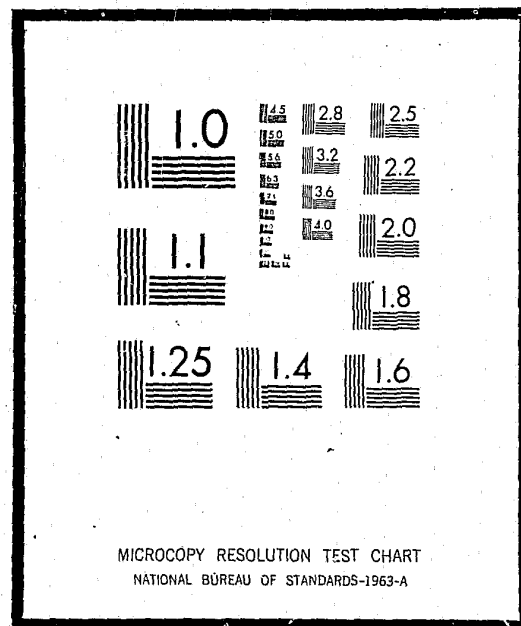


NCJRS

This microfiche was produced from documents received for inclusion in the NCJRS data base. Since NCJRS cannot exercise control over the physical condition of the documents submitted, the individual frame quality will vary. The resolution chart on this frame may be used to evaluate the document quality.



Microfilming procedures used to create this fiche comply with the standards set forth in 41CFR 101-11.504

Points of view or opinions stated in this document are those of the author(s) and do not represent the official position or policies of the U.S. Department of Justice.

U.S. DEPARTMENT OF JUSTICE
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION
NATIONAL CRIMINAL JUSTICE REFERENCE SERVICE
WASHINGTON, D.C. 20531

Date filmed

11/11/75

JULY 1973

DEVELOPING AND IMPLEMENTING A BURGLARY PREVENTION PROGRAM SUMMARY REPORT

by
Richard P. Joyce

The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the City of Alexandria, Virginia or the U.S. Government.



AMERICAN TECHNICAL ASSISTANCE CORPORATION
7655 OLD SPRINGHOUSE ROAD, McLEAN, VA. 22101

A SUBSIDIARY OF

GENERAL RESEARCH CORPORATION



FOREWORD

For many years law enforcement administrators have realized that burglary represented a large portion of the total Index crimes in the United States. Except for increasing patrol activity in areas of high incidence of burglary, very little was done to decrease burglary.

In recent years it has become obvious that patrol is only a small part of the burglary prevention arena. At this point the idea of "Target Hardening" was proposed. Simply stated, the proposal claims that crime (burglary) can be prevented if the potential target premise can be secured so as to make illegal entry difficult and time consuming.

In keeping with the hardening concept, several cities developed a security ordinance based on the experience and knowledge of veteran police investigators and others. The City of Alexandria, Virginia, became interested in the concept and discovered that very little research was available to support the hardening approach to burglary prevention.

The Alexandria Burglary Prevention Project was the result of a desire for detailed research to prove whether target hardening would, or would not, decrease the incidence of successful burglary.

This report deals with the research experiment, including the achievements, problems encountered, and the present status of the project.

Lt. Robert C. Key
Project Director

ACKNOWLEDGMENTS

This Summary Report of a project undertaken by Research Analysis Corporation and, subsequently, American Technical Assistance Corporation personnel between July 1970 and January 1973 in behalf of the Alexandria Police Department, recapitulates the work of many individuals, some of whom have since moved on to other endeavors. It is essentially the record of their achievements which is reported here, and it is to them that credit is owing for the successes which have been realized. The individuals concerned are Mr. Ronald E. Kirkpatrick and Mr. Richard C. Stevens, formerly of ATAC; Mr. James Bercos, formerly of RAC; and Mr. Charles M. Moltz, management analyst for the Alexandria Police Department and Lt. James P. Hill, formerly of the Alexandria Police Department. Also associated with the work and responsible for much valuable technical guidance to RAC and ATAC have been Capt. Carl A. Dutzman, Director of Research and Crime Prevention of the APD; Lt. Robert C. Key, Director of the Planning and Research Section of the APD and the Project Administrator of record for the project; and Mr. Clifford H. Rusch, Jr., Assistant City Manager, City of Alexandria.

CONTENTS

FOREWORD	iii
ACKNOWLEDGMENTS	iv
PROGRAM HISTORY	1
Background	1
Program Objective	2
Scope	3
PROBLEMS ENCOUNTERED	4
Technical Problems	4
Administrative Problems	8
ACCOMPLISHMENTS	10
RECOMMENDATIONS	13
APPENDICES	
1. Master Work Schedule	1-1
2. Experimental Design	2-1
3. Alternative Time Requirements for Recommended Methods of Hypothesis Testing	3-1
4. APD Forms 157 and 158, Burglary Data Collection	4-1

PROGRAM HISTORY

BACKGROUND

On 20 May 1970, the City of Alexandria, Virginia issued a Request for Proposal (RFP) to develop a program for the design and test of standards for burglary prevention. The City was at that time being considered by the US Department of Justice, Law Enforcement Assistance Administration, (DOJ LEAA) as a site for a demonstration project concerning the feasibility of reducing the incidence of burglaries through a variety of means including the adoption of an enforceable code of minimum standards of physical security for buildings to deter burglarly.

The Research Analysis Corporation (RAC), to which the General Research Corporation (GRC) and its wholly-owned subsidiary American Technical Assistance Corporation (ATAC) later became successors in interest by purchase, responded to the RFP on 27 May 1970. The RAC proposal emphasized the identification and test of low-cost, hardware devices to deter burglars and reduce losses to them, along with the development of enforceable standards of building security consistent with the deterrent capabilities of readily available, commercial devices.

On 10 July 1970, the City awarded the work to RAC consistent with the terms of its offer and consistent also with the terms of a 30 June 1970 Grant Award (Grant Award NI70-088) to the City from the National Institute of Law Enforcement and Criminal Justice (NILECJ), the action agent of the DOJ LEAA. RAC began work immediately on the project in cooperation with the Office of Research and Crime Prevention of the Alexandria Police Department, although the formalization of the working relationship

in a contract instrument did not occur until approximately eight months later in March 1971.

RAC and the Alexandria Police Department (APD) initially contemplated a 33 month program with sequential phases and associated tasks. The program schedule was eventually modified however, to reflect a 30 month effort and the formal contract of March 1971 stipulated that the term of the agreement would extend from 15 July 1970 to 15 January 1973.

RAC, in cooperation with the APD, compiled a detailed work effort schedule for the 30 month period to reflect both the sequencing of the tasks to be performed and the apportionment of responsibilities between RAC and the APD for each. The work schedule conformed to the Grant Master Schedule governing the City's relationship to the NILECJ* and indicated that of a total of 51 man months of technical effort to be applied to the program, RAC would supply 23 man months and the City would provide 28. The basic work schedule continued despite numerous delays which by January 1973, the originally programmed termination date for the project, had a cumulative impact of placing the project 14 months behind schedule. Because of these delays, both ATAC and the City were faced with the choice of 1) continuing the work without benefit of LEAA funding support for the key personnel involved in the program, or 2) abandoning the project, or 3) modifying the purpose of the program. None of these courses of action was acceptable to the City, but the second and third alternatives were less acceptable than the first, and the City has therefore decided to proceed with the experimental test utilizing whatever resources can be made available for the purpose.

PROGRAM OBJECTIVE

The Alexandria experimental project is designed to determine whether improved security procedures by owners and occupants of residential and commercial properties will: 1) reduce the incidence of successful burglaries; 2) reduce losses from burglaries; 3) increase the probability of apprehending burglars in the process of committing their crime; and 4) facilitate an increased police clearance rate for burglaries.

*The original schedule is reproduced in Appendix 1.

SCOPE

The program was and remains structured as a research experiment which, if successful, will lead to the development and adoption by Alexandria of an enforceable code of building security standards. It was intended at the outset that the successful demonstration of the concepts inhering in the experiment would form a basis of action by NILECJ to encourage other cities, nationwide, to adopt the Alexandria approach.

The experimental effort in which Alexandria has been engaged with professional research and analytical assistance from RAC and its successor, ATAC, is narrowly (and quite properly) focused on the problem of developing a set of minimum standards of physical security for buildings with a view to incorporating these standards into an enforceable city code. Although narrowly focused in scope, the experiment has required considerable research and analysis of security devices; the design of a system for classifying these devices and rating them according to their protective capabilities; the design of a system for rating the vulnerabilities of buildings; the design of a system for assembling and the subsequent assembly of a validated base of data on burglary incidents in relation to the use or non-use of various security devices and in relation also to factors of building vulnerability; the design of an experimental test to prove or disprove the hypothesis that the improvement of building security through low-cost means will reduce the incidence of burglary; the development of a draft building security code; and the development of a community education program concerning ways to deter burglaries.

All of the foregoing tasks essential to the project have been completed. What remains uncompleted and what the City now proposes to complete is the experimental test of the basic hypothesis underlying the project. The City expects to be in a position to initiate this test on 1 September 1973 and to conduct it over the course of at least a year, and longer if necessary, to derive statistically valid results. Subsequent to the completion of the test, and assuming a successful outcome, the City will be able to proceed with legislation for an enforceable building security code.

PROBLEMS ENCOUNTERED

Throughout the course of the Alexandria burglary experiment, a number of problems have been encountered which were not and probably could not have been foreseen at the outset. The problems have been of two principal types—technical and administrative—and are discussed here in that frame of reference. All are fully documented and discussed in the Quarterly Progress Reports which the City has submitted to the NILECJ, and those reports are incorporated by reference in this Summary as essential parts of the project's history.

TECHNICAL PROBLEMS

Of the technical problems encountered in the Alexandria experiment, three were of such significance as to warrant discussion in this Summary Report. They were: 1) the development of standards for measuring the effectiveness of hardware intended to prevent unauthorized entries of buildings; 2) the development of a system for rating buildings in terms of the relative degrees of security which they proffer against unauthorized entries; and 3) the development of an experimental design to test the hypothesis that the use of relatively low-cost hardware devices in combination with other actions will significantly reduce the incidence of burglary in areas which normally experience relatively high rates of that crime.

Standards for Measuring Hardware Effectiveness

One of the first and most significant problems encountered in the burglary prevention program was to devise a set of standards for measuring the effectiveness of various types of locks, latches, and other associated

means of securing building apertures against unauthorized entries. After consultation with numerous recognized authorities on this subject, and consistent with the practices of Consumer Union Laboratory in Mt. Vernon, N. Y., the study team devised a rating system based on the relationships between the time required to defeat individual security protective devices under different modes of attack, and the retail costs of the individual devices. The rating system was explained in detail in Grant Report No. 2 of September 1971. Performance Effectiveness ratings were established for 37 types of hinged door locks, 24 types of hinged doors, 13 types of sliding doors, 11 types of overhead doors, 11 types of window locks, 17 types of windows and associated materials, 10 types of other locking devices, and 7 types of roof doors and windows. The data for each of the items considered were displayed in tabular form in the September 1971 Report.

Building Security Rating System

Concurrent with the need to develop the Performance Effectiveness rating system for standard hardware, there arose a need to devise a standard system for rating building security and for collecting data on burglary incidents. This work was undertaken by the APD with advice and assistance from the RAC study team. The system was needed for many reasons. Among these were the requirement to collect and analyze data on the incidence of burglary in relation to the relative ease with which unauthorized entry could be gained to the various types of premises attacked (to establish a benchmark from which to plan for the experimental test of devices and systems to deter burglaries) and the requirement to acquire detailed knowledge of the features and conditions of buildings within the city as a point of departure for the drafting of an enforceable code of standards.

This problem was one of the most difficult encountered. It was solved through patient application of effort by APD and ATAC personnel in cooperation with NILECJ and the Federal Insurance Administration of the Department of Housing and Urban Development. Products which resulted from these efforts were: 1) APD forms for the uniform collection of

burglary data* ; a minimum Building Security Guide; and a Security Guide for the Stevenson Avenue Housing Project in Alexandria. The APD forms were designed for use by police officers when making an initial investigation of a burglary or burglary attempt, and were organized in such a way that the investigating officer had only to check appropriate boxes to record the required environmental data. The forms were further designed to facilitate the transcription of the recorded data onto punched cards for subsequent machine-assisted analysis. Pictorial guides to the different types of locking devices enumerated on the forms were included as aids to investigating officers in completing the data forms. The minimum building security guides in addition to establishing an initial set of minimum security standards, contained estimates of installation costs for each item listed. By means of these guides buildings could be easily rated as below, at, or above minimum standard, and reasonable cost estimates could be quickly developed for bringing any building up to a minimum standard of protection.

Experimental Test Design

Perhaps the most difficult technical problem encountered by the project was the design of the experiment to determine whether the improvement of certain security features of buildings would in fact reduce the incidence of burglary within the city. In designing the experiment, ATAC and the APD were faced with a number of constraints which were not (and so remain) subject to removal or manipulation. Principal among these were time and funds required to "harden" a sufficient number of buildings to enable the experiment to be conducted under statistically valid procedures, and the ineluctable requirement to predicate the experiment on the validated base of data concerning burglaries in relation to the physical security features of the buildings in which the crime was committed.

The "hardening" requirement was not originally foreseen and funds had not been budgeted for the purpose. It has since proved to be one of the principal reasons for delay in completing the program. Essentially, the requirement was to improve the physical security of approximately

* Cf. Appendix 4.

250 test premises within a sample group of 1000 on which historical data were available, with a view to determining whether the test group, after "hardening" experienced a statistically significant difference in burglaries. "Hardening" was to be accomplished by installation of security hardware devices, primarily locks, with relatively high performance effectiveness ratings in relation to purchase and installation costs.

The experimental design and the procedure for conducting the test under the types of controlled conditions required to yield valid results have been discussed by the City with NILECJ on numerous occasions since December 1971, as indicated in the record of the City's Quarterly Progress Reports to NILECJ.* Unfortunately, NILECJ has neither approved nor disapproved the proposed test. NILECJ has expressed reservations about the plan, especially in regard to tradeoffs between increased costs and extra time required to conduct the test to the highest levels of statistical confidence and lowest probabilities of error. However, NILECJ has neither proposed any alternatives nor indicated how problems of cost might be satisfactorily resolved. In the absence of guidance from NILECJ on this matter, the City has proceeded to follow the original plan and is in process of completing the "hardening" of 250 test sites at its own expense (with support from the Richmond Virginia Council of Criminal Justice). The APD expects "hardening" of the test sites to be completed on 31 August 1973 following which the experimental test will be initiated. The APD plans to run the test for a length of time sufficient to yield statistically valid results. The City intends to follow this course because it believes strongly in the probability of a successful outcome. NILECJ has indicated that further extensions of the grant period will not be approved, without modifying the scope of the program. Therefore, the City has elected to continue to pursue the program independently. ATAC shares the City's belief that the experimental test will prove successful and that the results will warrant the adoption by the City of a Code of Minimum Building Security.

* Cf. Progress Reports of 16 December 1971, 12 July 1972, 4 August 1972, and 10 January 1973.

ADMINISTRATIVE PROBLEMS

Of the problems encountered in this program, which may be classified as administrative in nature, one of the more significant has already been alluded to; i.e., the coordination of the work with NILECJ especially in regard to obtaining approval of the test plan. In fairness to all parties it must be noted that turnovers in personnel associated with the project in behalf of NILECJ, the City and the City's contractor, ATAC, have been fairly high, and the advent of different Project Monitors (NILECJ), Project Administrators (The City), Principal Investigators (ATAC), and project personnel (APD and ATAC) has not been without impact on program operations. Every change has required a period of familiarization on the part of the individuals concerned, and each person new to the work has brought experience and outlooks which differed from those of his predecessor. The familiarization processes contributed to the delays which have been encountered, and the differences in background experience and outlooks have tended to work against continuity in program approach. It is, perhaps, remarkable that the project has not suffered more than it has from these factors, and that the work has proceeded much according to plan.

Hardening of Sites

The original concept involved matching well-secured new construction with similar units of older construction with below standard security. In the search for a sufficient number of units in each category, it became evident that the City of Alexandria was "built up" almost to saturation. This concept was abandoned owing to the low rate of new construction. New methods became an obvious need.

A major, time-consuming administrative problem was now posed by the requirement to improve or "harden" the protective security features of the 250 premises which will comprise the test group for the experiment. The problem had two, interrelated elements; viz., costs and owner/occupant permission to install devices with relatively high performance effectiveness ratings. The solution sought in mid-1971 was to enlist the cooperation of the builder of the FHA-supported Stevenson Avenue Housing Project with a view to having him voluntarily incorporate into his construction,

materials and devices which, in the aggregate would raise the protective security features of the housing units to a minimum acceptable level for purposes of the proposed experimental test. The builder, Macro Housing Inc., declined to cooperate because of reluctance to absorb the increased costs of construction.

Following this, the City undertook to solve the problem through administrative action that was clearly foreseen as time-consuming but which offered the only hope of eventual success. The actions required were:

- 1) obtain funds for purchase and installation of hardware required to harden 250 test premises;
- 2) establishing the minimum standard for the test based on the estimated cost and showing significant increase in the security level of each unit;
- 3) obtain permission from the owners and occupants of 250 premises to install the devices and monitor their performance throughout the period of the test;
- 4) prepare and advertise an invitation to bidders to furnish and install the security devices according to specifications;
- 5) evaluate bids and award a contract;
- 6) commence the experiment upon completion of the work by the contractor to "harden" the 250 test premises.*

All but the last of these steps have been successfully completed and the contractor is expected to complete the hardening work by 31 August 1973. The test will begin on 1 September. It must be noted here that the process of obtaining permissions from owners and occupants was indeed difficult. In this process the APD had to work patiently and dedicatedly to overcome suspicions and hostilities on the part of many owners and tenants as to why their premises and not someone else's were being singled out for the purpose. Much credit is owing to the personnel of the APD for having followed this effort through to a successful conclusion. The result is certainly one of the more significant accomplishments of the program.

* As of August 30, 1973 NILECJ funding will be exhausted. The City will continue the project and will develop an adequate statistical test as a basis for a building security code.

ACCOMPLISHMENTS

Despite the delays and the difficult problems encountered, the Alexandria Burglary Prevention Experiment has compiled a record of accomplishment from which all who have participated in the work can derive much pride and satisfaction. Briefly summarized, these accomplishments are as follows:

1) A System for Classifying and Rating Standard Hardware and Associated Construction Materials in Terms of Their Capabilities to Deter or Prevent Unauthorized Entries of Premises. The system is admittedly imperfect insofar as it represents only an initial attempt to classify and rate the items considered. The ratings are not based upon detailed, scientific testing of individual devices or combinations of the devices considered, but are geared to provable factors of cost and average times required to defeat the intended purposes of the items under different modes of attack. Even in its imperfect form the system has achieved a measure of recognition nationwide as judged from reports of its dissemination that have from time-to-time come to the attention of the APD and ATAC.

2) An Initial Federal Security Code—Minimum Building Security Guide. As part of the Alexandria experiment, RAC analysts participated in the development of this guide by NILECJ for the Federal Insurance Administration, HUD. The guidelines have achieved recognition nationwide as also judged from reports which have come to the attention of the APD and ATAC. More importantly for purposes of the program, however, is the fact that the initial guide forms the prospective basis for a Building Security Code which the City may adopt given a successful outcome of the planned experiment.

3) A Minimum Building Security Guide for the Stevenson Avenue Housing Project in the City of Alexandria. This guide is less-comprehensive than the above but is consistent with its thrust. Had the builder of the Stevenson Avenue project chosen to adopt it, the problem of "hardening" premises for test would have been solved in 1971. Even though unused for this original purpose, the Minimum Building Security Guide augments the basis for eventual action by Alexandria in respect of the proposed Building Security Code.

4) Development of a Citizen Educational Program. The original plan of action called for the development and implementation of a community education program on burglary prevention with a view to predicating the program on the results of the experimental test. Owing to the lack of such results, the City has been unable to develop the education program as originally envisioned. Nonetheless, in November 1972 a film was developed in cooperation with the Northern Virginia Planning District Commission on Burglary Prevention and through April 1973 this film had been shown more than 47 times to over 1300 citizens. Personnel of the APD are on hand during film showings to discuss and explain its content, and also to supplement it with handouts depicting various types of locking devices and security procedures which citizens may employ to improve the security of their residences and places of business.*

5) Historical Data Base. Certainly one of the most significant accomplishments of the Alexandria project to date is the assembled base of machine-coded data on the incidence of burglary in the city during 1971. The data were so gathered and compiled as to permit analysis under multiple modes; i.e., by census tract, by point of entry, by types of premises, by modes of attack, etc. Also forming part of this data base and comprising an integral element of the experimental test to be performed are the results of the environmental survey of the 1000 premises of the experimental group. Through this survey it has been established whether the premises are above, at, or below average for their class in terms of degrees of protection offered against burglary. Very few presently meet the minimum security standards contemplated for the prospective Building Code, and the establishment of this fact through the data base is itself

* Cf. Progress Report of 19 April 1973.

a significant accomplishment. This historical data base will be the benchmark for comparative analysis of data acquired during the experimental test.

6) Standardized Forms for Collecting and Recording Data on Burglary Incidents. Another product of this project has been the development of forms for the collection of burglary data for research purposes.

7) Improvement in Security Standards of 250 Premises. Apart from their intended role in the experimental test, and apart also from the previously noted achievement record of APD personnel in winning the cooperation of owners and tenants in the experiment, the hardening of 250 premises against burglaries in areas which traditionally experience a high incidence of this crime, must be ranked among the accomplishments of the project.

RECOMMENDATIONS

Based on this summary review of the Alexandria Burglary Prevention experiment, and based also on its intimate knowledge of the history of the program and the accomplishments and dedication of the APD in regard to it, ATAC offers the following recommendations:

- 1) The APD should proceed to conduct the experimental test as originally designed for as long a period as necessary to derive statistically valid results at confidence levels and within limits of probabilities of error acceptable to the City.
- 2) Upon successful outcome of the experiment, the City should move toward the adoption of the proposed Building Security Code.
- 3) Upon indication of a likely successful outcome of the experiment, the City should consider apprising the insurance industry, through appropriate City and State offices, of the impact which relatively low cost "hardening" has on the incidence of burglary.

Appendix 1
MASTER WORK SCHEDULE

Appendix 1.
MASTER WORK SCHEDULE

Work Effort in Man-Months		Schedule Item	Output	Prime Responsibility	% Complete		1970			1971			1972												
RAC	Alex				RAC	Alex	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
2.5	1.0	1. <u>Survey of information & development of technical standards for devices</u>																							
1.0	.3	A. Survey of information	Reference sources	RAC	60	-																			
1.5	.7	B. Development of standards	Standards for device categories	RAC	10	-																			
4.0	2.0	2. <u>Assessment of devices & application of standards</u>																							
1.5	1.0	A. Survey and collect data on devices	Listing & catalog of devices	RAC	50	-																			
2.5	1.0	B. Application of standards to devices and assessment	Device categorization with standards (fit)	RAC	0	-																			
1.0		3. <u>Preparation of Grant Report No. 2</u>	Preliminary collection system Preliminary standard devices information	RAC/Alex	0	0																			
4.0	3.0	4. <u>Survey of information re: methods & procedures for deterring burglaries</u>																							
2.0	1.5	A. Survey of existing methods	Data base on what has been done & results	RAC	30	0																			
2.0	1.5	B. Procedural information, prevention deterrence, other		RAC	10	0																			
4.0	2.0	5. <u>Development & application of standards for evacuating methods & procedures</u>																							
2.0	.5	A. Development of evaluation techniques		RAC	0	0																			
2.0	1.5	B. Application of the techniques as standards to the evaluation	Evaluation standards	RAC	0	0																			
1.0		6. <u>Preparation of Grant Report No. 2</u>	Effective ratings, & categories of devices	RAC/Alex	0	0																			

1-1

Appendix 2
EXPERIMENTAL DESIGN

Appendix 2

EXPERIMENTAL DESIGN

I. INTRODUCTION

In Grant Report Number 2 the Research Analysis Corporation (RAC) suggested standards for the use of security hardware to reduce the occurrence of burglary. Before adopting these standards the City must apply them under experimental conditions to evaluate the effectiveness of rated security hardware in reducing burglary occurrences. To make this evaluation, RAC has designed an experiment, based on statistical methods of hypothesis testing.

II. ELEMENTS OF EXPERIMENT

A. Experimental Group

The experimental group is a group of sites (townhouses, offices, etc.) which is of workable size and which has a relatively high average probability of burglary during the test period. This group will be divided into the test group and the control group.

B. Test Group

The test group includes sites chosen randomly from the experimental group to be established as "hardened" sites.

C. Control Group

The sites remaining in the experimental group after test site selection constitutes the control group. It is assumed that the only difference between the test and control groups, aside from size, is the degree of "hardening" against burglary.

D. Test Period

The test period begins after the test group is "hardened" and continues for about one year or as long as necessary to draw the required sample of burglary incidents from the experimental group.

E. Historical Period

A period of two or more years previous to the test period will constitute the historical period. Data analysis will be concerned with differences between burglary data collected during the historical and test periods.

F. Data Analysis

The data collected will be analyzed in terms of the burglary experience ratios for the test group and the control group. If these ratios show the test group experience greater than the control group, it may be concluded that the standards are not effective. However, if the ratio shows that the test group experience is less than the control group then it must be determined whether the difference is sufficiently large to support a conclusion that the standards are effective.

G. Evaluation Method

The determination will be based on statistical methods of hypothesis testing which are described in detail in Section IV.

III. ASSUMPTIONS AND CONDITIONS OF EXPERIMENT

The distribution of burglaries throughout the City of Alexandria will be the same during the test period as it was during the historical period. The monthly variation in burglary incidents is compensated for by using historical data (2 years or more) which covers a longer period of time than the test period.

During the test period, additional "hardening" by individuals, rather than by the City, will be proportionately distributed throughout the experimental group, and the security level will also be proportionately distributed. This will be verified by field surveys taken before and after the test period.

Changes in land use and occupancy will be distributed throughout the experimental group in the same proportion as they were during the historical period.

Changes in police patrol boundaries; (type, frequency, etc.) street lighting, private police coverage, renewal projects, traffic patterns, and other factors which may affect burglary will be proportionally distributed throughout the experimental group.

"Spill over" experience and recognition of "hardened" sites will not be a factor because of the selection process of the sites to be hardened.

The experimental group will contain homogeneous categories of premises with a high incidence of burglary experience. Certain types of structures will be excluded. The smallest geographic area to be used will be one block face.

A test period of one year will eliminate seasonal variations in data and will permit additional time, if necessary, to gain an adequate body of data for statistical purposes.

There shall be no change in the manner in which the City of Alexandria records and counts its incidence of burglary and attempts, and the data collection process used during the historical period will be maintained, unchanged, during the test period.

If the difference in burglary experience is such that the hardened group receives proportionately fewer "hits" than the control group, it is assumed that this difference is attributable to the hardening, because to the extent possible, except for size, the two groups have been selected and maintained to be otherwise equivalent.

IV. DETAILED DESCRIPTION OF THE EXPERIMENT

A. Selection of the experimental group.

1. The practical constraints of time, manpower, and money indicate that it is feasible to establish a test group of at least 250 potential burglary targets.
2. The statistical constraints for relative sizes of control and test groups ideally would make the control group equal in size to the test group, but the control group size may be as much as four times the test group. Additional consideration for the minimum sample size of burglaries necessary for valid hypothesis testing has indicated that a control group of 750 potential burglary targets would be appropriate.

3. Thus, an experimental group of 1,000 potential burglary targets has been determined.

4. The experimental group will be composed of geographic areas of at least one block face which have histories of at least 15 percent per year burglary incidence. Within these geographic areas certain types of commercial and public structures will be excluded in order to achieve homogeneity of the experimental group and to reduce the expense of hardening. Selected in this way, the experimental group largely will include townhouses, basement and first floor garden apartments, and certain small businesses.

5. Upon selection, each of the 1,000 potential targets will be uniquely identified by a number designation to facilitate random selection of the test group.

B. Selection of the test group

In the selection process the test group will be stratified to include the same proportion of premises as those existing in the experimental group (i.e., for an experimental group of 1,000 targets and a test group of 250 the ratio is 4 : 1). Therefore, there should be one townhouse in the test group for each four townhouses in the experimental group, and similarly for each other type of premise.

The random selection will be done with a table of random numbers in the customary way.

C. Selection of the control group

The control group selection will occur simultaneously with the test group selection because the test group plus the control

group make up the experimental group. (Thus the control group will be 750 potential burglary targets stratified in the same proportions as the experimental group and the test group).

D. Hardening of the test group by implementing the standards

1. A field survey will be made to describe each potential target in the experimental group and to determine the current degree of hardness.
2. The degree and extent of hardness achieved on the test sites will be determined from the survey data, the historical burglary experience relative to points of entry, the burglary standards, and the program constraints such as time, money, etc.
3. The standards will then be implemented in the test group to a feasible degree and extent of hardness. If for any reason implementation cannot be carried out for some of the potential targets in the test group, replacement potential targets must be drawn from the control group by the same random process, and those potential targets that are replaced now become part of the control group.

E. Data Collection

1. As stated in the assumption, the specific period of time for the data collection will be a minimum of one year to compensate for seasonal variations and to permit additional time, if necessary, to gain an adequate body of data for statistical purposes.
2. In this period of at least one year, and based upon Section IV, A, 4, (15 percent per year incidence rate), it is

expected that approximately 150 burglaries will occur against the experimental group. Should more than 150 burglaries occur, the conditions for valid hypothesis testing are improved. On the other hand, should fewer than 150 burglaries occur, data collection must continue beyond one year until at least 150 burglaries have occurred.

3. The data acquisition plan developed and used during the first year of the grant will be continued for the data collection period.

F. Analysis of Data

1. For the convenience of discussion the experimental group shall be symbolized as E, the test group after hardening as T, and the control group as C; also, B shall symbolize the burglary experience in the historical data, and b shall symbolize the burglary experience during the experience.
2. It should be noted that the division of the experimental group into two groups correspondingly divided the historical data into two groups—the burglary experience against the test group and the burglary experience against the control group; thus the historical experience and the experimental experience respectively are symbolized:
E(B) and E(b) for the experimental group,
T(B) and T(b) for the test group, and
C(B) and C(b) for the control group.

3. The analysis of the data will be concerned with differences between the ratios of historical experience and experimental experience for the test group and the control group, or is

$$\frac{T(b)}{C(b)} \geq \frac{T(B)}{C(B)} ?$$

Note that the ratio $\frac{T(B)}{C(B)}$ may vary from zero to an indeterminately large number depending upon which T of the many possible T's is drawn from E. Because T for the experiment is to be representative of E relative to the historical experience as well as the kinds of structures in E, the average $\frac{T(B)}{C(B)}$ for all possible T's must be used.

4. Under the null hypothesis that the security hardening will make no difference in burglary experience, if:

$$\frac{T(b)}{C(b)} \geq \left(\frac{T(B)}{C(B)} \right) \text{ avg.},$$

there is insufficient reason to reject the hypothesis; however, if:

$$\frac{T(b)}{C(b)} < \left(\frac{T(B)}{C(B)} \right) \text{ avg.},$$

then, we must determine whether the difference is sufficiently large to warrant rejecting the hypothesis, and to conclude that the standards are indeed effective in preventing burglaries. Statistical methods of hypothesis testing will be used to make this determination. In all such methods the analysts risk rejecting the hypothesis when it is in fact true (error of the first type, α), or accepting the hypothesis when it is in fact false (error of the second type, β).

5. Thus, the null hypothesis, H_0 , is formulated as:

$$H_0 : \frac{T(b)}{C(b)} \geq \left(\frac{T(B)}{C(B)} \right) \text{ avg.}$$

Because $E = T + C$, the distribution of burglaries against E is binomial. To limit the risk of an error of the first type an α equal to 0.05 (or as close to this value as possible) will be used to determine the rejection number, RN, the value(s) of T(b) for which the hypothesis will be rejected.

6. Thus for $E = 1,000$ and $T = 250$ then $C = 750$ and

$$\left(\frac{T(B)}{C(B)} \right) \text{ avg.} = \frac{250}{750} = \frac{1}{3}.$$

With $S = 150$ (the number of burglaries against E during the data collection period), reference to a table of the cumulative binomial probability distribution gives a RN equal to 29 (for an α equal to 0.04167).

Thus for T(b) equal to or less than 29 reject H_0 .

7. Against an alternative hypothesis H_1

$$H_1 : \left(\frac{T(B)}{C(B)} \right) \text{ avg.} = \frac{1}{4}.$$

Using $RN \leq 29$ to reject H_0 gives a β equal to 0.61307 (or 61 percent of the time one will fail to reject the hypothesis H_0 when he should). Similarly against an alternative hypothesis H_2 ;

$$H_2 : \left(\frac{T(B)}{C(B)} \right) \text{ avg.} = \frac{1}{5},$$

using $RN \leq 29$ to reject H_0 gives 0.21859 for β .

V. ANALYSIS AND EVALUATION OF BURGLARY DATA

The following statements are presented as merely indicators of the analysis that may be included in Grant Report No. 6. It is anticipated that when the data are collected other desirable analyses will be indicated.

- A. Additional use of the experimental test data in analyzing the burglary experience for sub-sets of data within the experimental group (e.g., a test and control group analysis of garden apartments, etc.).
- B. Analysis of the test group burglary experience relative to a point of entry and areas hardened.
- C. Further analysis of the experiment test data in order to measure to what extent the "standards" were effective (e.g., implementation of the Burglary Standards reduced the incidence of burglary of the test group by x percent).
- D. Use of the Chi Square analysis in a "goodness of fit" sense to measure the significance of deviations of actual experience from expected experience for the several classes of targets in the experimental group.

Appendix 3

TIME REQUIREMENTS FOR RECOMMENDED METHODS OF HYPOTHESIS TESTING

Appendix 3

TIME REQUIREMENTS FOR RECOMMENDED METHODS OF HYPOTHESIS TESTING

Notes:

- Hypothesis - The hardening of test premises to a standard significantly higher than the average levels of security existing in the experimental group of premises will not result in a difference in burglary experience.
- Type 1 error - Reject the hypothesis when it is true.
- Type 2 error - Accept the hypothesis when it is false.
- Critical number - If burglaries in the test group exceed the critical number, accept the hypothesis. If burglaries in the test group are less than the critical number, reject the hypothesis.
- Burglary rate - The percentage of premises in the experimental group which have been burglarized in each of the past two years.

TEST WITH A FIXED SAMPLE

Probability of Error (%)		Total Burglaries in Experimental Group	Critical Number	Weeks Required If Burglary Rate Is:	
Type 1	Type 2			15%	19%
5	53	150	29	52	41
10	10	456	102	157	125
10	15	357	78	123	98
10	20	301	65	104	82
10	25	256	54	88	70

SEQUENTIAL TEST

Probability of Error (%)		Average Sample Size		Weeks Required If Burglary Rate Is:	
Accept H_0	Reject H_0	Accept H_0	Reject H_0	15%	19%
5	50	67	119	41	33
5	5	359	380	131	104
10	10	238	252	87	69
10	15	189	222	77	61
10	20	156	195	67	54

Appendix 4
APD FORMS 157 AND 158
BURGLARY DATA COLLECTION

PATROLMAN'S DATA SHEET
BURGLARY STUDY

Officer _____

Case No. _____

Date Surveyed _____

Complainant _____

Address _____

DOORS														
Primary Lock					Primary Lock Mechanism					Lock and Alarm in Use During B&E				
	F	R	S	B		F	R	S	B		F	R	S	B
None	0	0	0	0	None	0	0	0	0	No Lock; Not Alarmed	0	0	0	0
Snaplatch	1	1	1	1	Tumbler Types Lock In Knob-Standard	1	1	1	1	Locked; Not Alarmed	1	1	1	1
Snaplatch With Dead Man	2	2	2	2	Lock in Door-Standard	2	2	2	2	Locked; Alarmed	2	2	2	2
Horizontal Dead Bolt Less Than 1"	3	3	3	3	Lock in Knob-Pick Resistant	3	3	3	3	Unlocked; Not Alarmed	3	3	3	3
Vertical Dead Bolt Less Than 1"	4	4	4	4	Lock in Door-Pick Resistant	4	4	4	4	Unlocked; Alarmed	4	4	4	4
Horizontal Dead Bolt More Than 1"	5	5	5	5	Spring Type	5	5	5	5					
Vertical Dead Bolt More Than 1"	6	6	6	6	Combination Lock	6	6	6	6					
Chain Lock	7	7	7	7	Electronic	7	7	7	7					
Horizontal Bar	8	8	8	8										
Padlock	9	9	9	9										

COMMENTS:

Auxiliary Lock					Auxiliary Lock Mechanism & Status During B&E				
	F	R	S	B		F	R	S	B
None	0	0	0	0	None	0	0	0	0
Snaplatch	1	1	1	1	Locked Tumbler Type	1	1	1	1
Snaplatch With Dead Man	2	2	2	2	Locked Combination Type	2	2	2	2
Horizontal Dead Bolt Less Than 1"	3	3	3	3	Locked Other	3	3	3	3
Vertical Dead Bolt Less Than 1"	4	4	4	4	Unlocked Tumbler Type	4	4	4	4
Horizontal Dead Bolt More Than 1"	5	5	5	5	Unlocked Combination Type	5	5	5	5
Vertical Dead Bolt More Than 1"	6	6	6	6	Unlocked Other	6	6	6	6
Chair Lock	7	7	7	7					
Horizontal Bar	8	8	8	8					
Padlock	9	9	9	9					

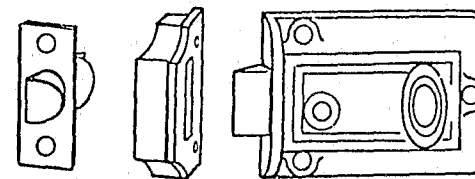
WINDOWS

Framing and Hardware					Window & Alarm Status During B&E				
No Window (Cross out letter)	F	R	S	B		F	R	S	B
Wood Framing - No Hardware	0	0	0	0	No Window	0	0	0	0
Standard Hardware	1	1	1	1	No Lock; Not Alarmed	1	1	1	1
Security Hardware, Keyed	2	2	2	2	Locked; Not Alarmed	2	2	2	2
Security Hardware, Pinned	3	3	3	3	Locked; Alarmed	3	3	3	3
Security Bars/wire mesh	4	4	4	4	Unlocked; Not Alarmed	4	4	4	4
Metal Framing - No Hardware	5	5	5	5	Unlocked; Alarmed	5	5	5	5
Standard Hardware	6	6	6	6					
Security Hardware, Keyed	7	7	7	7					
Security Hardware, Pinned	8	8	8	8					
Security Bars/wire mesh	9	9	9	9					

ARTIFICIAL LIGHTING				ALARMS					
Exterior		Exterior - Light Intensity		Interior		Type System		Status	
None	0	None	0	None	0	No Alarm	0		
Front	1	High	1	Front Only	1	Local Alarm	1	System On	1
Rear	2	Average	2	Throughout	2	Local & Central	2	System Off	2
Side	3	Low	3	Accent or		Central (Silent)		System	
Front & Rear	4	Unknown	4	Random	3	Auto Dialer	3	Inoperable	3
Front & Side	5					Telephone Monitor	4		
Side & Rear	6					Motion Detector	5		
Front, Side and Rear	7					Other Direct Line to H.Q. or Private Agency	6		

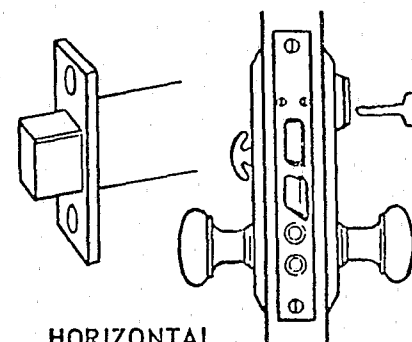
MISCELLANEOUS								
Occupancy at Time of B&E			How Long Has Resident Lived There; or Business Operated There?		Was Lock(s) Changed When Present Occupant Took Over?		Dog?	
Unit Unoccupied	0	Adjacent Unit(s) No Adjacent Unit in Building	0	Unknown	0	No Change In Lock(s) When Occupied	No Dog	0
Unit Unoccupied & Evidence of no Occupancy	1	Adjacent Unit Unoccupied (same building)	1	Less Than 1 Mo.	1	Primary Lock(s) Changed	Dog Inside	1
				1-6 Months	2			
Unit Occupied	2	Adjacent Unit Occupied (same building)	2	6 Mo.-1 Year	3	Auxiliary Lock(s) Changed	Dog Outside	2
				1-3 Years	4			
				More Than 3 Yrs.	5			
						Both 1 & 2 Above		3

PICTORIAL AID FOR COMPLETING DATA FORM 157

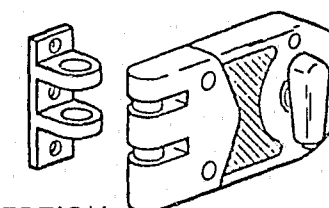


SNAP LATCHES

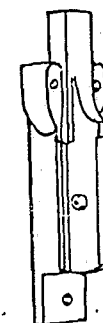
SNAP LATCHES WITH DEAD MAN



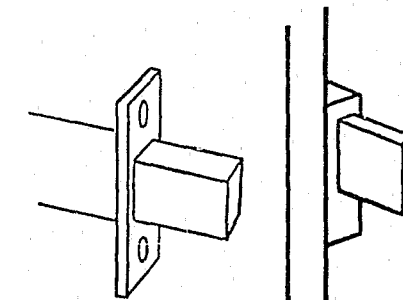
HORIZONTAL DEAD BOLT LESS THAN 1"



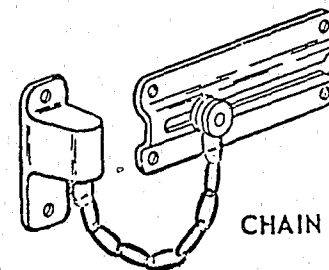
VERTICAL DEAD BOLT LESS THAN 1"



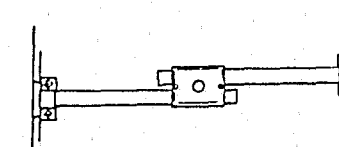
VERTICAL DEAD BOLT 1" OR MORE



HORIZONTAL DEAD BOLT 1" OR MORE



CHAIN LOCKS



HORIZONTAL BARS

FOLLOW-UP DATA SHEET
BURGLARY STUDY

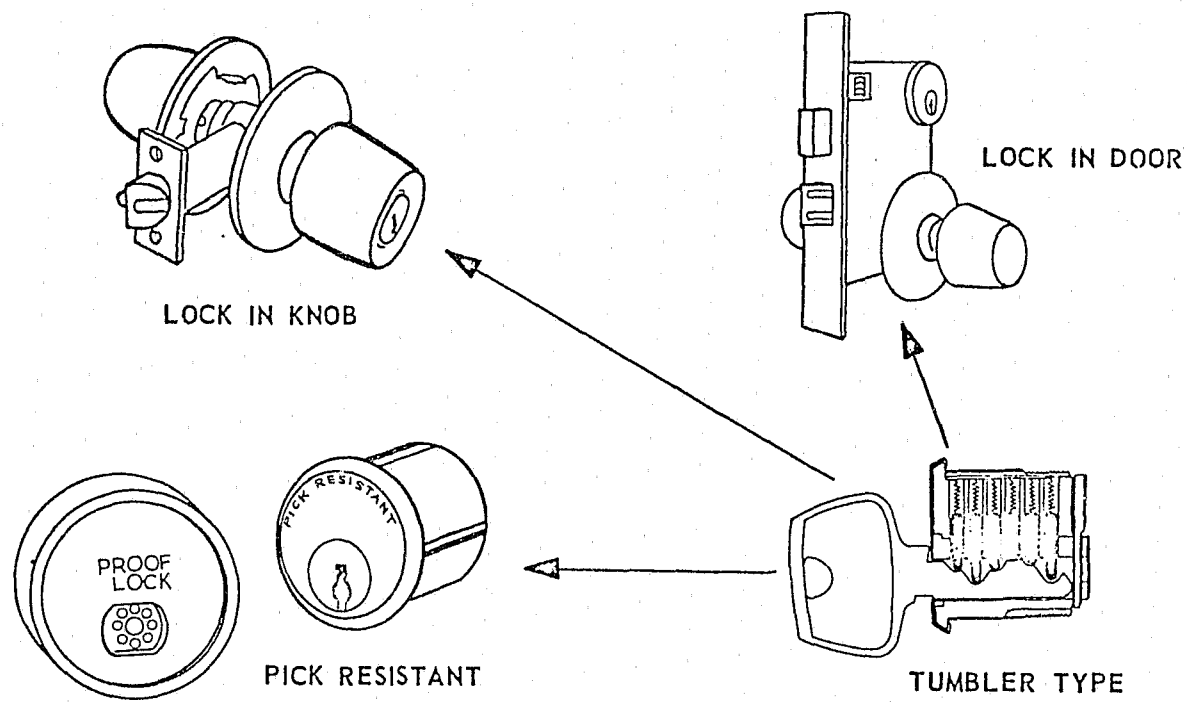
Officer _____

Case No. _____

Date Surveyed _____

Complainant _____

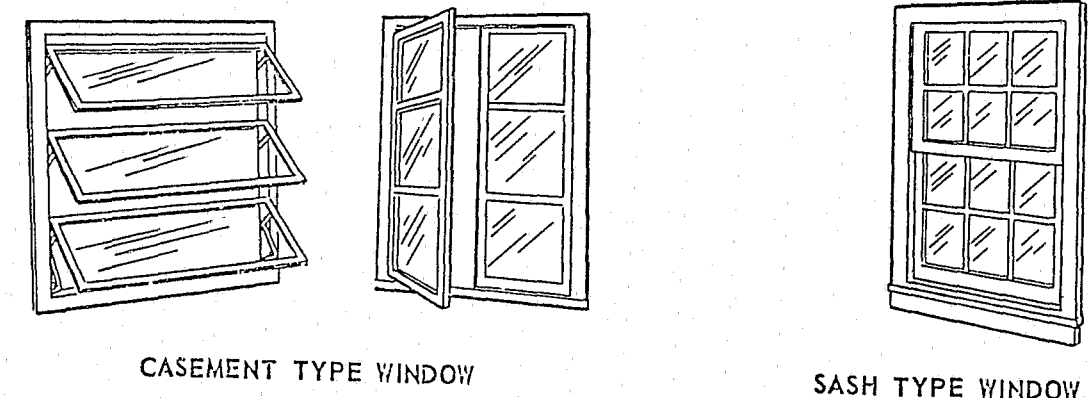
Address _____



LOCATION				BUILDING CONSTRUCTION			
				F	S	R	
On Main Street	1	Downtown	1	Glass	1	1	1
On Side Street	2	Suburb	2	Masonry	2	2	2
On Rear Street	3	Development/ Shopping Center	3	Wood	3	3	3
In Alley	4			Metal Over Glass	4	4	4
				Other	5	5	5



Construction	ROOF		ADJOINING BUILDINGS				
	Opening		Configuration		Security		
Unknown	0	None	0	Attached/Same Configuration	1	Same Security/Lighting	0
Shingle	1	Skylight	1	Separate/Same Configuration	2	Known Security	1
Slag	2	Emergency Exit	2	Att./Different Configuration	3	Better Lighting	2
Metal	3	Both 1 & 2 Above	3	Sep./Different Configuration	4	Both Security & Lighting	3
Slate	4	Other	4			Other	4



	DOORS					DOORS			
	F	R	S	B		F	R	S	B
No Doors	0	0	0	0	No Doors	0	0	0	0
Glass	1	1	1	1	Wood Jamb: Hinged Inward	1	1	1	1
Glass & Wood	2	2	2	2	Hinged Outward	2	2	2	2
Wood, Solid	3	3	3	3	Sliding	3	3	3	3
Wood, Paneled	4	4	4	4	Overhead	4	4	4	4
Wood, Hollow	5	5	5	5	Metal Jamb: Hinged Inward	5	5	5	5
Metal	6	6	6	6	Hinged Outward	6	6	6	6
Metal & Glass	7	7	7	7	Sliding	7	7	7	7
Metal & Wood	8	8	8	8	Overhead	8	8	8	8
Other	9	9	9	9	Other	9	9	9	9

2
4-4

BURGLARY STUDY

Instructions For Completing Form 158

WINDOWS					WINDOWS				
	F	R	S	B		F	R	S	B
No Windows	0	0	0	0	No Windows	0	0	0	0
Fixed Type	1	1	1	1	Plate Glass	1	1	1	1
Sash Type	2	2	2	2	Sheet, Single Strength	2	2	2	2
Casement Type	3	3	3	3	Sheet, Double Strength	3	3	3	3
Sliding(Horizontal)	4	4	4	4	Safety	4	4	4	4
Display	5	5	5	5	Laminated	5	5	5	5
					Insulating	6	6	6	6
					Plastic	7	7	7	7

LANDSCAPING Choose up to 4		NATURE OF POINT OF ENTRY			
No Landscaping	0	Not Concealed	0	Not Weakest Pt.	0
Trees & High Shrubbery	1	Concealed from View	1	Weakest Point	1
Low Shrubbery	2	COMMENTS: <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>			
Wooded Area	3				
Wooded Side(s)	4				
Front Fence or Hedge	5				
Side Fence or Hedge	6				
Rear Fence or Hedge	7				
Fence Four Feet or More	8				
Fence Less than Four Feet	9				

In General

Form 158 is used in conjunction with P.D. Form 157 to gather data on the physical characteristics of burglarized buildings. Form 157 is completed by the patrolman making the P.D. 7 since it includes data that could change soon after the burglary. The information on Form 158 is less likely to change and can be collected by officers in the Identification Bureau or other personnel who investigate the burglary at a later date.

To complete the follow-up data sheet, the investigator should check one number in each column on both sides of the form.

Some columns are grouped in sections and headed by F, R, S, or B. This represents the Front, Rear, Side(s), and Basement of a building. The address or street side of a building is the front. The sides of a detached building are usually alike and can be described in one column. If one side is attached to another building, report on the exposed side. The construction of doors and windows on one entire wall of a building should be described by checking one number in each column provided for that wall. If there are different types of doors or windows on the same wall, describe the one that appears to be the most insecure.

Adjoining Buildings or Units

The adjoining building or unit is the residence, store or apartment next door to the one burglarized. If a house is burglarized, consider the house(s) next door. If an apartment is burglarized, consider the apartment(s) down the hall. The adjoining building or unit may have a higher level of security as indicated by burglar alarms or security hardware. There may also be brighter lights next door. This information should be indicated in the proper column. If there is no apparent difference in security levels of adjoining buildings or units, check "0."

Doors

The door(s) on each wall should be described according to the materials and categories provided. For apartments, offices, or stores that are entered from a hallway, describe the hallway door as the front door.

Windows

Windows are generally either fixed or movable. Movable windows are either sash, casement, or sliding. Display windows are fixed, but should be checked as "display" when used on stores or offices.

Landscaping

When the point of entry is on an exterior wall of a building, landscaping can be a security factor. Check up to four factors in this column that apply to the burglarized building. "No Landscaping" would apply to apartments above the first floor.

Nature of Point of Entry

If the point of entry is concealed from the view of passersby or other tenants in the building, it should be indicated. Also, indicate whether the point of entry appears to be the weakest entrance to the unit burglarized.

END