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A PRELIMINARY EVALUATION  
OF THE  
PORTLAND LIGHTING PROJECT

Oregon Law Enforcement Council  
State of Oregon

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A PRELIMINARY EVALUATION  
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SUMMARY

Somewhat more than \$50,000 in lights were added to streets and alleys in roughly 300 residential city blocks in north and northeast Portland as part of a \$250,000 lighting project funded by the Law Enforcement Assistance Administration and the City of Portland. The goal of the project was to reduce stranger-to-stranger street crimes.

This preliminary evaluation examined possible project effects on nighttime robberies, assaults, and burglaries known to the police. The study took into account:

- (1) usual fluctuations in crime levels;
- (2) crime trends in areas of north and northeast Portland with social and economic characteristics similar to the project area;
- (3) seasonal fluctuations; and
- (4) possible displacement of crimes into nearby areas.

The study did not take into account:

- (1) possible changes in patrol activity;
- (2) possible changes in pedestrian and motor traffic;
- (3) possible changes in lighting in nearby areas.

This preliminary study concludes that this part of the lighting project did not reduce crimes in the areas of improved lighting. Substantiation of this conclusion must await further study.

## PROJECT DESCRIPTION

Three police patrol districts in north and northeast Portland which had shown a high incidence of Impact target crimes were selected for addition of a total of \$180,000 of lights. Original plans were to install all lights within a few weeks along streets and alleys most in need and on school grounds and in parks. However, difficulties and delays in equipment acquisition resulted in phased installation.

One patrol district was the first area to receive lights. This area (hereafter called Target Area One, or T-1) received 172 additional lights between December 12, 1972 and January 12, 1973. All lights were 175 watt, 7,000 lumen units attached at a modal height of 25 feet to existing utility poles along streets in a nearly square area roughly 3,000 by feet by 3,300 feet (95 rectangular city blocks). The second area consisted of the other two police patrol districts. This area (hereafter called Target Area Two, or T-2) received 158 similar lights between May 5 and June 6, 1973 along streets and alleys in a roughly rectangular area 3,400 feet by 6,000 feet (about 220 mostly rectangular blocks). Total cost for these two phases was \$51,829, with an estimated annual operating cost of \$7,260.65. On the average, illumination was increased from a baseline level of one-half foot-candle to a project level of one foot-candle.

## RESEARCH QUESTIONS AND HYPOTHESES

This preliminary evaluation focuses around questions which can be asked of the most readily available data.

- (1) What happens to night robbery, assault, or burglary when lighting along streets and alleys is improved?
- (2) How does this compare to changes in these crimes during the same period in comparable areas where there has been no improvement?
- (3) Are these crimes displaced into adjacent areas where lighting has not been improved?

With reference to the primary goal of the Lighting Project to decrease night crimes in the target areas, these research questions can be reformulated into the following research hypotheses.

- (1) In the target areas, night robbery, assault and burglary will decrease.
- (2) Night occurrences of these crimes in target areas will decrease more rapidly than in comparable areas without improved lighting, or alternatively will increase more slowly.
- (3) Some displacement effects will occur.

## COMPARISON AREAS

The evaluative hypotheses were tested through comparison of night robbery, assault and burglary rates in five primarily residential areas selected on the basis of demographic similarity. Each target area (T-1 and T-2) has an associated displacement area

called Displacement Area One (D-1) and Displacement Area Two (D-2). In addition a larger comparable area called Control Area (C) was selected which roughly surrounds the other four areas. Each of the five areas consists of a set of police grids, the smallest convenient unit of analysis. This accounts for the irregular shape of the areas (see Figure 1). Some grids to the south and west were eliminated from analysis since they are in census tracts with dissimilar characteristics (lower population density, more commercial development) or in an area nearly obliterated by freeway construction. In general, D-1 and D-2 consisted of the nearest "ring" of grids surrounding T-1 and T-2 respectively. As can be seen, the areas which received lighting correspond nearly perfectly with the boundaries of the sets of grids included in T-1 and T-2 for analysis convenience.

Figure 1 -- Five Comparison Areas

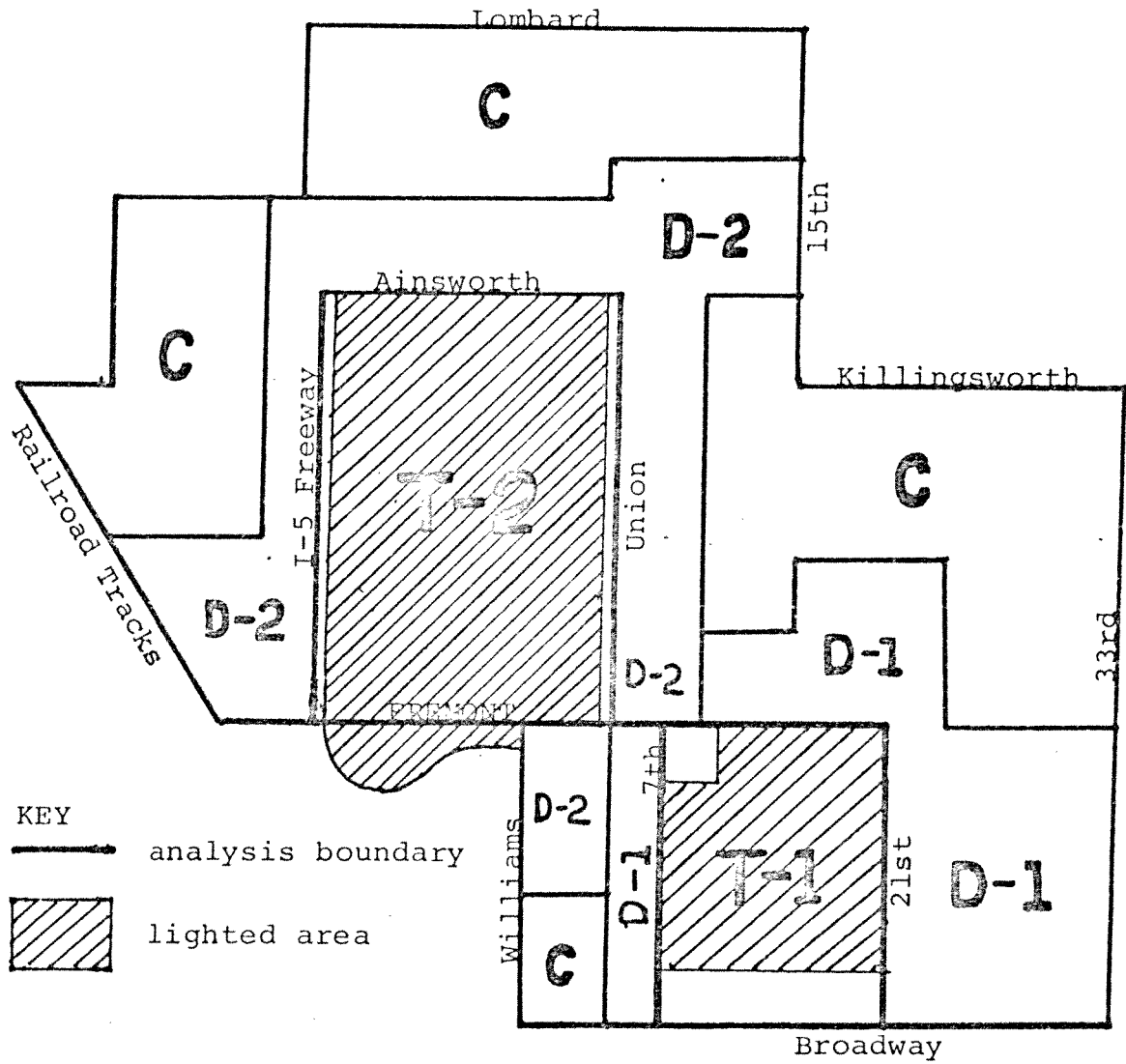


Table 1 summarizes characteristics of the five areas. Displacement and control areas were confined to areas which matched the target areas on population density, median family income and racial mix whenever possible. The value shown for a given demographic characteristic for a given area was estimated by a weighted average of the values on that characteristic for census tracts which contained any portion of that area. Weights were the portion of the area in each respective tract.

Table 1 -- Characteristics of the Five Areas					
Area	Size, Square Miles	Size, Acres	People Per Acre	Median Family Income	Percent Black
T-1	.458	293	16.62	10,031	28.6
D-1	.759	486	15.92	9,867	19.2
T-2	.757	485	13.86	7,301	51.8
D-2	.944	604	12.15	7,824	30.9
C	1.700	1088	13.21	8,649	16.4
City-Wide	19.180	12275	6.40	9,799	5.6

The areas are quite similar, especially with regard to population density and median family income, the characteristics which have accounted for the greatest amount of variance in crime levels across areas in numerous studies. Notice particularly the close similarity of each displacement area to its respective target area. City-wide values

are included to show that differences between the areas are small relative to differences between any of the five areas and the city as a whole.

#### DATA BASE

The source of data utilized in the present study was a set of magnetic tapes of all criminal incidents known to the Portland police in 1971, 1972 and 1973. Data elements contained in the automated records for each incident included, among other items, FBI crime classification, hour and date of occurrence, and police grid location ( a patrol district consists of a set of grids ). First, all robberies, assaults, and burglaries were sorted out. Second incidents in grids selected for the five areas were sorted out and split into five subsets of data. Next, utilizing mean monthly onset times for darkness and daylight with hour and date information, incidents were divided into known daylight, known night, and unknown time classifications. Finally, tables were prepared listing monthly values of known night occurrences of each of the crime classes for the entire thirty-six month period. It should be pointed out that time of day of occurrence was unknown for 52% of burglaries known to the police, whereas time of day was known and recorded for virtually all robberies and assaults.

#### STATISTICAL TESTS

To aid in interpreting the data, tests of statistical significance have been performed. These tests offer a more exact way of evaluating what may be intuitively under-



stood as the strength of the findings. Since there is always some variation in crime rates over time and across areas, and since this variation will occur even in the absence of lighting changes, it is necessary to somehow distinguish between these usual (or "chance") variations and those that may be attributable to lighting.

Tests of statistical significance determine the probability that observed changes in rates are part of this chance variation. When the probability is below .05, differences are considered not likely due to chance and are called statistically significant. Other explanations of these differences are then sought, and in this study, the most likely candidate would be lighting changes.

The statistical analysis techniques applied were (1) a two-factor analysis of variance design (three levels of areas by two levels of pre-and post-lighting installation, with repeated measures within the six cells formed) and (2) tests on simple main effects. The contrasts within an area level determined whether chance could be ruled out as an explanation of change within the area. The area by pre-post interaction term of the analysis of variance determined whether chance could be ruled out as an explanation for relative changes among the three areas (e.g. T-1, D-1, and C). Determination of relative changes controls for general trends across all areas and clarifies whether changes in target or displacement areas could be correctly attributed to lighting. Repeated measures on corresponding months controls for

any seasonal effects. Contrasts within the analysis of variance were utilized instead of separate t-tests to avoid the statistical fallacy known as "capitalizing on chance," which otherwise arises when many tests are performed on portions of the same data set without making proper adjustments to the probability level for ruling out chance as an explanation for changes found.

## RESULTS

The effects of lighting were examined separately for the two target areas and for each of the three crimes. For Target Area One (T-1) crime rate values for the first eleven months following installation of lights (January through November, 1973) were compared with the corresponding eleven monthly values of the previous year. For Target Area Two (T-2) reliable data was available for six months only, thus the first six monthly values following installation of lights (June through November, 1973) were compared to the first six monthly values of the previous year. December data was available for both years but the 1973 value was so far out of trend that December was excluded from analysis.

Table 2 summarizes the crime data tables prepared for this study by collapsing monthly values. Grouping of the data in Table 2 reflects the structure of the analyses of variance. The triplets of Pre and Post values are also plotted in Figures 2 through 7, which illustrate the true relative changes in levels of the three crimes across areas.

Table 2 -- Data Summary						
Crime	Area	Pre (11 mo)	Post (11 mo)	Area	Pre (6 mo.)	Post (6 mo.)
Robbery	T-1	20	24	T-2	53	26
Robbery	D-1	18	24	D-2	64	28
Robbery	C	145	94	C	86	67
Assault	T-1	22	34	T-2	111	84
Assault	D-1	49	41	D-2	87	65
Assault	C	223	204	C	132	131
Burglary	T-1	49	75	T-2	85	75
Burglary	D-1	78	109	D-2	69	55
Burglary	C	267	246	C	158	148

Figure 2 -- Robberies

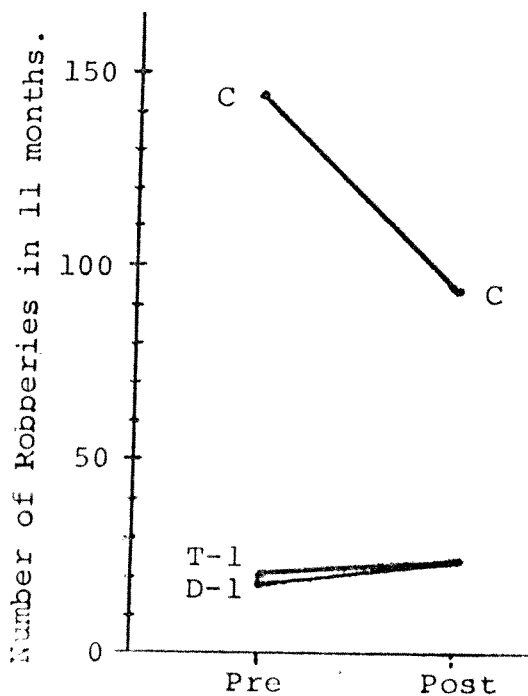


Figure 3 -- Robberies

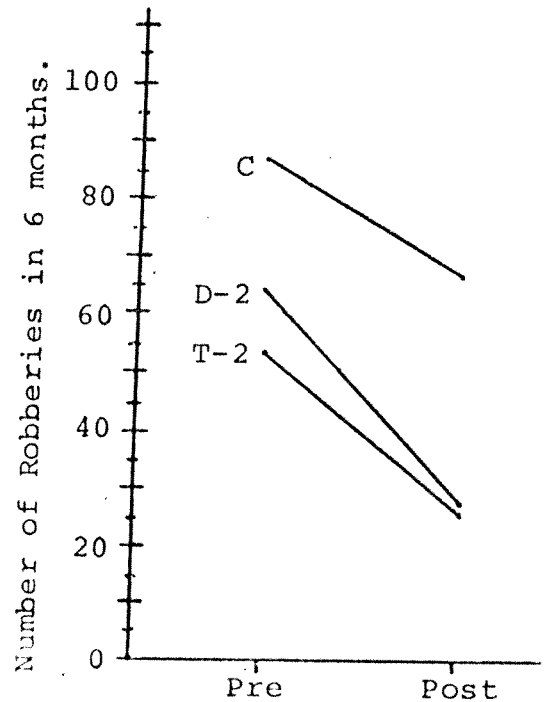


Figure 4 -- Assaults

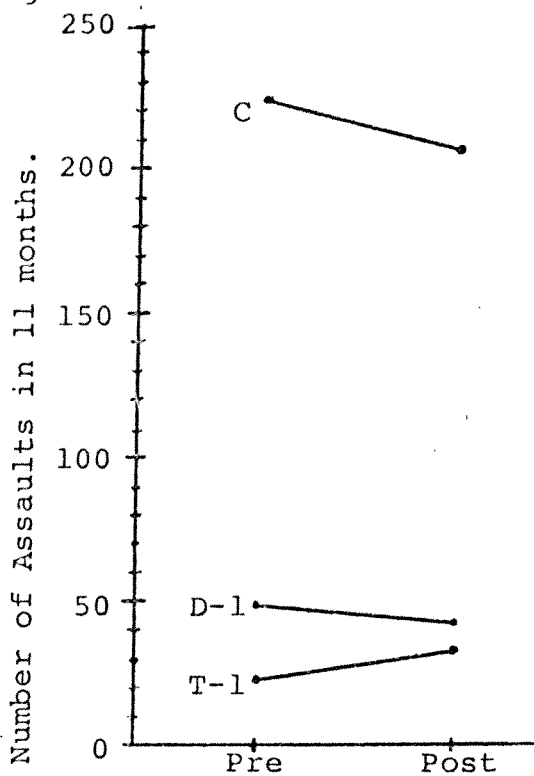


Figure 5 -- Assaults

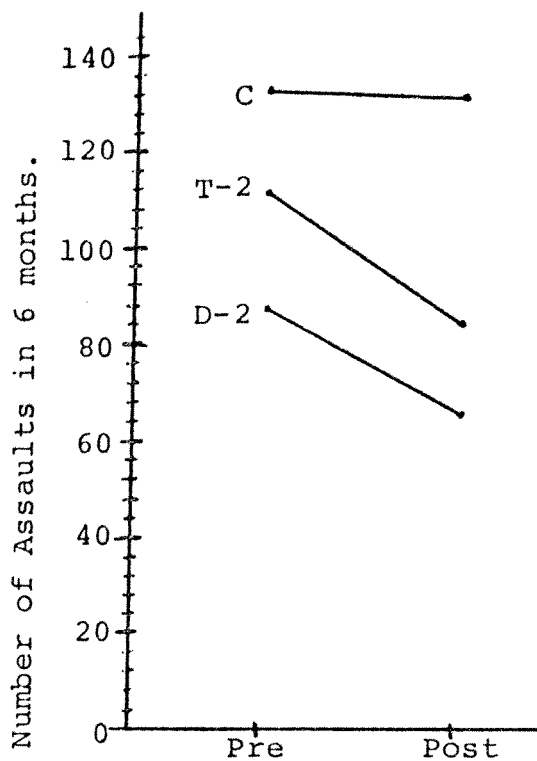


Figure 6 -- Burglaries

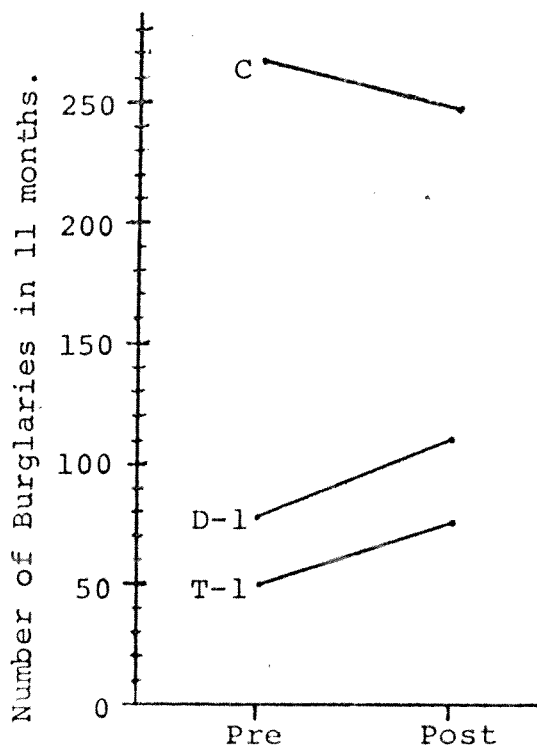


Figure 7 -- Burglaries

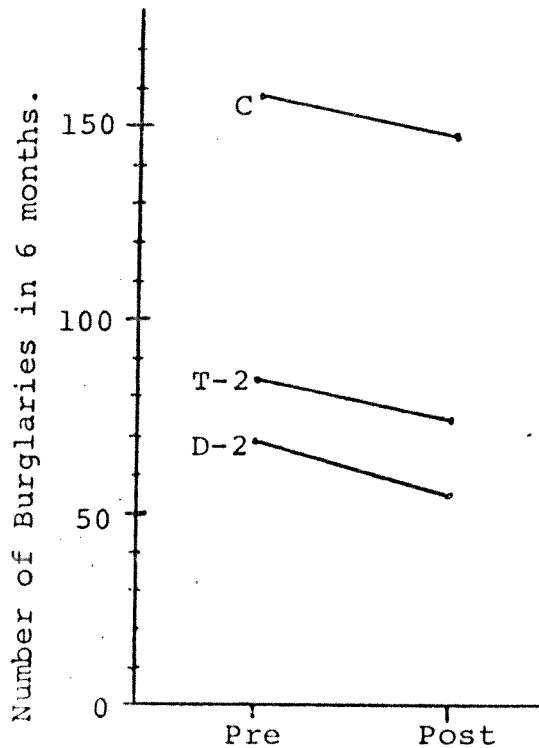


Table 3 summarizes statistical test performed as translated into intuitive terms. Type I error probability is labelled "Probability that Chance Accounts for Differences", pre-post contrasts within an area level of the analysis of variance is labelled "Change within Area", and the pre-post by area interaction term of the analysis of variance is labelled "Change Depends on Area". An example of one of the six analyses of variance performed is included in the Technical Appendix.

Table 3 -- Statistical Tests		
	Probability that Chance Accounts for Differences	Can Chance Be Ruled Out?
ROBBERIES		
Change within T-1	more than .20	No
Change within D-1	more than .20	No
Change within C (11 months)	less than .001	Yes
Change Depends on Area	less than .001	Yes
ASSAULTS		
Change within T-2	less than .05	Yes
Change within D-2	less than .01	Yes
Change within C (6 months)	more than .10	No
Change Depends on Area	more than .20	No
BURGLARIES		
Change within T-1	more than .20	No
Change within D-1	more than .20	No
Change within C (11 months)	more than .10	No
Change Depends on Area	more than .10	No
Change within T-2	less than .05	Yes
Change within D-2	equal to .10	No
Change within C (6 months)	more than .20	No
Change Depends on Area	more than .20	No

A quick look at the data and figures for T-1, D-1 and C (11 months) should be sufficient to support the conclusion that addition of lights in T-1 has not effected levels of the three crimes, as known to the police, in accordance with the goals of the project. Night occurances of all three crimes increased (although not significantly) in T-1, while they decreased (significantly for robberies) in the Control Area. Displacement becomes an irrelevant question under these circumstances.

The data and figures for T-2, D-1 and C (6 months) are more difficult to interpret. Chance variation is a likely explanation for changes in burglaries for all three areas. Also, the observed (insignificant) changes coincided, further indicating that lighting changes had no attributable effect on burglaries in T-2 or D-2.

Robberies decreased in T-2 sufficiently to rule out chance variation as an explanation. They also decreased dramatically (significantly) in D-2 and decreased (although not significantly) in C. Taken together, these changes indicate that decreases in robberies in T-2 should not be attributed solely to lighting changes but rather to an across-area trend. There is no evidence in robbery data to support the displacement hypothesis.

Assaults decreased significantly in T-2 but also decreased (nearly significantly) in D-2, while no change occurred in C. The difference between what occurred in T-2 and C offers evidence that the lighting changes produced the desired effect on the assault rate. However, D-2 assaults decreased also, thus providing evidence against the displacement hypothesis and weakening the previous conclusion. Either lighting changes drove assaults out of

D-2 as well as T-2 (the displacement area was too narrow to test the displacement hypothesis) or something other than lighting changes produced the decreases in assaults in both areas. Also, inferences across areas should not be made solely on what occurred within the individual areas. The statistical test which measured relative changes among areas (the significance test of the pre-post by area interaction term of the analysis of variance) did not rule out chance variation as an explanation.

#### CONCLUSIONS

Usual (or "chance") variation was a likely explanation for changes in robberies, assaults, and burglaries in Target Area One, and for the change in burglaries in Target Area Two. Chance variation could not account for decreases in robberies and assaults in Target Area Two.

There was no evidence that night occurrences of robbery or burglary in either target area, or assaults in Target Area One changed in the desired (hypothesized) way relative to the Control Area. There was weak evidence that assaults in Target Area Two changed in the desired (hypothesized) way relative to the Control Area. This evidence was weakened further by the similar relative change in assaults in Displacement Area Two.

In light of the failure to detect suppression effects on the three crimes in either target area, the displacement hypothesis was rendered unanswerable, with the possible exception of Target Area Two assaults. For that single instance, evidence existed

contrary to the displacement hypothesis; assaults decreased nearly as fast in Displacement Area Two as in Target Area Two.

#### FURTHER STUDY

The fact that the present study detected virtually no evidence to support the research hypotheses should not be construed as hard evidence for failure of the Portland Lighting Project to meet its goals. First, this study was limited to possible effects of the first \$50,000 out of a total of \$180,000 of lights. Although this first \$50,000 of lights were all that were planned for installation along streets and alleys, subsequent lights were added in an additional 40-block area south of and adjacent to Target Area One, and the major expenditure for lights was planned for two parks in hopes that youthful offenders might be distracted from crime through increased recreational opportunity. Second, the project had additional goals with reference to arrests, fear of victimization, use of streets and parks, and cooperation with the police. Data relevant to evaluation of these goals (except arrests) is currently being collected by means of the first Annual Sample Survey. Results of that survey and future surveys shall be presented in future reports. Third, possible concomitant changes in illumination, police patrol activity, and activity levels of motor and pedestrian traffic were not measured or taken into account. Any reliable data relevant to these three possible changes as well as changes in arrests, which can be obtained shall be incorporated in further studies of the effects of the Portland Lighting Project.



TECHNICAL APPENDIX

Below are presented the data, the summary of the analysis of variance, and the internal contrasts within areas utilized to determine (1) whether significant changes occurred in night assaults within Target Area Two, Displacement Area Two, and Control Area between the first six months following installation of the lights in Target Area Two and the corresponding six months of the previous year and (2) whether relative changes between the areas were significant.

Night Assaults in T-2, D-2, and C				
Area	Month	Pre	Post	Total
T-2	Jun	18	14	32
	Jul	21	11	32
	Aug	22	20	42
	Sep	16	13	29
	Oct	14	12	26
	Nov	20	14	34
D-2	Jun	18	8	26
	Jul	14	16	30
	Aug	17	12	29
	Sep	11	9	20
	Oct	17	13	30
	Nov	10	7	17
C	Jun	25	17	42
	Jul	18	26	44
	Aug	23	24	47
	Sep	24	30	54
	Oct	19	21	40
	Nov	23	13	36

Source of Variation	SS	df	MS	F
Between Months	769.89	17		
Area	522.06	2	261.03	15.80**
Months within Areas	247.83	15	16.52	
Within Months	298.00	18		
Pre-Post	69.45	1	69.45	5.29*
Area X Pre-Post	31.71	2	15.86	1.21
P-P X Months w/in Areas	196.84	15	13.12	
Contrasts within Areas				
Pre-Post at T-2	60.75	1	60.75	4.63*
Pre-Post at D-2	40.33	1	40.33	3.07
Pre-Post at C	.08	1	.08	.01

\* p less than .05

\*\* p less than .01