AEROSPACE REPORT NO.
ATR-77(7617-20)-1

EQUIPMENT SYSTEMS IMPROVEMENT PROGRAM

CITIZEN ALARM SYSTEM FIELD TEST

Project Final Report

Law Enforcement Development Group

February 1977

Prepared for

National Institute of Law Enforcement and Criminal Justice
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION
U.S. DEPARTMENT OF JUSTICE

The Aerospace Corporation

Aerospace Report No.
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Contract No. J-LEAA-025-73

This project was supported by Contract Number J-LEAA-025-73 awarded by the National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U.S. Department of Justice, under the Omnibus Crime Control and Safe Streets Act of 1968, as amended. Points of view or opinions stated in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Justice.

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Approved

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ABSTRACT

A summary of the program activities that were implemented to conduct a field evaluation of the Citizen Alarm System is presented. The objectives of the system are: to reduce the frequency and consequences of personal attack crimes (rape, robbery, murder, and assault) and related citizen fear of crime by permitting crime reporting at or near crime initiation, thereby facilitating earlier police arrival. A formal field test was anticipated in order to determine the system effectiveness and acceptance by both citizens and the police personnel. The test planning activities associated with implementing the field evaluation of this concept are discussed together with the different scenarios in which the testing could be accomplished. A description of the residential scenario in Elizabeth, New Jersey, selected as the test site, is included together with a summary of the crime statistics for the test area and control sites. A functional description of the four hardware components (actuator, primary receiver relay, secondary receiver relay, and central station) is also provided. The report concludes with a discussion of the interface issues that were still to be resolved at the time of program termination.

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SUMMARY

This report documents the accomplishments of the field test of the Citizen Alarm System prior to task termination. The Citizen Alarm System is a new concept in law enforcement that provides the capability for a citizen to summon assistance at the onset of a criminal attack. Existing systems usually delay the victim's reporting until after the crime has been perpetrated.

The acceptance of the Citizen Alarm System by the general public and the response agents (e.g., police, guards) will depend on a number of different factors. For the citizen user, the primary concerns may be:

- Will my signal for help be received?
- Will the police get here in time to help me?
- How will the criminal react to my using the system?
- Is it easy to use?
- Is my actuator obvious to others?

On the other hand, the police will be concerned with such issues as:

- What is the nature of the emergency I am responding to - a man with a gun or a cat in a tree?
- Is this another false alarm?
- Will I be able to find the user?

Very little actual data from the operation of similar systems exist which can be used to help provide answers to these and other equally important questions.

The purpose of the field test program was to demonstrate that the Citizen Alarm System is a viable concept, that the equipment will reliably transmit the alarm message from an endangered citizen to a response agent, that the actuator carried by the citizen is durable and easy to purposely operate but difficult to accidentally actuate, and that a high percentage of citizens of a normal adult population mix can confidently use the actuator during periods of need.

The effectiveness of the system needs to be determined for both the users and the response agents. To provide a valid assessment, test planning was initiated to define a test of adequate size and variety such that the system can be quantitatively evaluated and its performance capabilities established. One phase of this planning was the definition of the data to be gathered which, when analyzed, will show the effect on crime, the degree of protection provided, how well the equipment performed, and how acceptable and marketable the system is.

Four different test scenarios (institutions, small business, residential, and public areas) were defined, together with hardware quantities and test period requirements. Public housing complexes in the city of Elizabeth, New Jersey (residential scenario), were selected by the National Institute of Law Enforcement and Criminal Justice as the initial test site. Copies of police incident reports for crimes occurring in these low-income, government housing projects during the 1971-1975 time period were analyzed by The Aerospace Corporation to provide insight into the following questions:

- Who are the most likely victims of crime?
- Who are the assailants?
- Where do the crimes occur?
- In how many instances would a Citizen Alarm System conceivably be of value?

Data were also gathered from similar projects in other areas to permit the selection of a control site.

Procurement activities were under way to select a subcontractor for manufacturing the hardware for the field test, installing it in the appropriate locations, and providing the maintenance during the test period. A second subcontractor was being selected to serve as the test conductor with responsibility for the detailed test planning, the performance of field surveys, test management, and data collection and reduction. An additional subcontractor for the production of an orientation and training film was also being selected.

These activities were terminated when the program for field testing the Citizen Alarm System was canceled by the Institute on 20 August 1976.

CHAPTER 1. INTRODUCTION AND CHRONOLOGY

In specific response to national concern over crimes involving personal attack (i.e., murder, robbery, rape, and assault), the Law Enforcement Assistance Administration initiated a program in 1973 to develop a Citizen Alarm System to provide a means for people to signal for help at the onset of a criminal attack. As envisioned, the system was to function indoors, as well as outside, and in private residences as well as public facilities.[1*] The development of the system has proceeded to the point of prototype manufacture and feasibility tests in various scenarios to demonstrate hardware operability (signal propagation, compatibility with existing power lines, and telephone lines). As developed, the system consists of four components:

- An actuator for initiating the call for help
- A primary receiver relay for detecting the presence of the alarm signal
- A secondary receiver relay to couple up to 127 primary receivers to a common data link
- A central station to process the alarm data and present it in useful form to the response agent

This development program was completed in June 1976, and a close-out report[2] was submitted to the National Institute of Law Enforcement and Criminal Justice in July 1976. System hardware is described in Chapter 5.

To provide a comprehensive assessment of the performance of the Citizen Alarm System under real-world operating conditions, a field test program of a combined indoor/outside system was initiated in FY 75. The objectives of the field evaluation include an assessment of the system by citizen users and by the responding law enforcement agencies, as well as an evaluation of the system impact on the person-to-person crime rate and the fear of crime in the test community. The program was intended to provide quantitative answers to such questions as:

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*Numbers refer to Notes on page 59.

- Is the Citizen Alarm System a viable concept?
- Will the equipment reliably transmit a message from an endangered citizen to a response agent?
- Is the actuator carried by the citizen easy to operate purposely but difficult to trigger accidentally?
- Can a high percentage of a normal adult population mix use the actuator with confidence during periods of need?

The FY 75 effort focused on general test planning and the development of a comprehensive field test plan. Program goals and test objectives were identified and then analyzed and quantified. An initial estimate of the data requirements necessary to evaluate each goal was developed. Aerospace was assisted by a subcontractor, the J. H. Wiggins Company, in a comprehensive data gathering effort in support of this test planning activity. Experts in the field of evaluation research, police programs, and citizen participation programs were visited or contacted by telephone to allow the test planning to profit by the experience others have gained in the implementation of similar evaluation programs. Survey methods and measurement techniques used on other programs were reviewed with respect to their applicability to the Citizen Alarm System field evaluation program.

In addition to the data gathering effort, the methods and procedures necessary to implement an evaluation of the system in four distinct applications were defined. The applications considered included: institutions such as schools, prisons, or hospitals; small businesses such as liquor stores or convenience stores; residences such as public housing or apartment complexes; and outside public areas such as streets and parks.

The residential scenario was selected as the test site for the initial evaluation of the Citizen Alarm System. Formal contacts were established with the city of Elizabeth, New Jersey, to determine the suitability of low-income Federal housing projects as test sites. Crime data for the years 1969-1974, plus test site geographic, demographic, and architectural data, were obtained from the police department and analyzed.

In late FY 75, two procurement packages, one for the field evaluation hardware and the other for a test conductor, were completed, approved by the National Institute for Law Enforcement and Criminal Justice, and requests for proposals were sent to industry. The hardware subcontract encompasses tasks for fabrication, installation, and maintenance for approximately 1500 citizen units in the test area. The test conductor subcontract covers tasks for detailed test planning, pretest surveys, test implementation, and data analysis and evaluation for the same scenario. In support of this procurement activity, a tour of the test sites was conducted for the prospective bidders on the two subcontracts. Precautions were taken to minimize any impact on the attitudes and impressions of the test site residents.

In early FY 76, three qualified bidders responded with proposals for the test conductor subcontract. These were evaluated, and the winning subcontractor was identified. However, due primarily to the lack of adequate data on the hardware development, no acceptable responses were received for the hardware fabrication subcontract. Additional activities were then initiated under the development task to complete the development and provide qualified sources for fabrication of the field test hardware. The subcontract for the test conductor was held in abeyance pending the selection of the hardware subcontractor.

In parallel with the development activity, additional crime data from Elizabeth, New Jersey, were analyzed, and three low-income housing projects (Pioneer Homes, Migliore Manor, and Mravlag Manor) were selected as the test site. Data were also gathered from other cities in order to identify suitable control sites. A public housing project in Trenton, New Jersey (Donnely-Page Homes), was identified as a control site. This facility has a functioning guard force, like Elizabeth, and is physically and demographically similar to the test site.

A subcontract was awarded to the Franklin Institute Research Laboratories for the measurement of radio frequency signal attenuation at 452 MHz within the Elizabeth, New Jersey, test site. The data indicated that the building walls and floors were somewhat transparent to the signal.

The source selection activity (i.e., preparation of the statement of work and technical requirements, proposal evaluation, and preparation of the subcontract data package) was also completed for the production of a training film. This film was to be used by Aerospace and the test conductor subcontractor to introduce the citizen users and the police response agents to the Citizen Alarm System concept and to the field test program and their role in it.

The final development activities for the Citizen Alarm System were completed under subcontracts to American Electronics Laboratories, Inc., and Rockwell International. Following successful hardware demonstrations at each of their facilities, requests for proposal for the production of the hardware for the field test program were sent to both companies. Technical evaluation of their proposals was completed, and a recommended source was identified. The subcontract data package was prepared for approval by the Institute.

The source selection activity and final negotiations were also completed for the subcontract for a test conductor to direct the test implementation, including data collection and analysis. This subcontract data package was completed and ready for delivery to the Institute.

The Citizen Alarm System field test program was terminated by direction of the Law Enforcement Assistance Administration on 20 August 1976, and all activities directed toward the implementation of the test program stopped as of that date.

CHAPTER 2. PROBLEM DEFINITION

The Citizen Alarm System is a new but unproven concept for reducing the number of crimes involving personal attack (i.e., murder, rape, robbery, and assault), and thereby minimizing the individual citizen's fear of being a victim of such a crime. This concept is based on the premise that providing citizens with the means of signaling for help at the onset of a criminal attack or when threatened instead of requesting assistance after the criminal attack has been perpetrated will provide earlier assistance to the user and will increase the probability of arresting the criminal. These two factors — earlier assistance and increased arrests — are expected to reduce the number of personal crimes and the corresponding fear of victimization. The realization of this objective is dependent upon acceptance of the system by both the users and the response agents.

The acceptance of the Citizen Alarm System as a concept for reducing crime and the fear of crime by police agents and private citizens will depend on three major factors:

- Its operability (ease of use and freedom from malfunction)
- Its freedom from false alarm abuse
- Its effectiveness in increasing the apprehension of criminals

These factors can be measured only by an appropriate field test.

The objective of the field test program was to perform a field test of adequate dimensions so that the effects of the system can be quantitatively evaluated and its performance capabilities established. The effectiveness of the system must be assessed from the viewpoints of both the user and the response agent.

CHAPTER 3. TEST PLANNING

The Citizen Alarm System field test program is intended to determine the impact of the system on such factors as crime rate, citizen/community attitudes, and response agent attitudes and resources with respect to true and false alarm situations. Formal test planning has identified the primary goals and objectives of the test program and the specific data requirements that will yield a statistically valid assessment of the system. The four primary goals and related test objectives are listed in Table 3-1.

The methods and procedures necessary to implement an evaluation of the system in four distinct applications have also been defined. The applications considered included institutions such as schools, prisons, or hospitals; small businesses such as liquor stores or convenience stores; residences such as public housing or apartment complexes; and outdoor public areas such as streets and parks. The potential test sites are listed in Table 3-2, and a brief summary of each of the four types of scenarios follows.

3.1 Institution Scenario

Institutions represent test situations with special populations and well defined boundaries. In general, crime conditions in an institution are known and some system of incident reporting already exists. Three logical institutional applications have been considered as potential test scenarios for the Citizen Alarm System: hospitals, schools, and prisons. Of these, the prison offers the best opportunity for testing because there is a need for such an alarm system, crime rates are high, deployment will be fairly straightforward due to typical prison geometry, and any positive effects of the system will be easily observed. Therefore, the prison scenario is used as the example of institutional application.

Several prisons were reviewed during the field evaluation preliminary planning phase to determine their suitability as field test sites. Site selection should be based on staff willingness and cooperation, high

Table 3-1. Citizen Alarm System Program Goals and Test Objectives

Program Goal	Test Objective
Provide rapid crime reporting to summon early assistance	o Determine user acceptance o Determine actuator handling capability o Determine response agent acceptance o Determine level of user/response agent communication o Determine probability of alarm usage o Determine number of calls-for-service o Determine crime reporting time o Determine response agent response time
Reduce the effects of violent crime	o Determine change in user fear level o Determine user assistance in response agent operations o Determine change in actual and reported crime rate o Determine deterrent effects o Determine displacement effects o Determine changes in arrest rate o Determine changes in number of persons injured o Determine changes in property loss due to crime
Determine hardware operability	o Determine hardware reliability o Determine transmission reliability o Determine transmission limitations
Provide benefits analysis	• Determine total costs • Determine measurable benefits • Determine implementation limitations

Table 3-2. Potential Test Sites

Scenario	Location	Type
Institution	Jackson, Michigan Tracy, California Chino, California Statesville, Illinois	Prison Prison Prison Prison
Small business	Detroit, Michigan Kansas City, Missouri Houston, Texas	Small business Small business Small business
Residence	Elizabeth, New Jersey Kansas City, Missouri Dade County, Florida Pittsburgh, Pennsylvania New Orleans, Louisiana	Public housing Public housing Public housing Public housing Senior citizen housing
Public area	Kansas City, Missouri Seattle, Washington Washington, D.C. Hyde Park, Illinois	Downtown streets Downtown streets LEAA headquarters University area

crime rate (in excess of ten crimes per 1000 staff per year), size (staff greater than 500 and inmate population exceeding 1000), and access of the test conductor to the prison grounds and facilities.

3.2 Small Business Scenario

The application of the Citizen Alarm System to small businesses represents a natural coupling between a special group of citizens (proprietors and clerks) and the public police. Many of this special group have alarm experience, since businesses have used silent alarms for a number of years. The on-person actuator will permit the proprietor or clerk to activate the system while separated from the cash-register-located alarm button. Dispatch is usually rapid, since the alarm is generally tied directly to a central station and/or police-monitored indicator board and the monitor knows that there is an emergency situation. Police usually assume that an armed robbery is in progress when a small business alarm is activated, and appropriate caution is exercised.

Field testing and evaluation of the small business scenario should be conducted in a group of establishments that are representative of high crime rate targets in large cities. Each participating store should be equipped with both actuators and a primary receiver relay. The actuators may be rotated between shifts among the key store personnel. The central station will be located at the nearest police station with presently configured equipment. One set of equipment will be adequate to provide accurate location of the crime since the receiver-relay of each participating small business will identify the business location. There will be little doubt as to the location of the person activating the alarm since, even if two businesses are close enough that two receiver-relays are triggered, the actuator code identifies the user and, therefore, his business location.

One difficulty in applying the Citizen Alarm System to small business involves the dispatch method. There is no provision for bypassing or shortening the dispatch process in the present configuration.

However, if the alarm were sent in parallel directly to a patrol car or a command post car, the system effectiveness in apprehending and arresting offenders would be greatly increased. Equipment modifications that would permit both local and central reception of the alarm system should be investigated.

Among the more important objectives of field testing the small business scenario are: determination of the probability of using the actuator; reduction of personal injury; and robbery deterrence.

3.3 Residential Scenario

The residential scenario represents a broadening of the test and evaluation of the Citizen Alarm System from the prison and small business scenarios. Because the general public will be involved for the first time, the control of the experiment is more difficult. The experience and education level of the residential users is generally lower than that of the correctional officers (users) of the prison. The capability and responsibility of response agents may vary, depending on use of private or public police. The system and test results will have a greater exposure to public observation and will probably reflect an increase in number of false alarms over the prison and small business applications. There is a greater possibility of all types of violent crimes being present.

Initial evaluation of the residential scenario can most easily be controlled by having it take place in one or more low-income public housing complexes. For this scenario, receiver relays would be placed in apartments, hallways, stairwells, and in outdoor areas around the buildings, and actuators would be given to adults and some teenagers, and perhaps be limited to one per apartment. Among the more important objectives to be evaluated in the residential scenario are whether or not the test participants will wear the actuator, use it in the event of an attack, or misuse it (either by physical abuse or by creating false alarms). A comprehensive training program will be required to encourage proper use of the device.

3.4 Public Area Scenario

The public area scenario is the most comprehensive and the most difficult one to define for the test and evaluation of the Citizen Alarm System. Widespread distribution of actuators to the general public and extensive installation of receiver relays on buildings, power poles, and light standards in streets and parks are anticipated. This scenario contains most of the critical aspects of the other scenarios (e.g., interface with public police), plus additional characteristics unique to this one (e.g., increased problems of victim location).

The complexities of the public area scenario are judged to be prohibitive with regard to probable early successes of system evaluation. Therefore, the initial evaluation of the public area scenario is expected to be delayed until some experience is gained from testing other scenarios, and then performing the test in a reasonably well-defined outdoor area.

One example of a public area test site might be a relatively well defined inner-city neighborhood area which has a higher than average crime rate. Such areas are found in many older sections of cities in the United States. Actuators would probably be distributed to only a fraction of the population to avoid saturating the response force with false alarms. Receiver relays would be placed at appropriate locations both inside the dwellings and in the surrounding streets and parks. Adequate definition of receiver relay location and installation is critical in the outdoors because greater opportunity exists for tampering, vandalism, environmental exposure, and general lack of observation. In this scenario, the training needs and objective priorities will be similar to those prescribed for the residential and small business scenarios.

3.5 Test Planning Conclusions

A direct comparison of the four scenarios previously discussed is shown in Table 3-3. The following assumptions were made:

Table 3-3. Summary of Preliminary Estimates for the Four Scenarios

Scenario Example Site (Size Factor)	Crime Rate (Per Year)	Measurement Resources	Coverage/ Site	Equipment Requirements/ Site	Survey Requirements (Personal Interview at Pre-Test, Questionnaire Subsequent)			Expected Number of Sites
					User Attitude	Response Agent Attitude	Victim- ization	
Institutions								
Southern Michigan State Prison (1100 staff on three shifts)	13 attacks on staff per 1000 staff	950 actuator-years	245 actuators per shift	[illegible] actuators 480 primary receiver-relay 40 secondary receiver-relay 1 Central Station	Yes	Yes	No	4
Small business								
Detroit (28,200 businesses of less than 4 employees)	147 reported robberies per 1000 small businesses	325 actuator-years	325 actuators (one per business)	356 actuators 356 PRR 356 SRR 1 CS	Yes	Yes	No	1
Residences								
Elizabeth, N.J. (655 units in Pioneer and Migliore)	33 reported crimes per 1000 residents	1400 actuator-years	655 actuators (one per unit) 22 actuators (one per officer)	734 actuators 982 PRR 76 SRR 1 CS	Yes	Yes	Yes	2
Public area								
Kansas City, Mo. (7000 residents)	40 reported crimes per 1000 population	1150 actuator-years	1150 actuators	1265 actuators 1305 PRR 65 SRR 1 CS	Yes	Yes	Yes	1 (Initially)

- An average of 4.5 staff members will be required to man one position 24 hours a day, 7 days a week, for the institutional scenario.
- Only businesses of less than four employees are to be considered for the small business scenario.
- Crime rates are listed according to common factors (staff, small business, residents, and population) in computing measurement resources.
- Equipment requirements assume 10 percent spares; actuators are passed on to next shift in prisons and small businesses; only one receiver relay is required for each small business; in the residential scenario, one receiver relay is placed in each apartment, at strategic locations in hallways and stairways, and on 200-ft grid spacing outdoors; and one secondary receiver relay processes 12 to 20 primary receiver relays in the various scenarios.

Multiple test sites will be required for institution and residence scenarios. Tests of the other two scenarios require the number of actuators (users) shown, although test results may indicate the need for additional testing at alternative sites.

Table 3-3 lists the scenarios in reverse order of both difficulty and complexity of conducting the test and the desirability of application of the Citizen Alarm System. The public area scenario is the most difficult, most complex, and most desirable application because of the widespread distribution of actuators to the average citizen for use in an open, relatively unrestricted area. However, for the test application the reverse is true, and the prison scenario provides the best characteristics for testing with limited return, high degree of control, and special population. The residential scenario chosen by the Institute for initial testing represents a compromise that should yield the maximum Citizen Alarm System activity per unit test cost using a controlled public setting with average citizens.

3.6 Test Site

After the residential scenario was selected by the Institute for the initial field test of the Citizen Alarm System, three low-income Federal

housing projects in the city of Elizabeth, New Jersey, were selected as the specific test site. This test site consists of two housing projects, Pioneer Homes and Migliore Manor, located adjacently in the southern portion of the city, and a similar housing project, Mravlag Manor, located 1.5 miles west of the other two, as shown in Figure 3-1.

Pioneer Homes, Migliore Manor, and Mravlag Manor are made up of a complex of low-rise (three stories) brick buildings of 1940 to 1960 vintage. The physical layout of these projects is shown in Figures 3-2 through 3-4. Characteristics of these housing projects are as follows:

	Pioneer	Migliore	Mravlag	Total
Number of buildings	12	8	15	35
Number of apartments	405	250	423	1078
Number of entrance doors	56	24	52	132
Population	1278	1409	996	3683
Part I crime rate [a/]	0.10	0.10	0.05	--

[a/] Reported incidents of murder, rape, robbery, and assault per resident for 1974.

The construction of these buildings is typically brick and concrete, as shown in Figure 3-5. However, there are some variations that may impact hardware deployment. Specifically, plaster on wire lath is used on some, but not all, interior walls, and steel doors are used both inside and outside some, but not all, apartments. Brick and block construction is used for some exterior and stairwell walls, and brick and structural tile are used for others.

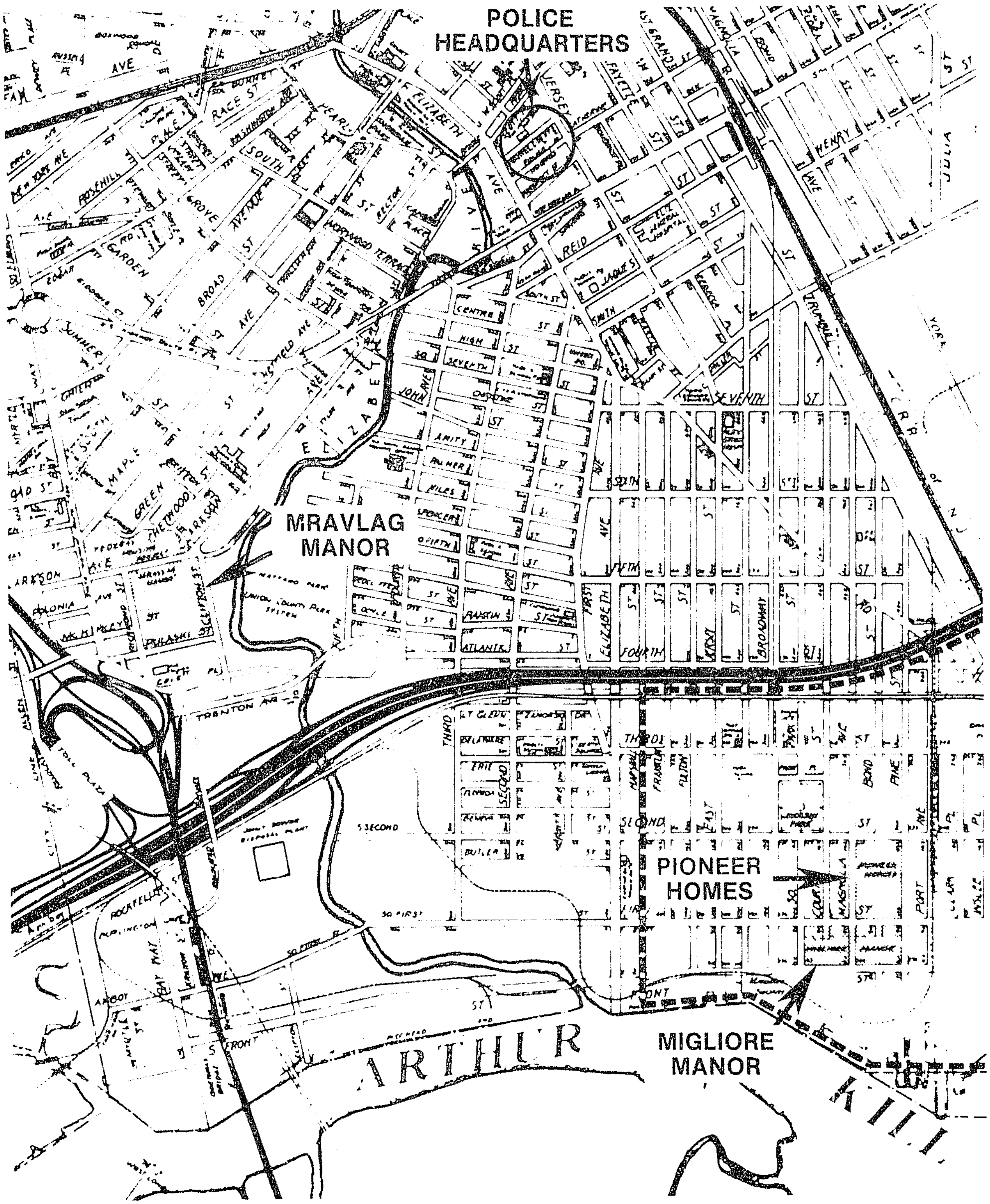


Figure 3-1. Elizabeth, New Jersey, Test Site

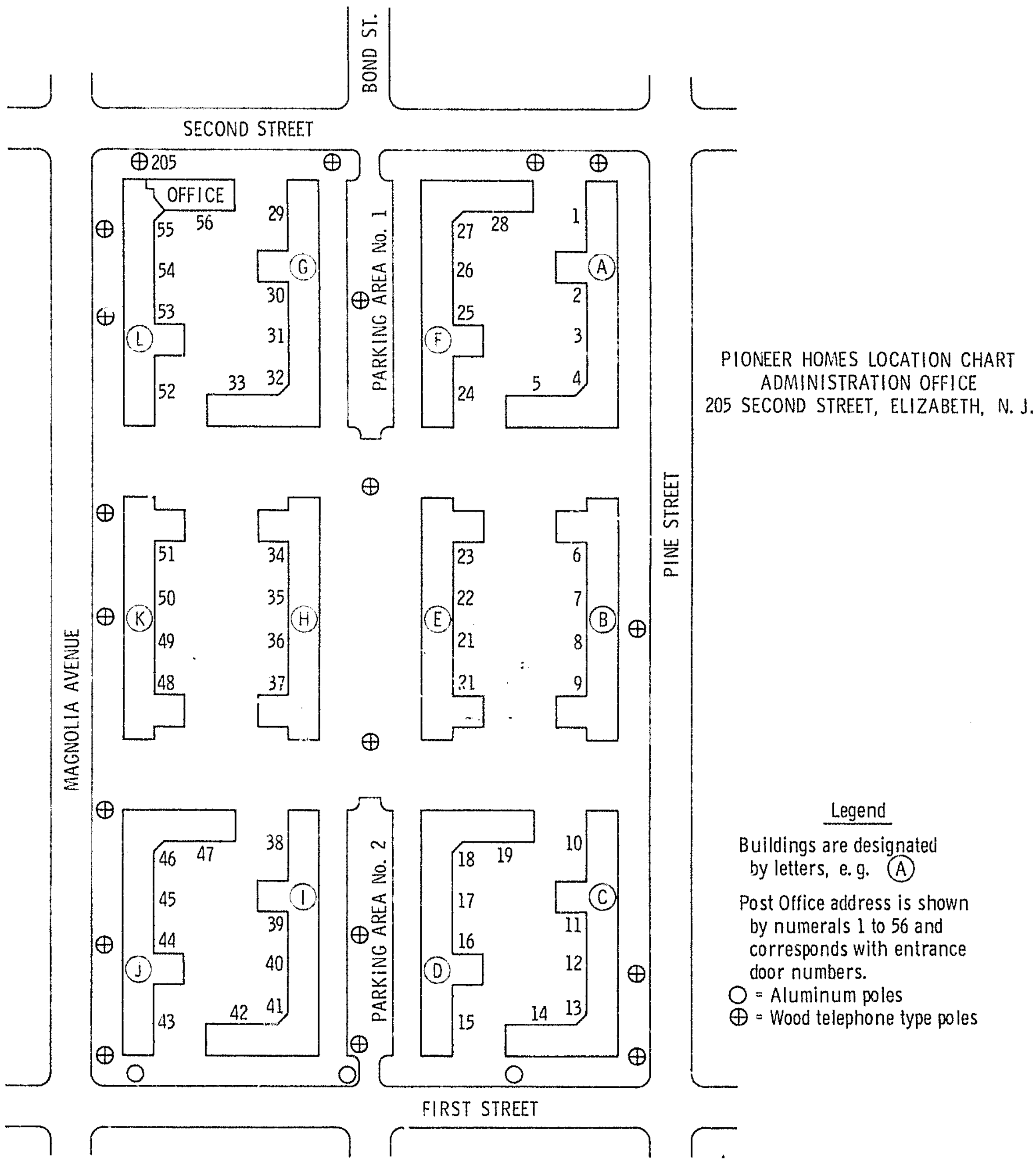


Figure 3-2. Pioneer Homes Test Site

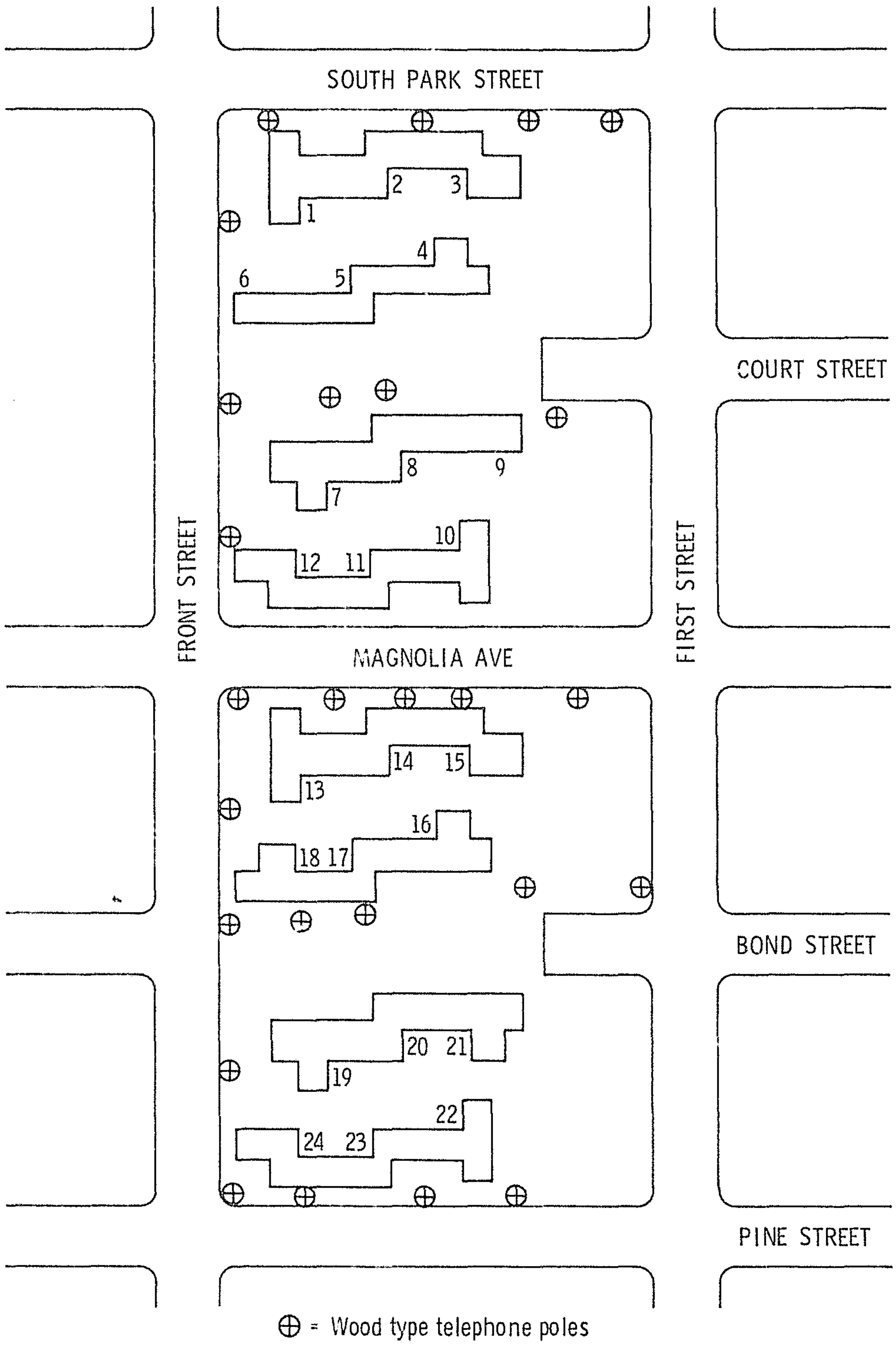


Figure 3-3. Migliore Manor Test Site

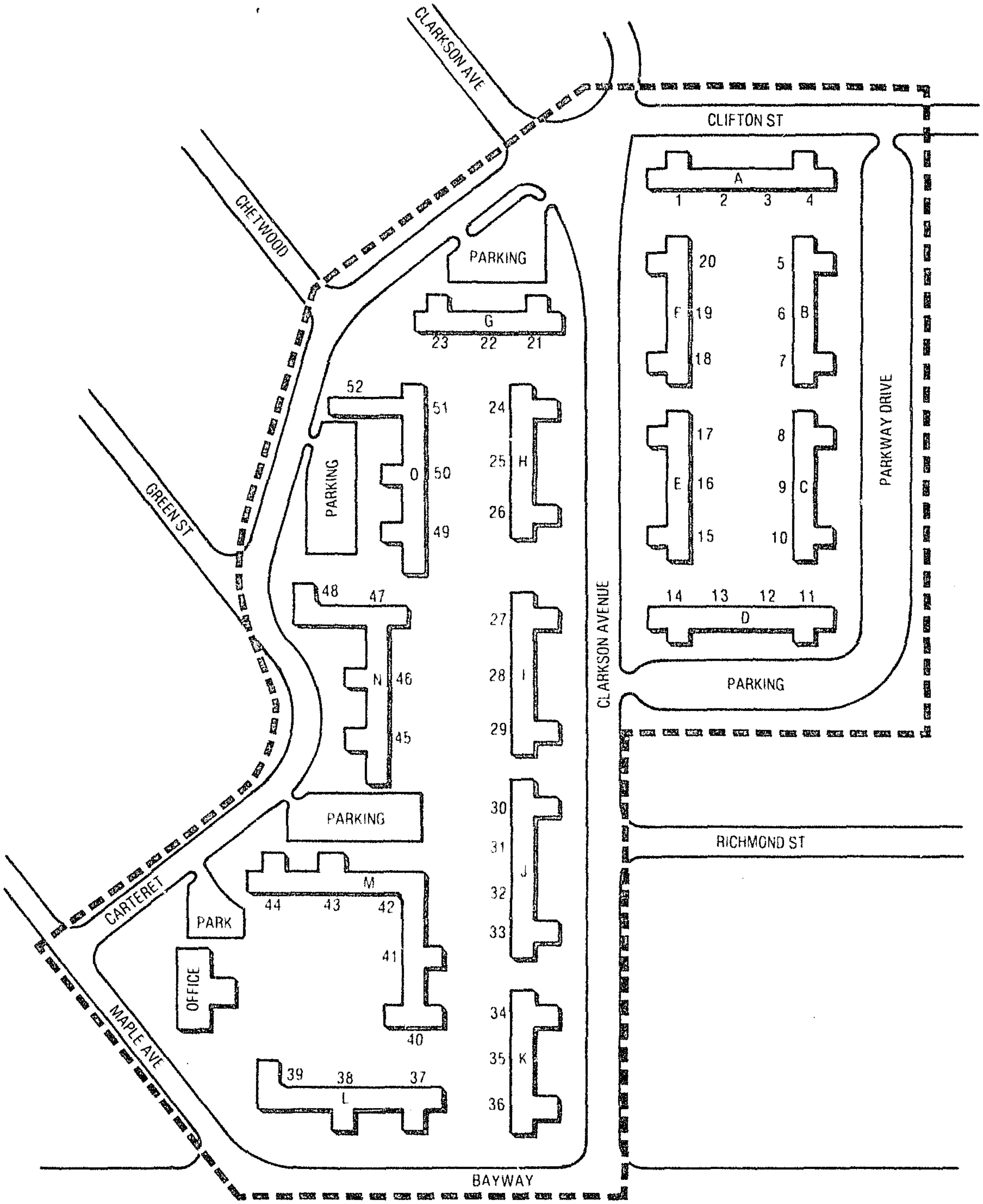
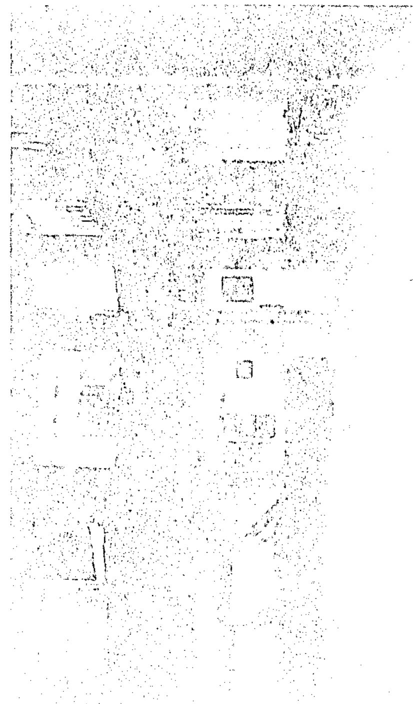
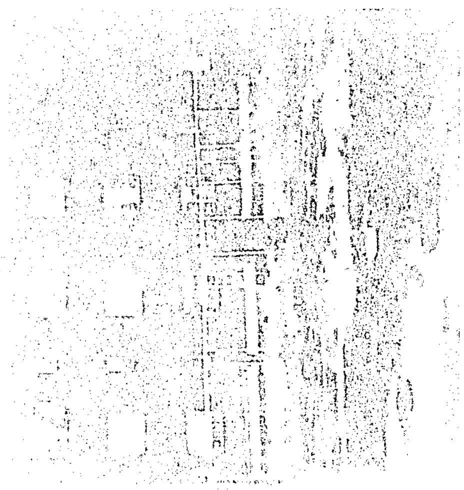


Figure 3-4. Mravlag Manor Test Site





Characteristics of the Donnely-Page housing project are as follows:

Number of buildings	27
Number of apartments	928
Number of entrance doors	193
Population	4176
Part I crime rate [a]	0.07

[a] Reported incidents of murder, rape, robbery, and assault per resident in 1974.

The Tasker Homes project in South Philadelphia, Pennsylvania, was recommended by Aerospace as an additional control site for the field test. This recommendation was made after considering several factors:

- The officials are most cooperative and eager to assist in any effort that may benefit the public housing scene as a whole.
- A functioning security force exists, providing 24-hour coverage, 7 days per week.
- The size, building structure, and ethnic mix are strongly similar to the Elizabeth, New Jersey, test site.
- Preliminary examination of crime statistics indicates that the crime rate in this project is comparable to that of the test site.
- A data collection system is presently established which will provide the statistics necessary to determine a baseline.
- The security force is stable for the indefinite future.

There are two points which detract from the overall acceptability of this project. First, the security force has been effective in reducing crime in the project over the past year, and this reduction is likely to continue (a normalization process will be required during data analysis to factor out this effect). Second, a contract has been let for the improvement of the project exterior in a further effort to reduce crime. The first year or more will involve the designing of appropriate improvements, with actual alterations to follow.

CHAPTER 4. TEST SITE DATA

4.1 Crime Statistics

4.1.1 Test and control site comparability. The assessment of the effectiveness, acceptability, usability, and benefit of the Citizen Alarm System is site dependent. In addition, any measurements of the above factors are conditioned upon the environment, participants (and all associated factors), trends, and spurious events. Such factors may be "normalized" in part by using pseudocontrol groups or nonequivalent groups. The successful measurement of the test effects is highly dependent upon the independent isolation of the test parameters for measurement. Confounding (interaction) of factors will always be present and should be measured where possible. However, the diversity of human behavior perpetrates a high risk of error in the interpretation of results. It is, therefore, desirable to minimize variates having undefined but possibly significant effects. Hence, a control site, including one or preferably more pseudocontrol groups, is a requirement for proper design of the tests.

4.1.1.1 Purpose of comparison sites. The purpose of the comparability study was to provide baseline comparability and insight into the characteristics and factors that are significantly related to the scenario and persons involved in the Citizen Alarm System function. Additional analysis included a preliminary characterization of detectable patterns.

4.1.1.2 Scope of comparison of sites. This study was limited to comparable time intervals. Since many factors vary with time, any simplistic assumptions or attempts to detrend the data were considered inappropriate to sound analytic methodology. Additionally, the comparability of two sites does not provide an adequate measure of comparability with additional sites. The two-site comparability provides an absolute difference only. The scope would be broadened if additional data for alternative sites became available.

The types of comparison are constrained by the existing forms of data. The available data were extracted from forms that were designed to document events rather than serve as a primary source of data for analysis. Data instruments designed specifically for analysis and evaluation were planned for actual test implementation.

4.1.2 Analytic procedure. The optimal planning procedure for data acquisition for comparability is generally:

- Define objectives
- Establish criteria for comparisons
- Develop comparative measures
- Determine data requirements
- Determine analytic methods

This procedure was followed within the constraints of available data and existing format which dictated the choice of analytic methods.

The data sources were the Elizabeth, New Jersey, Police Department, and the Trenton, New Jersey, Public Housing Security Force. The data instruments were investigation reports that were designed for investigative purposes rather than analyses. The data instruments, therefore, were not optimum for analytic purposes.

To extract usable information from the investigation forms, a method was devised for categorization and quantization of the data where possible. Categorization was standardized to National Crime Survey definitions when compatible. Initial coding for Elizabeth included categorization of narrative information from the investigation reports. However, subsequent evaluation for consistency between the individuals who selected the categories indicated that the variance was too high and the time required was too great to justify the extraction of narrative information for analytic use.

4.1.2.1 Crime categories. The crimes given primary consideration were those involving personal confrontation between victim and assailant. The Part I personal crimes (crimes of violence) of murder, rape, robbery, and aggravated assault, were considered in one category. Crimes involving victimization without personal confrontation (i.e., breaking and entering, burglary, and theft) were added to the Part I crimes and category as constituting all crimes in the data. Investigative reports for miscellaneous incidents, such as dog bites, incorrigible juveniles, and arrests on outstanding warrants, were not included in the analysis.

4.1.2.2 Editing of data. The investigation forms were used in Elizabeth for myriad incidents not directly related to criminal activity. This diversified use resulted in a higher percentage of miscellaneous and missing data than the data received from Trenton. This difference in consistency is partly attributable to the Trenton investigation reports being generated by the Housing Project Security Officers who saw to it that the forms were generally completed by one individual.

Data were initially available from Elizabeth for the period beginning January 1972 through May 1975. The interval over which data from the control site were available began at the time the Security Force became operational in April 1974 and continued through May 1975. Therefore, the period for comparability of the two locations was June 1974 through May 1975. Additional data were received from Elizabeth for the remainder of 1975. However, these data were of limited usefulness due to noncompatibility (in time) of data from Trenton, New Jersey.

4.1.3 Data analysis. The selection of sites for consideration as the test and control sites included the following composition factors:

- Crime
- Law enforcement
- Demography

- Socio-economic
- Geography
- Residential structures
- General scenario

An inherently implicit requirement is the availability of data on the factors required for initial comparability, which are also needed for a continuing baseline reference.

The sequence of analysis for comparability includes, first, the preliminary analyses, such as determining absolute numbers of events (counts) and proportions, missing data, and descriptive statistics. The second type of analysis involves tests for goodness of fit to distributions for which a valid theoretical basis or model exists. Also, factor analysis and correlation computations are performed to identify important attributes and interrelations where data measure permits. The third step is to perform tests on basic hypotheses and competing hypotheses for similarity and differences. The final step is the validation and evaluation of test results.

4.1.3.1 Preliminary analysis. Using the acquired data, a profile of the scenario could be presented in a number of ways. For example, the means or averages for factors such as age and time could be used, but this is considered to be too general. Another extreme would be to use all incidents of occurrence without categorization. This approach is muddled and considered to be counterproductive to valid statistical analysis. The alternative, considered optimal for these data, is quantile representation or categorization which permits significant categories to be isolated to the desired precision. The categories are represented as absolute counts and proportions (see Appendix A). The proportions are considered most important for use in making comparisons.

In order to generalize the scenario in absolute terms, the following may be stated:

- Teenagers predominate as offenders in Elizabeth, and young adults predominate in Trenton.
- Females are victimized more often than males in both locations, but the proportional difference is greater in Trenton.
- Elizabeth has a much higher portion of crime than Trenton between 1 AM and 9 AM.
- 70 percent of all crimes are committed against blacks in Elizabeth, compared to 80 percent in Trenton.
- The crime rate increases significantly in both locations during the months of June, July, and August.
- More crimes are committed on Saturday than any other day in Elizabeth; Tuesday, then Monday, are the days of most frequent crime occurrence in Trenton.
- The majority of crimes are committed in the victims' residences and on perimeter streets in both cities.
- Most crimes are committed by a single individual in both locations.
- For offenders, the most common age groups are 15 to 20 and 31 to 55 in Elizabeth, compared to 21 to 30 in Trenton.

4.1.3.2 Tests for distributions. Before performing any statistical analyses, goodness-of-fit tests for distributions were made on a number of variables of interest. Kolmolgorov-Smirnov tests were made to determine the probability of the sample variates being normally distributed and to establish the valid constraints imposed by the available data. The limitations on meaningful transformations were also assessed.

The results of the goodness-of-fit tests for the same parameters from both cities against empirical data produced probabilities of 11 percent or less that the data could have come from normally distributed populations. Consequently, in the analysis, tests requiring assumptions of normality of underlying populations were not used.

4.1.4 Comparability evaluation. A number of comparability tests were made for patterns, similarity, and differences. The more general and powerful tests for similarity were two-sample Kolmolgorov-Smirnov tests. Tests were made to determine the probability of no significant differences in the Elizabeth-Trenton populations for the test parameters considered. When all available data are tested for all categorized crimes (1 to 8) without any deliberate controls, the results are as given in Figure 4-1(a). The pattern indicates a common sample population between sites based on age, number of suspects, month and sequence — all of which have a computed probability of being a common population. The probability is less for day-of-the-week and sex (0.70 and 0.62, respectively), and the probability of no significant difference between site populations based on race and time is very small. The probability of the occurrence of similar crimes at a given time approached zero. However, even though the between group probabilistic differences appear great for the latter four variates, the pattern suggests possible interdependence of race with the time of the incident and, to a lesser degree, day-of-the-week with sex. This probability was examined using nonparametric correlation techniques.

When the crimes of burglary, breaking and entering, and theft are eliminated, the results are as given in Figure 4-1(b).

4.1.4.1 Differences. Another important comparison is to determine how the two sites differ in the level of dependence that exists between two or more factors. More than 40 variable pairs were tested using the chi-square test for independence. The extreme contrasts in independence of variable pairs are given in Table 4-1 for all categorized crimes and in Table 4-2 for the personal crimes of robbery, assault, assault with battery, breaking and entering, and burglary. Since the basic distributions by race are strongly skewed and the crime distributions by age groups are peaked over certain categories without controls, dependent relationships of other factors are expected. Table 4-1 shows that seven

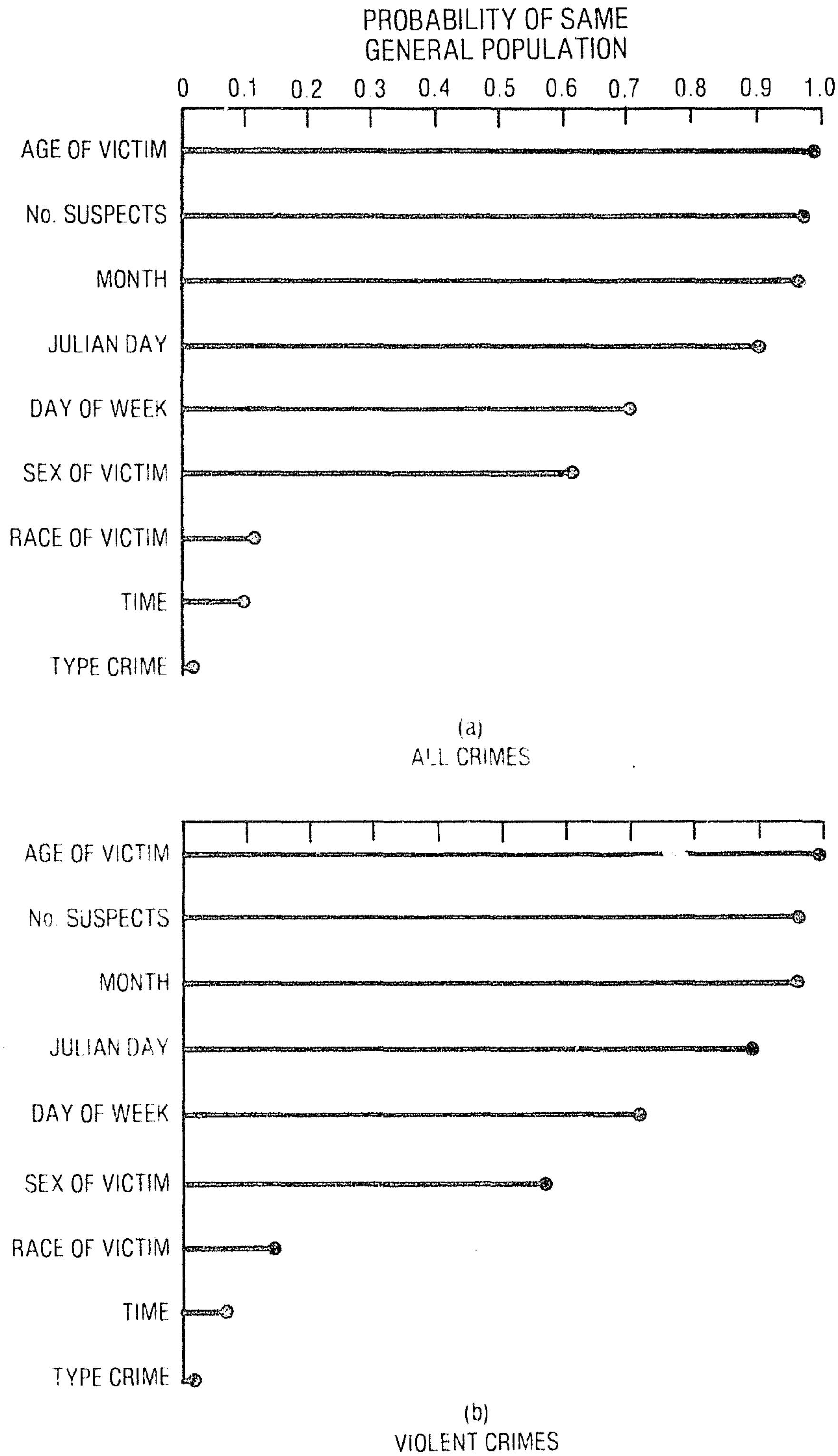


Figure 4-1. Similarity of Elizabeth and Trenton Populations: All Crimes and Violent Crimes

Table 4-1. Chi-Square Tests for Independence — All Crimes

Variable Pair	Elizabeth		Trenton	
	N	Significance	N	Significance
1. Month by location	290	0.6733	240	0.0001
2. Race by sex	180	0.0135	117	0.8003
3. Race by age	171	0.1727	116	0.0000
4. Race by crime	180	0.1543	115	0.0001
5. Race by age of youngest suspect	84	0.4709	88	0.0007
6. Sex by location	169	0.0000	118	0.1051
7. Age by suspects, number of	170	0.9967	117	0.0005
8. Location by age of youngest suspect	119	0.4458	123	0.0008
9. Number of suspects, age of youngest suspect	130	0.1221	125	0.0000

Table 4-2. Chi-Square Tests for Independence — Violent Crimes

Variable Pair	Elizabeth		Trenton	
	N	Significance	N	Significance
1. Month by day of week	200	0.0607	129	0.6620
2. Month by age of youngest suspect	97	0.0388	95	0.6557
3. Time by age	163	0.6910	101	0.0593
4. Race by sex	180	0.0135	117	0.8003
5. Race by age	150	0.2582	100	0.0000
6. Sex by crime	186	0.0623	116	0.7982
7. Age by number of suspects	154	0.9969	100	0.0117
8. Race by age of youngest suspect	94	0.4630	95	0.0010

of the nine most significant variable-pair differences involves race and age. Table 4-2 reveals the same trend; all significant variable-pair differences include race or age or both.

4.1.4.2 Discriminant analysis. Another method of testing for differences is a modified use of discriminant analysis for classification. For example, the occurrence of a personal crime in either of the two cities may be a function of the age of the victim and the time of day. If there are no statistically significant differences (as a function of time and age) between the incidence of crime in the two locations, the distinction should be comparable to that determined by chance alone — i.e., 50:50. Table 4-3 shows that, given the day and time of an incident, only age groups in both Elizabeth and Trenton and the sex of the victims in Trenton are distinguishable to a significant level.

4.1.4.3 Nonparametric correlation. Another method of comparison (paired) was Spearman's nonparametric correlation of location, day, and time. Correlation coefficients were computed for all categorized and personal crimes. The results for all crimes and personal crimes are given in Tables 4-4 and 4-5, respectively. The results indicate only slight correlation of location with time in Trenton and day with time in Trenton and Elizabeth.

4.1.5 Conclusions. The results of the comparability of the Elizabeth, New Jersey, test site scenario with the Trenton, New Jersey, pseudocontrol site scenario indicate that the two sites are compatible for evaluative test comparisons. The possibility of alternative control sites being more compatible does exist but has not been tested. The evaluation and use of alternative control sites would be strongly recommended.

4.2 Radio Frequency Propagation Measurements

The ultimate reliability of the system is dependent on the propagation of data from the actuator to the primary receiver relay. The location of the actuator within the test area at the time of an alarm will vary

Table 4-3. Direct Discriminant Analysis — Violent Crimes

Groups	Variables	Percent Correct City Identification	Significance
Cities	Day, time	50.5	0.086
Age (E)	Day, time	58.4	0.025
Age (T)	Day, time	58.6	0.063
Location (E)	Day, time	40.2	0.010
Location (T)	Day, time	51.2	0.790
Sex (E)	Day, time	53.5	0.342
Sex (T)	Day, time	64.4	0.002

Note: E = Elizabeth; T = Trenton

Table 4-4. Spearman's Correlation — All Crimes

Variables	Elizabeth		Trenton	
	τ	Significance	τ	Significance
Location with day	-0.008	0.885	-0.0805	0.215
Location with time	0.059	0.312	0.1194	0.066
Time with day	0.028	0.604	-0.0254	0.695

Table 4-5. Spearman's Correlation — Violent Crimes

Variables	Elizabeth		Trenton	
	τ	Significance	τ	Significance
Location with time	-0.010	0.887	0.132	0.119
Location with day	-0.026	0.726	-0.0727	0.417
Time with day	0.101	0.152	-0.176	0.046

at random, while the receiver location is always fixed, and the receivers must be deployed both inside and out of doors to provide the required coverage. The receivers mounted outside must be protected against the environment and should be located high up on the sides of buildings, or on light poles, to minimize vandalism. To protect the primary receivers mounted inside, it is desirable to mount them inside the apartments of the test participants. For emergencies that occur in the stairwell, the alarm data must be transmitted through a wall to the closest primary receiver.

A review of the test site construction blueprints indicated that metal lath and plaster were used in the outside and stairwell walls. Data in the literature, gathered in the interest of the communication paging business, indicated that propagation through these building walls presented a potential problem and that some means of enhancement might be needed for the Citizen Alarm System.

To establish the signal propagation characteristics in the test site buildings, a subcontract was awarded to The Franklin Institute to make attenuation measurements at 452 MHz. The data from these measurements would assist in determining the deployment of the primary receiver relays and would also verify coverage within the stairwells and within each room of the apartment.

The attenuation of an actuator signal due to the test site structure was found to be from 4 to 10 dB for outside walls and from 3 to 9 dB for floors and stairwell walls.[3] These values are well below what had been expected on the basis of industry literature (i.e., ~20 dB). The differences were surmized to be partly the result of leakage through doors and windows and partly because of differences between the building blueprints and the actual construction. The planned receiver deployment was thinned out slightly as a result of the reduced attenuation.

Plans were also being made to make background noise measurements, also at 452 MHz, to assist in the design of the radio receiver relay. These data are of particular importance in establishing the requirements for the receiver sensitivity and bandwidth to provide the required coverage, while at the same time minimizing the number of receiver relays that respond when an actuator is triggered.

The subcontract to make these background noise measurements was not implemented because of the program termination.

CHAPTER 5. HARDWARE

This chapter describes how the Citizen Alarm System hardware operates to provide the means of signaling for help at the onset of a criminal attack. The hardware design that resulted from the development phase is discussed, followed by a discussion of the changes that were proposed for the field test hardware by Rockwell International and American Electronics Laboratories, Inc.

5.1 Development

The Citizen Alarm System that has been developed consists of four principal components:

- An actuator for initiating the call for help by means of a coded radio frequency signal containing the citizen's identification.
- A primary receiver relay that detects an alarm signal, provides its own unique location information, and sends the message over the building power line.
- A secondary receiver relay to couple many primary receiver relays to a central station via a single telephone line.
- A cer ral station to operate on the alarm data and present it in usable form to the response agent.

The operation of each component and key interfaces are summarized in the following paragraphs.

5.1.1 Actuator operation. For the user, the actuator is the key element in the system. It is designed to be carried on the person and can be activated at any time and at any location within the confines of the protected area to summon assistance when the threat of personal attack exists. Each actuator is uniquely coded to identify the user and to transmit this information by radio frequency transmission to the primary receiver relay each time the unit is activated. The actuator digital code provides positive identification of the user and helps control false alarms. It also

permits the computer to keep track of units that have been lost or stolen and suppress signals from them to prevent malicious false alarms.

The radio frequency transmitter in the actuator is designed for narrow-band radiation. Three small wafer batteries power the transmitter with a radio frequency output of approximately 1 microwatt (-30 dBm). The transmitter frequency is crystal controlled, and the circuitry uses large-scale integration (LSI) technology. To maximize system location accuracy, it is important that a minimum number of receivers are triggered by a single alarm. The design goal was a 50 percent probability that a receiver at 500 feet will be triggered. This provides a probability of 0.99 that at least one receiver on a grid with 500 feet spacing will be triggered when the actuator is at the center of the grid.

A 32-bit identification code was implemented in the actuator. Twenty-four bits are used in a binary-coded-decimal format to provide unique identification for up to 100,000 individuals, while the remaining eight bits are used for synchronization and parity. This 32-bit code is transmitted at a rate of 500 bits per second. The alarm transmission occurs after a 2-second delay from the initiation of the alarm and lasts for 1 second. This delay permits the user to remove his hand from the switches, thereby minimizing pattern distortion and attenuation of the signal. A 30-second silent period then follows, after which the alarm is automatically retransmitted for an additional 1 second. During each 1-second transmission time, the user's identification code will be transmitted to the primary receiver relay approximately 15 times, thereby providing redundancy and improved reliability.

In the development phase, two LSI chips were utilized on the digital board of the actuator. A shift register chip manufactured by RCA was used to store the user identification code. The system timing and frequency control is provided by a standard LSI chip design,

customized through the interconnection circuits to satisfy system requirements. This unit was fabricated by International Microcircuits, Inc., in Santa Clara, California.

5.1.2 Primary receiver relay operation. The primary receiver relay was designed to be strategically located within the protected area and to continuously monitor for the presence of an actuator's radio frequency alarm signal. When an alarm signal is received, the user identification data are stored in the receiver and the central station is alerted that an alarm exists. Under control of the central station, the primary receiver relay then retransmits the user identification data, utilizing existing power lines within the protected building to transmit this data via a secondary receiver relay to the central station. Use of the existing building electrical wiring minimizes the installation costs of the system and provides a reliable transmission medium.

A time division multiplexing scheme was implemented during the development phase to control the transmission of data to the central station and to provide system supervision. Each receiver relay is designed to respond at a specific time that is keyed to a timing reference transmitted from the central station. Each receiver transmits a 4-bit message at its designated time slot, which identifies its operational status and either the presence or absence of an alarm.

In the development phase, the communication between the primary receiver relay and secondary receiver relay utilized the 110-volt, 60-Hz commercial power lines. However, the system could also be implemented using a number of other methods for relaying the actuator data from the primary receiver relay to the central station, including: hardwire, radio frequency link, and cable TV.

5.1.3 Secondary receiver relay operations. The secondary receiver relay serves as a transmission interface between the primary receiver relay and the central station. Data are received from the primary

receiver relay over the power lines and retransmitted over a dedicated telephone line to the central station. By utilizing the existing wiring circuits, the secondary receiver relay can couple a number of primary receiver relays (up to 127) to the central station via a single, dedicated telephone line.

5.1.4 Central station operations. The central station is the "brains" of the system. It must accept the digital data transmitted from the primary receiver relay, check for errors, determine the location of the primary receiver relay that received the alarm and the identification of the actuator transmitting the call for help, and then display these data in usable form to the response agent. A mini-computer is used to store the data on actuator serial number and user identification, primary receiver relay identification and installed location, and lost or stolen actuator data. It also contains the necessary software routines to translate the received data into information readily understandable by the response agent.

Hardcopy printout of the time of the alarm, and user identification and location, are generated to expedite response and to furnish a permanent record of the alarm. Audio and visual indicators are also provided to announce the presence of an alarm to the response agent.

The central station uses a commercially available mini-computer such as the PDP-11/05, manufactured by the Digital Equipment Corporation. Commercial equipment for the interface modems, displays, and hardcopy printers are also available.

5.1.5 System interfaces. In the development program, a time division multiplexing scheme was implemented to control the transmission of data from the primary receiver relays to the central station, and to provide a means of supervising the system. In this system, the central station provides a clocking pulse to each of the secondary receiver relays connected by a telephone line interface. This clocking pulse is

relayed, in real time, to each of the primary receiver relays interfacing with that particular secondary receiver. This pulse advances a clock within the primary receiver relays, each of which is programmed to respond at a different time slot. If the maximum of 127 primary receiver relays are connected to a single secondary receiver relay, each primary receiver relay would be interrogated every 1.7 seconds. For smaller numbers of primary receiver relays, the interrogation rate increases proportionately. Polling by the mini-computer is based on the actual number of primary receiver relays connected to the secondary receiver relay, and the supervision of each secondary receiver relay is independent of both supervision and alarm transmission on other secondary receivers.

At the appropriate time slot, each primary receiver relay transmits a 4-bit message to the central station, which is used to determine whether or not an alarm condition exists. Failure to respond at the appropriate time slot is interpreted by the central station as a hardware failure/tamper condition requiring maintenance, and the primary receiver relay in question is identified to the response agent. When an alarm condition is transmitted from the primary receiver relay and verified by the central station on two of three successive polling cycles, the central station stops at the appropriate time slot on the next polling cycle and extracts the actuator data from the primary receiver relay. The actuator code, primary receiver relay time slot, and secondary receiver relay input line are then used to identify the user and his location to the response agent. System supervision of primary receiver relays connected to other telephone lines continues independently of this data communication between the primary receiver relay and the central station.

Under the worst-case conditions (i.e., four polling cycles required to establish an alarm condition with two out of three voting), a maximum of 6.8 seconds (4 polling cycles × 1.7 seconds per cycle) will be utilized in determining the presence of an alarm at a primary

receiver relay; 0.85 second to transmit eight actuator identification codes to the central station; and 4 seconds to complete the data processing and print and/or display this information to the central station operator. After processing the first alarm, each succeeding alarm can be displayed by the central station in essentially 1-second intervals.

Receipt of a single alarm is sufficient to dictate action by the response agent. The central station component is designed to be compatible with either private or public security response agents.

5.2 Field Test

Following the completion of the development efforts, both Rockwell International and the American Electronics Laboratories, Inc., were requested to review the system requirements in light of the design and test results and recommend such changes, modifications, deletions, or additions that they felt would decrease the cost and schedule for fabrication of the field test hardware or improve its reliability. This section summarizes the major conceptual changes recommended by each contractor. For a more complete discussion of the proposed changes, the reader is referred to the development final reports [4,5] submitted by each contractor.

The basic system requirements for the configuration to be used during field testing are as follows:

- High system reliability, greater than 99 percent
- Hardware response time of less than 10 seconds
- Low susceptibility to environmental factors, noise, etc.
- Human engineering for acceptability and ease of use
- Selectable range of 50 to 200 feet between actuator and primary receiver relay
- Low cost per user (actuator costs of less than $100)
- Low probability of accidental false alarms
- Low susceptibility to interference due to simultaneous multiple actuations

5.2.1 Rockwell International. The major conceptual change to the system proposed by Rockwell was intended to aid the UHF receiver in the acquisition of the actuator signal. A second consideration was to provide discrimination against interfering signals in the expected dense signal environment at the test site.

5.2.1.1 Actuator. A technique preferred by Rockwell for signal acquisition is one in which the actuator transmits a unique and deterministic signal structure, thus allowing the primary receiver relay to search for the actuator signal format while rejecting undesired interfering signals. In selecting an actuator signal format, the deterministic signal can be provided by either a coded bit pattern or a unique sidetone frequency. The signal structure must be common to all actuators and would be transmitted during the first part of the alarm signal (e.g., 400 per second).

Although a coded bit pattern would provide the maximum degree of protection against false signal detection, it significantly increases the complexity of the signal processor in the primary receiver relay. The increased complexity was not warranted in lieu of an alternative sidetone system.

An actuator signal format was selected that is both deterministic and easily detected. This signal format employs the transmission of an FM sidetone, common to all actuators, during the first 500 milliseconds (acquisition period) of a 1-second alarm message.

Following the 500-millisecond period of acquisition tone, the actuator will transmit seven repeated data fields each 64 bits in length, a total of 448 bits in 448 milliseconds. Each data field is subsequently subdivided into a 36-bit sync field and a 14-bit Manchester coded (28-bit NRZ) identification field. The 14-bit identification field is sufficient to provide 16,384 unique identification codes.

5.2.1.2 Primary receiver relay. The signal acquisition process for the primary receiver relay is one that will scan the UHF receiver in discrete steps over the frequency uncertainty, and will check at each step for an actuator sidetone signal. The existence of a sidetone causes the scan to be inhibited, the AFC to be enabled, and a second check to be made. A success on the second check will allow the acceptance of the actuator identification portion of the message. The only time-consuming portions are those necessary for tone integration and message acceptance. The tone integration time is approximately the inverse of the tone filter half-bandwidth (e.g., a 100-Hz tone filter requires 20 milliseconds), and the message acceptance time is the period of the actuator transmission, 1 second).

5.2.2 American Electronics Laboratories, Inc.

5.2.2.1 General description. The proposed Citizen Alarm System uses frequency domain multiplexing techniques, as contrasted with the time domain multiplexing technique used in the existing development design. This change substantially reduces the complexity of the primary and secondary receivers and the workload of the central processing unit.

For the user, system operation is unchanged. The actuator is the same in both systems, and the hardcopy reports and displays are similar. The major difference is that the proposed system operates in real time. As shown in Figure 5-1, the primary receiver becomes a true relay unit which simply converts the receiver alarm signal to a new frequency and couples it to a coaxial transmission line. Up to 100 primary receivers may be coupled to the same coaxial line, with each converting to its own unique frequency. If necessary, two or more lines can be combined using a coaxial switch. At the central station, a synthesizer-tuned scanning receiver checks each of the 100 channels for signal occupancy. If a signal is encountered, the central processor unit commands a second receiver to the occupied channel. Since each primary receiver generates a unique frequency, and since the precise frequency of the synthesizer is known at

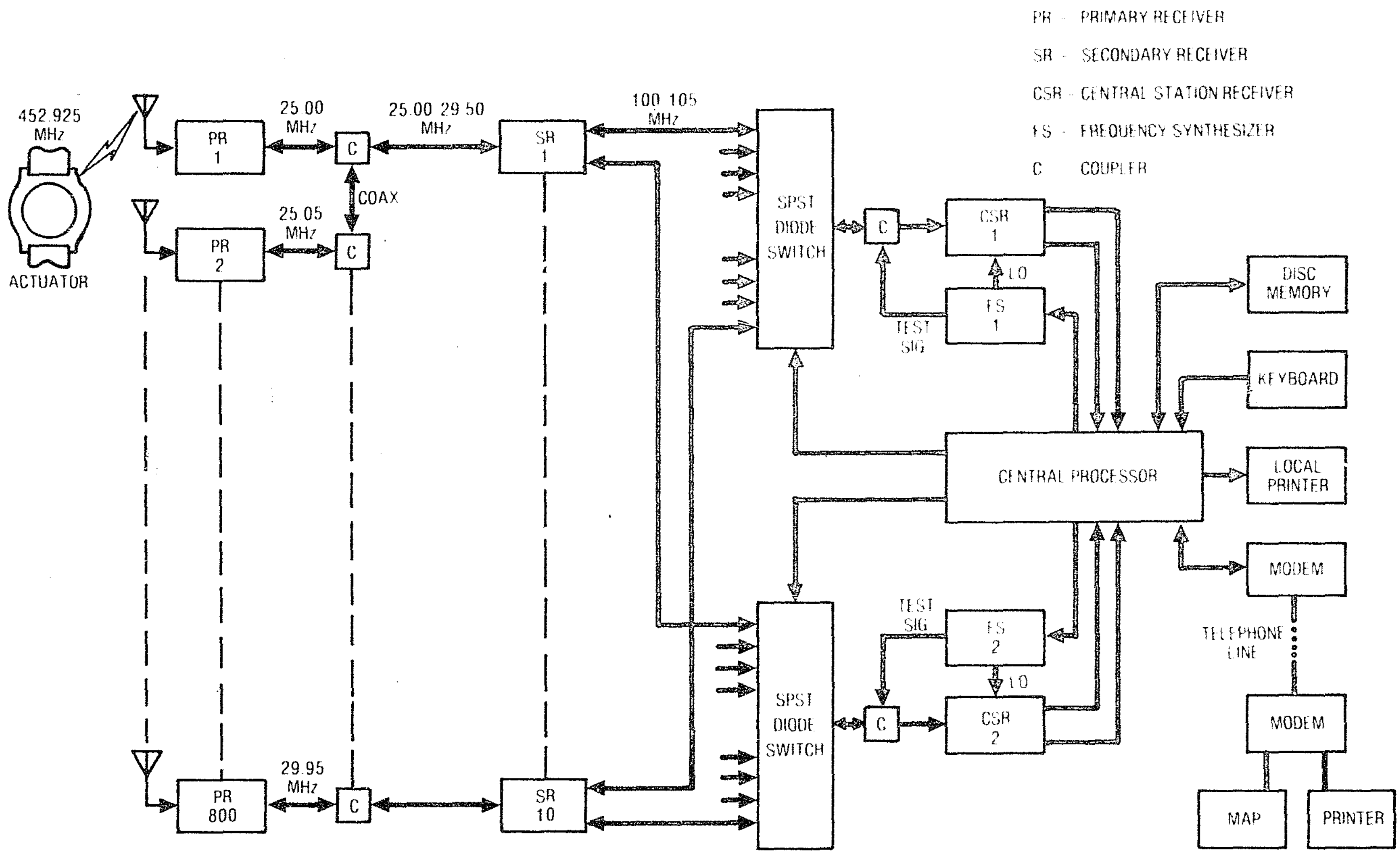


Figure 5-1. System Block Diagram

any given time, each primary receiver can be identified. Further, since the central station receives the actuator transmission in real time, and since the biphase-modulated code is self error detecting, it will usually not be necessary to process more than 200 milliseconds of the actuator transmission. Thus, four or more primary receivers receiving the same signal can be processed, and an accurate estimate of location can be made within a few seconds.

The proposed system implementation also allows a true self-test diagnostic capability. Since each primary receiver contains a unique local oscillator, and since coaxial transmission lines are inherently bidirectional, a test signal can be sent from the central station that will activate only one primary receiver. Thus, quantitative measurements of system performance can be made automatically, stored, and compared with data taken at other times.

5.2.2.2 Theory of operation. Two typical operational scenarios, alarm and test, are illustrated in Figure 5-2. Arrows indicate the direction of signal flow and nominal frequencies are indicated.

Normally, the system is "dormant," waiting for any alarm. When an actuator is triggered, its 452.925-MHz signal, with its unique digital code, is radiated to one or more nearby primary receivers. In this example, three receivers (PR 1 on line 1; PR 2 on line 1; and PR 1 on line 2) receive the alarm.

Each primary receiver converts the received signal to a new frequency based on its assigned PR number. For all PR 1 units, this signal is 25.00 MHz. For all PR 2 units, it is 25.05 MHz, etc. The signals on line 1 are, therefore, at 25.00 and 25.05 MHz, since only those units received the actuation. On line 2, PR 1 also received the signal and therefore it was converted to 25.00 MHz.

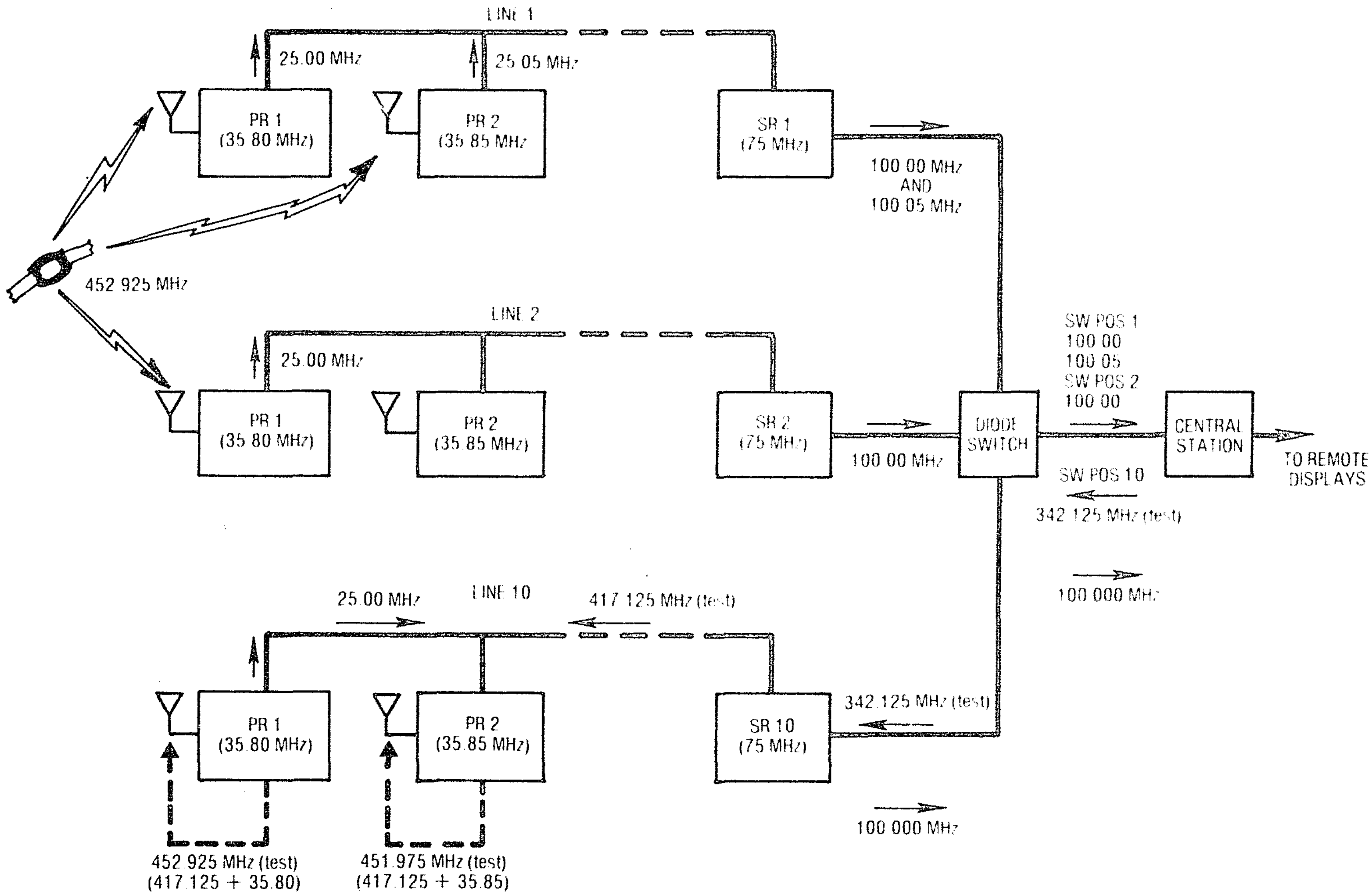


Figure 5-2. System Operation

The predetected signals pass down the line to their respective secondary receivers (SR). At the secondary receiver, signals from the primary receivers are converted to a new set of predetermined frequencies between 100 and 105 MHz.

The outputs of all secondary receivers are combined through a pin diode switch and transmitted to a scanning receiver that recognizes each unique active channel. The received actuator alarm will appear to this receiver as a signal on one of its 100 channels. The channel information and signal level information are then sent to the central processor unit, which selects the highest level received and commands a second receiver to the corresponding channel. The incoming signal is decoded and sent to the central processing unit. For a strong signal, this will require no more than 120 milliseconds. The central processing unit then commands the receiver to the remaining channels in signal strength order. As valid code is received, the central processing unit performs look-up operations in its files and reports the necessary data to the operator.

This is a "real-time" system. The operation described above occurs during the 1 second that the actuator is transmitting. Because the actuator is repeating its code many times during its 1-second transmission and the system knows which receiver has the strongest signal, the correct code from up to seven primary receivers can be obtained within 1 second.

The test mode of the proposed system is extremely powerful in that it checks the complete performance of the system. In the test mode, signals are provided which, when they arrive at a selected primary receiver, are at 452.925 MHz. This is shown in Figure 5-2. The 342.125-MHz test signal is shown on the right of the diagram. This signal, as it passes through secondary receiver SR 10, is converted to a test signal at 417.125 MHz. This signal, when it arrives at primary receiver PR 1 on line 10, is converted by the internal 35.80-MHz oscillator to

452.925 MHz. This signal is injected into the input of the receiver and is "received" as described above and, therefore, a 25.00-MHz test reply returns to secondary receiver SR 10 where it is converted to 100.00 MHz. The computer recognizes this as the unique signal from primary receiver PR 1 on line 10 that indicates it is operating properly within set limits.

Note that, at primary receiver PR 2 on line 10, the resultant signal is at 452.975; therefore, it is out of the passband of this receiver. To test PR 2 on line 10, the test signal must be at 342.175 MHz.

The test mode can be programmed to occur every minute, every hour, or as often as desired. It can also be controlled manually for maintenance or calibration purposes. Once every 8 hours should be enough to provide the required system availability once the system is fully operational. The duration of the test signal is approximately 0.1 second and, thus, will not seriously affect the normal reception of alarms.

At the central station is a computer that has in its memory the location of each primary receiver (both in text and in grid coordinates) and the owners of the actuators (both in text and in grid coordinates). When an alarm occurs, these data are available to remote printers and an illuminated map at the police station.

CHAPTER 6. TEST IMPLEMENTATION

The implementation of a test program to evaluate the effectiveness of a new concept such as the Citizen Alarm System requires the cooperative participation of a number of individuals who represent government agencies, private contractors, and individual citizens. The responsibilities of each participant must be clearly defined, and each must understand his role in relationship to the total program. The potential issues and risks associated with a program designed to reduce the effects of crimes against people must also be recognized.

6.1 Test Responsibilities

The key participants in implementation of the test program and their overall responsibilities are discussed in this section.

6.1.1 National Institute of Law Enforcement and Criminal Justice. The National Institute of Law Enforcement and Criminal Justice, U.S. Department of Justice, was the government agency responsible for the development and field testing of the Citizen Alarm System. The Institute had final approval in all matters relating to the site selection, development, procurement, distribution, and testing of the equipment in support of this evaluation program.

6.1.2 The Aerospace Corporation. Under a contract with the Law Enforcement Assistance Administration, The Aerospace Corporation was responsible for the system development, overall test planning, conduct of the test, and test evaluation. Subcontractor support was used in the development of the system, and support to Aerospace from local test site agencies and subcontractors was planned for the field test program.

6.1.3 Participating government, housing, and response agencies. The agencies and individuals who have participated in various phases of test planning are as follows:

6.1.3.1 Elizabeth Police Department, Elizabeth, New Jersey. Lieutenant Thomas J. Mango, Planning, and his supervisor, Deputy Chief Patrick J. Maloney, Administration Section, made available the entire staff and facilities of the Elizabeth Police Department. These officers provided copies of crime statistics from the test site, information on dispatch and response procedures, details on the guard force operations, and assistance in the collection of structural information about the test site. The Elizabeth Police Department served as the focal point for the planning effort in Elizabeth. Also, Mr. Joseph Brennan, Director of Police, and Michael D. Roy, Chief of Police, lent the authority and dignity of their offices to the test program and various public relations activities, such as discussions with representatives of the housing tenants and briefings for potential subcontractors.

6.1.3.2 Housing Authority of the City of Elizabeth. Mr. J. William Farley, Jr., Secretary-Treasurer and Executive Director, provided information about, and access to, the test site and the tenants of the test site. His office staff made available appropriate blueprints, together with maintenance assistance, during the measurement of alarm actuator signal attenuation caused by building walls and floors. Mr. Farley was helpful in the execution of a Memorandum of Understanding between the Housing Authority and Aerospace which defined mutual responsibilities during the field test. His office also provided key contact points with electric power and telephone company officials and engineers.

6.1.3.3 Housing Authority, City of Trenton. The Executive Director of Trenton's Housing Authority, Mr. Joseph Tysowski, provided details on control site demographics and physical layout. His assistant, Sergeant Ernest Williams of the Trenton Housing Police Force, made available copies of crime statistics for the control site (Donnely-Page housing project).

6.1.3.4 New Jersey State Law Enforcement Planning Agency. Mr. Thomas J. O'Reilly, Chief, Police Programs, and Mr. Alvin J. Beveridge, Principal Program Analyst, made available the authority and experience of their organization for the location of participating agencies. Their advice and recommendations led ultimately to the selection of the Elizabeth and Trenton test and control sites. As the New Jersey arm of the Law Enforcement Assistance Administration, their overall understanding of the test requirements and objectives was most valuable.

6.1.3.5 Philadelphia Housing Authority. The Philadelphia Housing Authority, in the persons of Mr. Robert Alotta, Public Information Director, and Mr. Philip J. Nicholson, Deputy Executive Director for Administration, offered the use and services of their Tasker Homes project as a control site. Preliminary data were supplied by their office to permit Aerospace and the Institute to make a decision on Tasker's acceptability.

6.1.4 Hardware production subcontractor. The Aerospace Corporation had planned to subcontract for the production of the field test hardware. The subcontractor's principal activities were to include evaluation of hardware requirements related to the test site, product engineering, and production of the quantity of Citizen Alarm System components for use in the field test program. The subcontractor would also have been responsible for the installation and checkout of the system at the test site and for shop-level maintenance of the system during the test program. A limited-source procurement had been initiated, with the two development subcontractors (American Electronics Laboratories, Inc., and Rockwell International) invited to submit proposals in response to the Institute-approved Request For Quotation (RFQ) package. Technical and financial evaluations of the two proposals had been completed, the recommended source selected, and the subcontract data package prepared. The program was canceled prior to the approval of the subcontract.

6.1.5 Test conductor subcontract. The Aerospace Corporation had planned to subcontract for a test conductor whose principal activities were to include the detailed test planning, performance of field surveys, test management, and data collection and reduction.

A fully competitive procurement had been initiated for the selection of a qualified company for this task. An announcement of the procurement activities was made in the Commerce Business Daily, and requests for proposals were mailed to each of the interested responders. A bidder's briefing was held in Elizabeth, New Jersey, to acquaint interested companies with the Citizen Alarm System concept, the goals and objectives of the field test program, and the Government Housing Project selected as the test site. Technical and financial evaluations of the submitted proposals were completed, and the recommended subcontractor was selected.

Because of the lead time associated with the production of the test hardware, this subcontract was scheduled to be awarded after the award of the hardware production subcontract. The program was canceled prior to the award of the subcontract.

6.2 Potential Issues

A number of sociological, technical, legal, political, procedural, and technological transfer issues were identified during the development and test planning efforts which might have affected the ultimate success or failure of the concept. Some of these issues impact the field evaluation program and are highlighted in this section. It should be recognized that some of these issues are common to any concept in which a citizen is able to call directly for emergency assistance, while others may be peculiar to this citizen alarm concept.

Some of the more significant issues that were recognized are listed below. The answers or solutions will be obtained only as the result of a properly formulated and implemented test program. Additional questions would probably surface during detailed test planning and test implementation.

6.2.1 Issues to be addressed

- Should there be user limitations based on age, responsibility, educational level, training received, geographical density of users, or other pertinent factors?
- What training methods will be most effective in educating those expected to use the system, especially regarding its capabilities and limitations?
- Will citizens report more crimes, as either victims or witnesses, when a convenient means for doing so is available to them? If so, what is the probability that the users will, in good faith, overuse the system?
- Will the system prevent criminal action? Specifically, will it prevent more crimes than it provokes?

6.2.2 Government omnipresence. It is conceivable that some users will view the personal actuator as a potential citizen tracking device. This issue can be disposed of early if a credible presentation of system function is presented during training (e.g., the actuator carried by the user has a citizen-initiated, one-way transmission path only; initiation by the user is purely voluntary, based upon his perception of need).

CHAPTER 7. CONCLUSIONS AND RECOMMENDATIONS

Data from the development program [4,5] have verified that an alarm message can be reliably transmitted from an actuator (user) to the central station (response agent). Preliminary test planning and the analysis of crime data suggest that, for some scenarios, benefits would be achieved with the deployment of a Citizen Alarm System. However, no real data exist from the testing of similar systems that could be used to accurately project the expected benefits or limitations associated with the system deployment. The actual measure of system benefits in terms of earlier assistance and decreased crime rate (through increased arrest rate), can be established only through a field test program.

The full-scale field testing of a system like the Citizen Alarm System is required before any decision on the operational deployment of the system can be made. This test program should be implemented by an agency of the Federal Government to ensure that the test program is structured to provide a general assessment of the system, one in which the results are applicable nationwide, instead of tailored to a particular test site.

Without the benefits of the data from such field test programs, it is highly unlikely that a citizen alarm system will be implemented on a large scale. This is due primarily to the risk associated with system deployment, considering the cost of procuring the system, coupled with its presently undemonstrated benefits.

NOTES

1. "Survey and Concept Definition for an Improved Citizen Alarm System," Report No. ATR-74(7905)-2, Vol. 1, El Segundo, California, The Aerospace Corporation (August 1974).

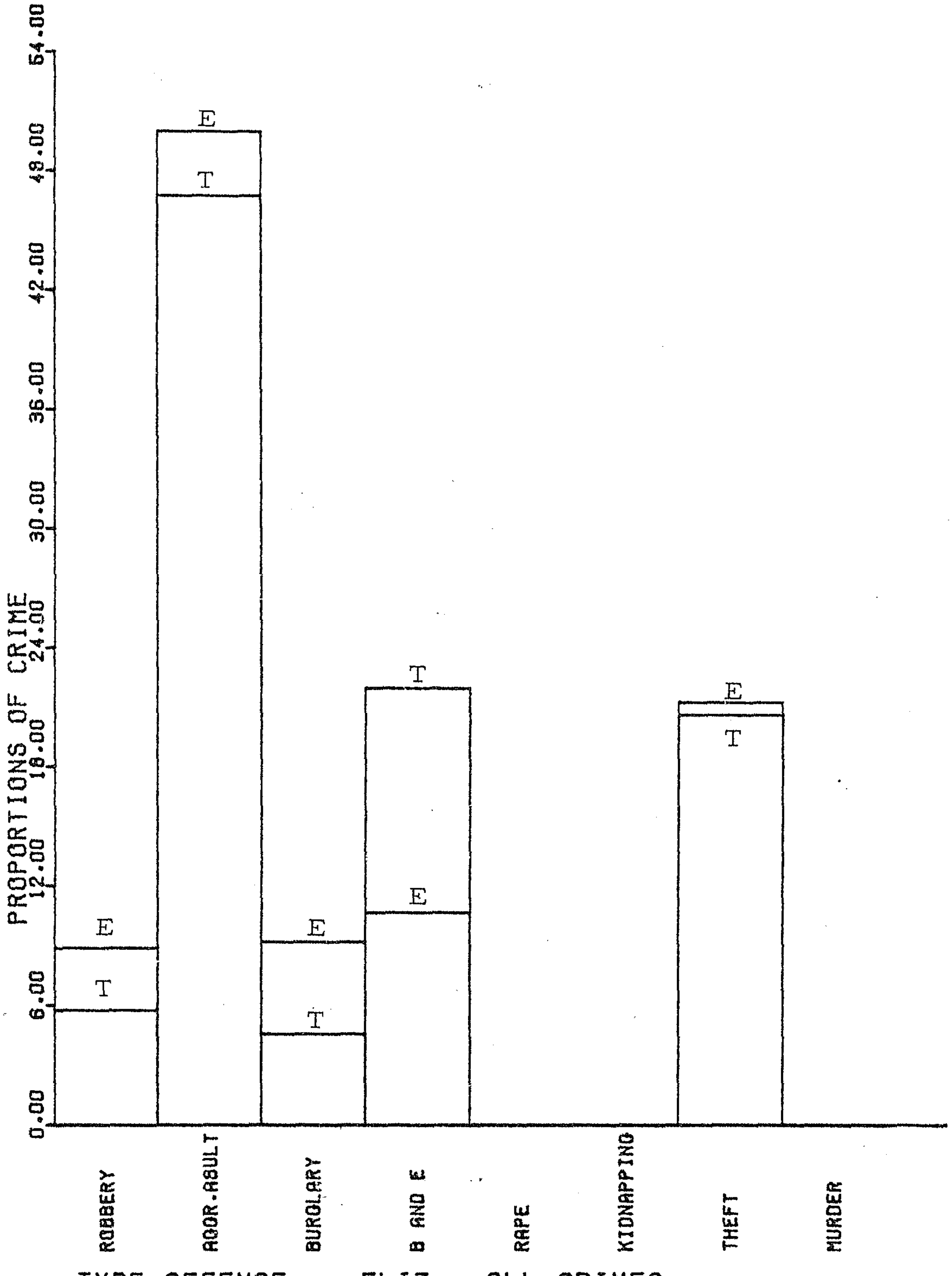
2. "Development Task Close-Out Report, Citizen Alarm System," Report No. ATR-76(7905)-1, El Segundo, California, The Aerospace Corporation (July 1976).

3. "Field Measurements of 452-MHz Transmission in Two Public Housing Areas," Report No. F-64425, Philadelphia, Pennsylvania, Franklin Institute Research Laboratories (July 1976).

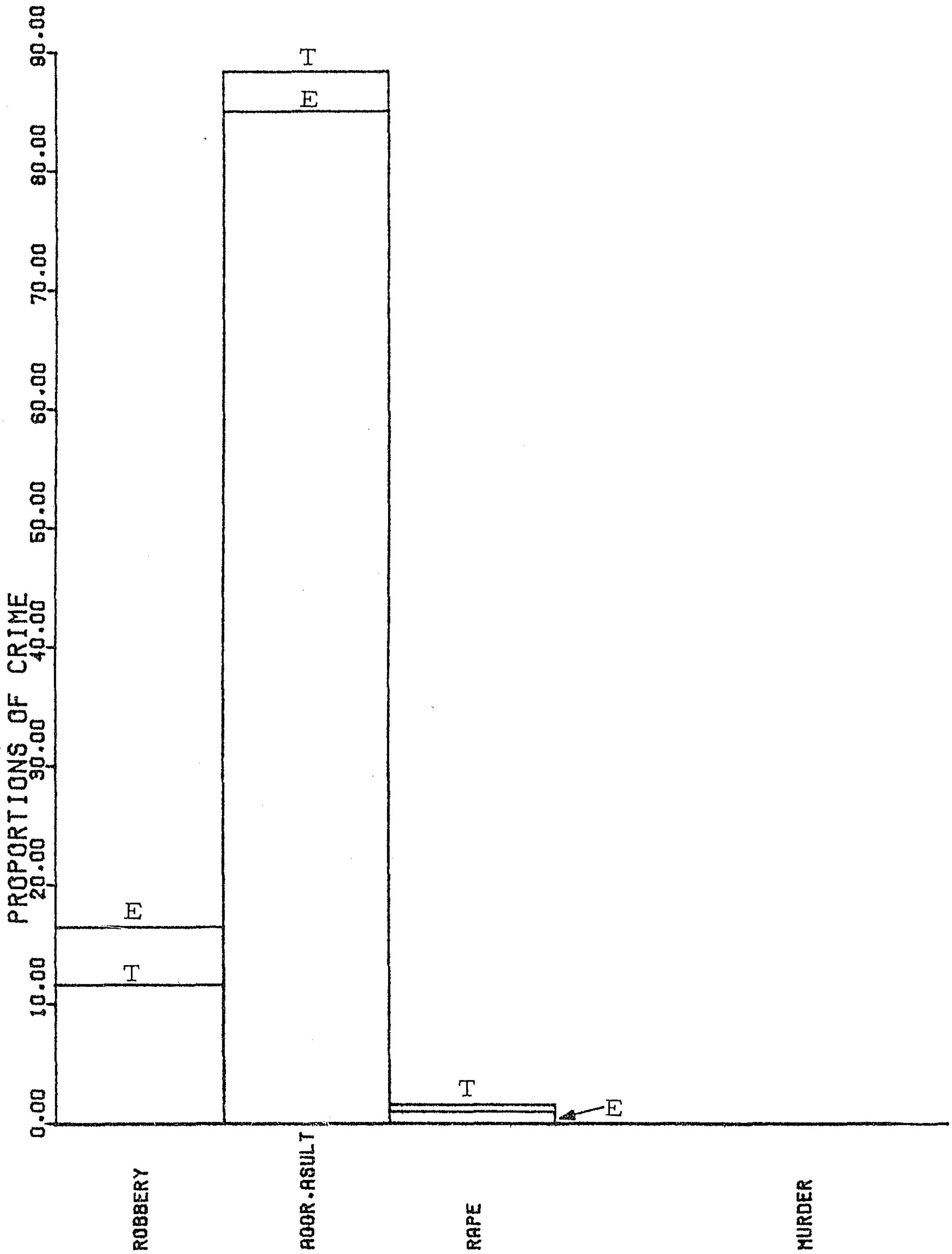
4. "Citizen Alarm System Final Report," Report No. C76-711/201, Anaheim, California, Rockwell International (June 1976).

5. "Development and Demonstration of a Citizen Alarm System," Final Report, Falls Church, Virginia, American Electronic Laboratories, Inc. (4 June 1976).

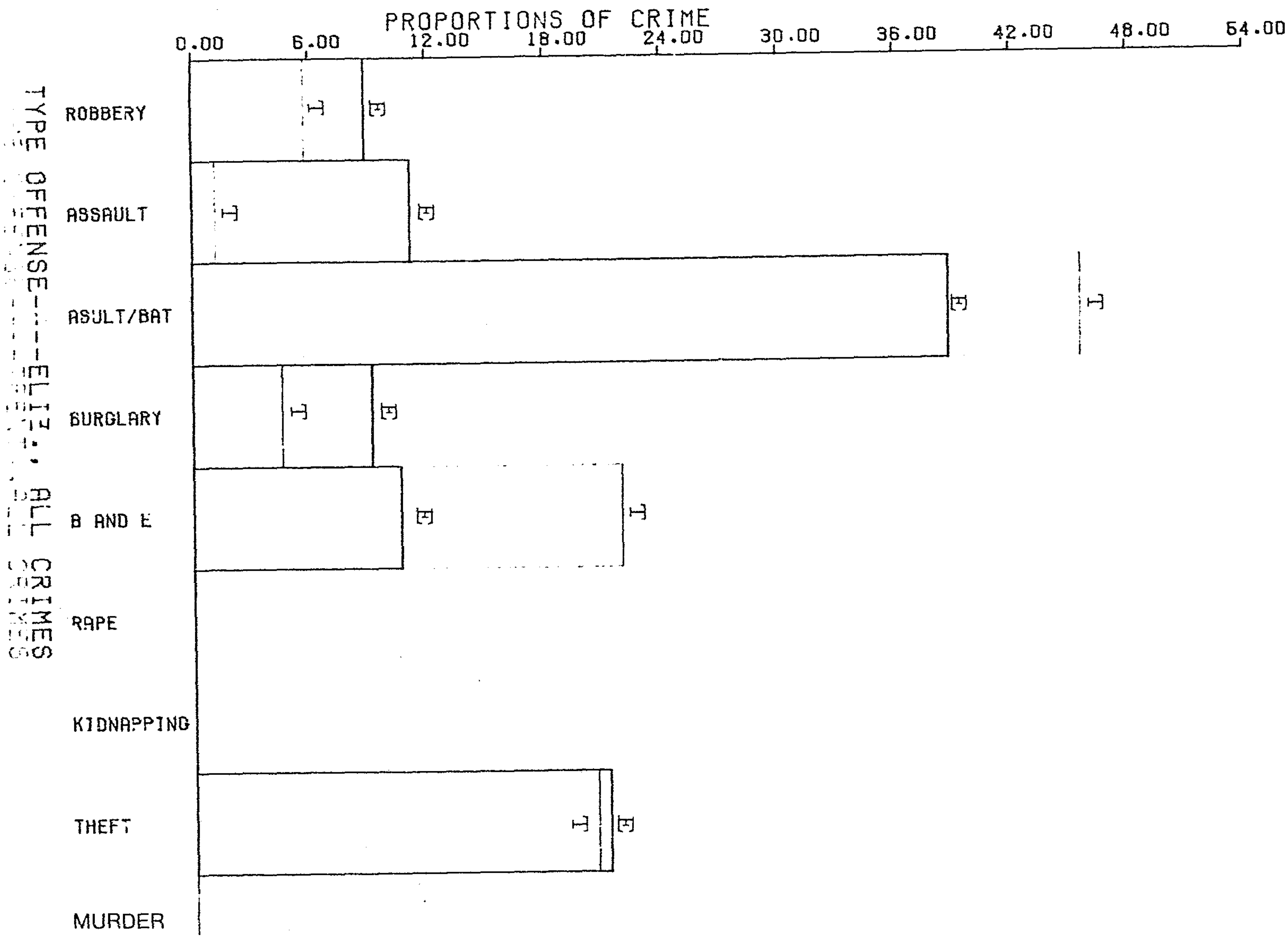
APPENDIX A. ABSOLUTE COUNTS AND PROPORTIONS

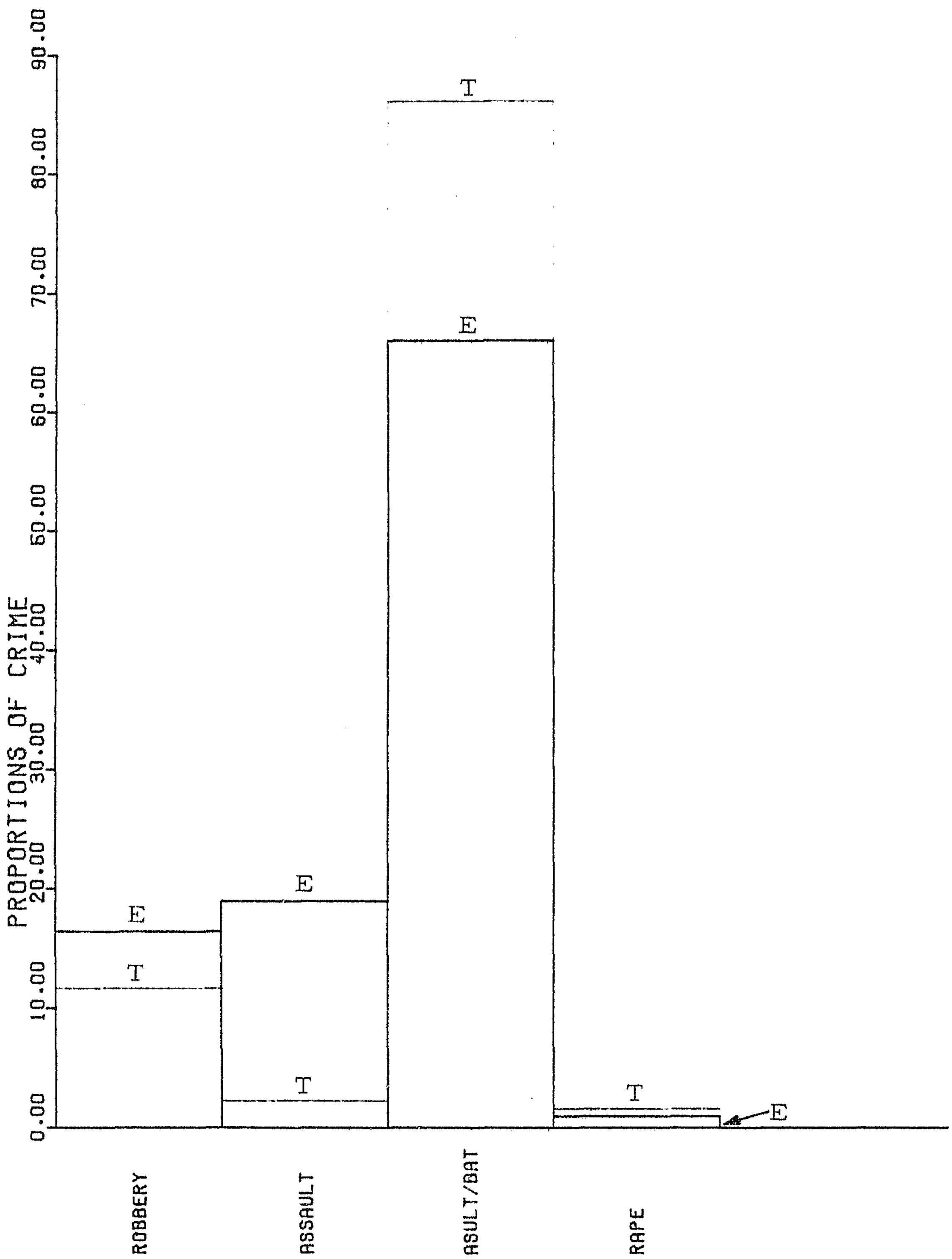


TYPE OFFENSE----ELIZ., ALL CRIMES
TYPE OFFENSE----TRENT.,ALL CRIMES

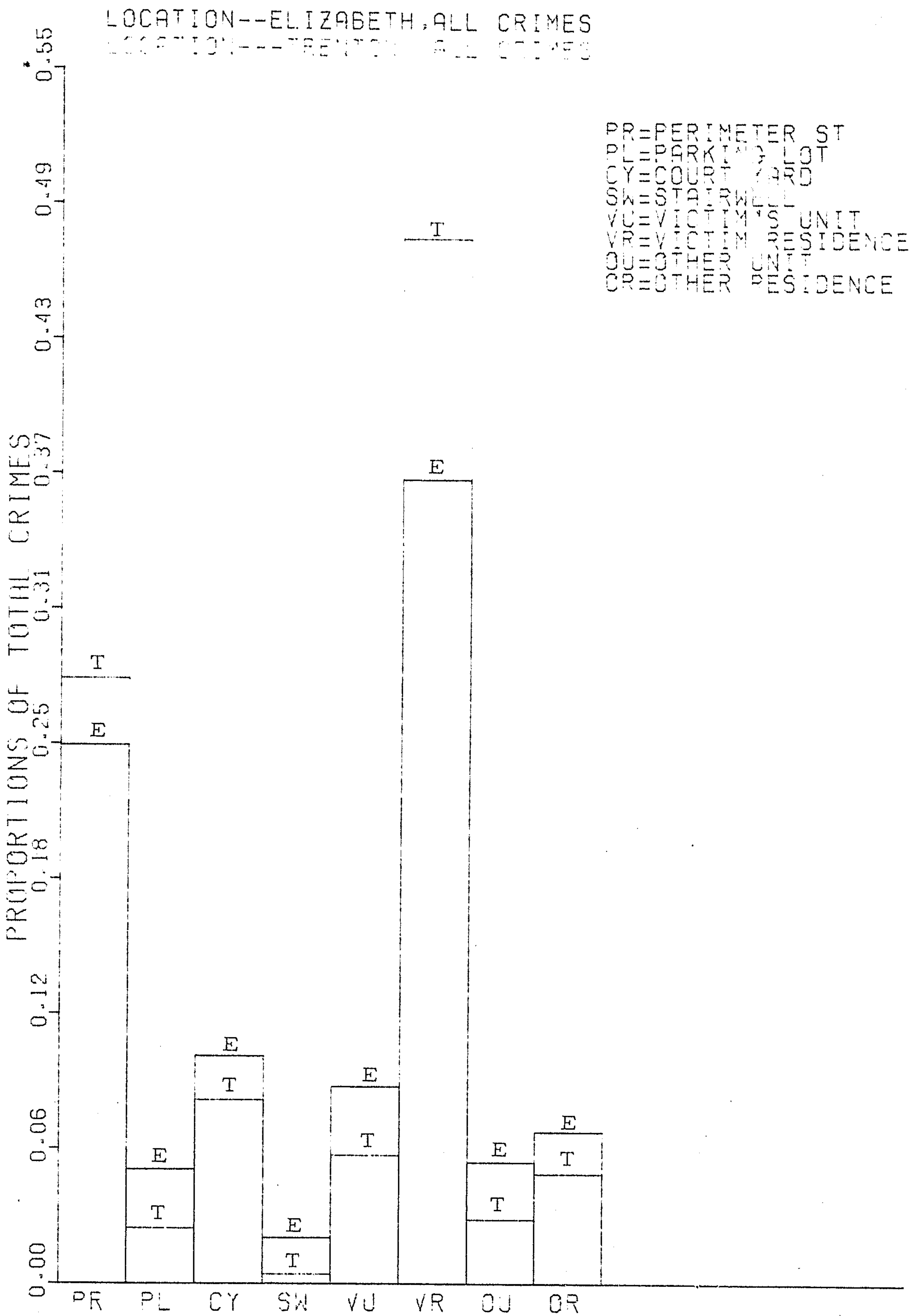


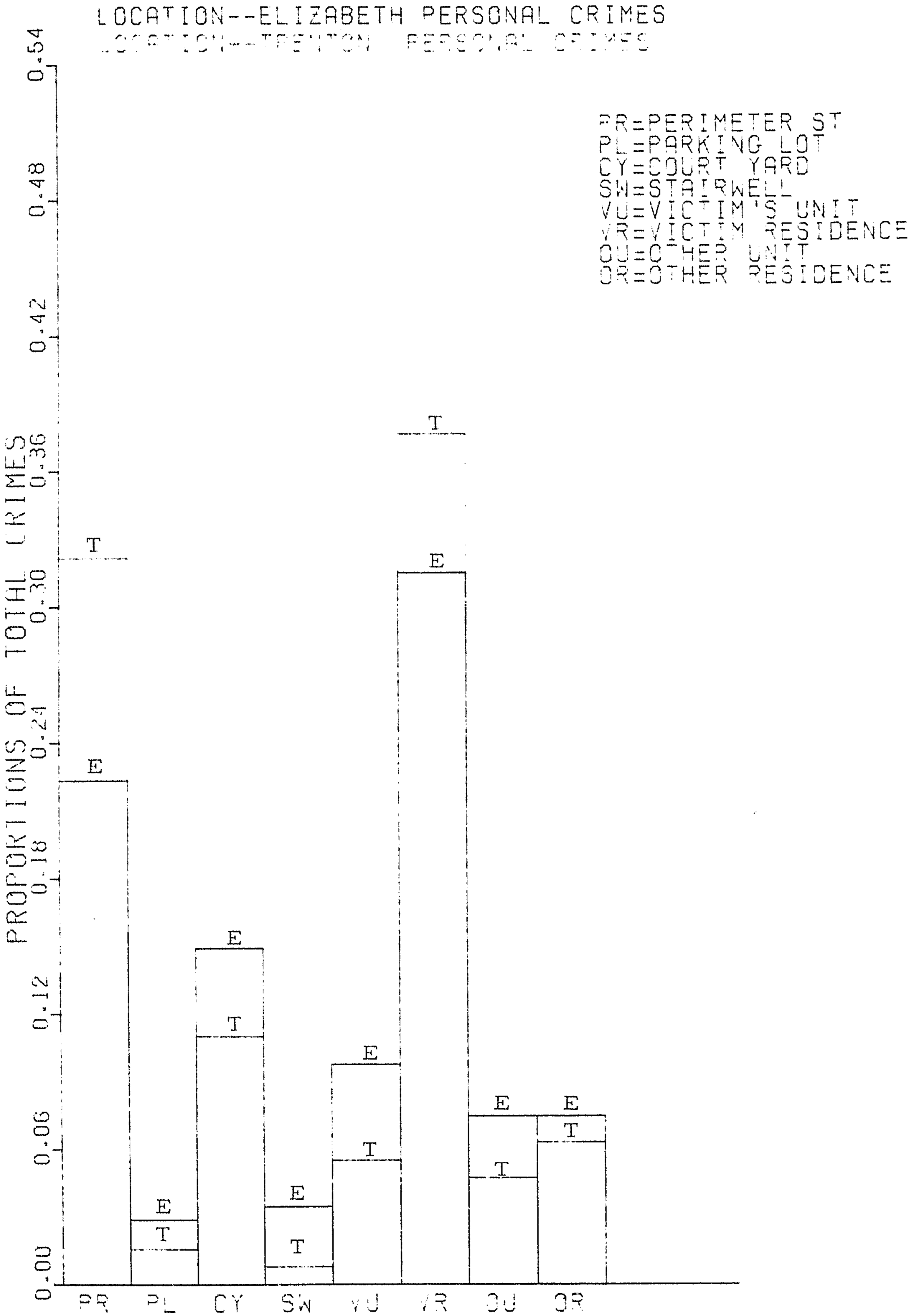
TYPE OFFENSE ---- ELIZ., VIOLENT CRIMES ONLY
TYPE OFFENSE ---- TRENT., VIOLENT CRIMES ONLY

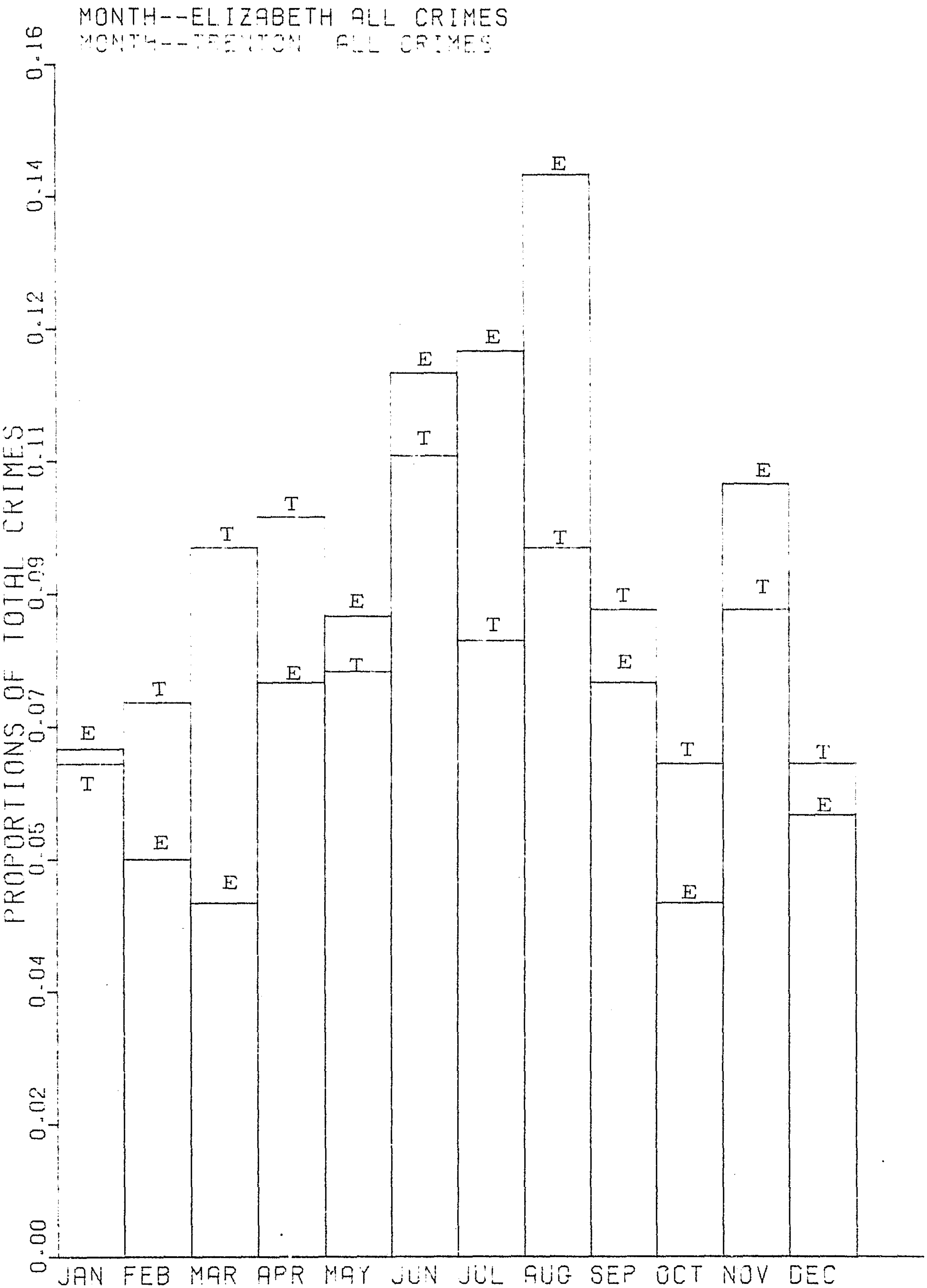

PROPORTIONS OF CRIME
0.00
6.00
12.00
18.00
24.00
30.00
36.00
42.00
48.00
54.00
TYPE OFFENSE---ELIZ., ALL CRIMES
ROBBERY
ASSAULT
ASULT/BAT
BURGLARY
B AND E
RAPE
KIDNAPPING
THEFT
MURDER
T
E

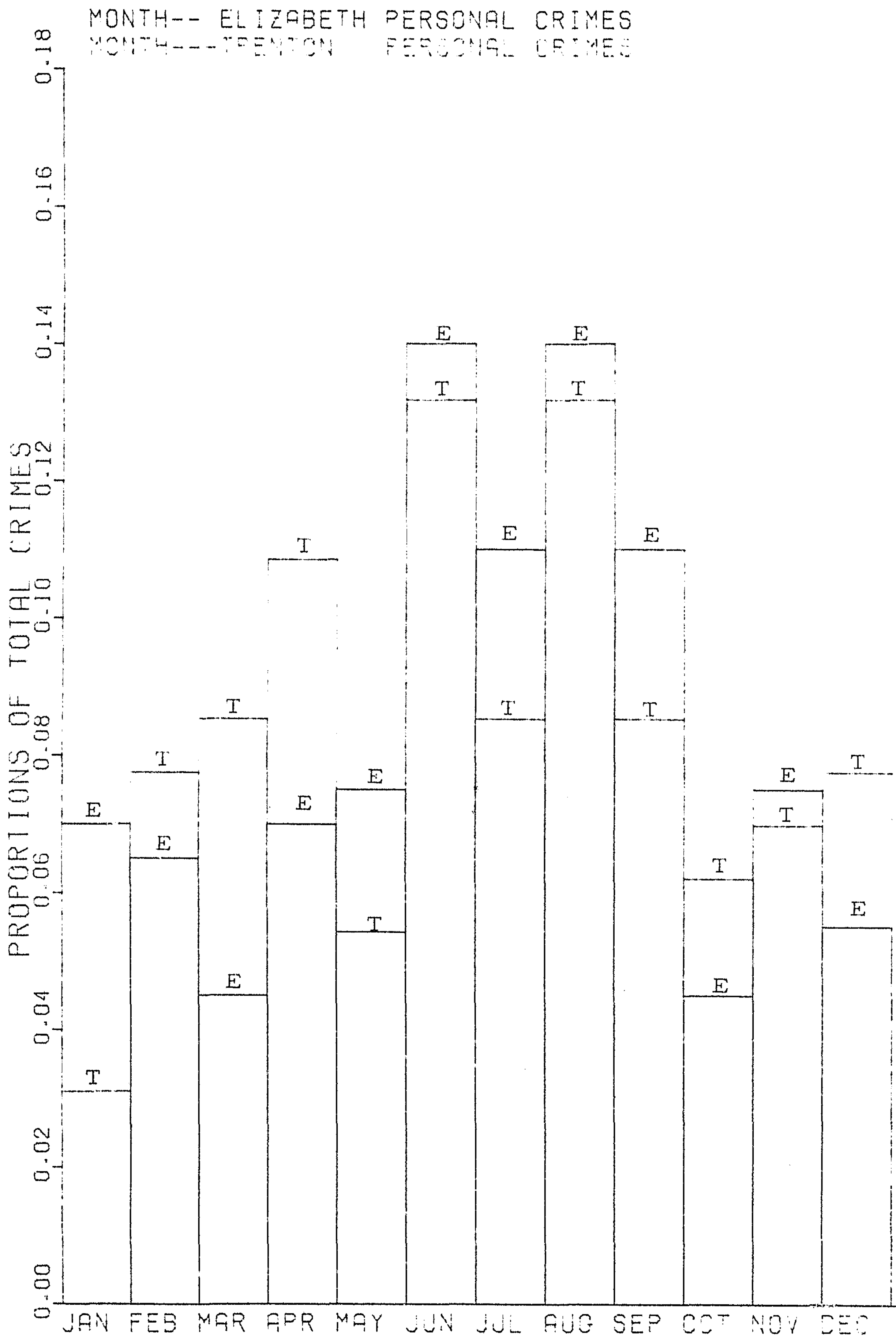


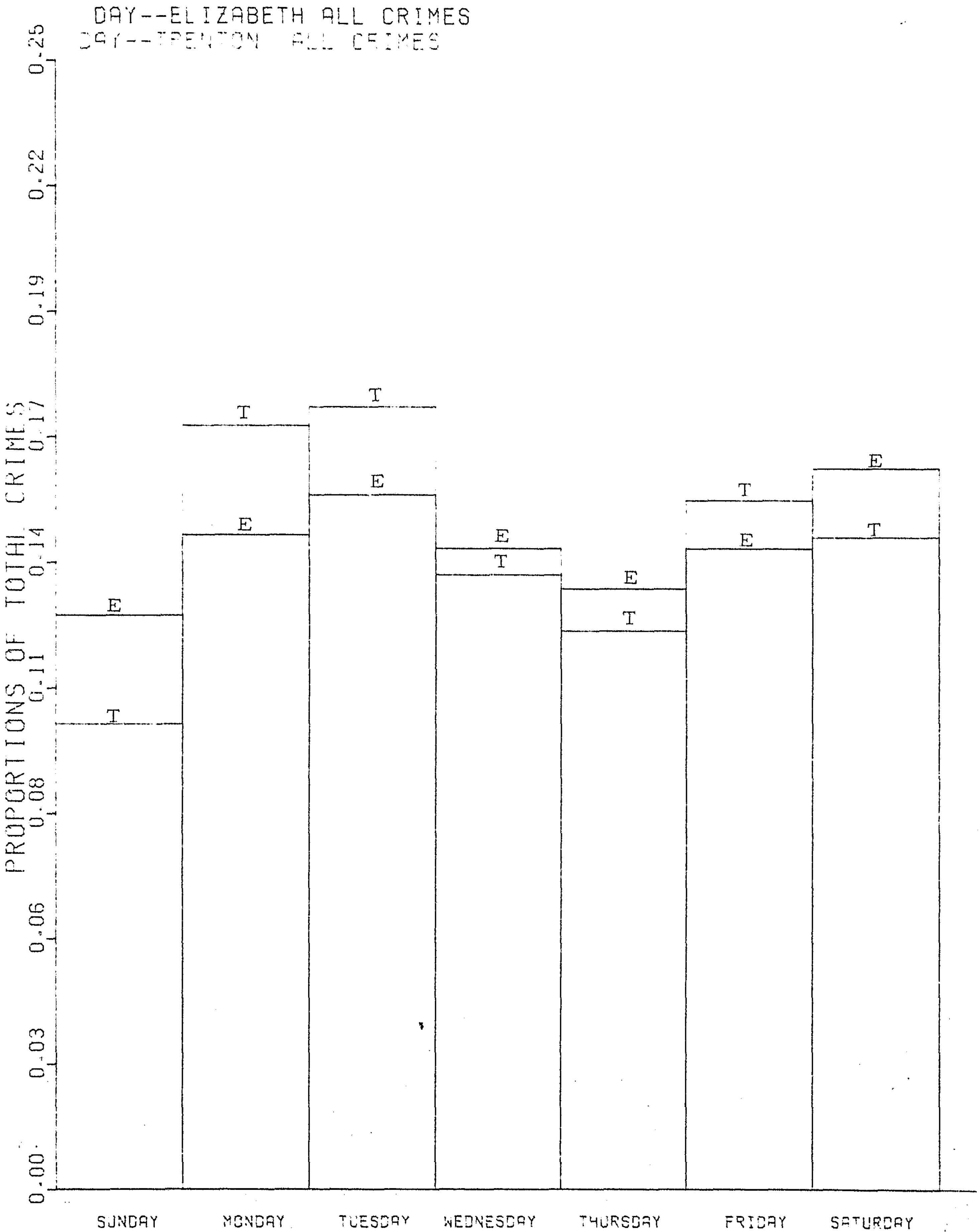
TYPE OFFENSE ---- ELIZ., VIOLENT CRIMES ONLY
TYPE OFFENSE ---- TRENT., VIOLENT CRIMES ONLY

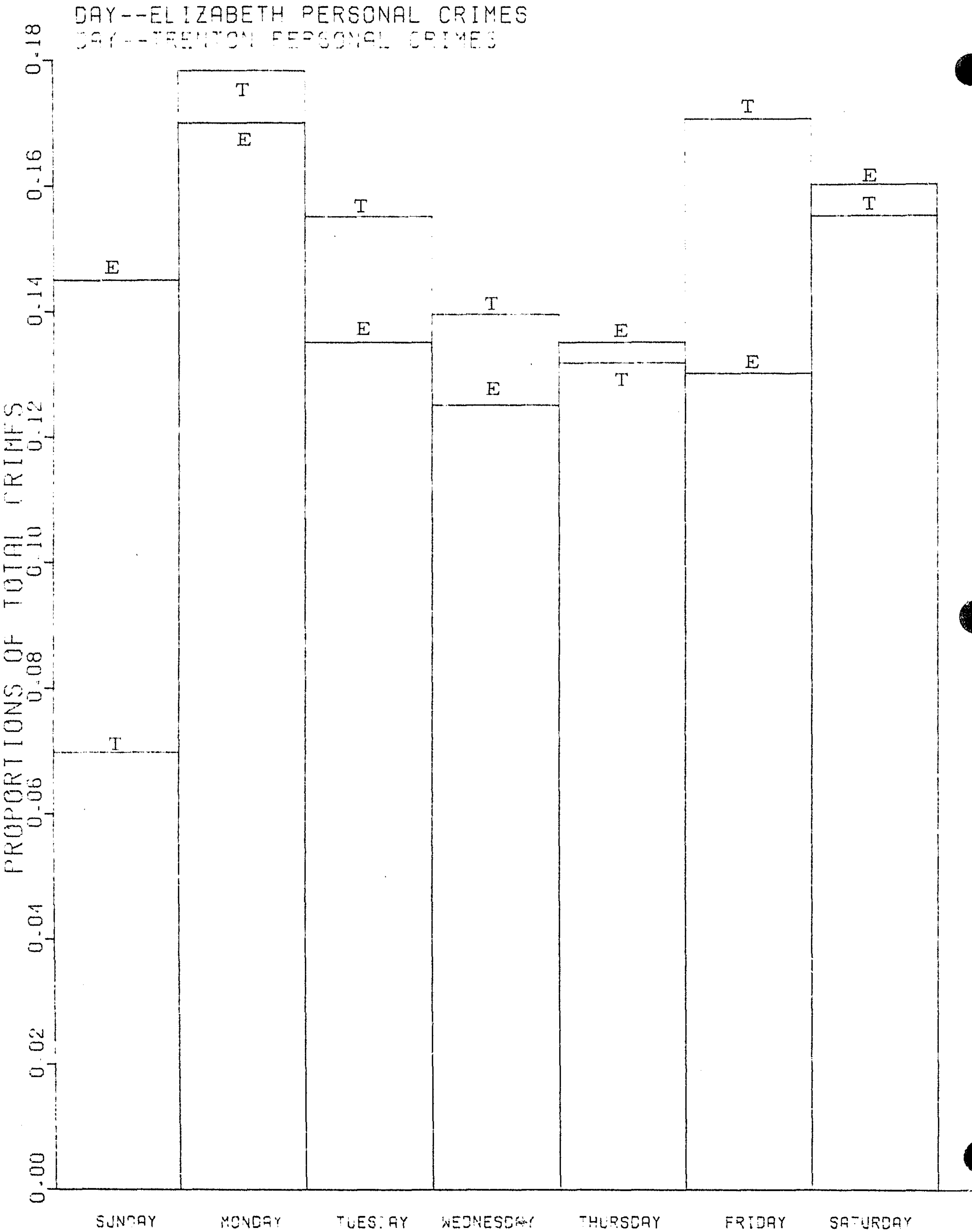

LOCATION--ELIZABETH,ALL CRIMES
LOCATION--TRENTON,ALL CRIMES
PR=PERIMETER ST
PL=PARKING LOT
CY=COURT YARD
SW=STAIRWELL
VU=VICTIM'S UNIT
VR=VICTIM RESIDENCE
OU=OTHER UNIT
OR=OTHER RESIDENCE
PROPORTIONS OF TOTAL CRIMES
0.00
0.06
0.12
0.18
0.25
0.31
0.37
0.43
0.49
0.55
PR
PL
CY
SW
VU
VR
OU
OR
E
T

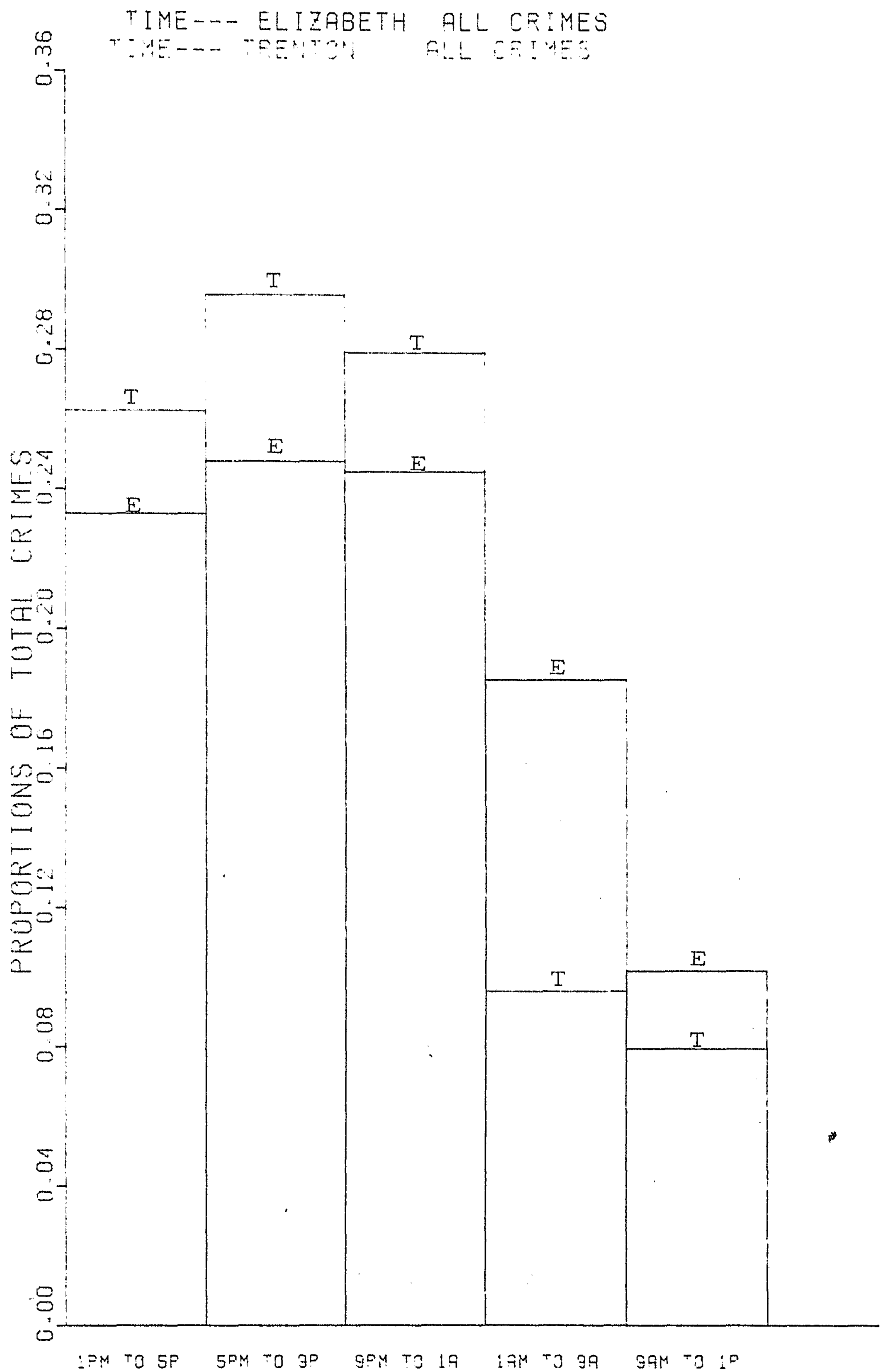

LOCATION--ELIZABETH PERSONAL CRIMES
LOCATION--TRENTON PERSONAL CRIMES
PR=PERIMETER ST
PL=PARKING LOT
CY=COURT YARD
SW=STAIRWELL
VU=VICTIM'S UNIT
VR=VICTIM RESIDENCE
OU=OTHER UNIT
OR=OTHER RESIDENCE
PROPORTIONS OF TOTAL CRIMES
0.54
0.48
0.42
0.36
0.30
0.24
0.18
0.12
0.06
0.00
PR
PL
CY
SW
VU
VR
OU
OR

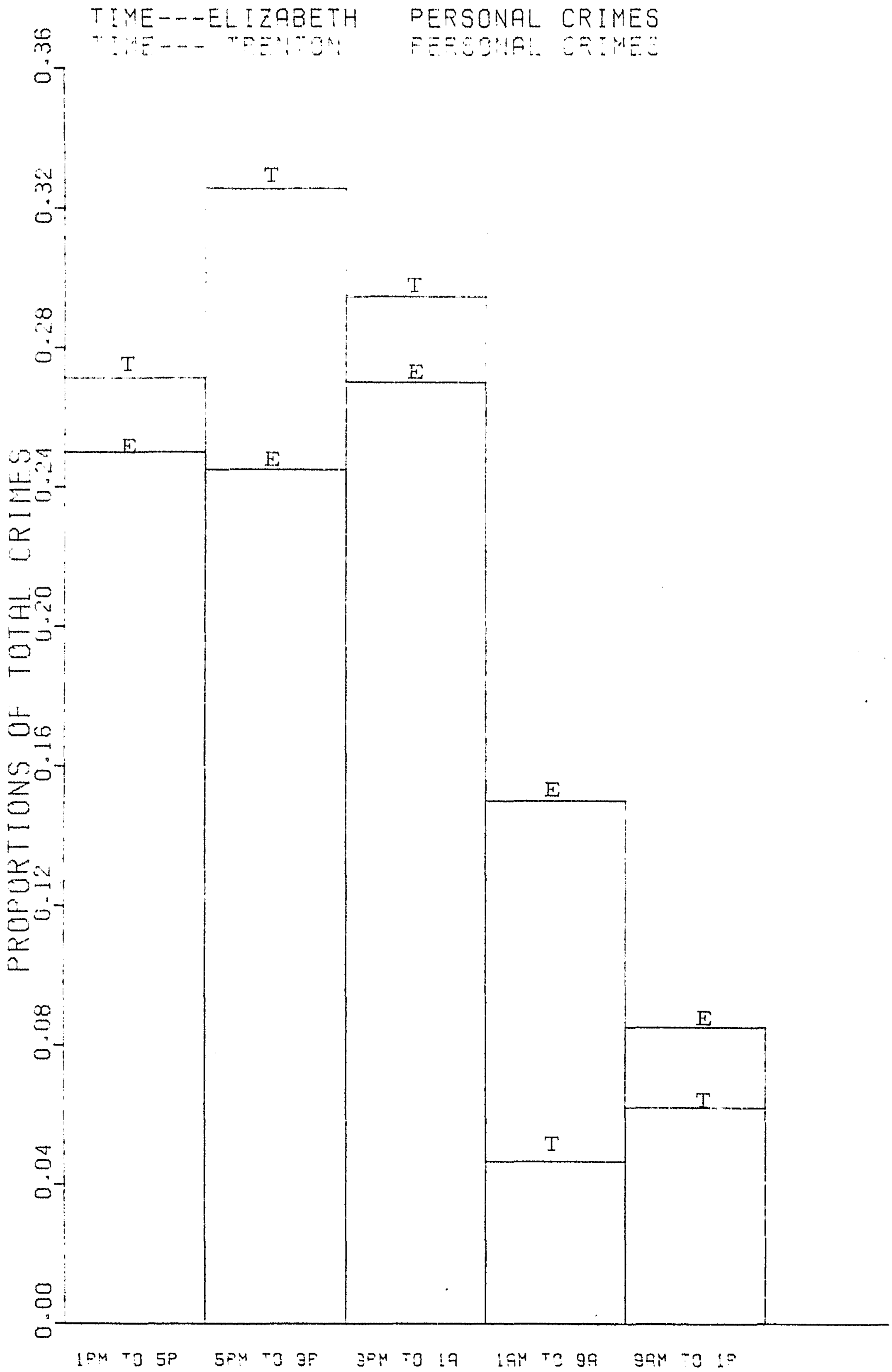

MONTH--ELIZABETH ALL CRIMES
MONTH--TRENTON ALL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.00
0.02
0.04
0.05
0.07
0.09
0.11
0.12
0.14
0.16
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
E
T

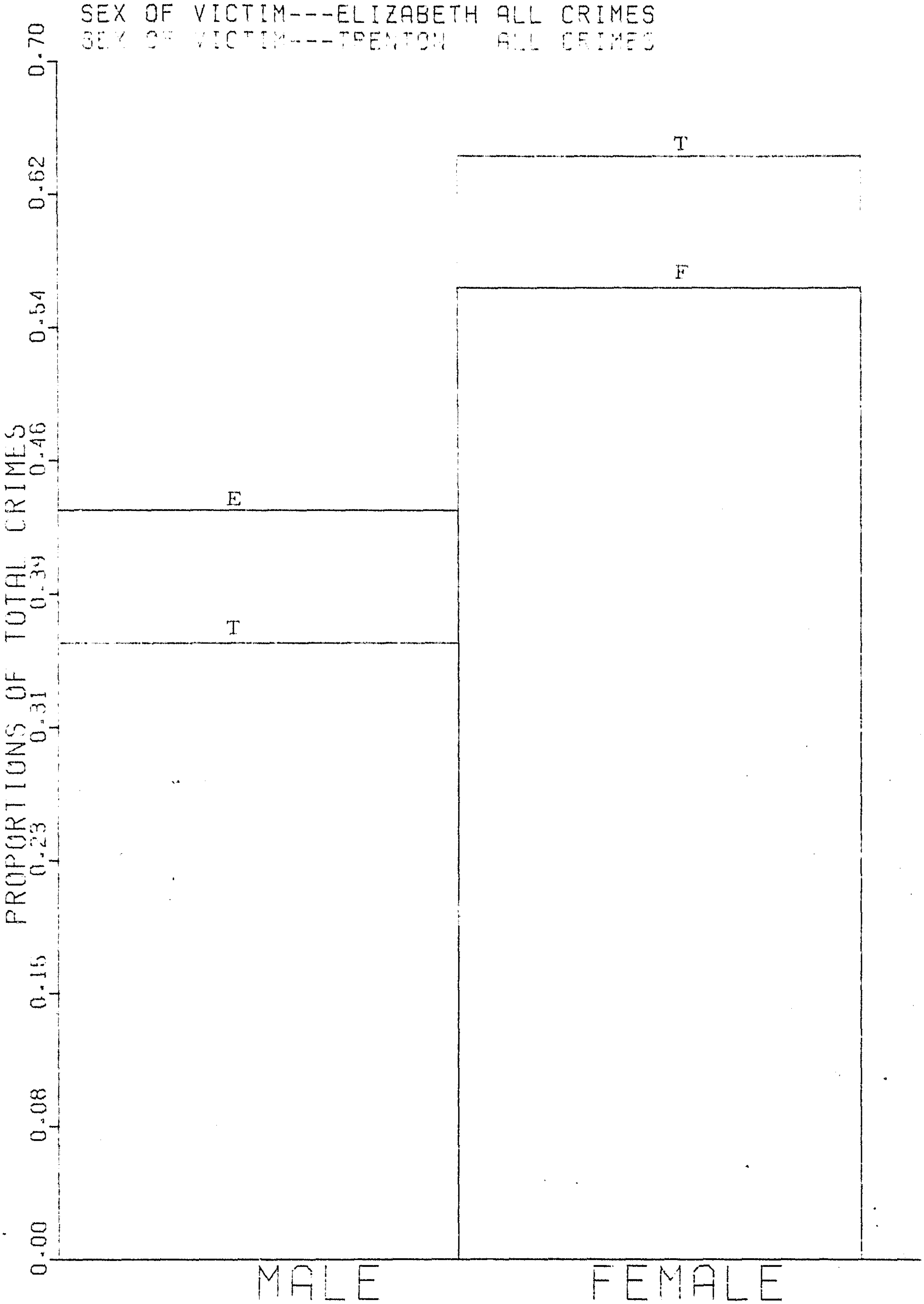

MONTH-- ELIZABETH PERSONAL CRIMES
MONTH---TRENTON PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
E
T


DAY--ELIZABETH ALL CRIMES
DAY--TRENTON ALL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.25
0.22
0.19
0.17
0.14
0.11
0.08
0.06
0.03
0.00
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
E
T

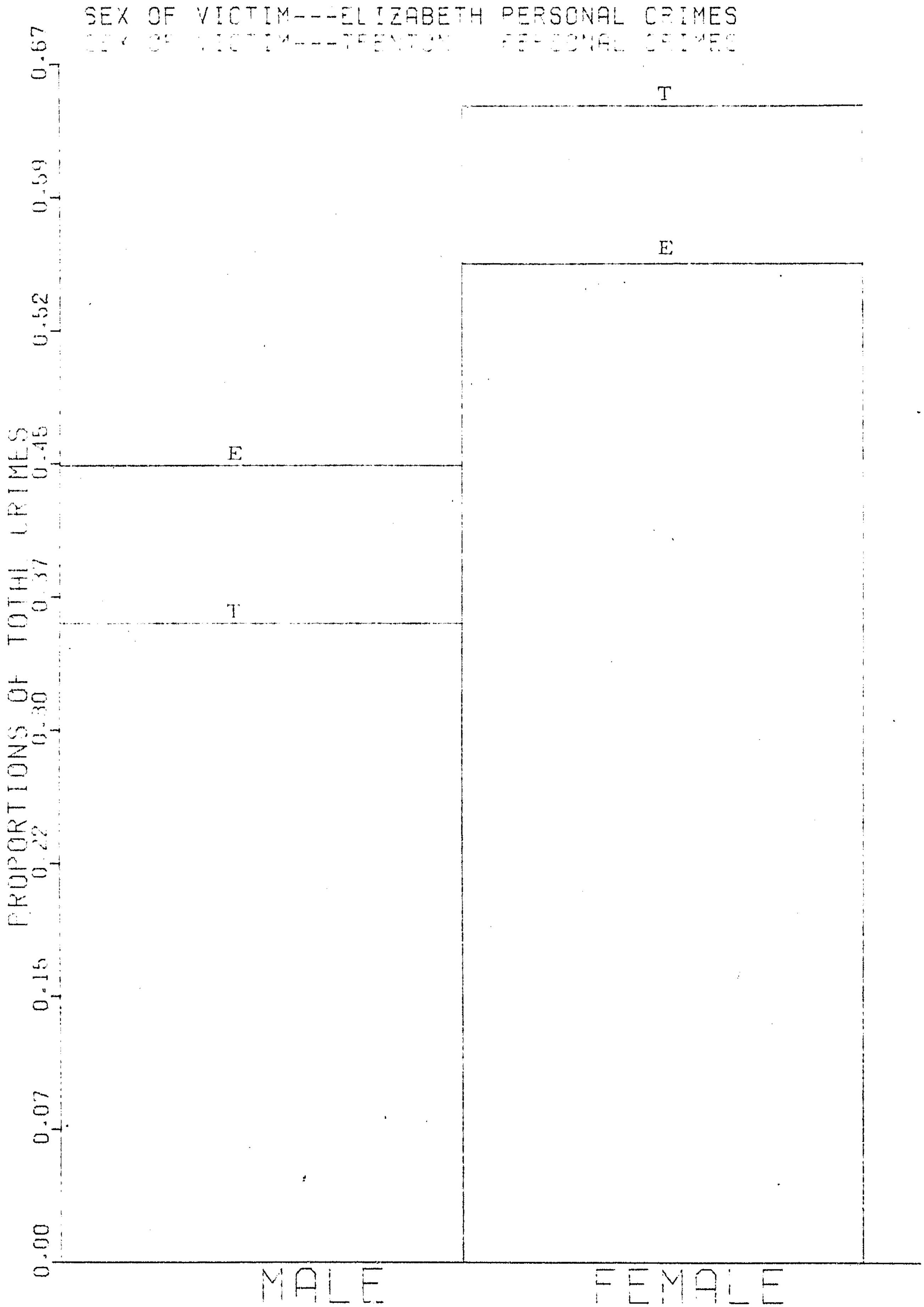

DAY--ELIZABETH PERSONAL CRIMES
DAY--TRENTON PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
T
E
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY


TIME--- ELIZABETH ALL CRIMES
TIME--- TRENTON ALL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.00
0.04
0.08
0.12
0.16
0.20
0.24
0.28
0.32
0.36
T
E
1PM TO 5P
5PM TO 9P
9PM TO 1A
1AM TO 9A
9AM TO 1P


TIME---ELIZABETH PERSONAL CRIMES
TIME--- TRENTON PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.00
0.04
0.08
0.12
0.16
0.20
0.24
0.28
0.32
0.36
T
E
1PM TO 5P
5PM TO 9P
9PM TO 1A
1AM TO 9A
9AM TO 1P

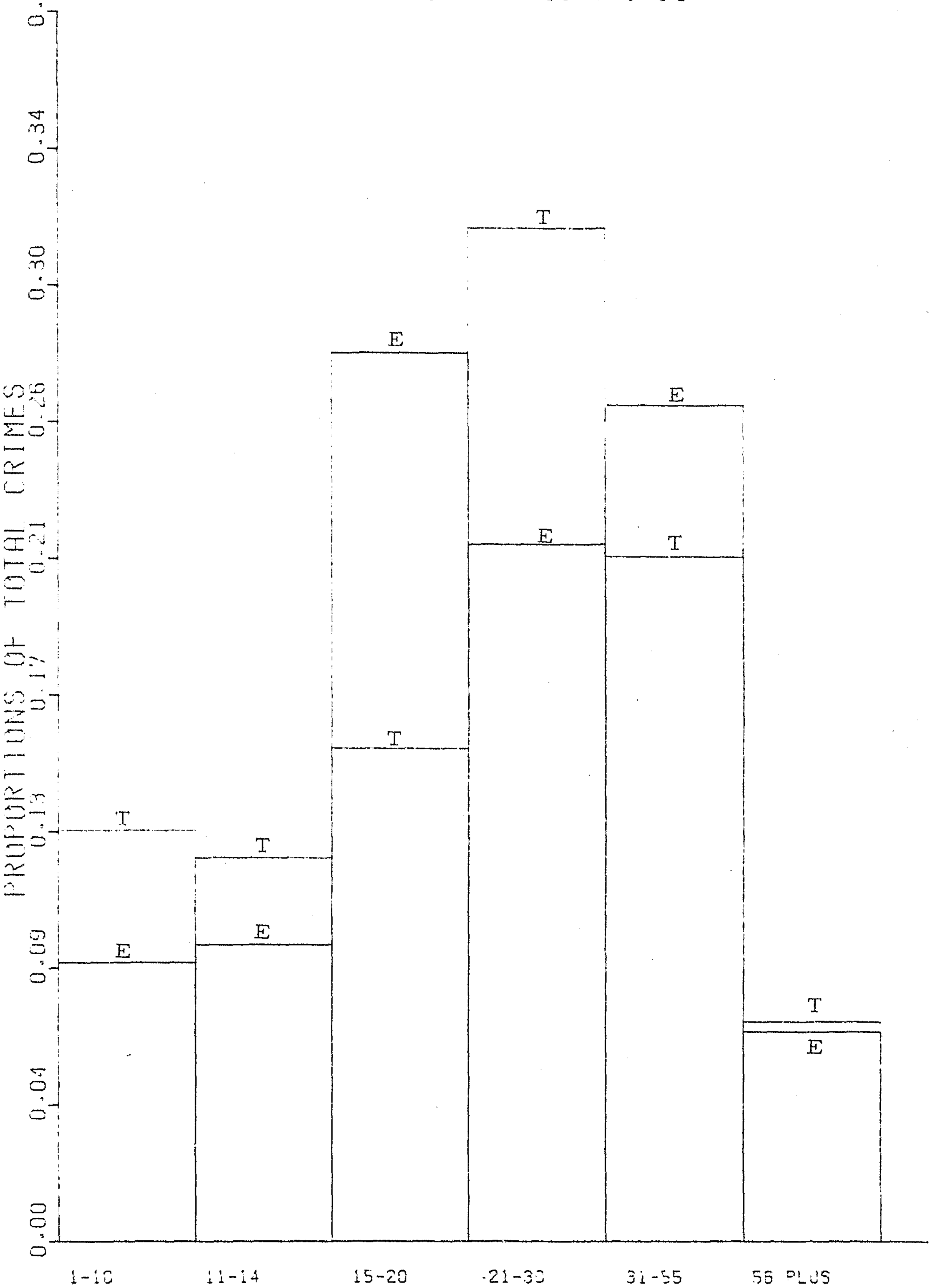


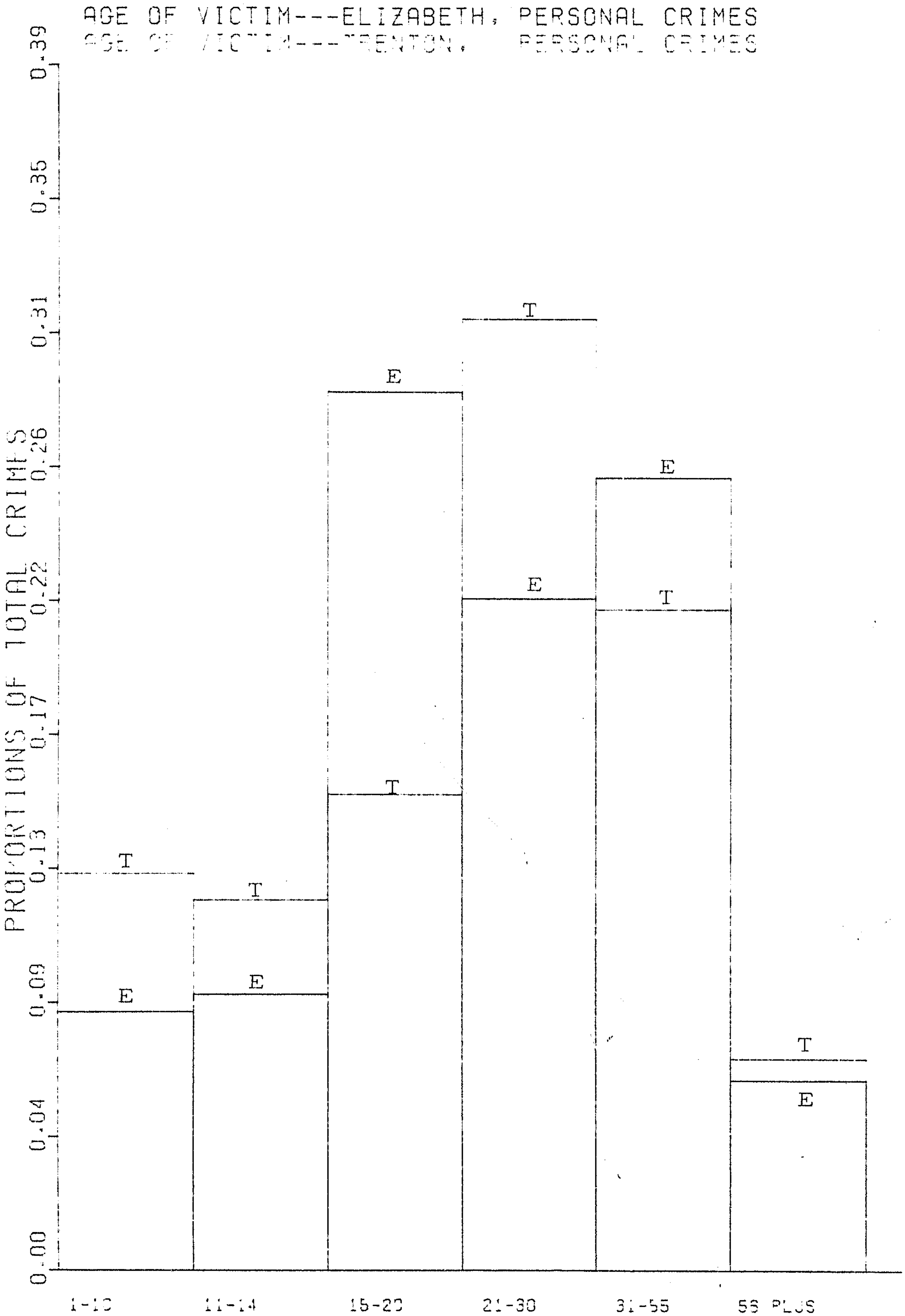
SEX OF VICTIM---ELIZABETH ALL CRIMES
SEX OF VICTIM---TRENTON ALL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.00
0.08
0.15
0.23
0.31
0.39
0.46
0.54
0.62
0.70
E
T
F
T
MALE
FEMALE

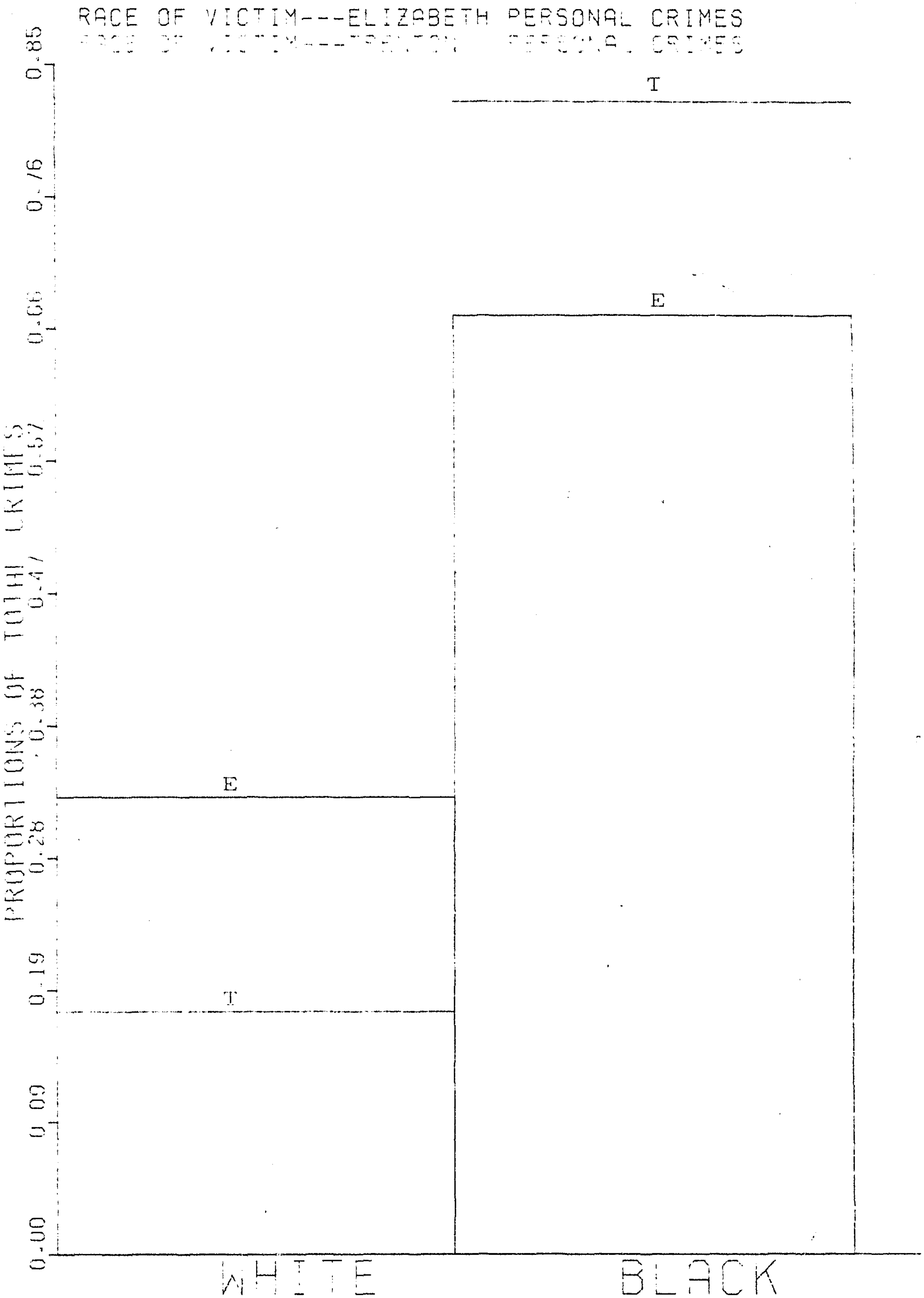


SEX OF VICTIM---ELIZABETH PERSONAL CRIMES
SEX OF VICTIM---TRENTON PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.67
0.59
0.52
0.45
0.37
0.30
0.22
0.15
0.07
0.00
T
E
E
T
MALE
FEMALE

AGE OF VICTIM---ELIZABETH, ALL CRIMES
AGE OF VICTIM---TRENTON, ALL CRIMES

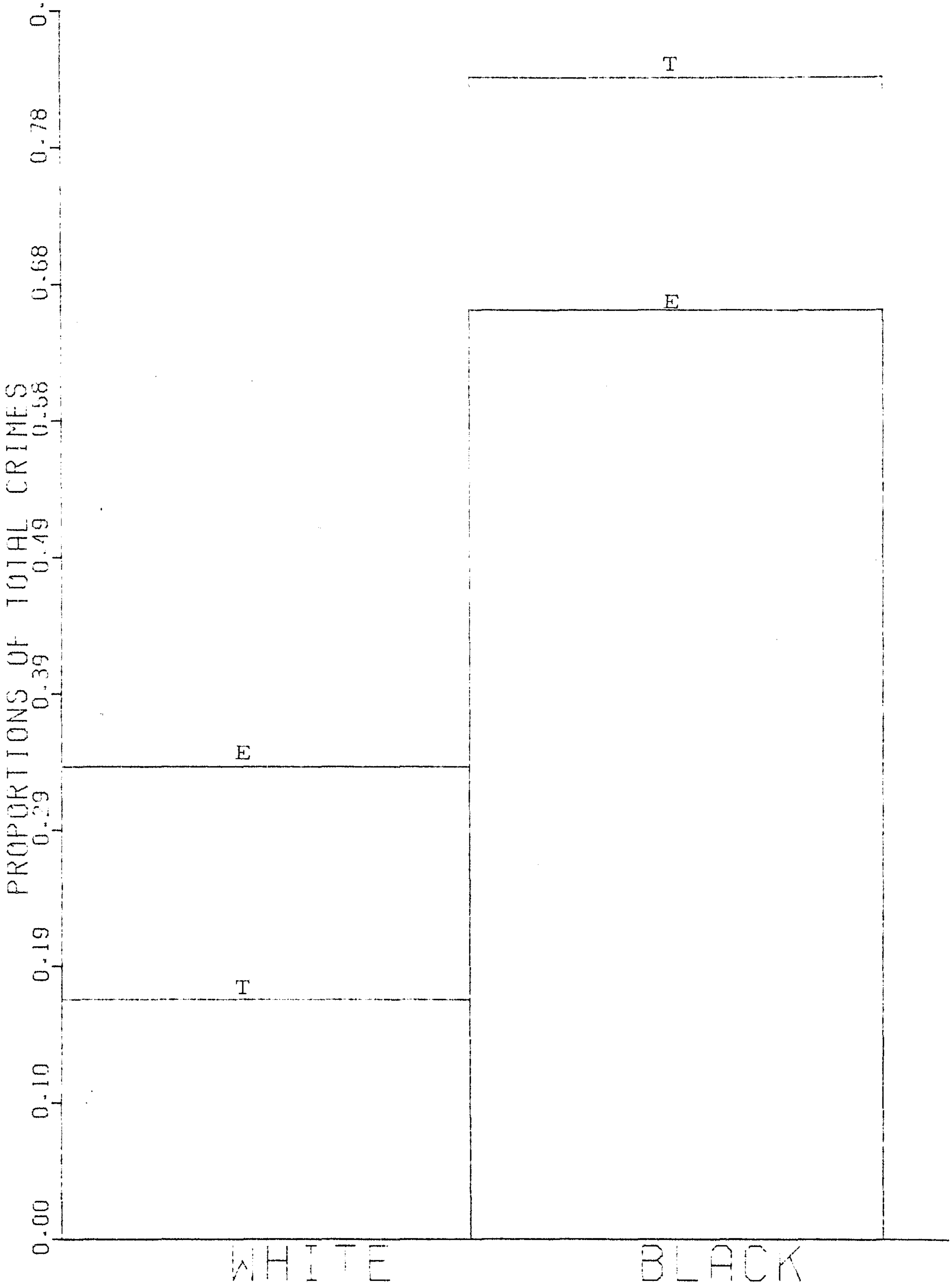


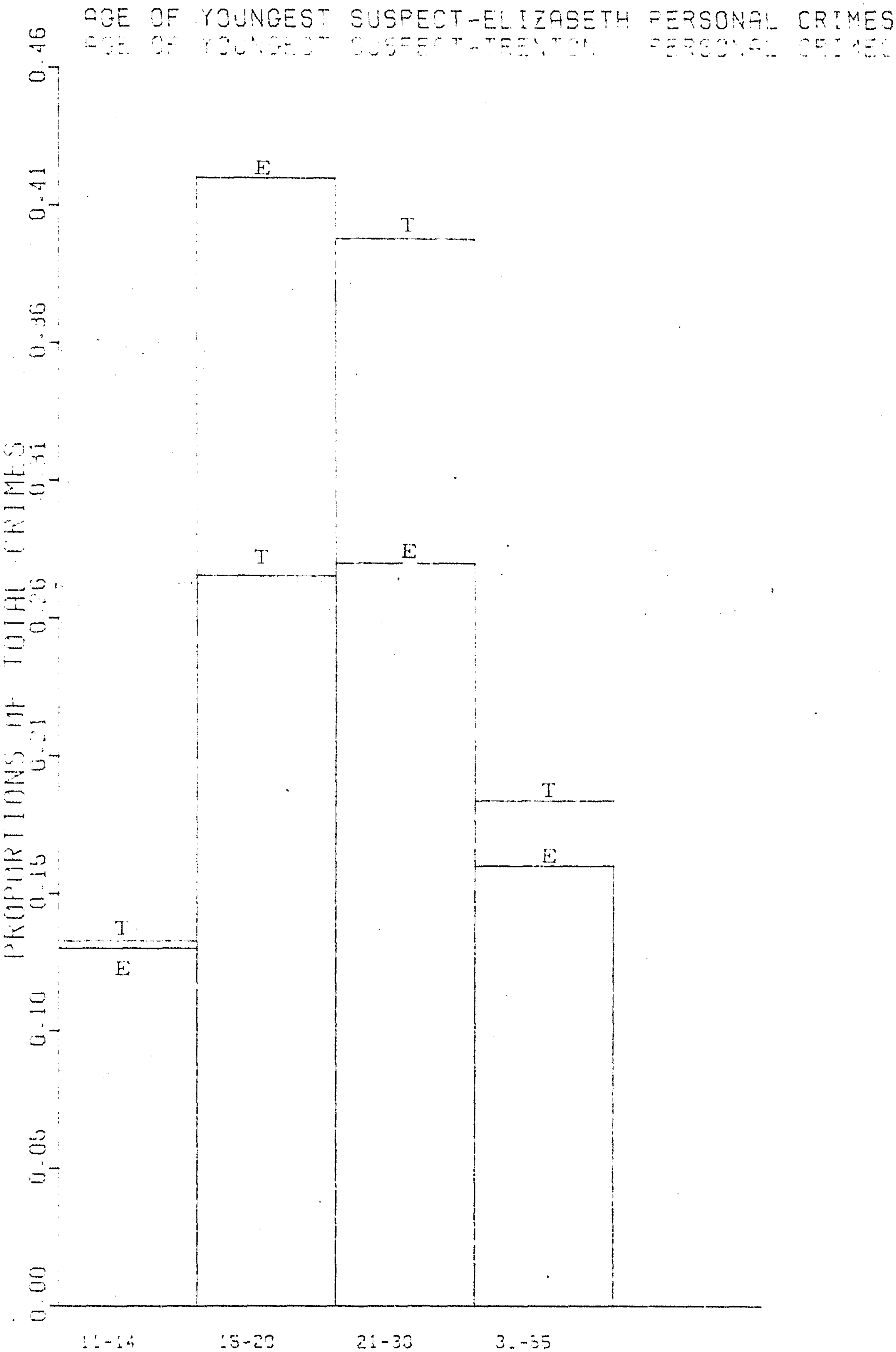

AGE OF VICTIM---ELIZABETH, PERSONAL CRIMES
AGE OF VICTIM---TRENTON, PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.00
0.04
0.09
0.13
0.17
0.22
0.26
0.31
0.35
0.39
E
T
1-10
11-14
15-20
21-30
31-55
56 PLUS

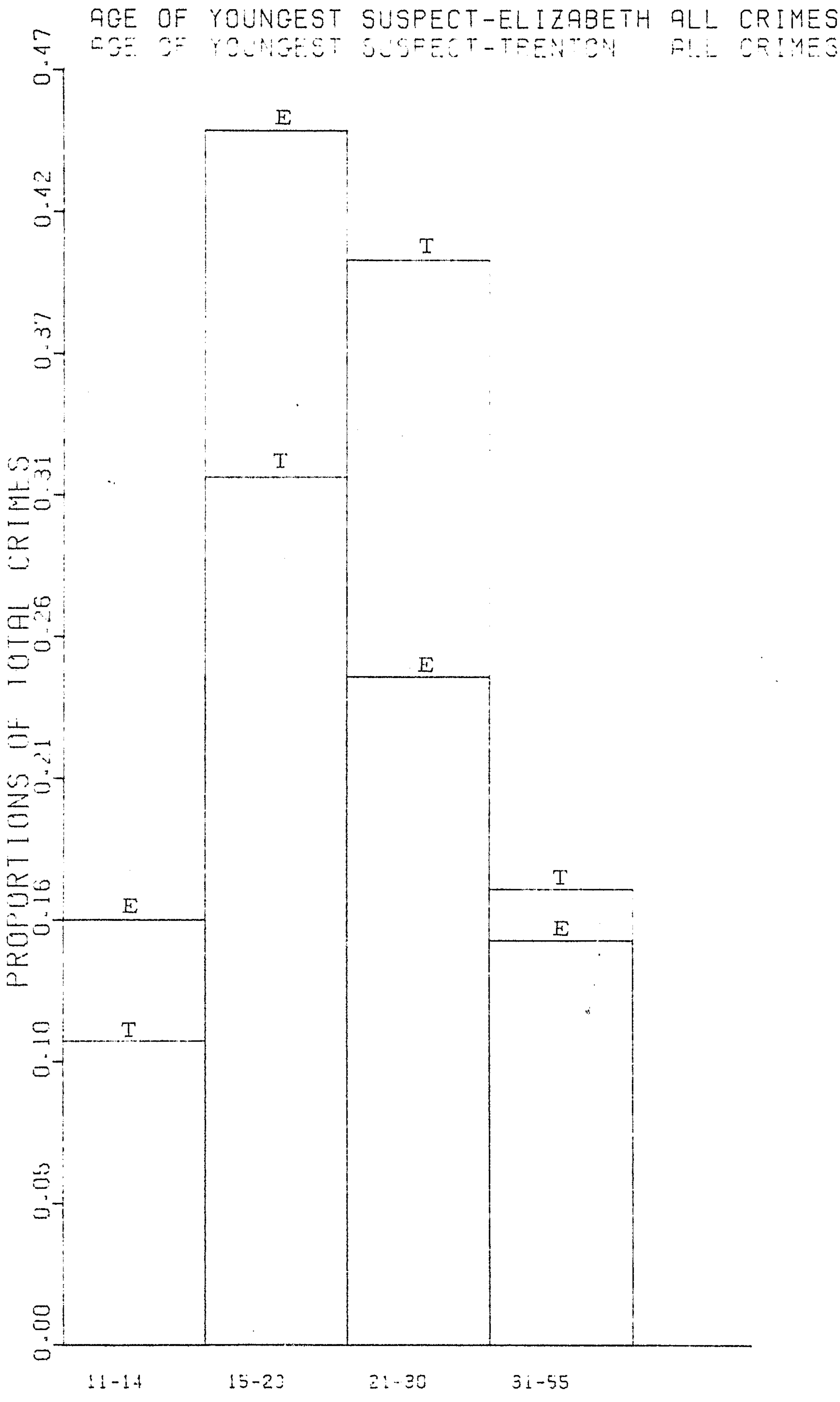


RACE OF VICTIM---ELIZABETH PERSONAL CRIMES
RACE OF VICTIM---TRENTON PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.85
0.76
0.66
0.57
0.47
0.38
0.28
0.19
0.09
0.00
T
E
E
T
WHITE
BLACK

RACE OF VICTIM---ELIZABETH ALL CRIMES
RACE OF VICTIM---TRENTON ALL CRIMES

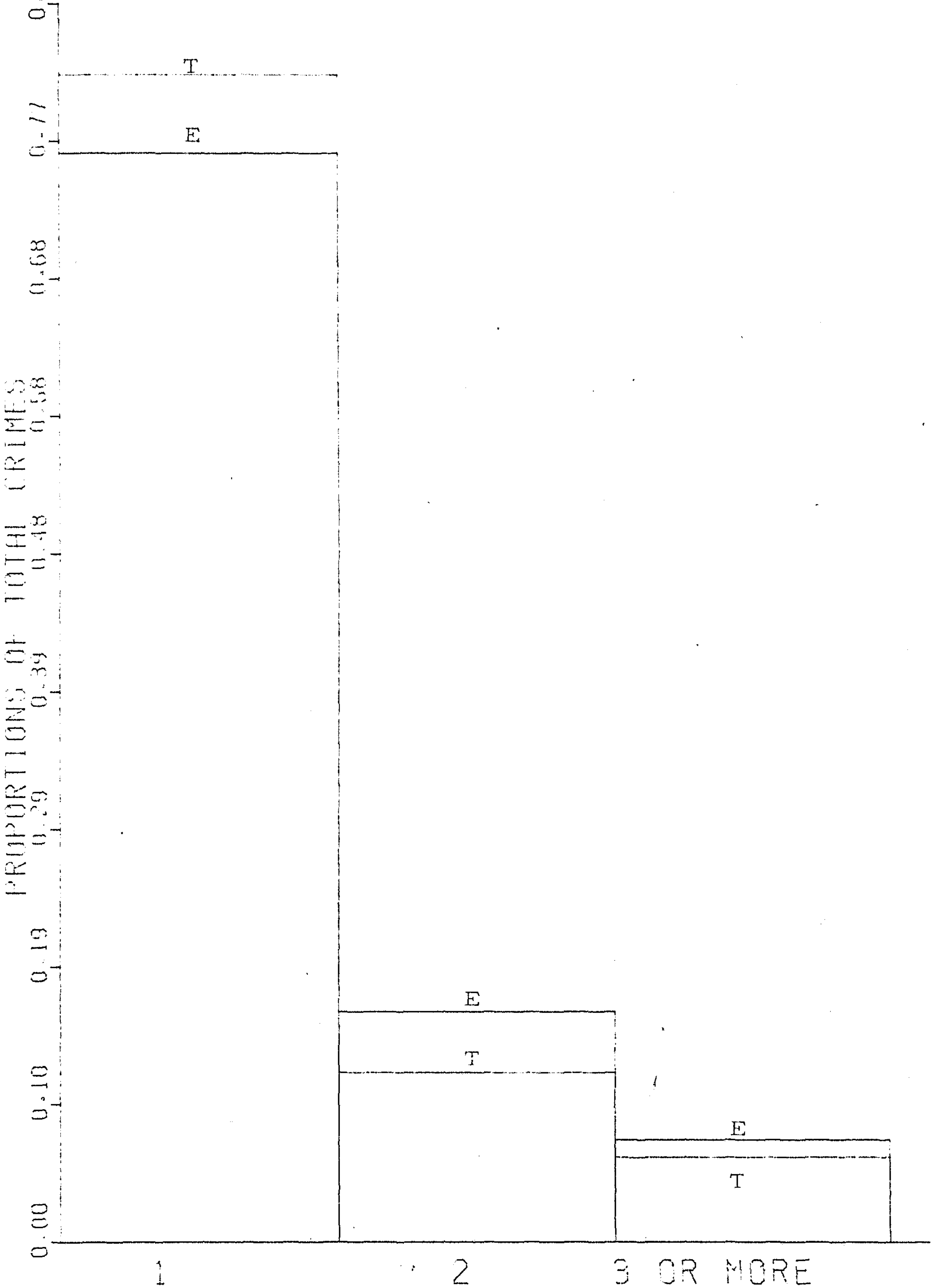


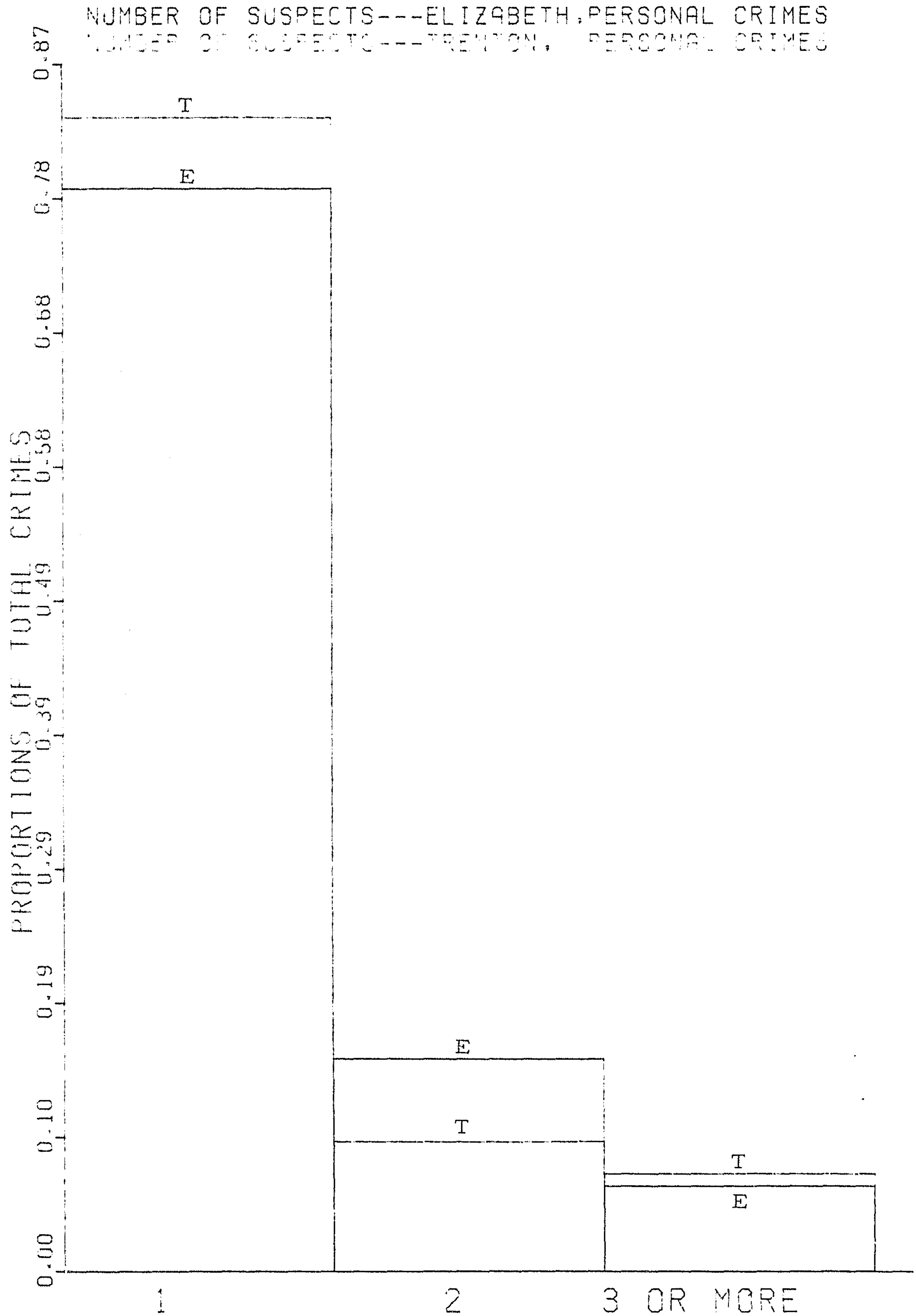

AGE OF YOUNGEST SUSPECT-ELIZABETH PERSONAL CRIMES
AGE OF YOUNGEST SUSPECT-TRENTON PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.46
0.41
0.36
0.31
0.26
0.21
0.15
0.10
0.05
0.00
E
T
T
E
T
E
T
E
11-14
15-20
21-30
3_-55

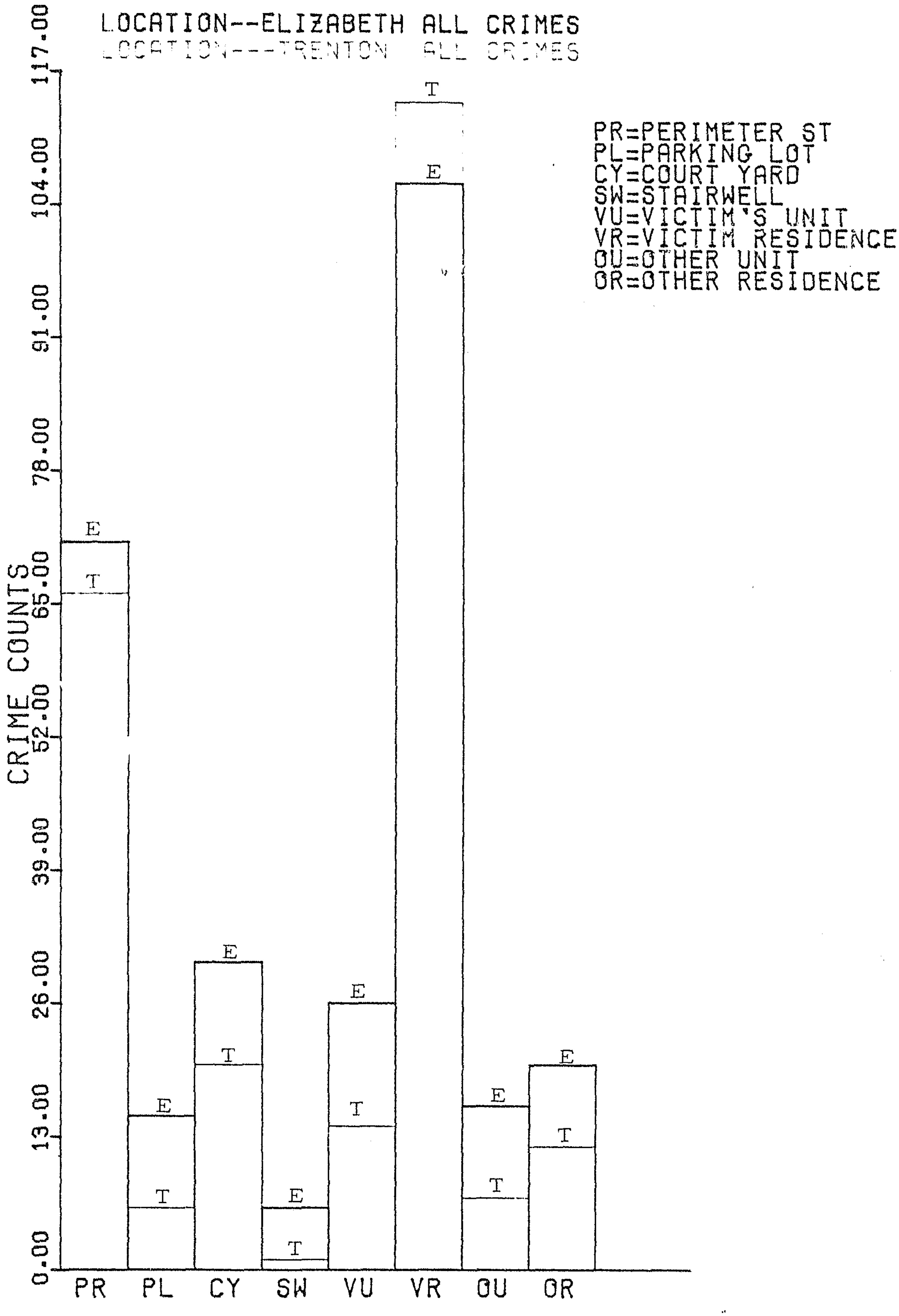


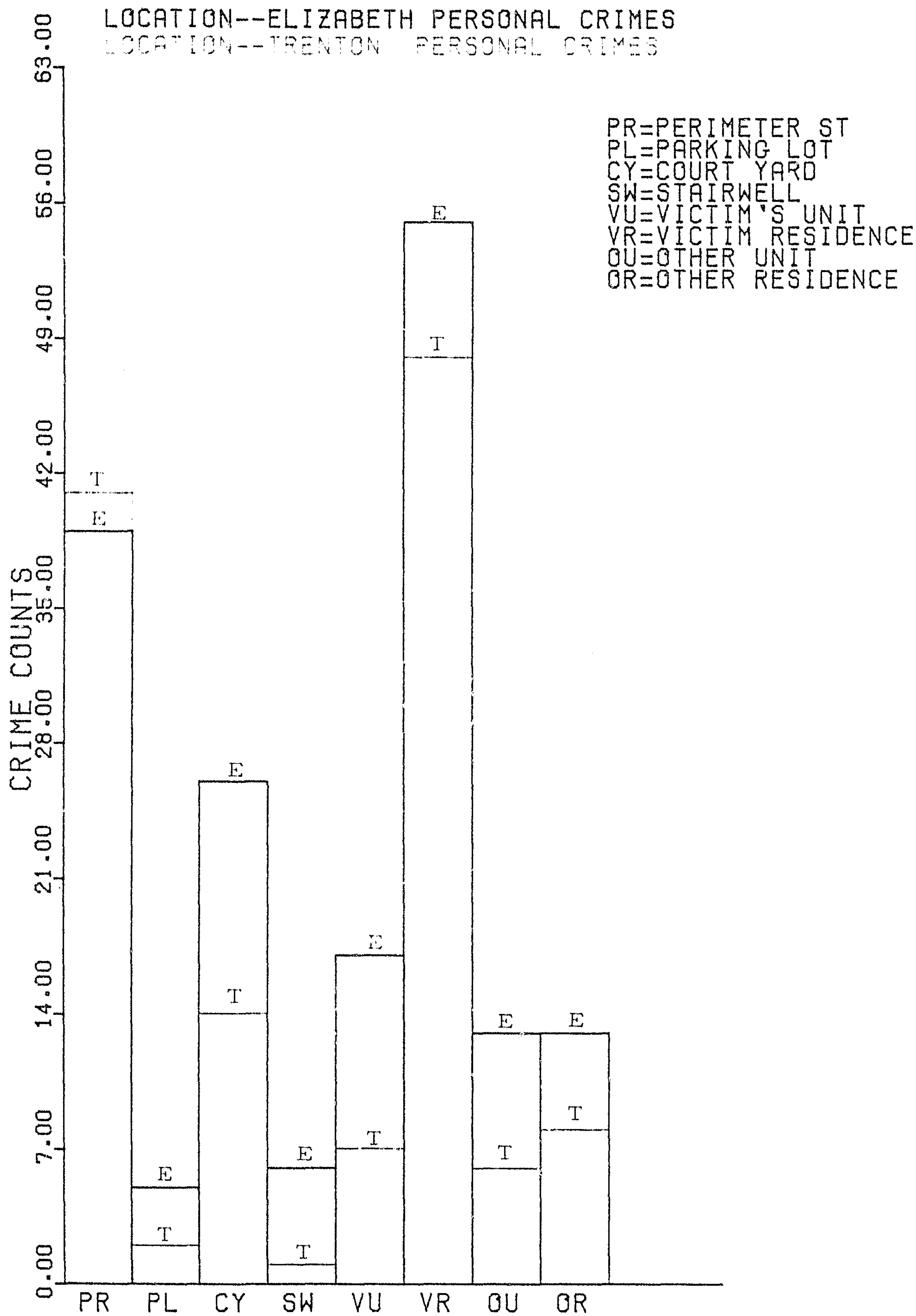
AGE OF YOUNGEST SUSPECT-ELIZABETH ALL CRIMES
AGE OF YOUNGEST SUSPECT-TRENTON ALL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.47
0.42
0.37
0.31
0.26
0.21
0.16
0.10
0.05
0.00
E
T
11-14
15-20
21-30
31-55

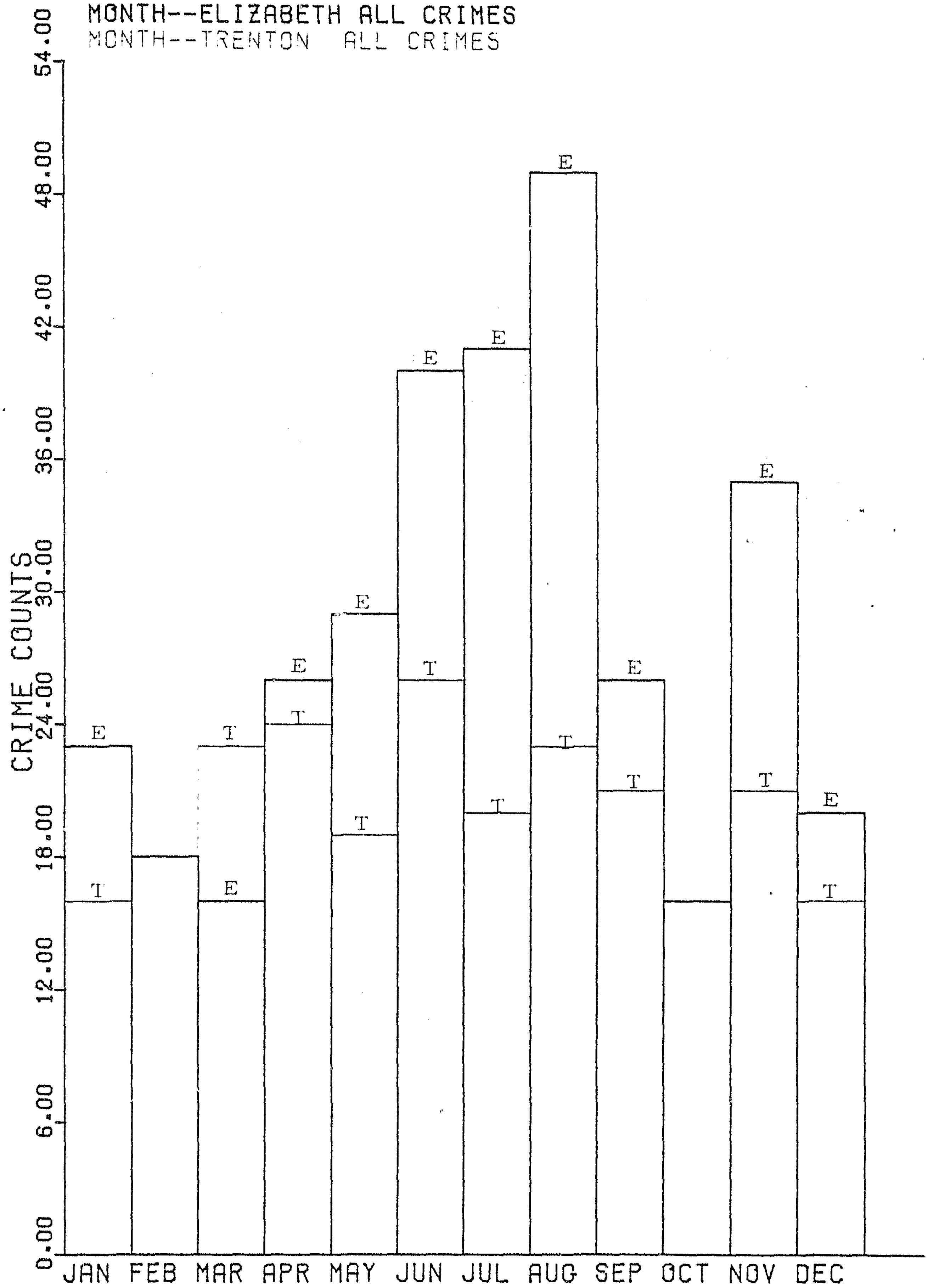
NUMBER OF SUSPECTS---ELIZABETH,ALL CRIMES

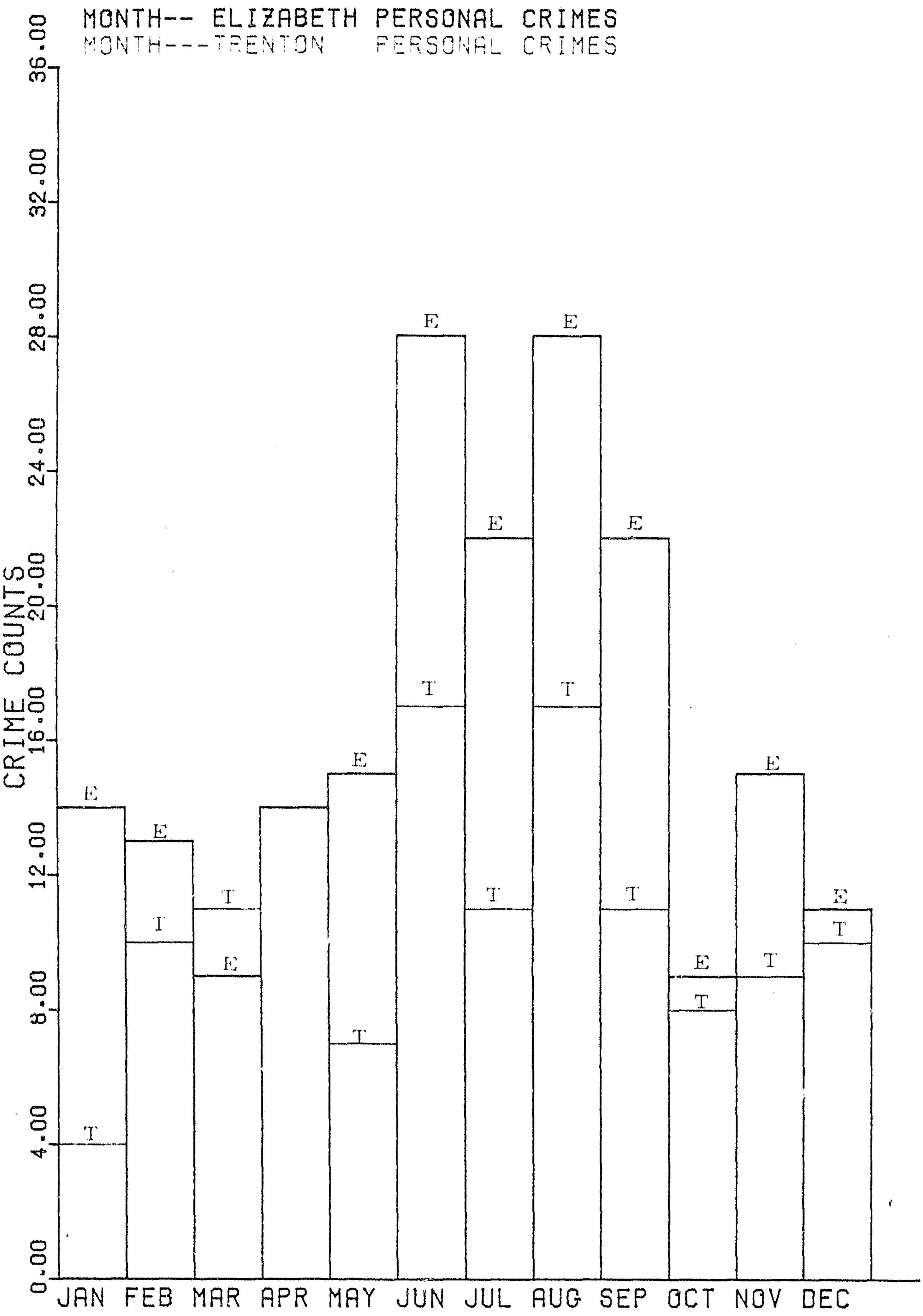


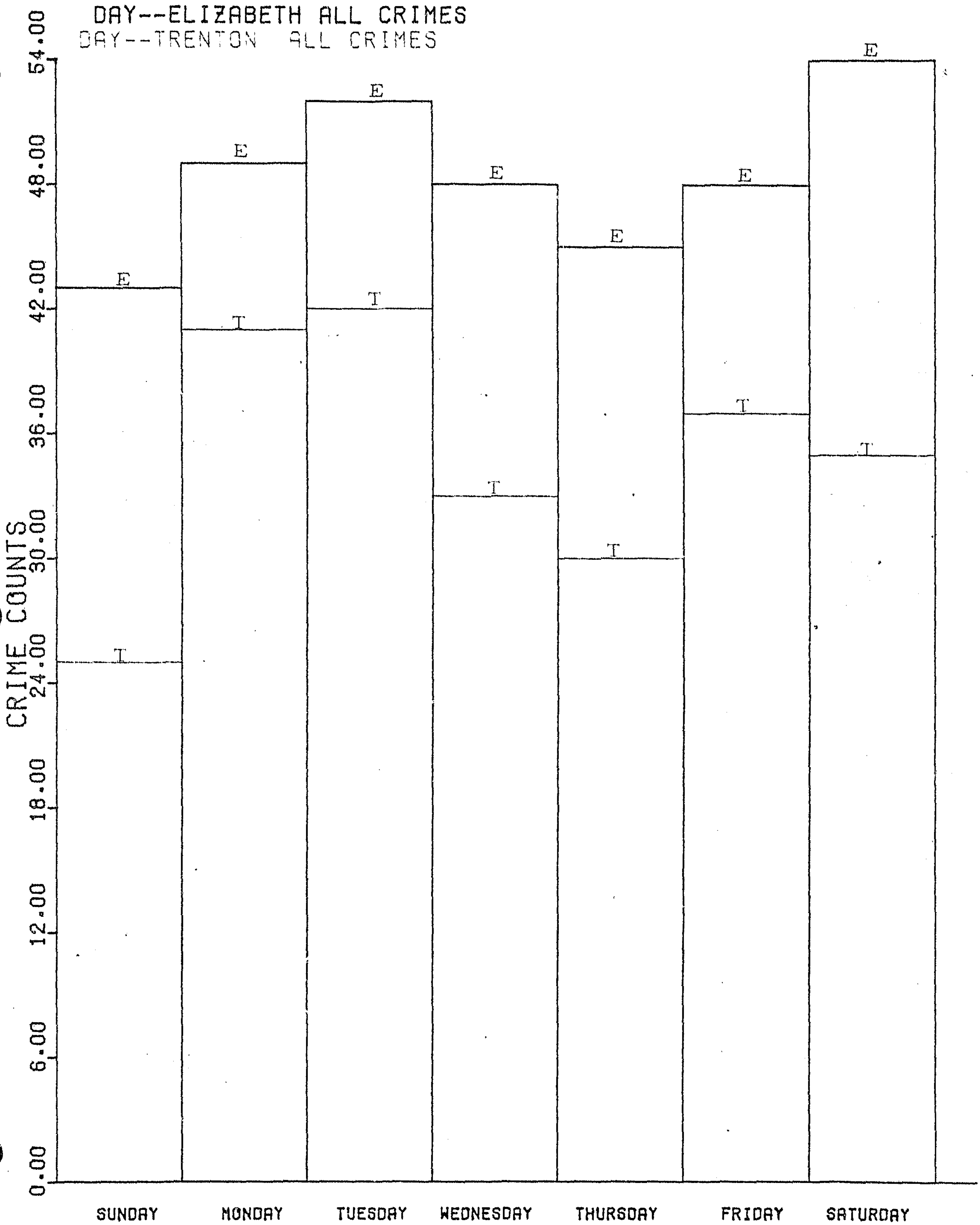

NUMBER OF SUSPECTS---ELIZABETH,PERSONAL CRIMES
NUMBER OF SUSPECTS---TRENTON, PERSONAL CRIMES
PROPORTIONS OF TOTAL CRIMES
0.87
0.78
0.68
0.58
0.49
0.39
0.29
0.19
0.10
0.00
T
E
1
2
3 OR MORE

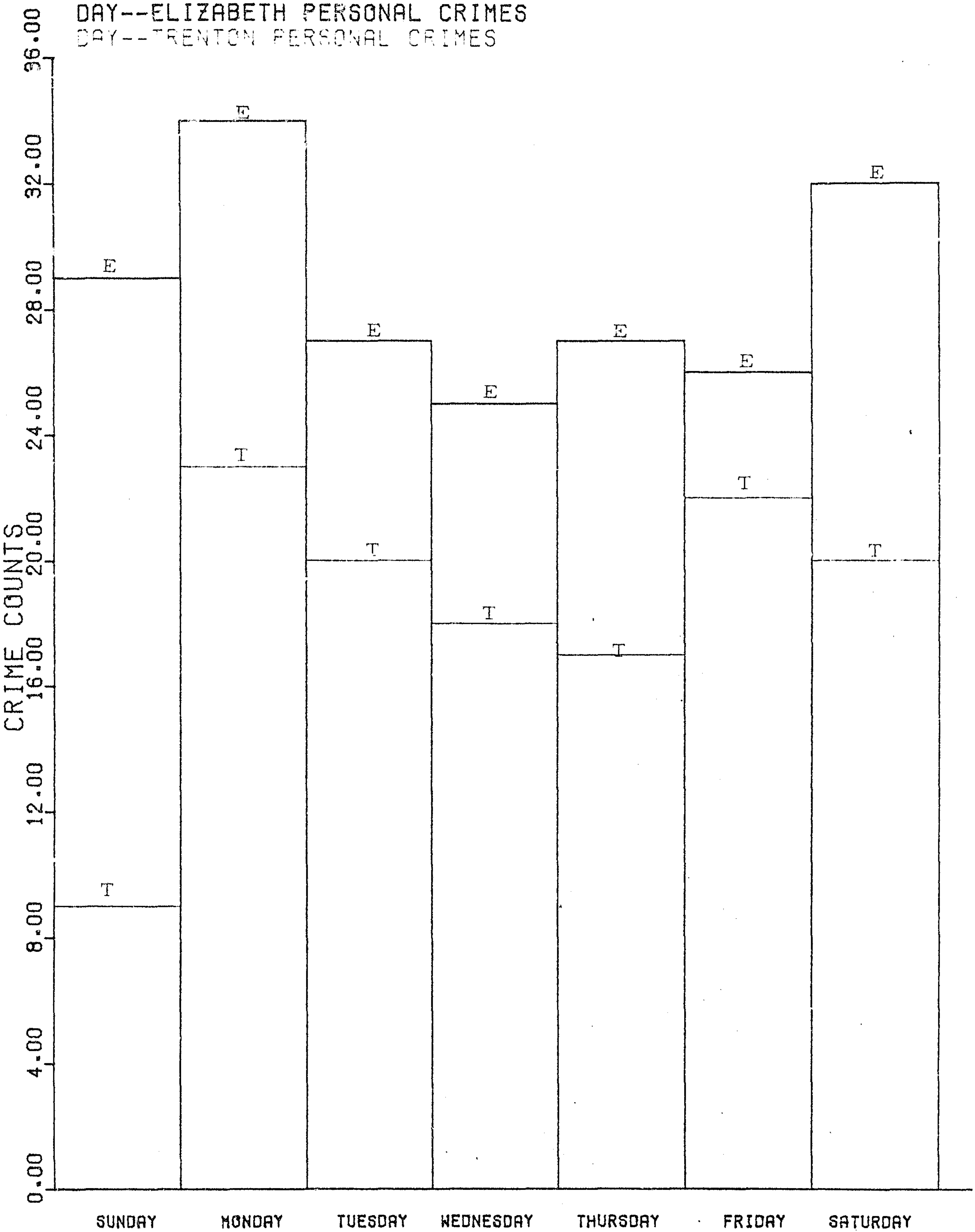

LOCATION--ELIZABETH ALL CRIMES
LOCATION---TRENTON ALL CRIMES
PR=PERIMETER ST
PL=PARKING LOT
CY=COURT YARD
SW=STAIRWELL
VU=VICTIM'S UNIT
VR=VICTIM RESIDENCE
OU=OTHER UNIT
OR=OTHER RESIDENCE
CRIME COUNTS
0.00
13.00
26.00
39.00
52.00
65.00
78.00
91.00
104.00
117.00
PR
PL
CY
SW
VU
VR
OU
OR
E
T


LOCATION--ELIZABETH PERSONAL CRIMES
LOCATION--TRENTON PERSONAL CRIMES
PR=PERIMETER ST
PL=PARKING LOT
CY=COURT YARD
SW=STAIRWELL
VU=VICTIM'S UNIT
VR=VICTIM RESIDENCE
OU=OTHER UNIT
OR=OTHER RESIDENCE
CRIME COUNTS
0.00
7.00
14.00
21.00
28.00
35.00
42.00
49.00
56.00
63.00
PR
PL
CY
SW
VU
VR
OU
OR

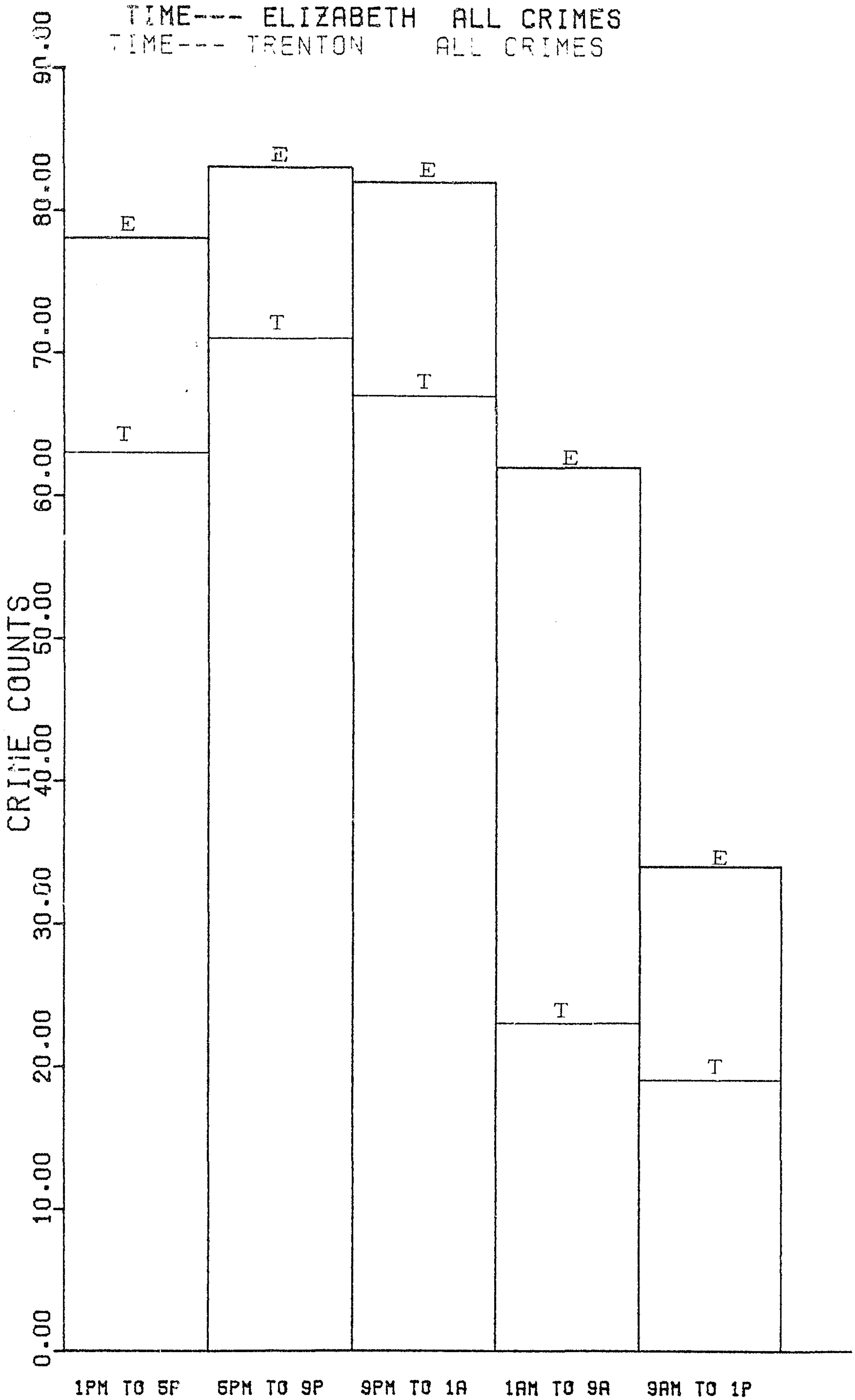

MONTH--ELIZABETH ALL CRIMES
MONTH--TRENTON ALL CRIMES
CRIME COUNTS
0.00
6.00
12.00
18.00
24.00
30.00
36.00
42.00
48.00
54.00
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
E
T


MONTH-- ELIZABETH PERSONAL CRIMES
MONTH---TRENTON PERSONAL CRIMES
CRIME COUNTS
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
36.00
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
E
T

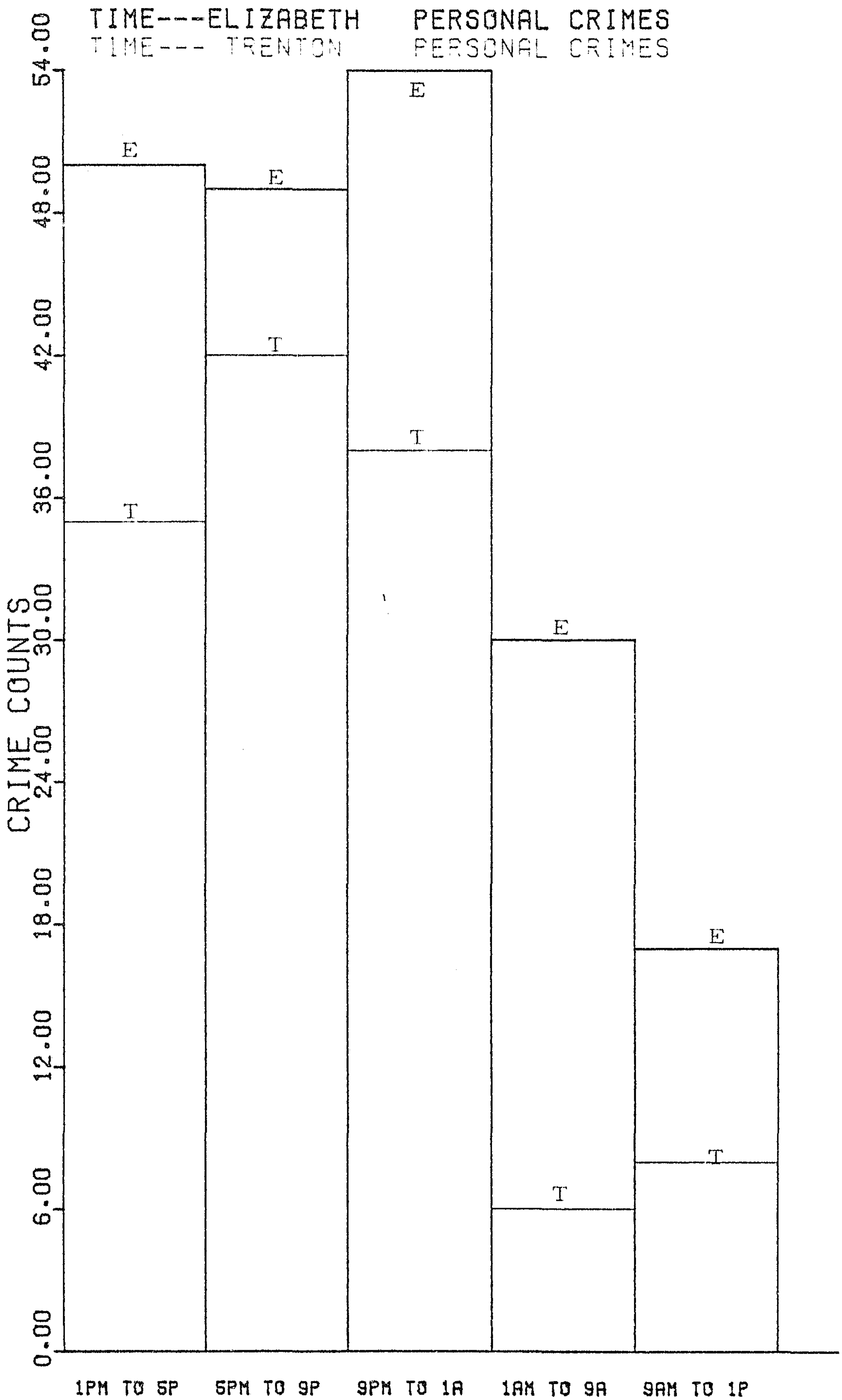

DAY--ELIZABETH ALL CRIMES
DAY--TRENTON ALL CRIMES
CRIME COUNTS
0.00
6.00
12.00
18.00
24.00
30.00
36.00
42.00
48.00
54.00
E
T
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY



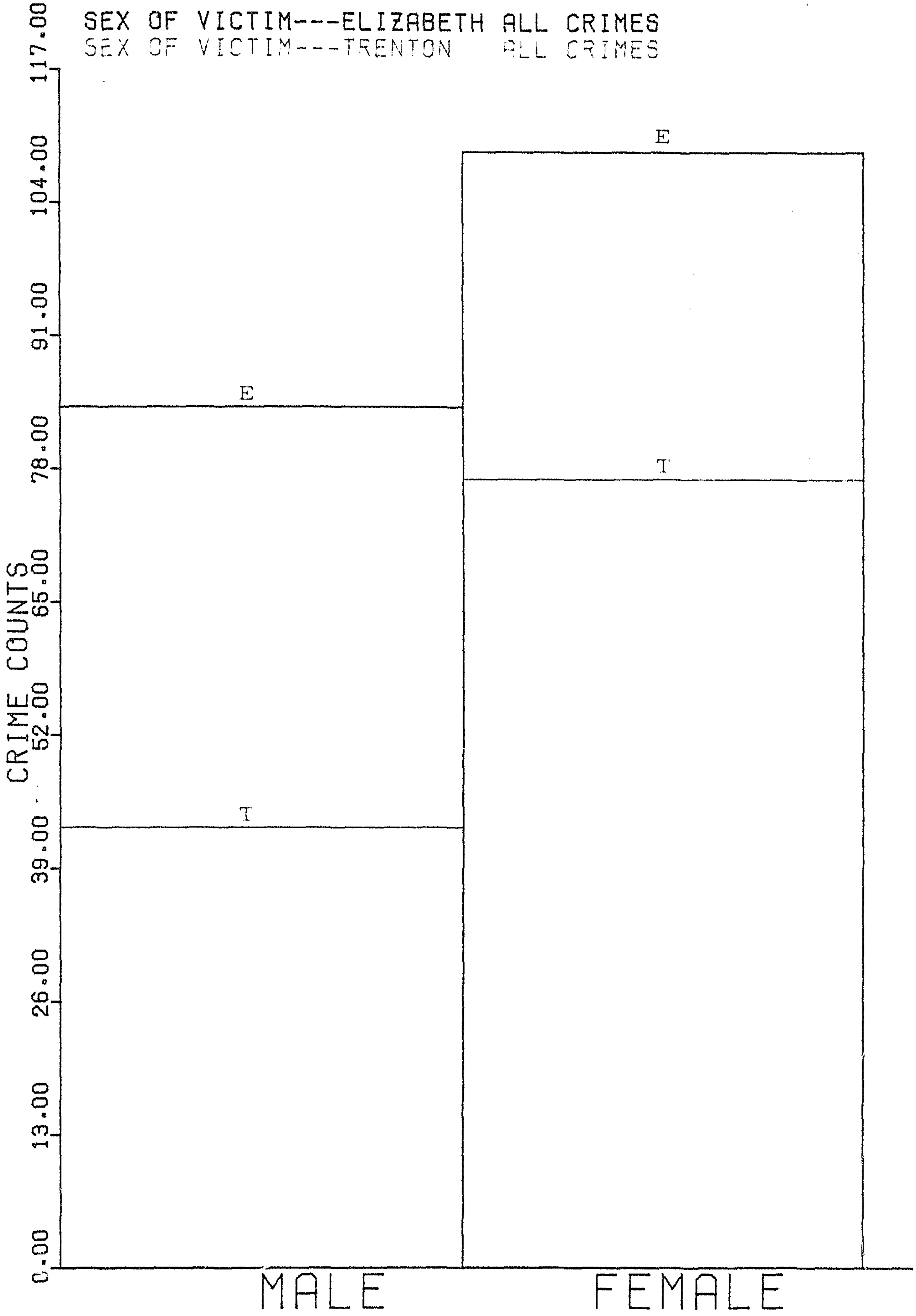
DAY--ELIZABETH PERSONAL CRIMES
DAY--TRENTON PERSONAL CRIMES
CRIME COUNTS
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
36.00
E
T
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY



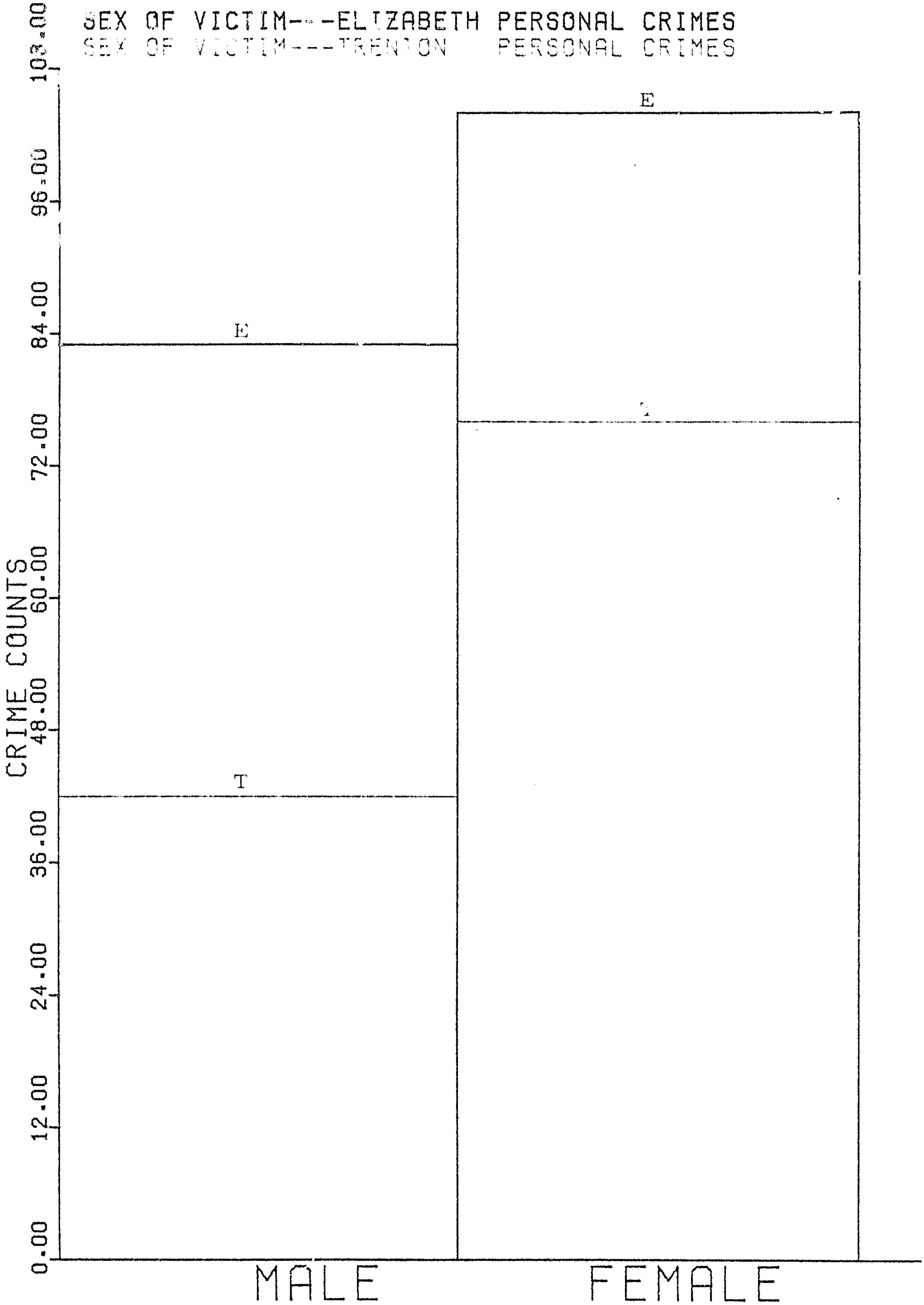
TIME--- ELIZABETH ALL CRIMES
TIME--- TRENTON ALL CRIMES
CRIME COUNTS
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
E
T
1PM TO 5P
5PM TO 9P
9PM TO 1A
1AM TO 9A
9AM TO 1P



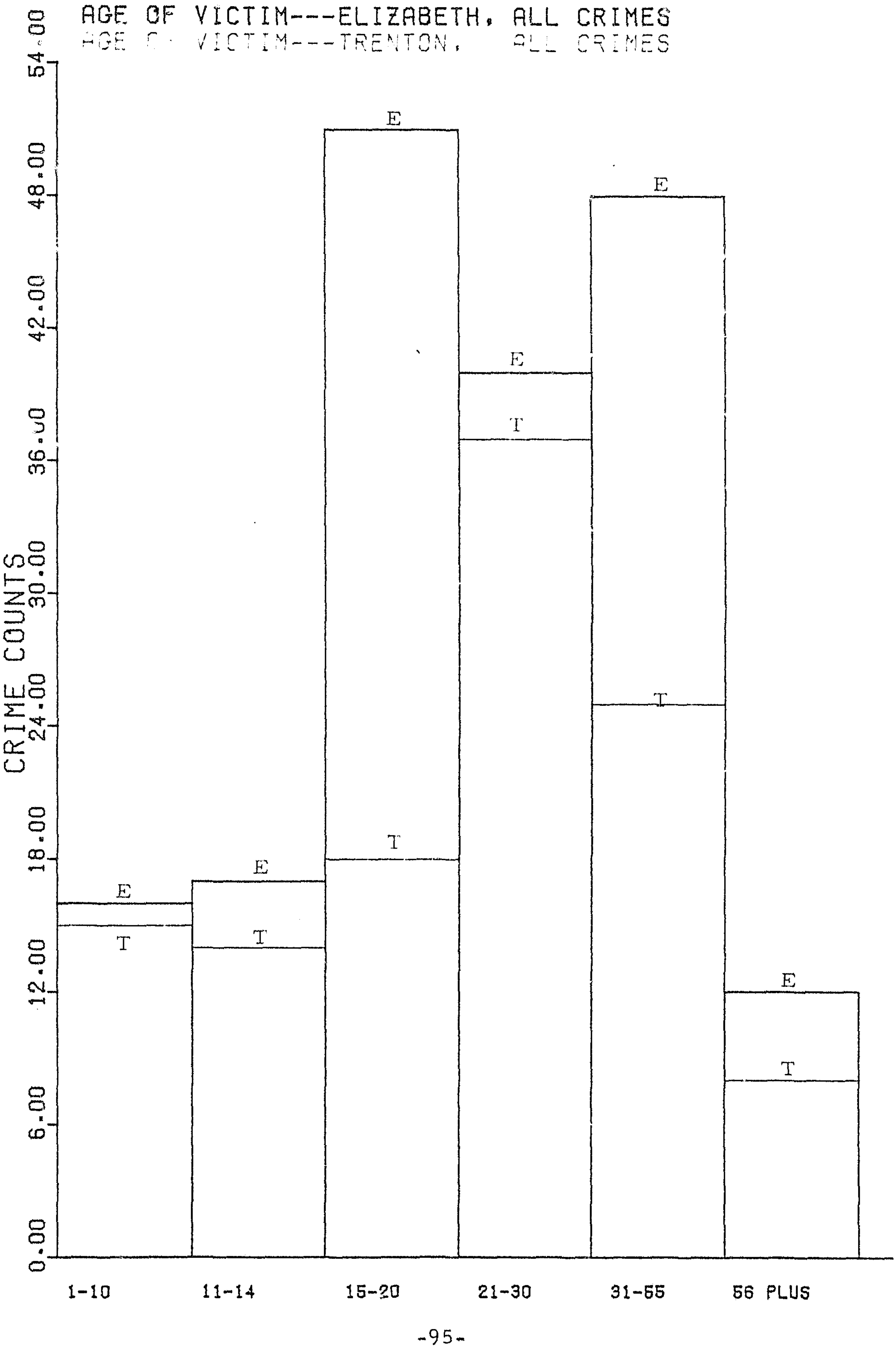
TIME---ELIZABETH PERSONAL CRIMES
TIME--- TRENTON PERSONAL CRIMES
CRIME COUNTS
0.00
6.00
12.00
18.00
24.00
30.00
36.00
42.00
48.00
54.00
E
T
1PM TO 5P
5PM TO 9P
9PM TO 1A
1AM TO 9A
9AM TO 1P

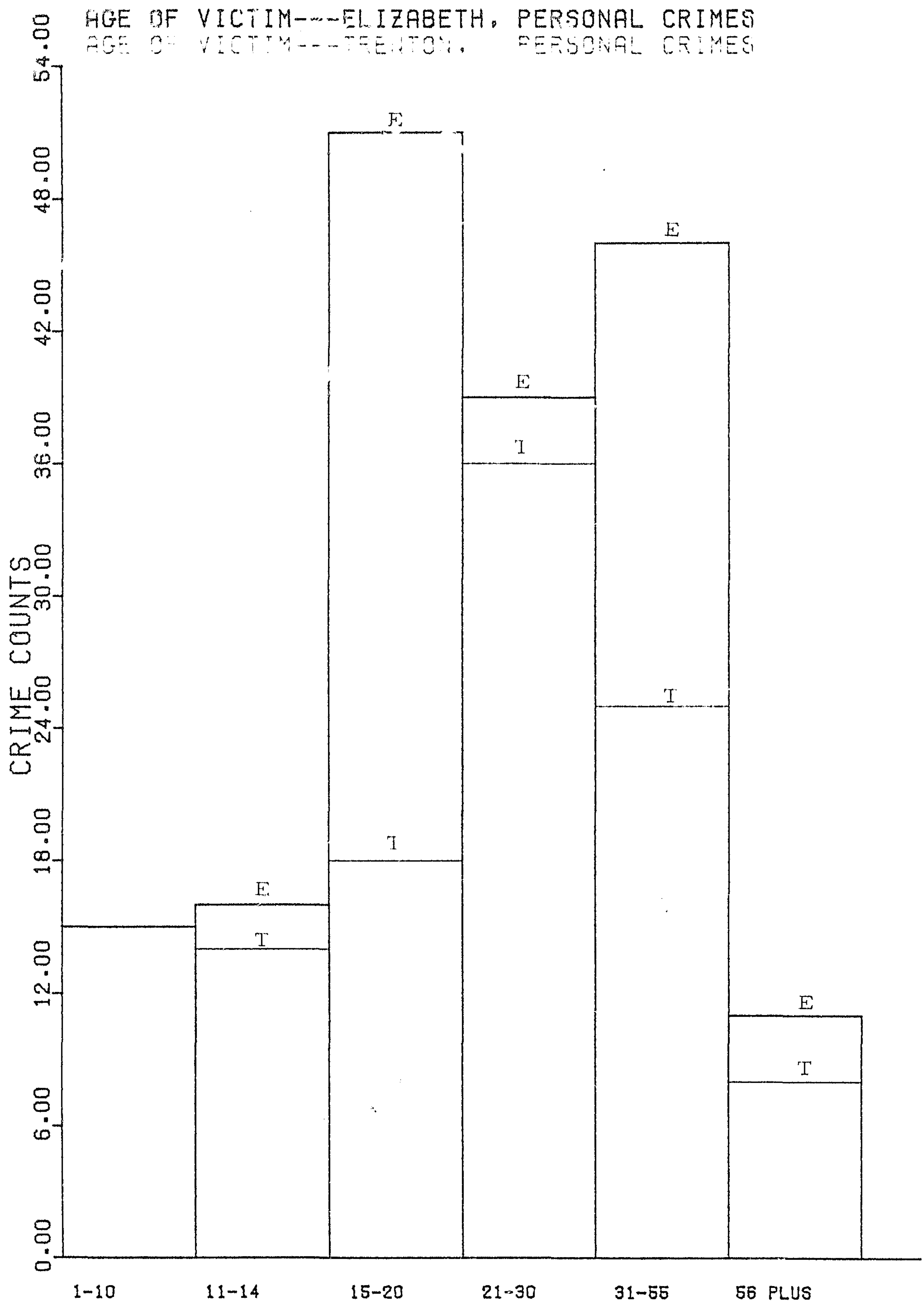


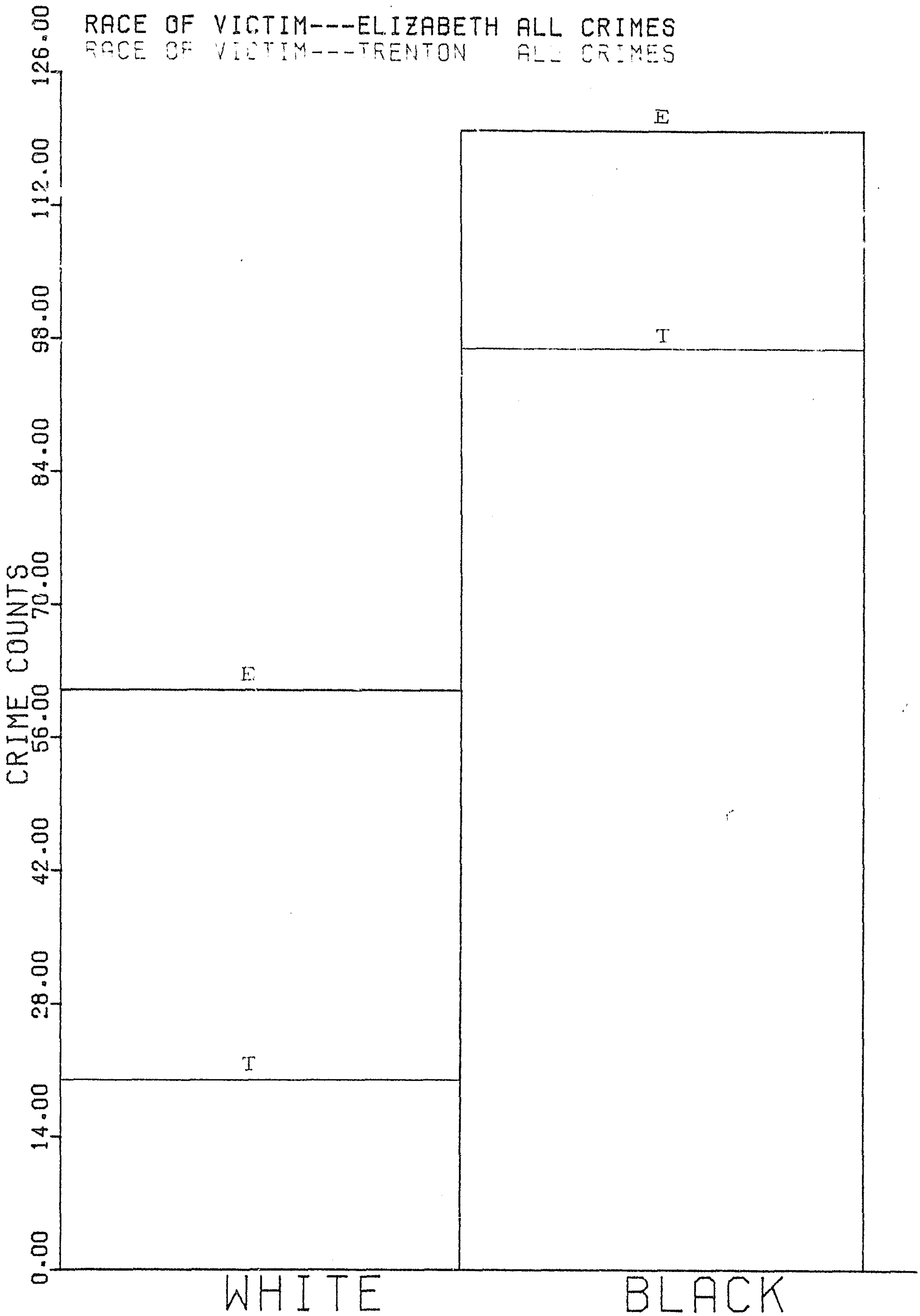
SEX OF VICTIM---ELIZABETH ALL CRIMES
SEX OF VICTIM---TRENTON ALL CRIMES
CRIME COUNTS
117.00
104.00
91.00
78.00
65.00
52.00
39.00
26.00
13.00
0.00
E
T
E
T
MALE
FEMALE

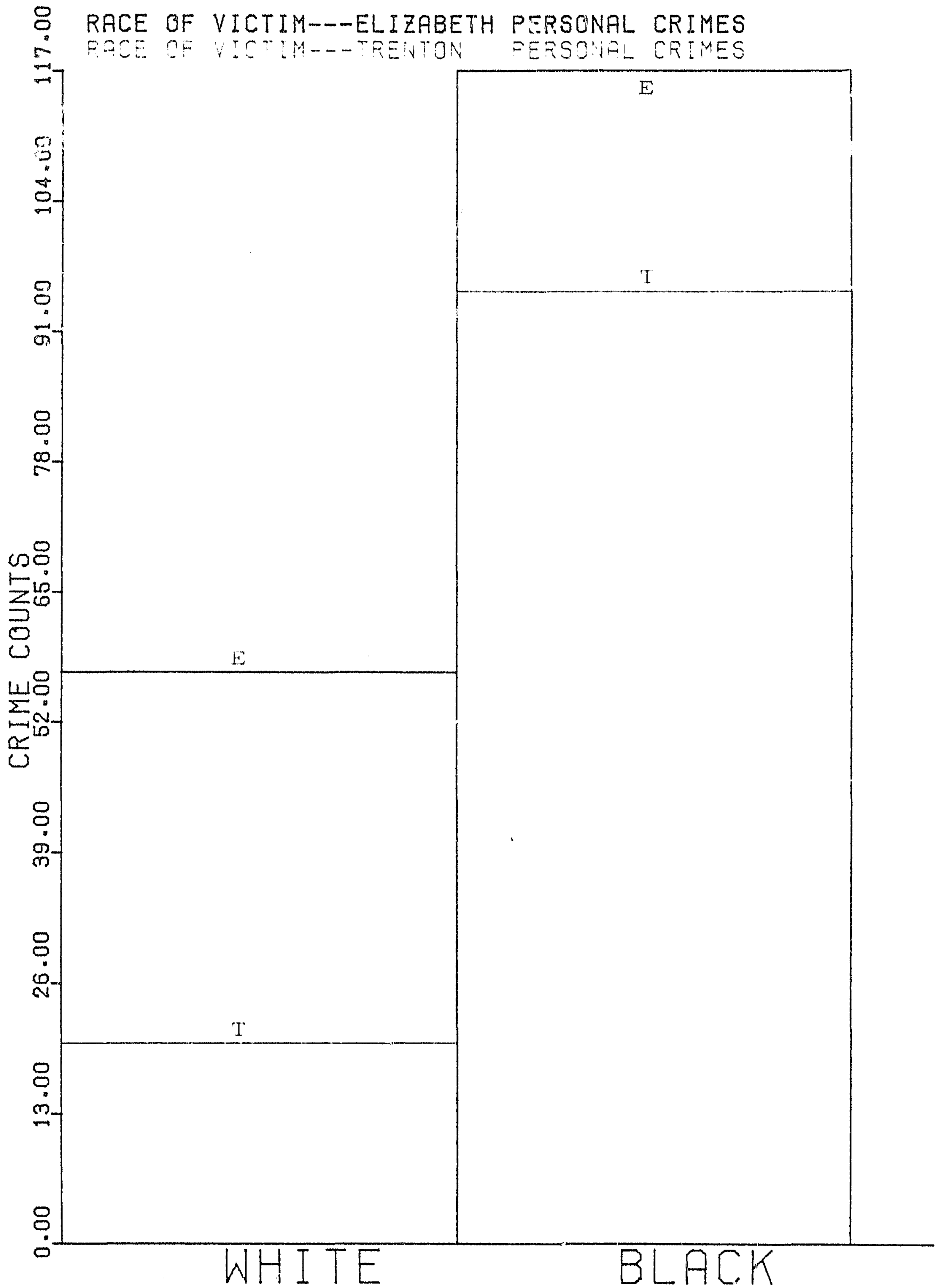


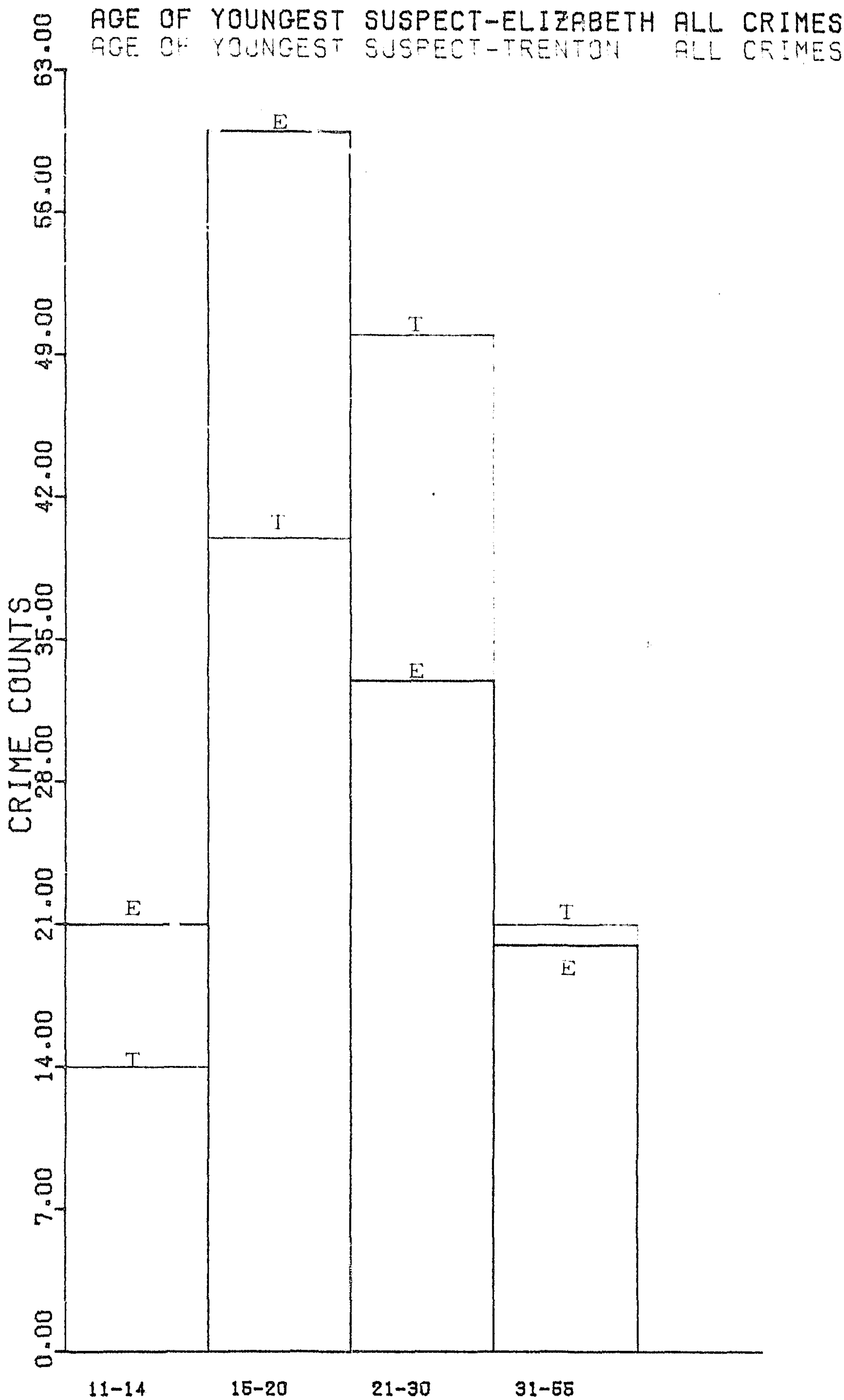
SEX OF VICTIM---ELIZABETH PERSONAL CRIMES
SEX OF VICTIM---TRENTON PERSONAL CRIMES
CRIME COUNTS
103.00
96.00
84.00
72.00
60.00
48.00
36.00
24.00
12.00
0.00
E
T
E
MALE
FEMALE

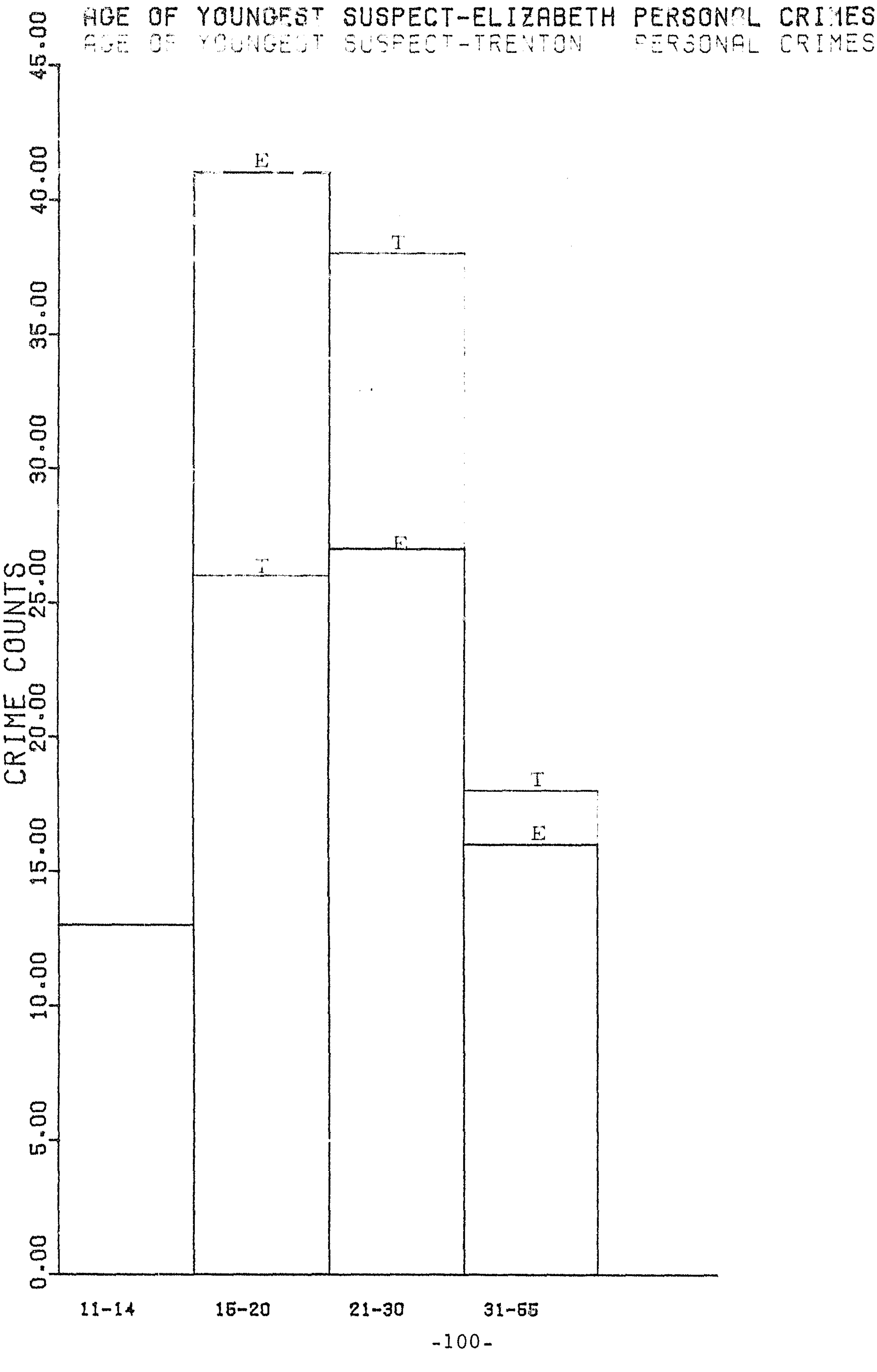

AGE OF VICTIM---ELIZABETH, ALL CRIMES
AGE OF VICTIM---TRENTON, ALL CRIMES
CRIME COUNTS
54.00
48.00
42.00
36.00
30.00
24.00
18.00
12.00
6.00
0.00
E
T
1-10
11-14
15-20
21-30
31-55
56 PLUS

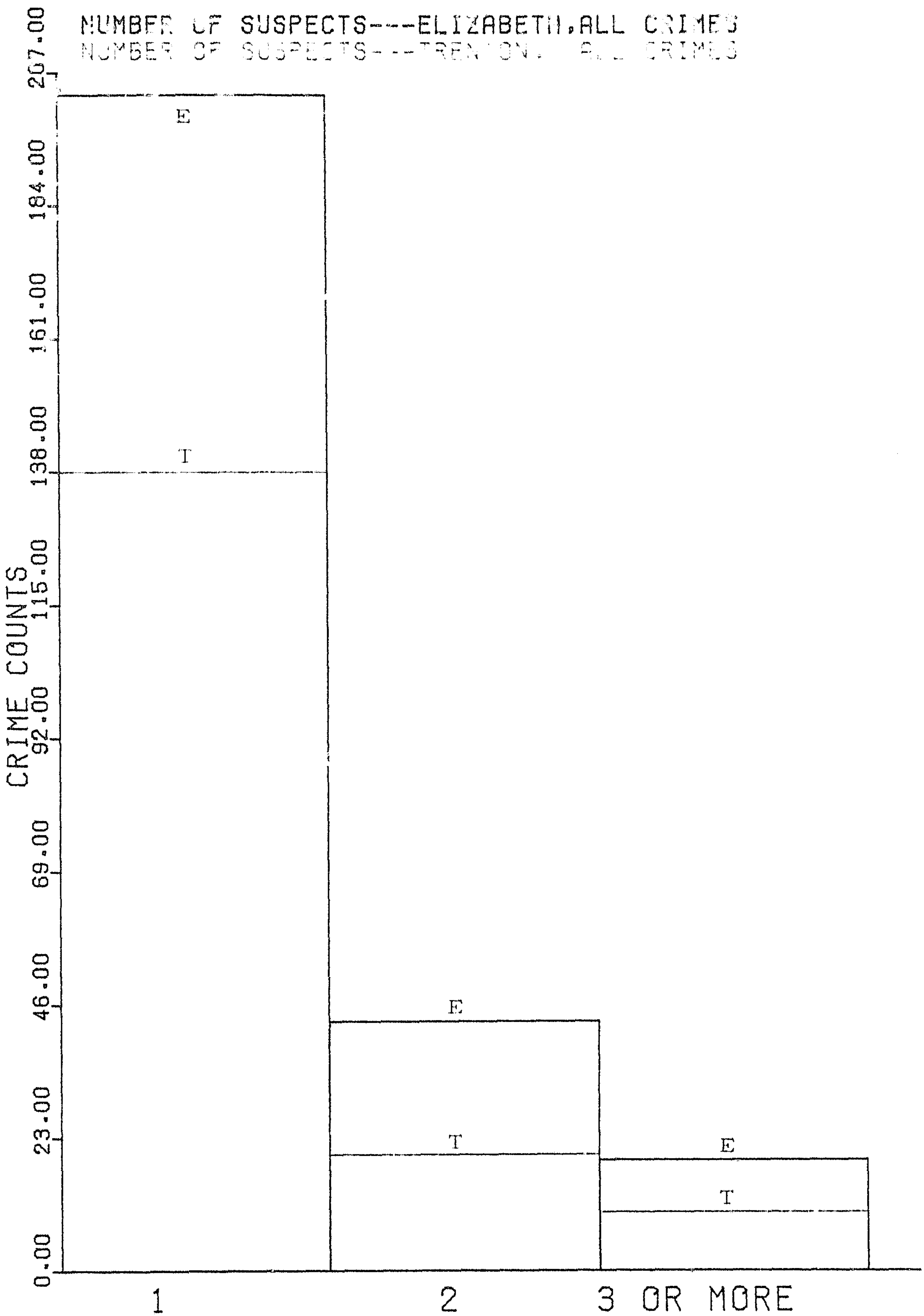

AGE OF VICTIM---ELIZABETH, PERSONAL CRIMES
AGE OF VICTIM---TRENTON, PERSONAL CRIMES
CRIME COUNTS
0.00
6.00
12.00
18.00
24.00
30.00
36.00
42.00
48.00
54.00
E
T
1-10
11-14
15-20
21-30
31-55
56 PLUS


RACE OF VICTIM---ELIZABETH ALL CRIMES
RACE OF VICTIM---TRENTON ALL CRIMES
CRIME COUNTS
0.00
14.00
28.00
42.00
56.00
70.00
84.00
98.00
112.00
126.00
E
T
WHITE
BLACK

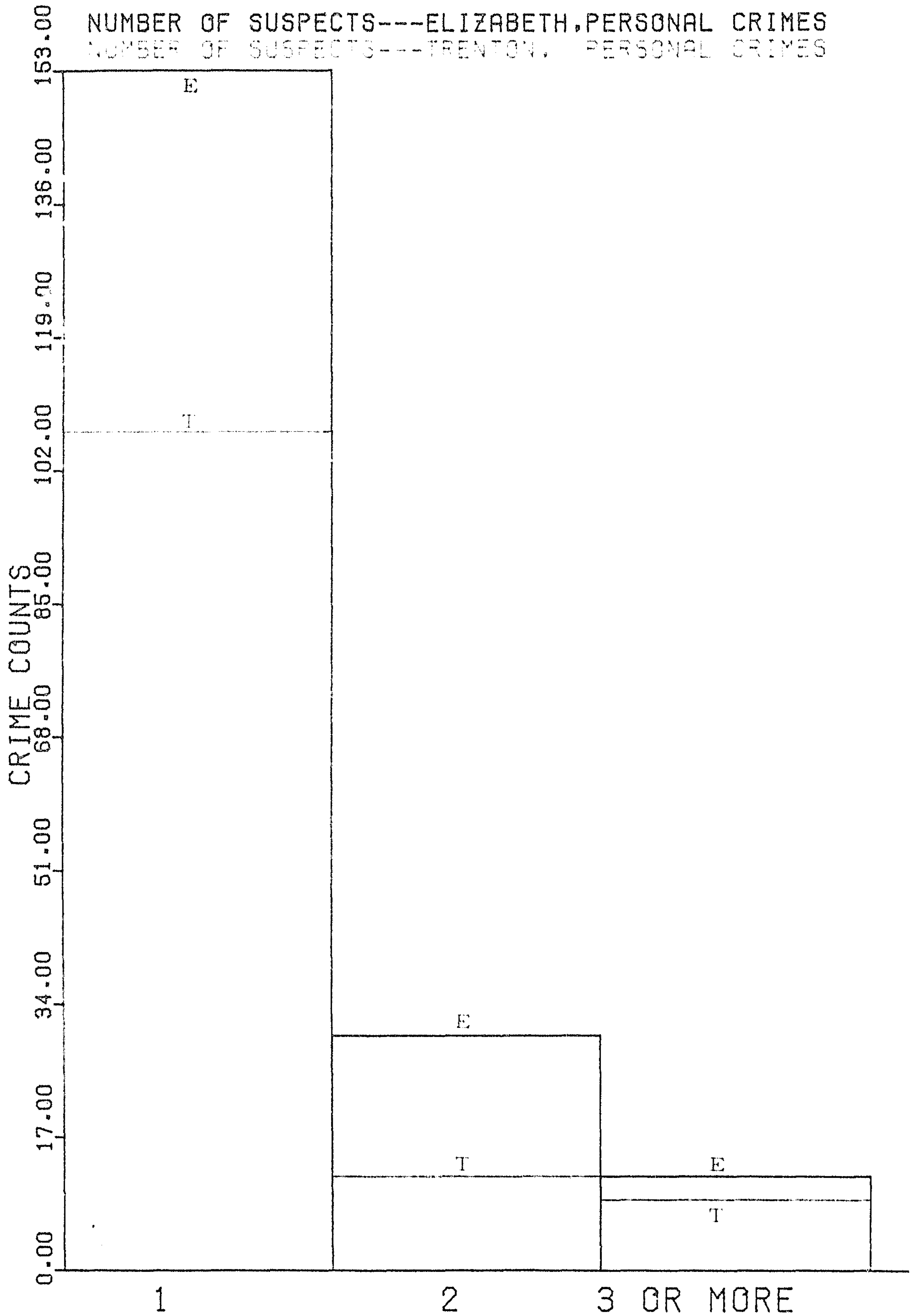

RACE OF VICTIM---ELIZABETH PERSONAL CRIMES
RACE OF VICTIM---TRENTON PERSONAL CRIMES
CRIME COUNTS
117.00
104.00
91.00
78.00
65.00
52.00
39.00
26.00
13.00
0.00
E
T
E
T
WHITE
BLACK


AGE OF YOUNGEST SUSPECT-ELIZABETH ALL CRIMES
AGE OF YOUNGEST SUSPECT-TRENTON ALL CRIMES
CRIME COUNTS
0.00
7.00
14.00
21.00
28.00
35.00
42.00
49.00
56.00
63.00
E
T
11-14
15-20
21-30
31-55


AGE OF YOUNGEST SUSPECT-ELIZABETH PERSONAL CRIMES
AGE OF YOUNGEST SUSPECT-TRENTON PERSONAL CRIMES
CRIME COUNTS
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
E
T
T
E
T
E
11-14
15-20
21-30
31-55



NUMBER OF SUSPECTS---ELIZABETH,ALL CRIMES
NUMBER OF SUSPECTS---TRENTON, ALL CRIMES
CRIME COUNTS
207.00
184.00
161.00
138.00
115.00
92.00
69.00
46.00
23.00
0.00
E
T
1
2
3 OR MORE


NUMBER OF SUSPECTS---ELIZABETH,PERSONAL CRIMES
NUMBER OF SUSPECTS---TRENTON, PERSONAL CRIMES
CRIME COUNTS
153.00
136.00
119.00
102.00
85.00
68.00
51.00
34.00
17.00
0.00
E
T
1
2
3 OR MORE

APPENDIX B. DOCUMENTATION

The following documents were delivered to the National Institute of Law Enforcement and Criminal Justice during the course of this program:

1 "General Field Evaluation Test Plan for the Citizen Alarm System," Aerospace Report No. ATR-75(7920)-1, dated July 1975.

This document describes the first level of planning for a full-scale field test. Test goals and objectives are identified. Potential test scenarios are discussed. Data requirements and methods of analysis are described, and certain key issues are identified as critical to task implementation.

2. "Planning for Test and Evaluation of the Citizen Alarm System," J.H. Wiggins Technical Report No. 75-1227-1, dated March 1975.

This report contains the information supplied to Aerospace by J.H. Wiggins Company as part of the preliminary test planning and research design for the test and evaluation of the Citizen Alarm System. Aerospace adapted this data to its own format and incorporated it into a general test plan for the Citizen Alarm System.

3. "Field Measurements of 452-MHz Transmission in Two Public Housing Areas," Franklin Institute Research Labs Report No. F-64425, dated July 1976.

The attenuation of an actuator signal due to the test site structures was measured and found to be 4 to 14 dB for outside walls and 3 to 9 dB for floors. These values are

well below those expected, presumably because of signal leakage through doors and windows and differences between the building blueprints and the actual construction.

END