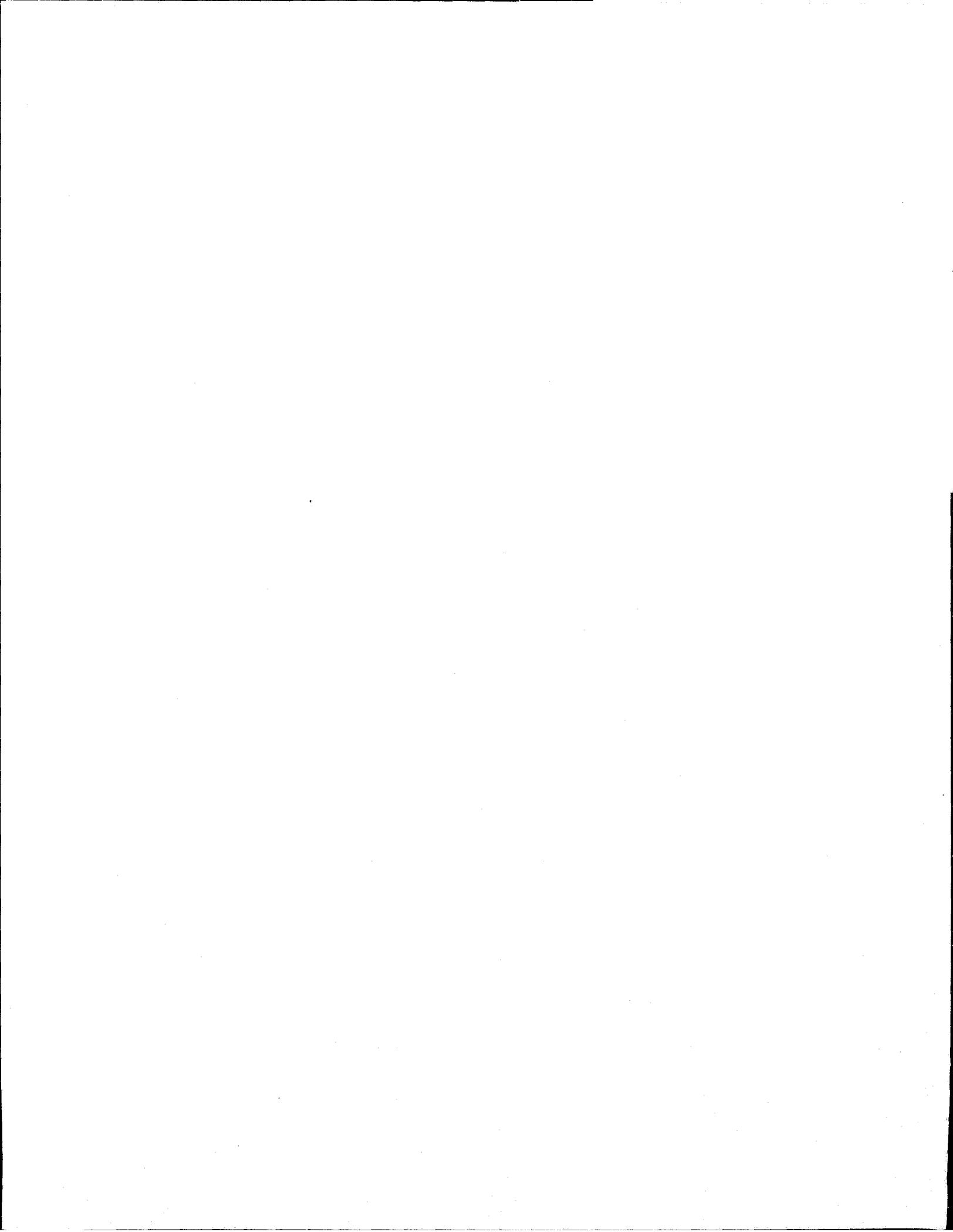


TABLE 9

SHA VS. NON-SHA BURGLARY RATE CHANGES:
Statistical Comparison of Pre- vs. Post-Hardening and SHA vs. non-SHA,
subdivided by project area

	Mean Difference SHA	Mean Difference non-SHA	Which housing had more favorable % change?	Was this SHA vs. non-SHA difference significant?
High Point Area (SPD Data)	$\bar{D} = 5.06$ $S_D = 9.37$ $\bar{D} > 0$ $p < .10$	$\bar{D} = 7.61$ $S_D = 14.86$ $\bar{D} > 0$ $p < .10$	SHA	NO $\bar{D} = -2.55$ $S_D = 10.30$ n.s.
Holly Park Area (SPD Data)	$\bar{D} = 3.05$ $S_D = 4.46$ $\bar{D} > 0$ $p < .10$	$\bar{D} = 12.59^*$ $S_D = 10.36$ $\bar{D} > 0$ $p < .05$	SHA	YES $\bar{D} = -9.54^*$ $S_D = 11.06$ $p < .05$
Yesler Terrace (SPD Data)	$\bar{D} = -0.11$ $S_D = 3.10$ $\bar{D} < 0$ n.s.	$\bar{D} = -0.32$ $S_D = 2.21$ $\bar{D} < 0$ n.s.	non-SHA	NO $\bar{D} = 0.21$ $S_D = 4.02$ n.s.
Rainier Vista (SPD Data)	$\bar{D} = 2.04$ $S_D = 4.04$ $\bar{D} > 0$ $p < .10$	$\bar{D} = -1.75^*$ $S_D = 2.52$ $\bar{D} < 0$ $p < .05$	SHA	YES $\bar{D} = 3.79^*$ $S_D = 4.28$ $p < .05$

* significant at the .05 level

Question 4: How did the mode of entry used by burglars in entering SHA housing change after hardening was completed?

Table 10 presents the mode of entry in SHA housing during the pre- and post-hardening periods for all burglaries for which mode of entry data were available from the SPD.

While data concerning the proportion of witnessed burglaries involving forced entry (relevant to Objective #3) were unavailable, data on changes in mode of entry after hardening were obtained. If these changes in mode of entry imply increased noise, time, and visibility for burglars forcing their way into living units, witnesses are more likely to observe the burglars.

Target hardening may be expected to have two effects upon modes of entry. First, the type of forced entry used may change, and second, burglars may have to rely more upon unlocked doors and windows for entry as forcing becomes more difficult.

The changes in type of forced entry are relevant to Objective #3. The first four categories of Table 10 involve forced entries. The changes in forced entry (total column) show increases for forcing and glass or frame removal, with decreases shown for glass-breaking and lock-opening modes of entry.

Forcing and removal of glass or frame are time-consuming and conspicuous operations which increase the likelihood that a burglar's entry will be witnessed and that he will be perceived as a burglar. In addition, such modes of entry are likely to provide physical evidence of the burglar's identity (fingerprints, tools used, modes of operation). Increases in such modes of entry are in line with Objective #3, which was to increase the proportion of forced-entry burglaries which had been witnessed.

Glass-breaking is a noisy but rapid mode of entry, so the decrease in this category has mixed effects for Objective #3.

Lock-opening showed a small decrease; this is a relatively quiet and inconspicuous mode of entry which can be quick if done with a key. The decrease in this mode of entry is in line with Objective #3.

There are marked increases in window entry after hardening. Window entry is more conspicuous and suspicion-arousing than door entry, particularly when combined with such noisy categories of entry as glass-breaking or time-consuming methods such as removal of glass or frame. The increased proportion of window entries is consonant with Objective #3.

In this discussion, it is important to remember that the total number of burglaries was reduced after hardening, so equal percentages in Table 10 do not reflect equal absolute numbers.

A second indication of the success of target hardening shows in the fifth category of Table 10, entry through unlocked doors or windows. Increases in the percentage of such entries after hardening shows burglars increasingly relied upon finding unlocked doors or windows when forced entry becomes more difficult.

It is interesting to note how the patterns of changes in Table 10 reflect the emphases of the hardening; glass was removed from the vicinity of the door latch, reducing the "broke glass-entered door" category; improved stub walls, improved door locks and metal sleeves in the lock area reduced door forcing and lock opening. Windows received the least emphasis in hardening: those not within 32" of the door latch were simply pinned to limit opening. The increases in window entry reflect this lack of hardening.

TABLE 10

CHANGES IN BURGLARS' MODE OF ENTRY FOR ALL SHA HOUSING (SPD DATA)

Total Burglaries for which mode of entry data were available;

PRE: 250
POST: 132

		WINDOW	DOOR	TOTAL
BROKE GLASS	Pre	28.4%	30.8%	59.2%
	Post	30.3%	2.3%	32.6%
FORCED	Pre	4.0%	12.8%	16.8%
	Post	14.4%	6.8%	21.2%
GLASS OR FRAME REMOVED	Pre	0 %	0 %	0 %
	Post	4.6%	1.6%	6.2%
LOCK OPENED WITH PICK OR KEY	Pre	0 %	4.0%	4.0%
	Post	0 %	2.3%	2.3%
UNLOCKED	Pre	12.4%	7.6%	20.0%
	Post	19.7%	18.2%	37.9%
TOTALS	Pre	44.8%	55.2%	100 %
	Post	69.0%	31.2%	≈100 %

Table 11 shows which of the mode of entry changes were significant, as measured by a chi-square test of association.

The decrease in "broke glass-entered door" mode of entry was significant, as were increases in "forced & entered window" and "entered through unlocked door" modes of entry. The switch from door to window entries was similarly significant.

In sum, the changes in forced entries are primarily to more time-consuming and conspicuous modes of entry which increase a burglar's chances of being seen and of being perceived as a burglar rather than as a legitimate occupant. The increase in percentage of entries through unlocked doors or windows reflects the success of hardening in making forced entry more difficult.

TABLE 11

χ^2 TESTS OF ASSOCIATION BETWEEN CHANGES IN BURGLAR'S MODE
OF ENTRY AND HARDENING - ALL SHA HOUSING

PRE VS. POST

	WINDOW	DOOR	TOTALS
Broke Glass vs. other modes	INCREASE $\chi^2 = 0.15$ df = 1 n.s.	DECREASE $\chi^2 = 42.46^*$ df = 1 p < .001	DECREASE $\chi^2 = 24.49^*$ df = 1 p < .001
Forced vs. other modes	INCREASE $\chi^2 = 13.30^*$ df = 1 p < .001	DECREASE $\chi^2 = 3.23$ df = 1 p < .10	INCREASE $\chi^2 = 1.12$ df = 1 n.s.
Glass or Frame Removed vs. other modes	INCREASE $\chi^2 = 11.54^*$ df = 1 p < .001	INCREASE $\chi^2 = 3.81$ df = 1 p < .10	INCREASE $\chi^2 = 15.48^*$ df = 1 p < .001
Lock opened with pick or key vs. other modes	NO CHANGE $\chi^2 = 0$ df = 1 n.s.	DECREASE $\chi^2 = 0.78$ df = 1 n.s.	DECREASE $\chi^2 = 0.78$ df = 1 n.s.
Unlocked vs. other modes	INCREASE $\chi^2 = 3.62$ df = 1 p < .10	INCREASE $\chi^2 = 9.68^*$ df = 1 p < .005	INCREASE $\chi^2 = 14.29^*$ df = 1 p < .001
DOOR VS. WINDOW	$\chi^2 = 20.22^*$ df = 1 p < .001	(window increased) (door decreased)	

* significant at the .05 level

Question 5: Did the proportion of burglaries cleared by police arrest change for SHA housing after hardening? How did the changes in SHA clearance rates compare with changes for Seattle as a whole and for non-SHA housing?

Target hardening was intended to increase the arrest-per-burglary or clearance* rate for burglaries in SHA housing by increasing the evidence against burglars. When a living unit is more difficult to enter, burglars must spend more time outside of the unit, use unusual modes of entry (windows), use tools, and provide potential observers with more time to observe them and more indications of their purposes.

Table 12 shows the numbers and percentages of burglaries cleared through arrest in SHA housing, in Seattle as a whole, and in non-SHA housing during pre- and post-hardening time periods.

SHA housing shows a slight increase in clearance rate after hardening; Seattle shows a marked increase; non-SHA housing shows a marked decrease. A chi-square test of association shows the SHA change to be non-significant, while the increase for Seattle and the decrease for non-SHA housing were both significant.

Looking at the specific percentages of burglaries cleared in Table 12, one can see that SHA housing remains the highest in percentage cleared, while Seattle has become a close second and non-SHA housing has dropped to well below the city average. While the clearance rate for SHA housing has not been raised significantly, it has been maintained in the face of declining clearance rates for other housing in the same census tracts.

To sum it up, SHA housing showed a slight increase but no significant change in rate of burglary clearance by police after hardening. Seattle showed a significant increase in clearance rate and non-SHA housing showed a significant decrease.

* Here police clearance of a burglary means that a burglary suspect has been arrested for that particular offense.

TABLE 12

NUMBERS OF BURGLARIES CLEARED BY SPD
PRE- VS. POST-HARDENING

	SHA HOUSING		SEATTLE		NON-SHA HOUSING	
	Pre	Post	Pre	Post	Pre	Post
Cleared by SPD	28 10.3%	18 11.9%	584 8.6%	1,405 11.2%	125 10.4%	85 7.8%
Not Cleared	244 89.7%	133 88.1%	6,216 91.4%	11,079 88.8%	1,072 89.6%	1,005 92.2%
TOTAL	272 100%	151 100%	6,800 100%	12,484 100%	1,197 100%	1,090 100%
	χ^2 Pre vs. Post $\chi^2 = 0.26$ df = 1 n.s.		χ^2 Pre vs. Post $\chi^2 = 33.83^*$ df = 1 p < .05		χ^2 Pre vs. Post $\chi^2 = 4.78^*$ df = 1 p < .05	

* significant at the .05 level

Question 6: Did robbery and vandalism show any changes in rate during these time periods in SHA housing? (Was there displacement to these other crimes within the housing projects?)

Reports of robbery and vandalism during the pre- and post-hardening time periods were obtained from SHA housing managers. The reported rates for these crimes are given in Table 13.

Robbery was selected because, like burglary, it is a crime of economic gain. Thus it is reasonable to assume that a criminal unable to enter hardened housing units might turn to robbery to get the valuables he wants. Theft is even closer to burglary because it combines an economic motive with a lack of personal violence. Unfortunately, statistics on theft were not available. Vandalism was considered because attempted forced entry may be reported as vandalism.

Table 13 shows that the reported rates for both robbery and vandalism went down after hardening, showing that no displacement from burglary to these other crimes was apparent. In the case of robbery, a t-test on pre- and post-hardening average rates showed the decrease to be significant, while the decrease in vandalism was not significant.

In summary, there were no indications that hardening had resulted in a displacement to other crimes within the housing projects, as both robbery and vandalism within the projects decreased after hardening.

TABLE 13

AVERAGE RATES OF ROBBERY AND VANDALISM FOR SHA HOUSING
(Rates per 100 households per year)

	PRE	POST	t-SCORE
ROBBERY (SHA Data)	$\bar{X} = 1.78$ S = 1.16 N = 12	$\bar{X} = 0.23$ S = 0.21 N = 5	t = 2.80* p < .05 df = 15
VANDALISM (SHA Data)	$\bar{X} = 12.33$ S = 12.48 N = 12	$\bar{X} = 0.86$ S = 0.51 N = 5	t = 1.96 n.s. df = 15

* significant at the .05 level

Question 7: What was the overall result of target hardening?

Target hardening produced a significant reduction in burglary rates for hardened SHA housing. This reduction ranged from 44.4% (SPD reports) to 59.2% (SHA reports). This reduction in burglary compares favorably with a 5.8% reduction for Seattle as a whole during these time periods.

Hardening of the projects did not displace burglary into surrounding areas. Non-SHA housing in the same census tracts as the hardened SHA projects showed an 8.9% decrease in burglary rates after hardening. This decrease exceeds the 5.8% decrease for Seattle as a whole.

Specifically, High Point, Holly Park, and Rainier Vista projects all showed significant reductions in burglary rates from pre- to post-hardening, according to SPD or SHA data sources. Yesler Terrace, which had an extremely low pre-hardening burglary rate, showed no significant change in rate after hardening, using the same data sources.

Burglar's mode of entry for these census tracts was tabulated for pre- and post-hardening time periods, using SPD reports. Hardening was successful in decreasing the percentage of burglaries by forcible means: after hardening, a significantly higher percentage of burglaries were perpetrated through unlocked doors or windows than before hardening. Significant reductions in entries through doors reflected hardening's emphasis on door security, while the increase in entries by means of removing glass or frame slows down the entry process, making burglars more conspicuous and observable.

Clearance rates for burglaries in hardened SHA housing increased slightly but not significantly.

There were decreases in robbery and vandalism rates for hardened SHA housing, indicating that no displacement from burglary to these crimes took place after hardening.

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APPENDIX A: VICTIMIZATION SURVEY DATA RESULTS AND PROBLEMS

As mentioned in the body of this report, data from the victimization surveys presented a number of problems: some interviews were falsified, interviewers were inexperienced, only a sample of interviews could be verified, and the later survey included only three months of data after hardening was 67% completed. In addition, the data from these surveys were inconsistent with reports from SHA and SPD data sources.

Table A-1 shows the contradictions between the trends shown by victimization survey data and SPD and SHA data. For this comparison, the SPD and SHA rates were based on the same months used in the victimization survey data. The pre-hardening months were July, 1973 through June, 1974; the post-hardening months were March, 1975 through June, 1975. The victimization data show considerable increases in burglary for both SHA and non-SHA housing; SPD and SHA data show considerable decreases in burglary for SHA and non-SHA housing over the same time periods. For the victimization data to be right and the other two data sources to be wrong, one would have to assume that some other irrelevant factor had affected reporting to both SPD and SHA simultaneously.

As mentioned on page 3, victimization surveys usually show higher rates of burglary than do data sources which depend upon victims' reports (such as do SPD and SHA). The pre-hardening victimization data display the opposite relationship with SPD and SHA data, as shown by the rates in Table A-1. For example, the pre-hardening burglary rate for SHA housing as shown by victimization data is 6.58, but the SPD rate is 7.07 and the SHA rate is 11.13. For non-SHA housing, the pre-hardening victimization data rate is 5.13, but the SPD data rate is 9.52. In all of these comparisons of pre-hardening rates, the victimization survey showed lower burglary rates than did the other data sources.

For post-hardening rates, the expected relationship between victimization and other data sources appears: victimization data rates are uniformly higher than are SPD and SHA rates.

Therefore, it seems that considerable under-reporting or unreliable data occurred in the earlier (pre-hardening) victimization survey. The later survey shows the expected relationships with other data sources, but the artificially low rate of the earlier survey creates an "increase" in burglary rates when both surveys are compared.

TABLE A-1

SHA VS. NON-SHA BURGLARY RATE CHANGESVictimization Survey Data:

	PRE	POST	% CHANGE	MEAN DIFFERENCE
SHA Housing (Victimization Data)	$\bar{X} = 6.58$ $S = 5.16$ $N = 12$	$\bar{X} = 7.92$ $S = 10.46$ $N = 3$	+ 20.4%	$\bar{D} = 0.85$ $S_D = 8.79$ $\bar{D} > 0$ n.s. $N = 3$
NON-SHA HOUSING (Victimization Data)	$\bar{X} = 5.13$ $S = 5.13$ $N = 12$	$\bar{X} = 10.71$ $S = 5.36$ $N = 3$	+108.8%	$\bar{D} = -4.53$ $S_D = 10.00$ $\bar{D} < 0$ n.s. $N = 3$

SPD AND SHA DATA FOR SAME TIME PERIODS

	PRE	POST	% CHANGE	MEAN DIFFERENCE
SHA Housing (SPD Data)	$\bar{X} = 7.07$ $S = 4.98$ $N = 12$	$\bar{X} = 3.50$ $S = 0.78$ $N = 3$	- 50.8%	$\bar{D} = 2.00$ $S_D = 5.29$ $\bar{D} > 0$ n.s. $N = 3$
SHA Housing (SHA Data)	$\bar{X} = 11.13$ $S = 4.07$ $N = 12$	$\bar{X} = 4.28$ $S = 1.35$ $N = 3$	- 61.3%	$\bar{D} = 6.33$ $S_D = 4.73$ $\bar{D} > 0$ n.s. $N = 3$
NON-SHA HOUSING (SPD Data)	$\bar{X} = 9.52$ $S = 1.28$ $N = 12$	$\bar{X} = 7.64$ $S = 0.40$ $N = 3$	- 19.8%	$\bar{D} = 11.00$ $S_D = 5.29$ $\bar{D} > 0$ n.s. $N = 3$

Table A-2 shows the victimization data for rates of robbery, theft, and vandalism/arson for SHA and non-SHA housing. For crimes which are as infrequent as robbery, such small samples are not good indications of the frequency of the crime in the total population. For such a sample, one crime may make a tremendous difference in average rates. Unfortunately, there are no comparative data for non-SHA housing, as SPD data were not obtained for these crimes. For SHA housing, SHA reports indicate a decrease in robbery and a decrease in vandalism during these time periods, (see page 23 of this report), while the victimization data indicate no change for these crimes in SHA housing. If one can assume under-reporting for these crimes similar to under-reporting of burglary during the pre-hardening victimization survey, the pre-hardening figures in Table A-2 are underestimates. Therefore, there may have been a decrease masked by the under-reporting problem of the earlier survey. Similarly, the under-reporting during the earlier survey may have caused the apparent increase in theft post-hardening.

TABLE A-2

MEAN RATES OF ROBBERY, THEFT, AND VANDALISM/ARSON
Victimization Survey Data

	PRE	POST	t-SCORE
<u>ROBBERY</u>			
SHA Housing	$\bar{X} = 0.00$ $S = 0.00$ $N = 12$	$\bar{X} = 0.00$ $S = 0.00$ $N = 3$	$t = 0.00$ n.s. $df = 13$
NON-SHA Housing	$\bar{X} = 1.55$ $S = 2.78$ $N = 12$	$\bar{X} = 0.00$ $S = 0.00$ $N = 3$	$t = 0.73$ n.s. $df = 13$
<u>THEFT</u>			
SHA Housing	$\bar{X} = 1.32$ $S = 2.37$ $N = 12$	$\bar{X} = 3.96$ $S = 3.96$ $N = 3$	$t = 1.38$ n.s. $df = 13$
NON-SHA Housing	$\bar{X} = 0.49$ $S = 1.79$ $N = 12$	$\bar{X} = 7.12$ $S = 8.20$ $N = 3$	$t = 2.39^*$ $p < .05$ $df = 13$
<u>VANDALISM/ARSON</u>			
SHA Housing	$\bar{X} = 2.64$ $S = 2.76$ $N = 12$	$\bar{X} = 2.64$ $S = 4.56$ $N = 3$	$t = 0.00$ n.s. $df = 13$
NON-SHA Housing	$\bar{X} = 2.04$ $S = 3.00$ $N = 12$	$\bar{X} = 1.80$ $S = 3.12$ $N = 3$	$t = 0.12$ n.s. $df = 13$

* significant at the .05 level

Table A-3 gives the victimization survey data on burglary reporting rates. Each respondent in the 1974 and 1975 victimization surveys who reported being victimized by one or more crimes was asked whether each crime had been reported to the police. Respondents living in SHA housing were also asked whether each crime had been reported to the manager of the project.

TABLE A-3

BURGLARY REPORTING RATES TO SPD AND SHA
Victimization Survey Data

TIME PERIOD	% BURGLARIES REPORTED		
	To SHA by SHA residents	To SPD by SHA residents	To SPD by non-SHA residents
PRE (12 months)	63.2% 12 of 19	61.1% 11 of 18	81.8% 9 of 11
POST (3 months)	70.0% 14 of 20	76.2% 16 of 21	71.8% 28 of 39

Table A-4 shows the inconsistencies in reporting rates as found from victimization data and from actual reports of burglaries to SPD and SHA. According to victimization data, pre-hardening non-SHA burglary rates are 5.13 (see Table A-4) and 81.8% of these burglaries were reported to SPD (Table A-3). Thus the survey-estimated rate for SPD-reported burglary is 5.13 times .818, or 4.20. However, the actual reports of burglaries to SPD gave an SPD rate of 9.52, signifying that considerably more burglaries are reported to SPD than victimization survey data would imply. This means respondents are claiming to have reported fewer burglaries than were actually reported. This is the opposite of what one would expect. The pre-hardening victimization survey again shows a marked under-reporting of burglary data; the survey-estimated rates are markedly and consistently below the actual SPD and SHA rates for the pre-hardening time period as shown in Table A-4.

For the post-hardening victimization survey, the data show a much more reasonable relationship: respondents claim to have reported more burglaries to SPD and SHA than were actually reported, and the actual SPD and SHA rates do not differ as markedly from the survey estimate of these rates as for the pre-hardening victimization survey data.

To sum it up, the pre-hardening victimization survey shows contradictions and inconsistencies indicating a lack of reliability and validity in the data, possibly due to serious under-reporting of burglary. The post-hardening victimization survey data show more reasonable relationships with data from other sources. Unfortunately one needs reasonable data from both time periods to indicate change due to hardening.

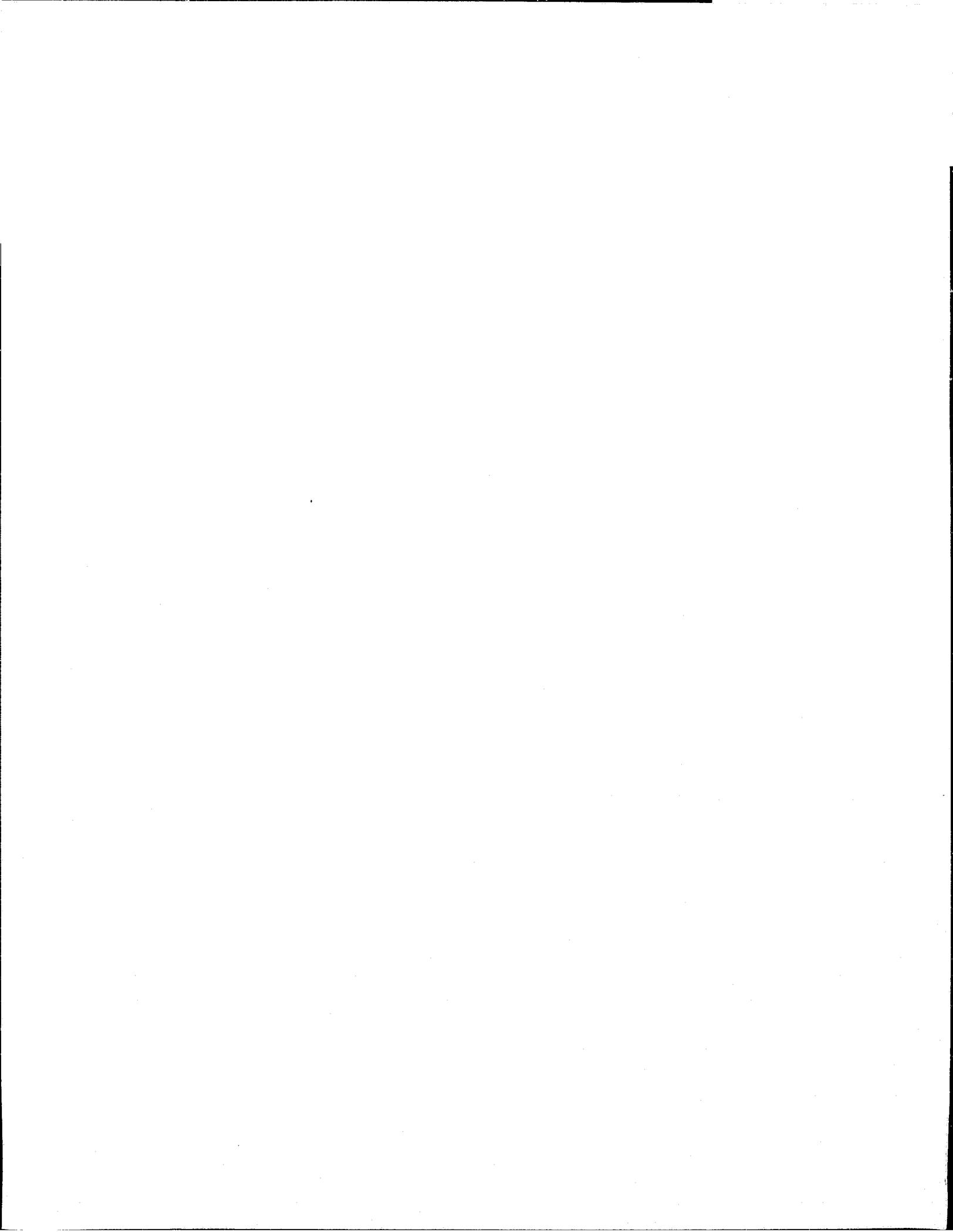


TABLE A-4

VICTIMIZATION DATA: REPORTING RATE INCONSISTENCIES FOR BURGLARY DATA

SPD Data and Victimization Data

TIME PERIOD	SHA HOUSING			NON SHA HOUSING		
	Victimization Data	Actual SPD Data	Survey- Estimated SPD Data	Victimization Data	Actual SPD Data	Survey- Estimated SPD Data
PRE (12 months)	6.58	7.07	4.02	5.13	9.52	4.20
POST (3 months)	7.92	3.50	6.04	10.71	7.64	7.69

(30)

SHA DATA (for SHA Housing Only) and VICTIMIZATION DATA

TIME PERIOD	Victimization Data	Actual SHA Data	Survey- Estimated SHA Data
PRE (12 months)	6.58	11.13	4.16
POST (3 months)	7.92	4.28	5.54

Victimization Survey Time Periods Used for all data sources

APPENDIX B: EXPLANATION OF MEAN DIFFERENCE SCORES AND SIGNIFICANCE TESTS FROM TABLE 2.

SPD burglary data for SHA housing will be used to illustrate the pairing of months and finding of mean difference scores for the statistics in the right-hand column of Table 2.

TABLE B-1

RAW FREQUENCY OF BURGLARY IN SHA HOUSING: SPD DATA

Month	1973	1974	1975	1976
January	5	25	7	6
February	8	19	11	3
March	8	8	12	5
April	13	10	7	6
May	7	11	11	9
June	13	9	9	10
July	8	24	15	11
August	12	8	14	4
September	19	9	6	7
October	12	10	9	
November	36	12	8	
December	49	16	11	

Numbers in the boxes represent burglaries occurring during the hardening process; these were not included in the pairing process. In pairing the months to find mean difference scores, each month of 1976 was paired with the same month of 1974 up to but not including July, 1974, when hardening began. The post-hardening months of 1975 were paired with the same-named months of 1973. The pre- minus post-hardening differences were as follows:

TABLE B-2

COMPUTATION OF RAW AND RATE-ADJUSTED DIFFERENCE SCORES

MONTHS USED	RAW FREQUENCIES	RAW* DIFFERENCES	RATE-ADJUSTED** DIFFERENCES
Jan '74 minus Jan '76:	25-6	19	7.40
Feb '74 minus Feb '76:	19-3	16	6.23
Mar '74 minus Mar '76:	8-5	3	1.17
Apr '74 minus Apr '76:	10-6	4	1.56
May '74 minus May '76:	11-9	2	0.78
Jun '74 minus Jun '76:	9-10	-1	-0.39
Apr '73 minus Apr '75:	13-7	6	2.34
May '73 minus May '75:	7-11	-4	-1.56
Jun '73 minus Jun '75:	13-9	4	1.56
Jul '73 minus Jul '75:	8-15	-7	-2.73
Aug '73 minus Aug '75:	12-14	-2	-0.78
Sep '73 minus Sep '75:	19-6	13	5.06
Oct '73 minus Oct '75:	12-9	3	1.17
Nov '73 minus Nov '75:	36-8	28	10.90
Dec '73 minus Dec '75:	49-11	38	<u>14.80</u>
* For 3,082 households for one month			$\bar{D} = 3.17$
** For 100 households for 12 months			$S_D = 4.86$
			$N = 15$

Thus the first 15 months post-hardening (March, 1975, through June, 1976) have been paired with same-named months two years earlier.* July through September of 1976 could not be paired with same-named months from a pre-hardening period and were excluded from this part of the data analysis. Months immediately following hardening were most relevant to this analysis, for the impact of hardening is greatest at this time.

Table B-2 shows the monthly differences for the 15 pairs of months and how these differences were obtained. Rates were used rather than raw differences because SHA housing differed from non-SHA housing in numbers of households, and rates allow one to compare changes across different sizes of populations. Appendix C shows how the rate-adjusted monthly differences were compared for SHA versus non-SHA burglary rate changes.

The summary statistics of Table B-2 are given at the bottom of the rate-adjusted difference column: \bar{D} (the mean difference), S_D (the standard deviation), and N (the number of pairs of months).

To test for the significance of this mean difference in monthly burglary rates from pre- to post-hardening, an interval estimate for D was made, using the .05 level of confidence. The formula used was as follows:

$$(t_{\alpha/2}, v) (\text{est. } \sigma_M) \leq \bar{D} \leq - (t_{\alpha/2}, v) (\text{est. } \sigma_M)$$

where:

$$\text{est. } \sigma_M = \frac{S}{\sqrt{N-1}} \quad \alpha/2 = .05/2 = .025 \quad v = N - 2$$

When the interval thus determined excluded 0, the pre- to post-hardening change was significantly different from zero; that is, real change was considered to be present with only a 5 percent chance of error.

* Months were paired by name because this would minimize effects of seasonal fluctuations in burglary rate upon the data analysis.

APPENDIX C: STATISTICAL COMPARISON OF SHA AND NON-SHA BURGLARY RATES.

Appendix A describes how mean difference scores were determined. The way data were gathered ensured that data for the same months were available for SHA and non-SHA housing.

TABLE C-1

MONTHLY DIFFERENCE SCORES FOR SHA AND NON-SHA BURGLARY RATES, SPD DATA

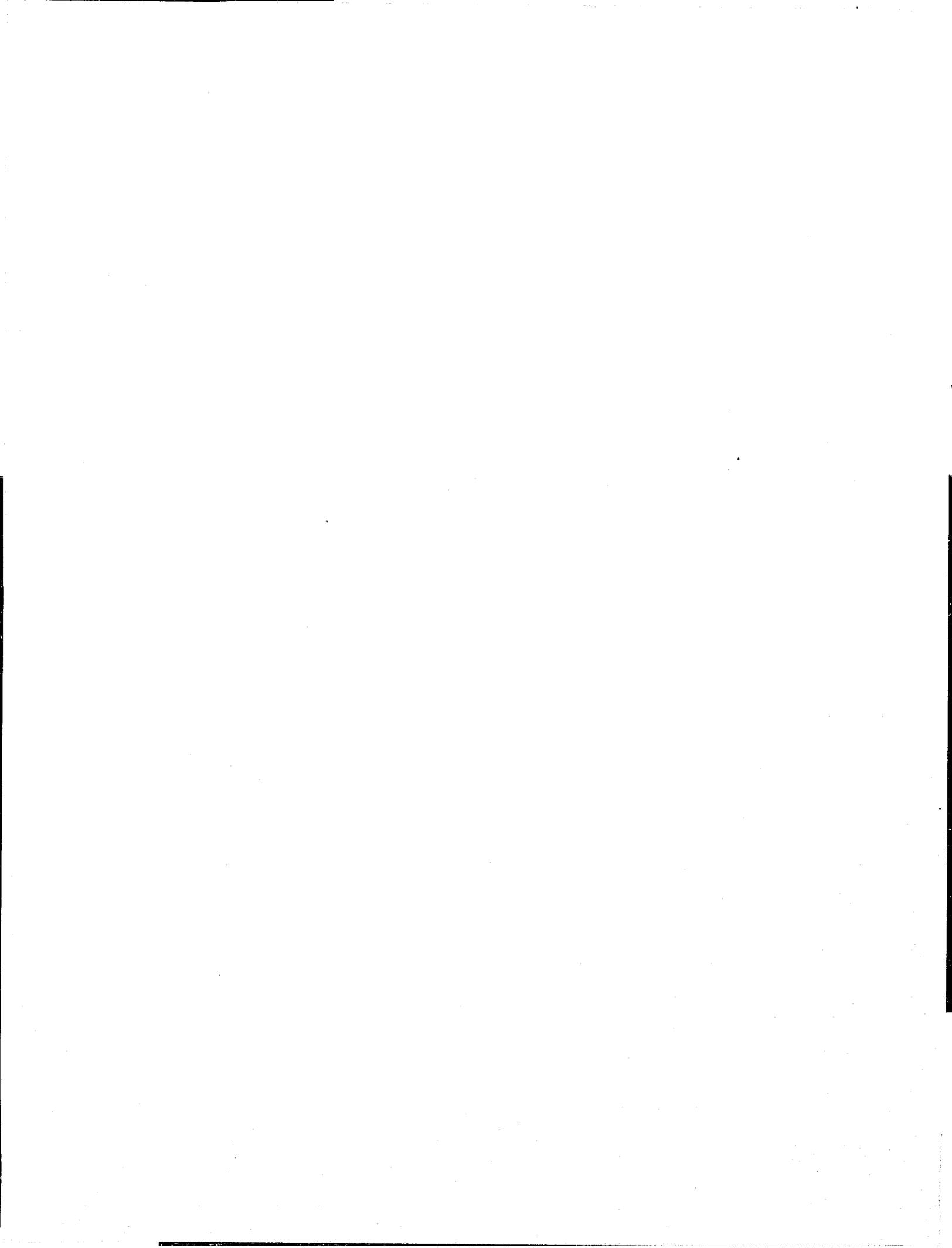
SHA			NON-SHA	
Raw difference	Rate-Adjusted difference	Months Used in Calculation	Raw difference	Rate-Adjusted difference
19	7.40	Jan '74, '76	15	2.07
16	6.23	Feb '74, '76	-6	-0.83
3	1.17	Mar '74, '76	2	0.28
4	1.56	Apr '74, '76	18	2.48
2	0.78	May '74, '76	9	1.24
-1	-0.39	Jun '74, '76	6	0.83
6	2.34	Apr '73, '75	13	1.79
-4	-1.56	May '73, '75	15	2.07
4	1.56	Jun '73, '75	5	0.69
-7	-2.73	Jul '73, '75	-13	-1.79
-2	-0.78	Aug '73, '75	3	0.41
13	5.06	Sep '73, '75	0	0.00
3	1.17	Oct '73, '75	13	1.79
28	10.90	Nov '73, '75	25	3.45
38	14.80	Dec '73, '75	12	1.66
	$\bar{D} = 3.17$			$\bar{D} = 1.08$
	$S_D = 4.86$			$S_D = 1.34$
	$N = 15$			$N = 15$

In comparing SHA and non-SHA monthly differences, therefore, one could take the same pair of months and have a pre- minus post-hardening rate difference for each type of housing. Table B-1 shows these raw difference scores and rate-adjusted difference scores by paired months for SHA and non-SHA housing, SPD burglary data.

In comparing these differences, the rate-adjusted differences were used, because there were 3,082 households in SHA housing and 8,695 households in non-SHA housing.

Because the rate-adjusted differences for SHA and non-SHA housing tended to be correlated (Pearson's correlation coefficient = + .38, a paired t-test* was used in comparing these differences. In a paired t-test, numbers naturally correlated are paired to reduce the error variance. In this case, each pair of rate-adjusted differences on the same line of Table B-1 (representing the same months' difference for both types of housing) were paired for this test. For example, the two differences representing the January 1974 rate minus the January 1976 rate in Table B are 7.40 for SHA and 2.07 for non-SHA housing. These two differences were paired for the t-test. Where the t-score reached a .05 level of significance, the change in burglary rates was considered significantly different for SHA and non-SHA housing.

* Hays, W., Statistics for Psychologists, New York: Holt, Rinehart, and Winston, 1963, pp. 333-335.



END