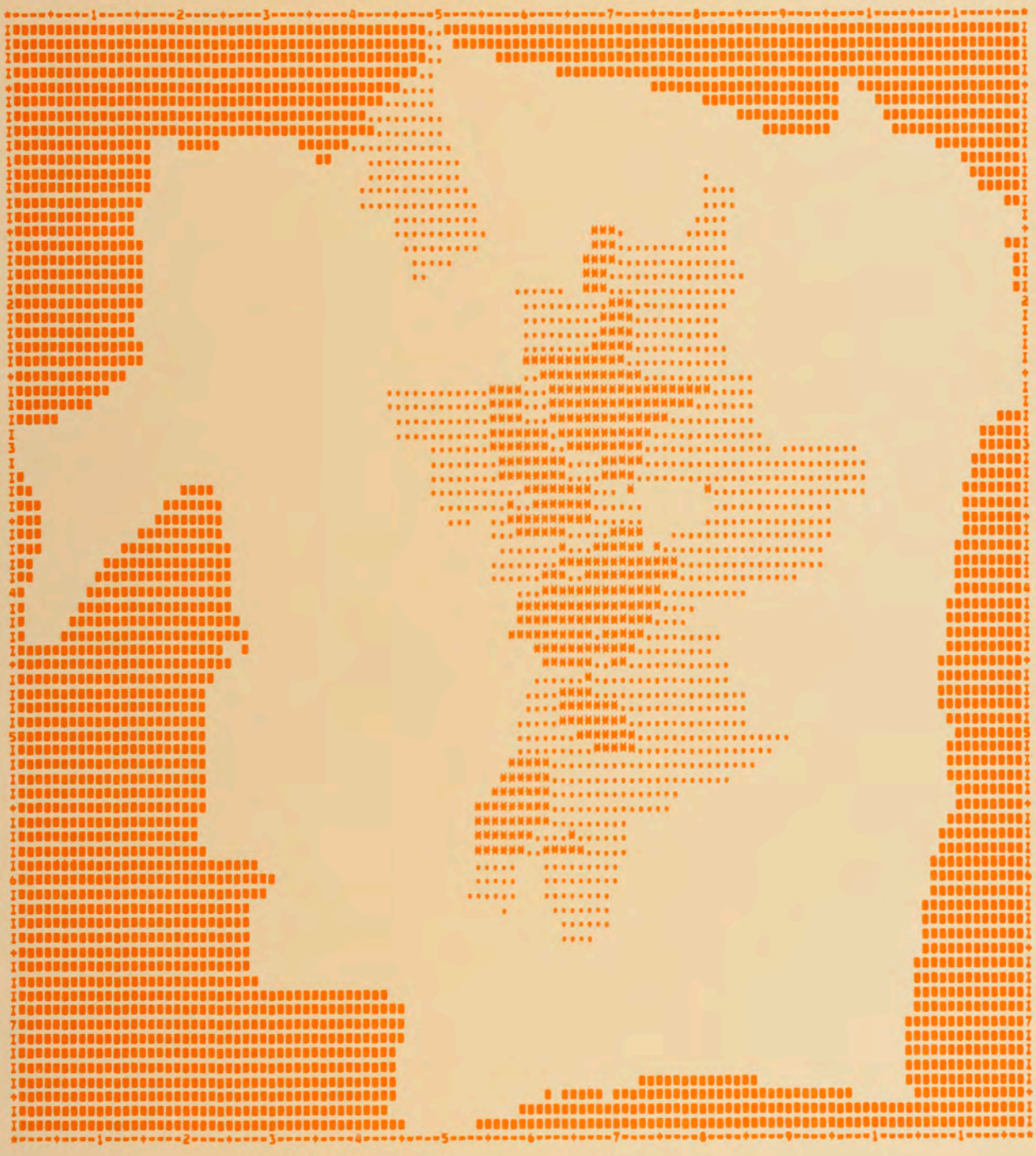
Analysis of Emergency Medical Services in Austin, Texas

Volume I: Results



Lyndon B. Johnson School of Public Affairs
The University of Texas at Austin
Policy Research Project Report

41

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Number 41

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Front Cover:

The illustration is a computer generated map of the areas in the City of Austin that can be reached within five minutes from any of twelve EMS vehicle stations of the proposed two-tiered Austin emergency medical service system. A period (.) indicates coverage by one station and a star (*) indicates coverage by two or more stations. The blank areas are more than five minutes away from an EMS station. Solid rectangles (■) outline the border of the City of Austin study area.

Foreword

The Lyndon B. Johnson School of Public Affairs has established interdisciplinary research on policy problems as the core of its educational program. A major part of this program is the nine-month policy research project, in the course of which two or three faculty members from different disciplines direct the research of ten to twenty graduate students of diverse backgrounds on a policy issue of concern to an agency of government. This "client orientation" brings the students face to face with administrators, legislators, and other officials active in the policy process, and demonstrates that research in a policy environment demands special talents. It also illuminates the occasional difficulties of relating research findings to the world of political realities.

This report, the first of two volumes, was produced by a policy research project in the academic year 1979-80. The study, funded by the City of Austin, the Texas Department of Human Resources, the Henry J. Kaiser Family Foundation, and the Lyndon Baines Johnson Foundation, developed a series of techniques to assist the City of Austin to deploy and manage emergency medical service vehicles. This volume provides statistical data about the Austin EMS system, including geographic and temporal distribution of historical EMS calls, geographic and ethnic distribution of the population, and performance of the current configuration of EMS vehicles. It then offers a vehicle deployment analysis which identifies alternative sites for basing service vehicles.

It is the intention of the LBJ School both to develop men and women with the capacity to perform effectively in public service and to produce research which will enlighten and inform those already engaged in the policy process. The project which resulted in this volume has helped to accomplish the former; it is our hope and expectation that the report itself will contribute to the latter.

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Chapter 1
Introduction

In 1978 The University of Texas at Austin contracted with the City of Austin to analyze the City's emergency medical service (EMS) system and to provide the City with the computer software necessary for it to perform similar analyses in the future. Project members developed or implemented four computer packages in generating the tables, graphs, and maps representing the results of this analytical effort. Some of these results are contained in the following chapters.

The results can be divided into two parts: EMS system information and EMS vehicle deployment analysis. EMS system information includes statistical data about the geographic and temporal distribution of historical Austin EMS calls, the geographic and ethnic distribution of the city's population, and the performance of the current configuration of EMS vehicles. The vehicle deployment analyses comprise a set of vehicle configurations, each of which represents the Austin EMS system under a unique set of demand and response time conditions. The first part of this chapter discusses the kinds of EMS system information that have been compiled in Chapters 2 and 3 of this volume; the second part describes the vehicle location analyses contained in Chapters 4 and 5.

DESCRIPTIVE ANALYSES OF THE AUSTIN EMS SYSTEM

City officials were interested in learning about the nature of EMS demand in Austin and about the performance of the current configuration of vehicles responding to those calls. To answer these questions Project members developed a computer package, CHAP, that can aggregate, array, and analyze historical EMS call data. Project members also used two computer mapping programs, SYMAP and SYMVU, to display CHAP results as two- and three-dimensional maps of Austin.

CHAP can aggregate EMS calls on the basis of the type, geographical location, day, and time of occurrence of the calls. Tables 2.1 through 2.8 and Figures 2.1 through 2.8 illustrate the temporal distribution of eight types of calls (incidents related to accidental injuries, automobiles, drugs, heart attacks, seizures, strokes, violence, and all other types) that occurred during the five-month period for which data were available. By aggregating information this way, project members were able to illustrate temporal patterns of particular components of EMS demand. For example, motor vehicle-related calls peaked between 4 p.m. and 8 p.m. on weekdays and between midnight and 4 a.m. on Saturdays and Sundays (see Figure 2.2).

Using CHAP-generated output from Tables 2.1 through 2.8, project members were able to derive "average days" for each call type (Table 2.9 and Figures 2.9 through 2.16). Each figure represents the expected frequency of occurrence of a call of a particular type during each of six four-hour intervals of the day. This information may be useful to EMS staff in planning for the types of incidents likely to be encountered during particular times of the day.

To learn about the geographical distribution of calls, CHAP was used to aggregate the number of calls for each serial zone and for each call type. These data were used as input to the computer mapping programs to generate Figures 3.1 through 3.27. These figures include two- and three-dimensional maps of the distribution of eight types of calls, those classified as "critical," and those transported or not transported by EMS vehicles. This information illustrates the spatial patterns of the components of EMS demand in Austin.

There was some interest in determining how the distribution patterns of age and ethnic groups compare with the patterns of recorded EMS demand. Figures 3.28 through 3.41 illustrate the geographic distribution of various population groups in Austin.

Finally, CHAP was used to describe the response patterns of EMS vehicles during the five-month data period. Tables 2.13 through 2.16 and Figures 2.20 through 2.23 summarize for the entire EMS system the relative and cumulative response time to the scene of the emergency; time spent at the scene; transport time to the hospital; and the time spent by the vehicle at the hospital.

Figures 2.24 through 2.37 map the relative frequency of individual vehicle responses to various parts of the city. These maps show that vehicles respond to a large number of calls outside their primary service areas.

LOCATION ANALYSIS FOR EMS VEHICLES

In addition to gathering information about EMS demand and system performance, the EMS Department was interested in identifying good bases for service vehicles. The Project employed two computer packages, GAS and CALL/CZSR, to select and evaluate alternative locations for the City's EMS vehicles.

The GAS program (described in Chapter 4) consists of two separate computer procedures, called GA and GAS,

that seek to maximize the amount of EMS demand that can be covered by a number of EMS vehicles, subject to an upper limit on the maximum allowable vehicle response time. The primary output of both GA and GAS is a set of vehicle sites that are accessible to a large percentage of the total EMS demand.

Project members initially made eleven exploratory GA runs and two GAS runs. The eleven GA runs tested the sensitivity of GA site configurations to changes in the maximum allowable response time and to the introduction of different sets of demand data. Figures 4.1 through 4.5 and Tables 4.1 through 4.5 show how the GA program allocated EMS vehicles to cover historical EMS calls, as response time was increased from four to eight minutes. Figures 4.6 through 4.11 show how vehicle deployment was affected by the substitution of different sets of demand data. Demand was defined as either some portion of the historical call data or the geographic distribution of different population groups.

In a second stage, project members sought to incorporate into the GAS analysis a City Council policy of joint facility use and a proposal to convert to a two-tiered system of response to emergency calls. To model the effect of the policy of joint use, project members solved five problems in which either one or two sites were "fixed," or specified by the user. Fixing sites represented the possibility that the City would have flexibility in siting only a portion of its EMS vehicles. All serial zones were considered as potential sites for the remaining vehicles. The purpose of excluding sites was to model the case in which the user was interested in finding the best configuration of feasible sites in areas containing City-operated fire stations or other City property. These five problems were then further constrained to exclude all but sixteen zones as potential vehicle sites.

Project members evaluated the relative performance of the constrained runs by comparing the coverages offered by the constrained and unconstrained GAS solutions. Tables 5.1 through 5.18 and Figures 5.1 through 5.12 compare the results of the constrained and unconstrained runs and list the system performance statistics generated by another location program, CALL/CZSR.

The CALL/CZSR package consists of a pair of computer procedures that work together to reduce the average response time of a system of EMS vehicles. The CALL program uses a Monte Carlo procedure to generate a random sample of EMS calls and a queuing model to simulate the process of dispatching vehicles to calls. The CZSR program is a search routine that takes a set of user-specified vehicle sites and evaluates the relative improvement in overall system response time that would result from moving vehicles to contiguous zones. The routine terminates when improvements in average system response time fall below a prespecified lower limit or after the program has reached a user-defined upper bound on the number of iterations. Project members used CALL/CZSR results primarily to evaluate the performance of a system of GAS-generated sites: a set of sites selected by GAS or GA was input into CALL/CZSR, and the CZSR program then computed systemwide operating statistics.

During the time this study was in progress the EMS Department began considering a proposal to implement a two-tiered EMS system. Under this proposal, specially equipped vehicles staffed by paramedics would respond to all of those calls where advanced life support would be required to treat the patient properly. Another group of vehicles, staffed by emergency medical technicians, would respond to all calls where advanced life support would not be required. Thus the EMS Department was interested in finding one set of vehicle sites that could best cover "critical" call demands and another set of sites that could cover all other EMS demands. Advanced life support units would most often be dispatched to critical calls or calls likely to require patient transport; basic life support units would respond to noncritical calls and calls unlikely to require patient transport.

This rationale led to the execution of several GAS runs where the demand data consisted of critical, noncritical, transport, or nontransport calls. Critical calls were defined as calls related to violence, heart attacks, strokes, and unconscious patients. The remaining call types were designated noncritical. Calls were also grouped according to whether or not the case required that the patient be transported to the hospital. Table 5.19 and Figure 5.13 show GAS-generated vehicle configurations for transport and nontransport calls. Table 5.20 and Figure 5.14 show GAS-selected sites for critical and noncritical calls.

DEVELOPMENT OF AN EMS VEHICLE DEPLOYMENT PLAN

Mr. Bill Bulloch, Director of the EMS Department, proposed an EMS vehicle deployment plan based upon (a) the areas frequently selected by GAS; (b) the City Council policy of joint use; (c) expected changes in future EMS calls. The Appendices reproduce several internal City of Austin memoranda on the topic of the station location study.

Chapter 2
CHAP Results

This section contains results of analyses of EMS call data obtained by using the Call History Analysis Package (CHAP). CHAP is a collection of computer programs that analyze records of the time, place, and nature of calls for assistance as well as the responses of the EMS system to these calls. Three CHAP programs were used to perform the analysis described here:

- Call Analysis Program (CAP)
- Response Analysis Program (RAP)
- Zonal Aggregation Program (ZAP)

CAP was used to aggregate call data by call type, by time of day and season, and by responding EMS vehicle. RAP calculated a historical frequency distribution of response time to the scene, on-scene time, transport time to the hospital, and time at the hospital. ZAP computed the total number of calls for each city serial zone by call type and ambulance. The ZAP output was used as input to the SYMAP and SYMVU mapping programs.

The input to the CHAP programs consisted of 4,331 incoming calls to the EMS system recorded in December of 1976 and January, June, July, and August of 1977. Fewer than 4,331 calls are considered in some analyses. This reflects data recording errors or runs that utilize only a portion of the data set. The following data were gathered on each call:

- the site (serial zone) from which the call originated;
- the day and time of day the call was made;
- the nature of each call;
- the location and identity of the responding EMS unit;
- the time (hour and minute) when an EMS vehicle arrived at the call scene; left the call scene; arrived at the hospital; and left the hospital.

This information may be displayed in the form of tables, figures, and maps. A detailed description of both the CHAP and the mapping programs can be found in a report by the 1978-1979 EMS Policy Research Project (1) and Volume II of this report.

ANALYSES

This chapter contains results of several separate analyses using CHAP programs. Each analysis will be described separately.

1. Distribution of Call Types

Project members grouped EMS call types for illustrative purposes into eight groups, as follows: (a) accidental injuries; (b) automobile accidents; (c) drug overdoses; (d) heart attacks; (e) strokes; (f) problems related to seizures; (g) calls related to violence; and (h) all other calls. CAP aggregated the total number of calls for the five-month period for each call type, by day of the week, and by four-hour time intervals for each day beginning at 12 midnight. The results of these analyses are shown in the Tables 2.1 through 2.8 and figures 2.1 through 2.8.

2. Distribution of Calls by Call Types for an Average Day

A second set of analyses calculated the total number of calls by call type and by time interval. An average day for any call type is defined as the total number of calls per four-hour interval divided by the number of days. Averages computed for each call type are shown in Table 2.9. Figures 2.9 through 2.16 depict the distribution of calls for an average day for each call type.

3. Distribution of Calls by Season and Call Type

The call data were analyzed by season as well as by call type. Calls from December 1976 and January 1977 represented the winter months; those from June, July, and August of 1977 represented summer calls. CAP was used to compare calls by call type for summer and winter months. The total number and percent of calls by season and call type are shown in Table 2.10 and Figure 2.17.

4. Distribution of Critical Calls

A subset of call types, including heart attacks, strokes, calls related to violence, and those calls where the patient was unconscious, were classified as "critical calls." These call types generally require advanced paramedic skills and transport to the hospital. Table 2.11 and Figure 2.18 show the total number of critical calls reported during the five-month period by day of week and by four-hour time intervals beginning at 12 midnight. Figure 2.19 shows the distribution of calls for an average day. Table 2.12 is a tabulation

(1) Emergency Medical Services Policy Research Project, *Location Techniques for Emergency Medical Service Vehicles, Volume I: An Analytical Framework for Austin, Texas* (Austin, Texas: LBJ School of Public Affairs, The University of Texas at Austin, 1979).

of the total number and percent of critical calls by responding vehicle.

5. Vehicle Performance Statistics

RAP was used to identify the relative and cumulative frequency of the time of four service parameters: response time to the scene; time at the scene; transport time to the hospital; and time at the hospital. Tables 2.13 through 2.16 display the results of these analyses. Each table has four columns of numbers. The first (Minutes) lists the one- to sixty-minute intervals for time calculations. For each interval n, the second column (Number of Calls) shows the number of times that the event occurred (e.g., the EMS vehicle responded to a call) in a time period greater than n - 1 minutes but less than n + 1 minutes. The third column (Relative Frequency) shows the proportion of all calls that this "Number of Calls" represents. The fourth column (Cumulative Frequency) indicates the percentage of incidents that occurred in a time period less than n + 1 minutes. Figures 2.20 through 2.23 show relative and cumulative frequency statistics for each service parameter.

6. Transport/Nontransport Calls

Tables 2.17 through 2.19 show RAP analyses of system performance for transport and nontransport calls. Table 2.17 compares transport and nontransport calls with respect to average service time, number of calls, calls per day, vehicle time in service, and utilization. Tables 2.18 and 2.19 show the total number and percentage of transport/nontransport calls for each vehicle.

7. EMS System Response Patterns

ZAP aggregated information on individual EMS vehicle response to city serial zones over all five months. For any vehicle, these data can be aggregated into a zonal distribution matrix. This information, when provided as input to the SYMAP and SYMVU mapping programs, can be graphed as two- and three-dimensional maps of the distribution of responses (Figures 2.24 through 2.37).

In each two-dimensional map, north appears as the top of the map. Symbols are used to distinguish between relative frequency levels. For example, the busiest zones are represented by squares, the least busy by dots, etc. The three-dimensional maps use the height dimension to represent the relative number of EMS vehicle responses to each zone. All three-dimensional maps are drawn 12 degrees off-center—true north is shown at an angle of 102 degrees; all are also viewed from a vertical perspective (azimuth) of 25 degrees.

Table 2.1

Number of Accident Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	6
	4 - 8	2
	8 - 12	18
	12 - 4 p.m.	26
	4 - 8	23
	8 - 12	9
Tuesday	12 - 4 a.m.	10
	4 - 8	8
	8 - 12	15
	12 - 4 p.m.	11
	4 - 8	19
	8 - 12	10
Wednesday	12 - 4 a.m.	1
	4 - 8	5
	8 - 12	14
	12 - 4 p.m.	21
	4 - 8	14
	8 - 12	25
Thursday	12 - 4 a.m.	6
	4 - 8	3
	8 - 12	12
	12 - 4 p.m.	27
	4 - 8	14
	8 - 12	18
Friday	12 - 4 a.m.	7
	4 - 8	4
	8 - 12	21
	12 - 4 p.m.	22
	4 - 8	16
	8 - 12	17
Saturday	12 - 4 a.m.	9
	4 - 8	9
	8 - 12	9
	12 - 4 p.m.	16
	4 - 8	22
	8 - 12	15
Sunday	12 - 4 a.m.	7
	4 - 8	4
	8 - 12	9
	12 - 4 p.m.	12
	4 - 8	21
	8 - 12	18

Total Calls = 555

Figure 2.1

Number of Accident Calls by Day of the Week and Time of the Day

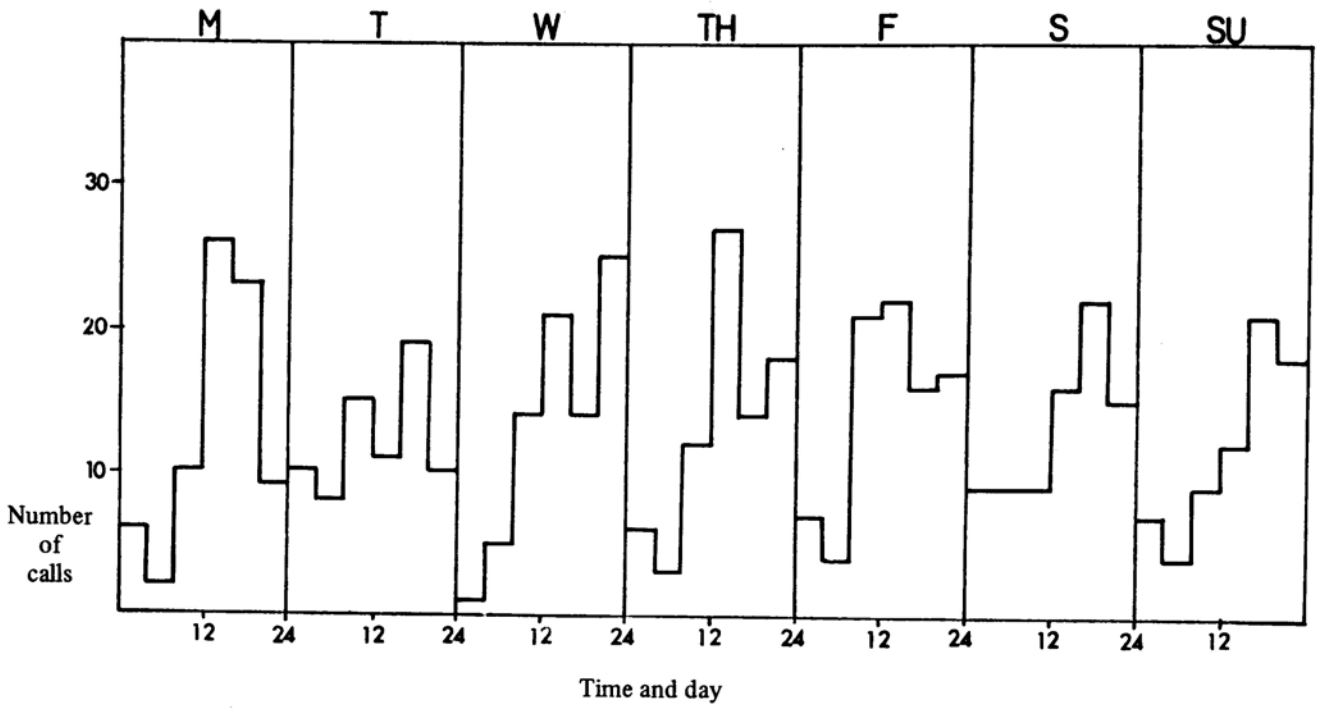


Table 2.2

Number of Auto Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	10
	4 - 8	4
	8 - 12	22
	12 - 4 p.m.	34
	4 - 8	40
	8 - 12	24
Tuesday	12 - 4 a.m.	14
	4 - 8	9
	8 - 12	18
	12 - 4 p.m.	29
	4 - 8	33
	8 - 12	26
Wednesday	12 - 4 a.m.	9
	4 - 8	9
	8 - 12	19
	12 - 4 p.m.	27
	4 - 8	28
	8 - 12	17
Thursday	12 - 4 a.m.	18
	4 - 8	7
	8 - 12	16
	12 - 4 p.m.	32
	4 - 8	47
	8 - 12	28
Friday	12 - 4 a.m.	13
	4 - 8	10
	8 - 12	20
	12 - 4 p.m.	34
	4 - 8	52
	8 - 12	29
Saturday	12 - 4 a.m.	49
	4 - 8	6
	8 - 12	19
	12 - 4 p.m.	30
	4 - 8	43
	8 - 12	32
Sunday	12 - 4 a.m.	43
	4 - 8	4
	8 - 12	12
	12 - 4 p.m.	26
	4 - 8	28
	8 - 12	15

Total Calls = 985

Figure 2.2

Number of Auto Calls by Day of the Week and Time of the Day

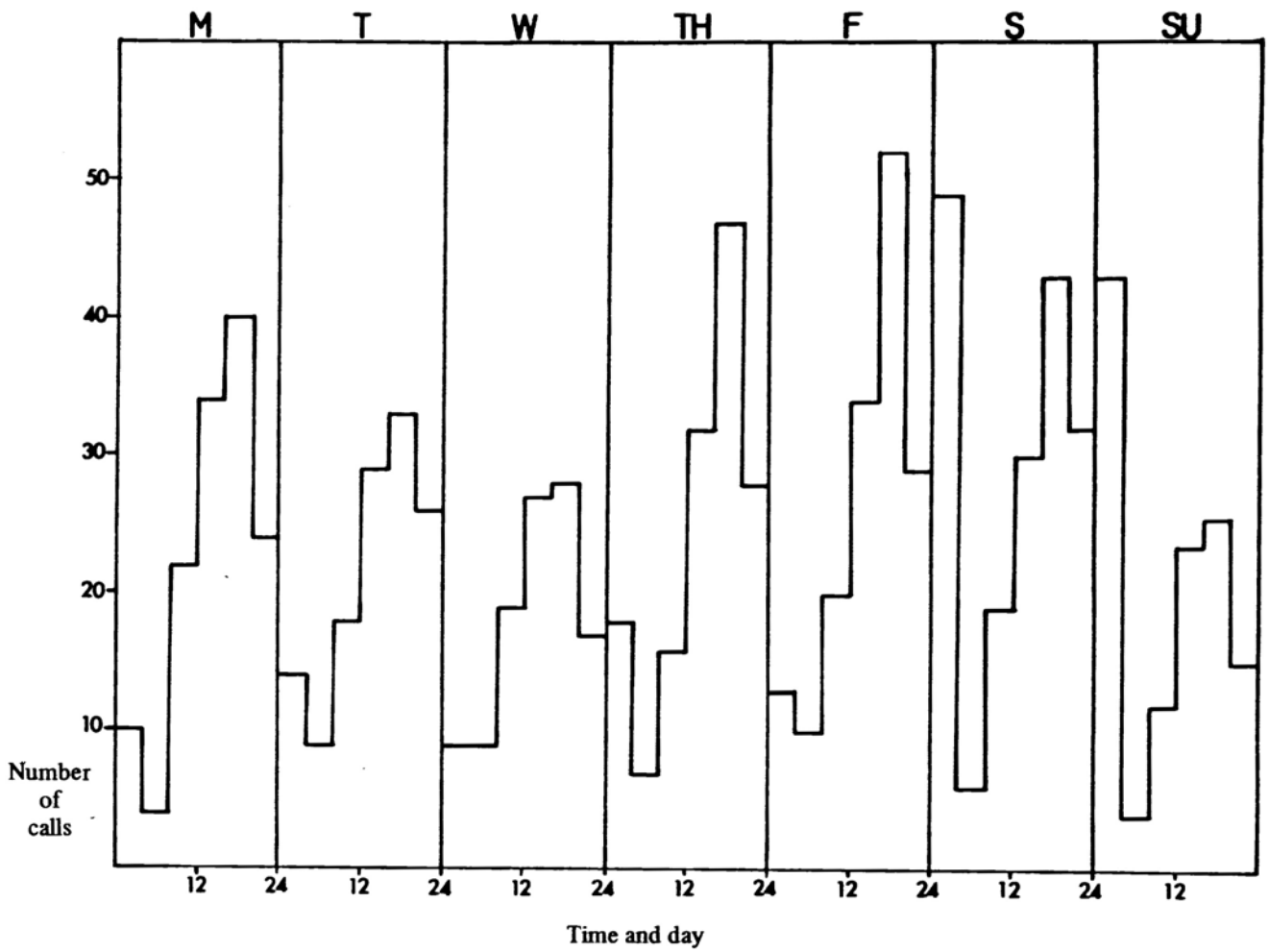


Table 2.3

Number of Drug Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	7
	4 - 8	5
	8 - 12	4
	12 - 4 p.m.	1
	4 - 8	5
	8 - 12	8
Tuesday	12 - 4 a.m.	5
	4 - 8	1
	8 - 12	2
	12 - 4 p.m.	6
	4 - 8	9
	8 - 12	10
Wednesday	12 - 4 a.m.	7
	4 - 8	1
	8 - 12	4
	12 - 4 p.m.	8
	4 - 8	2
	8 - 12	8
Thursday	12 - 4 a.m.	4
	4 - 8	3
	8 - 12	5
	12 - 4 p.m.	2
	4 - 8	6
	8 - 12	7
Friday	12 - 4 a.m.	8
	4 - 8	3
	8 - 12	3
	12 - 4 p.m.	3
	4 - 8	5
	8 - 12	8
Saturday	12 - 4 a.m.	4
	4 - 8	2
	8 - 12	0
	12 - 4 p.m.	4
	4 - 8	7
	8 - 12	8
Sunday	12 - 4 a.m.	3
	4 - 8	5
	8 - 12	3
	12 - 4 p.m.	6
	4 - 8	7
	8 - 12	5

Total Calls = 204

Figure 2.3

Number of Drug Calls by Day of the Week and Time of the Day

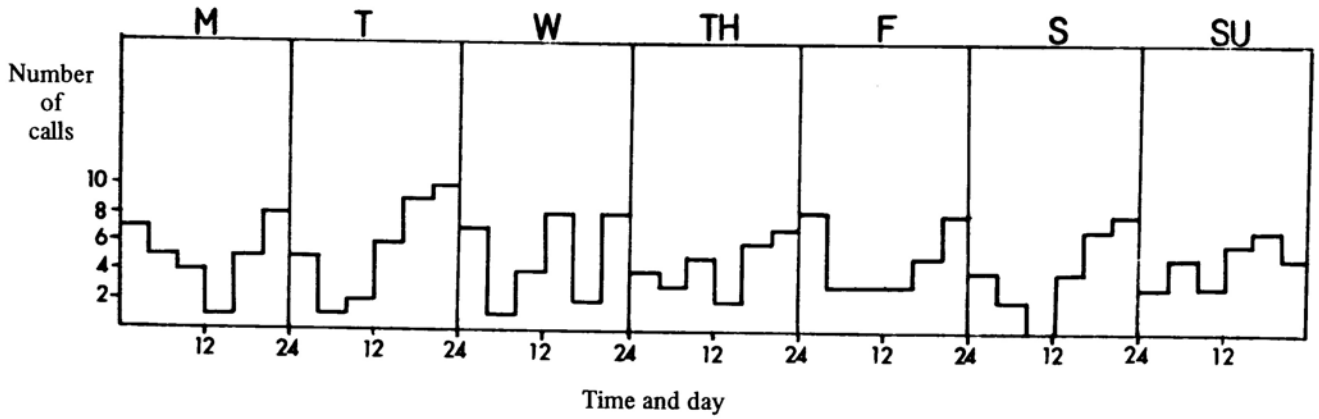


Table 2.4

Number of Heart Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	12
	4 - 8	8
	8 - 12	10
	12 - 4 p.m.	16
	4 - 8	17
	8 - 12	15
Tuesday	12 - 4 a.m.	12
	4 - 8	4
	8 - 12	16
	12 - 4 p.m.	18
	4 - 8	20
	8 - 12	17
Wednesday	12 - 4 a.m.	11
	4 - 8	7
	8 - 12	20
	12 - 4 p.m.	18
	4 - 8	12
	8 - 12	9
Thursday	12 - 4 a.m.	10
	4 - 8	5
	8 - 12	19
	12 - 4 p.m.	14
	4 - 8	12
	8 - 12	16
Friday	12 - 4 a.m.	10
	4 - 8	6
	8 - 12	10
	12 - 4 p.m.	10
	4 - 8	16
	8 - 12	17
Saturday	12 - 4 a.m.	7
	4 - 8	6
	8 - 12	7
	12 - 4 p.m.	10
	4 - 8	7
	8 - 12	17
Sunday	12 - 4 a.m.	9
	4 - 8	7
	8 - 12	11
	12 - 4 p.m.	14
	4 - 8	11
	8 - 12	19

Total Calls = 512

Figure 2.4

Number of Heart Calls by Day of the Week and Time of the Day

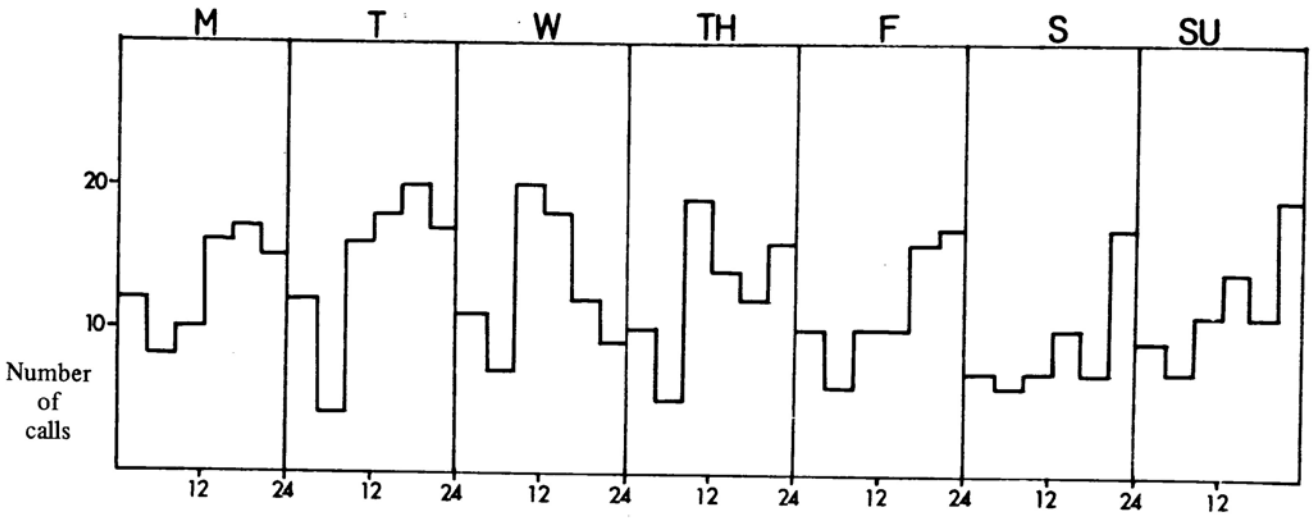


Table 2.5

Number of Seizure Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	3
	4 - 8	1
	8 - 12	4
	12 - 4 p.m.	4
	4 - 8	10
	8 - 12	3
Tuesday	12 - 4 a.m.	1
	4 - 8	2
	8 - 12	3
	12 - 4 p.m.	3
	4 - 8	4
	8 - 12	7
Wednesday	12 - 4 a.m.	0
	4 - 8	2
	8 - 12	3
	12 - 4 p.m.	7
	4 - 8	4
	8 - 12	4
Thursday	12 - 4 a.m.	2
	4 - 8	2
	8 - 12	4
	12 - 4 p.m.	6
	4 - 8	6
	8 - 12	2
Friday	12 - 4 a.m.	1
	4 - 8	1
	8 - 12	3
	12 - 4 p.m.	3
	4 - 8	3
	8 - 12	2
Saturday	12 - 4 a.m.	3
	4 - 8	3
	8 - 12	3
	12 - 4 p.m.	3
	4 - 8	2
	8 - 12	4
Sunday	12 - 4 a.m.	4
	4 - 8	3
	8 - 12	2
	12 - 4 p.m.	3
	4 - 8	3
	8 - 12	5

Total Calls = 138

Figure 2.5

Number of Seizure Calls by Day of the Week and Time of the Day

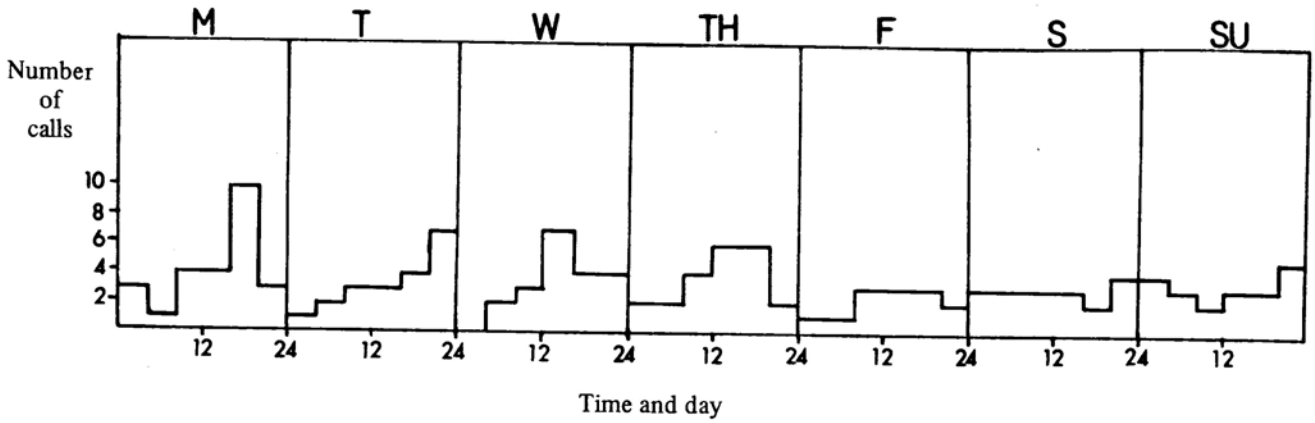


Table 2.6

Number of Stroke Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	5
	4 - 8	2
	8 - 12	7
	12 - 4 p.m.	5
	4 - 8	7
	8 - 12	2
Tuesday	12 - 4 a.m.	1
	4 - 8	1
	8 - 12	4
	12 - 4 p.m.	8
	4 - 8	0
	8 - 12	2
Wednesday	12 - 4 a.m.	1
	4 - 8	1
	8 - 12	3
	12 - 4 p.m.	6
	4 - 8	3
	8 - 12	2
Thursday	12 - 4 a.m.	2
	4 - 8	3
	8 - 12	2
	12 - 4 p.m.	4
	4 - 8	3
	8 - 12	2
Friday	12 - 4 a.m.	1
	4 - 8	3
	8 - 12	7
	12 - 4 p.m.	5
	4 - 8	7
	8 - 12	0
Saturday	12 - 4 a.m.	1
	4 - 8	1
	8 - 12	4
	12 - 4 p.m.	2
	4 - 8	1
	8 - 12	2
Sunday	12 - 4 a.m.	2
	4 - 8	3
	8 - 12	8
	12 - 4 p.m.	0
	4 - 8	5
	8 - 12	4

Total Calls = 132

Figure 2.6

Total Number of Stroke Calls by Day of the Week and Time of the Day

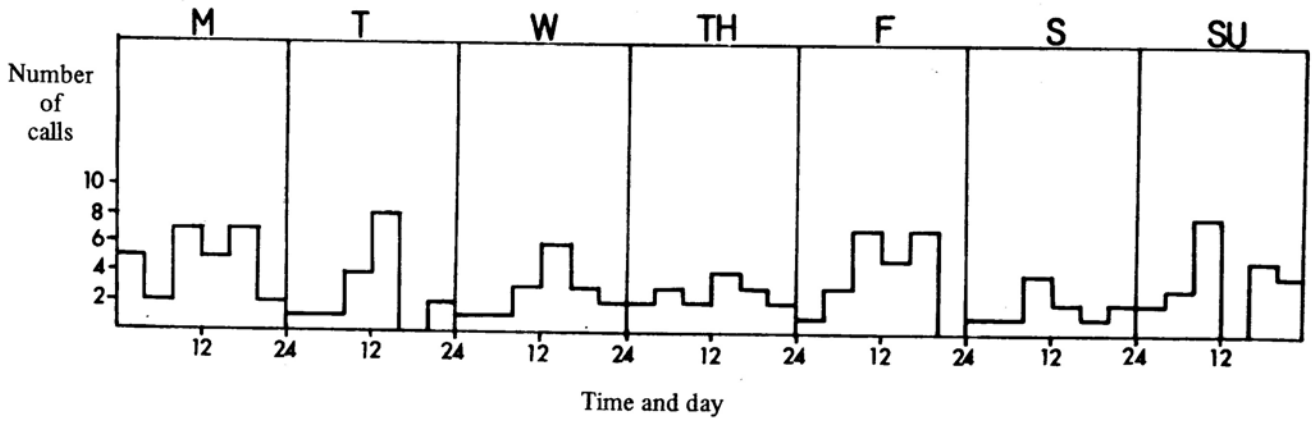


Table 2.7

Number of Calls Related to Violence by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	1
	4 - 8	1
	8 - 12	0
	12 - 4 p.m.	5
	4 - 8	5
	8 - 12	11
Tuesday	12 - 4 a.m.	6
	4 - 8	1
	8 - 12	0
	12 - 4 p.m.	3
	4 - 8	1
	8 - 12	14
Wednesday	12 - 4 a.m.	4
	4 - 8	1
	8 - 12	0
	12 - 4 p.m.	1
	4 - 8	3
	8 - 12	7
Thursday	12 - 4 a.m.	6
	4 - 8	1
	8 - 12	1
	12 - 4 p.m.	3
	4 - 8	3
	8 - 12	11
Friday	12 - 4 a.m.	9
	4 - 8	4
	8 - 12	1
	12 - 4 p.m.	4
	4 - 8	9
	8 - 12	26
Saturday	12 - 4 a.m.	22
	4 - 8	2
	8 - 12	3
	12 - 4 p.m.	6
	4 - 8	8
	8 - 12	13
Sunday	12 - 4 a.m.	15
	4 - 8	5
	8 - 12	2
	12 - 4 p.m.	2
	4 - 8	9
	8 - 12	9

Total Calls = 238

Figure 2.7

Number of Calls Related to Violence by
Day of the Week and Time of the Day

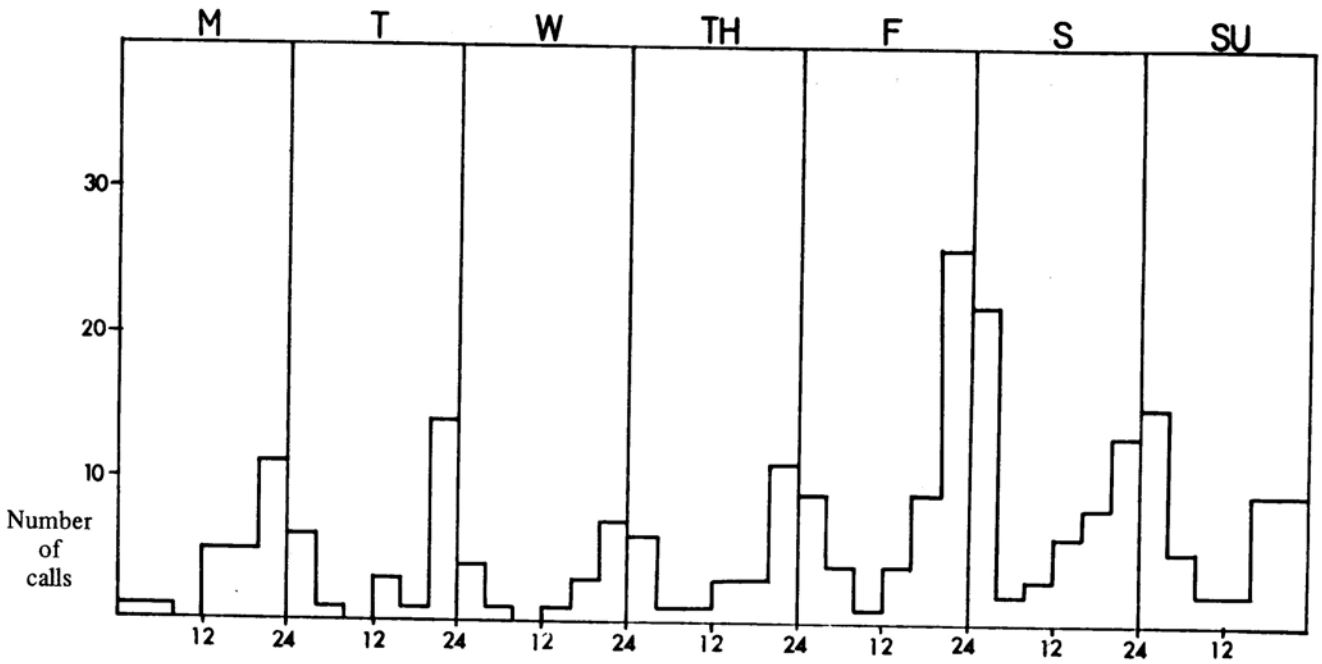


Table 2.8

Number of All Other Calls by Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	25
	4 - 8	21
	8 - 12	40
	12 - 4 p.m.	45
	4 - 8	35
	8 - 12	37
Tuesday	12 - 4 a.m.	27
	4 - 8	12
	8 - 12	42
	12 - 4 p.m.	44
	4 - 8	35
	8 - 12	45
Wednesday	12 - 4 a.m.	24
	4 - 8	16
	8 - 12	36
	12 - 4 p.m.	40
	4 - 8	44
	8 - 12	46
Thursday	12 - 4 a.m.	16
	4 - 8	11
	8 - 12	37
	12 - 4 p.m.	40
	4 - 8	27
	8 - 12	40
Friday	12 - 4 a.m.	24
	4 - 8	20
	8 - 12	40
	12 - 4 p.m.	45
	4 - 8	51
	8 - 12	55
Saturday	12 - 4 a.m.	40
	4 - 8	12
	8 - 12	30
	12 - 4 p.m.	30
	4 - 8	44
	8 - 12	42
Sunday	12 - 4 a.m.	28
	4 - 8	20
	8 - 12	22
	12 - 4 p.m.	34
	4 - 8	37
	8 - 12	33

Total Calls = 1,392

Figure 2.8
Number of All Other Calls by
Day of the Week and Time of the Day

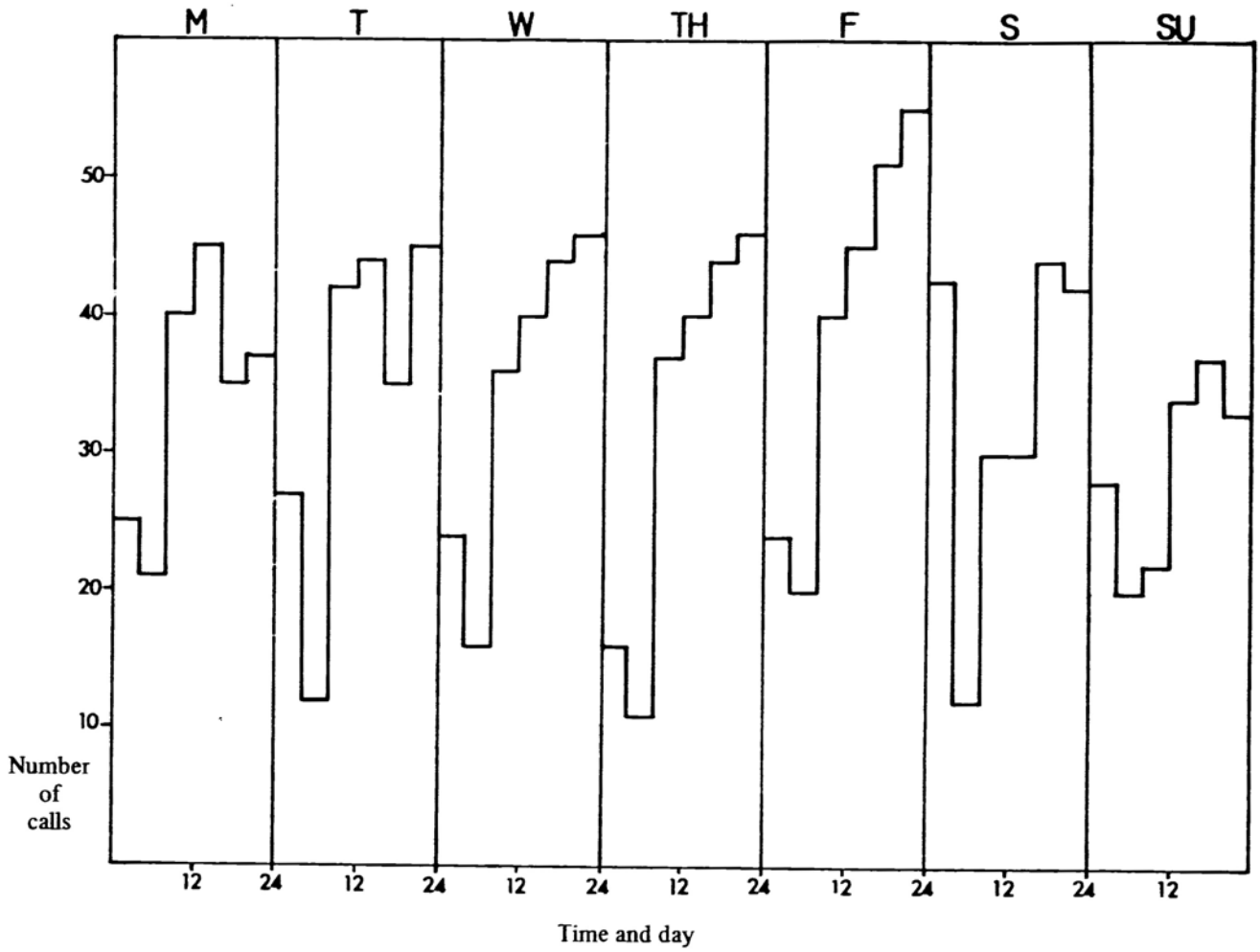


Table 2.9
An Average Day for All Call Types

Call Type	*Time of Day*					
	12 a.m.-4 a.m.	*4 a.m.-8 a.m.*	*8 a.m.-12 p.m.*	*12 p.m.-4 p.m.*	*4 p.m.-8 p.m.*	*8 p.m.-12 a.m.*
Accidental Injury	.30	.23	.58	.88	.84	.73
Auto	1.01	.32	.82	1.37	1.60	1.09
Baby, House, Unconscious, Unknown	1.19	.73	1.60	1.80	1.77	1.94
Drug	.25	.13	.14	.20	.27	.35
Violence-Related	.41	.10	.04	.16	.25	.59
Heart	.46	.28	.60	.65	.62	.71
Seizure	.09	.09	.14	.19	.21	.18
Stroke	.09	.09	.23	.20	.17	.09
Critical Calls	1.07	.50	1.01	1.22	1.26	1.64

Figure 2.9
An Average Day for Accidental Injury Calls

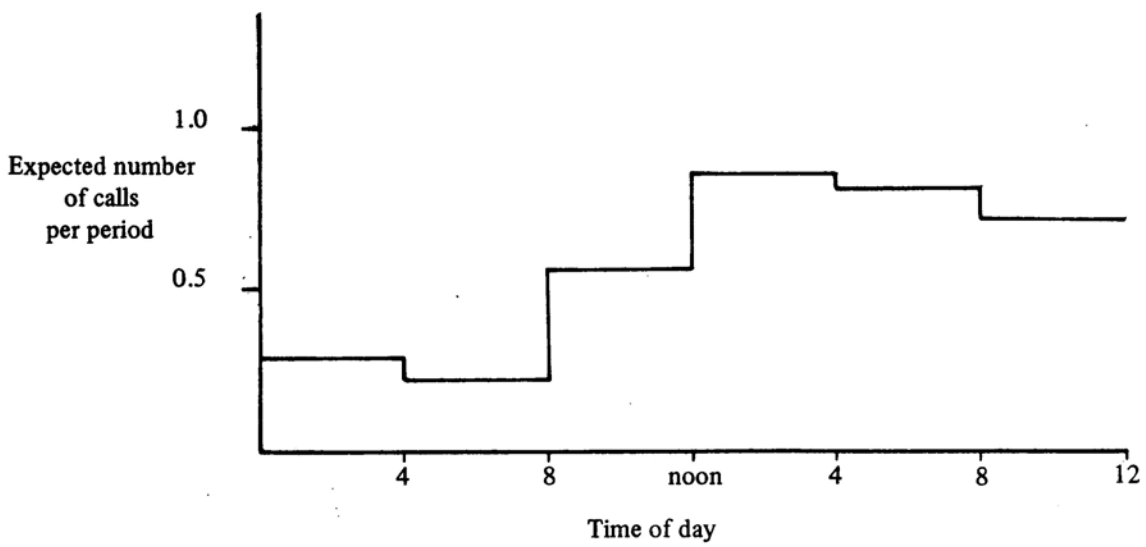


Figure 2.10
An Average Day for Auto Calls

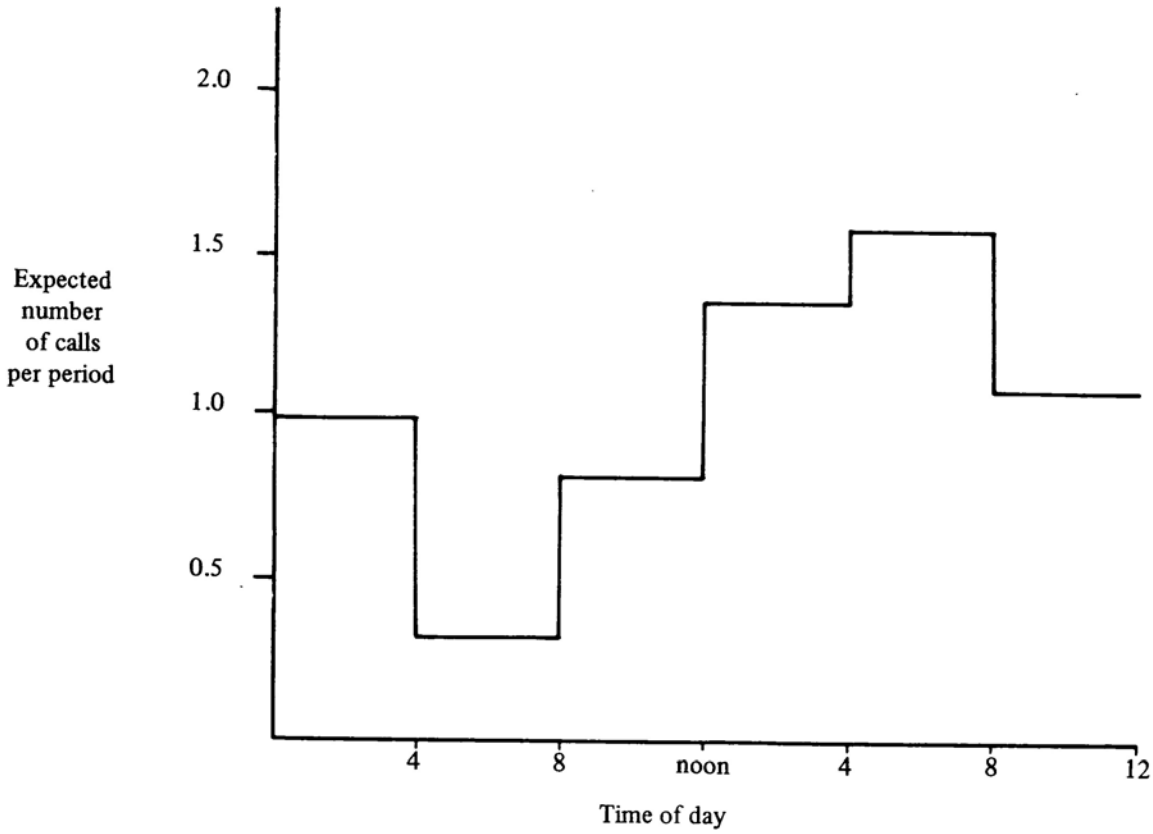


Figure 2.11
An Average Day for Drug Calls

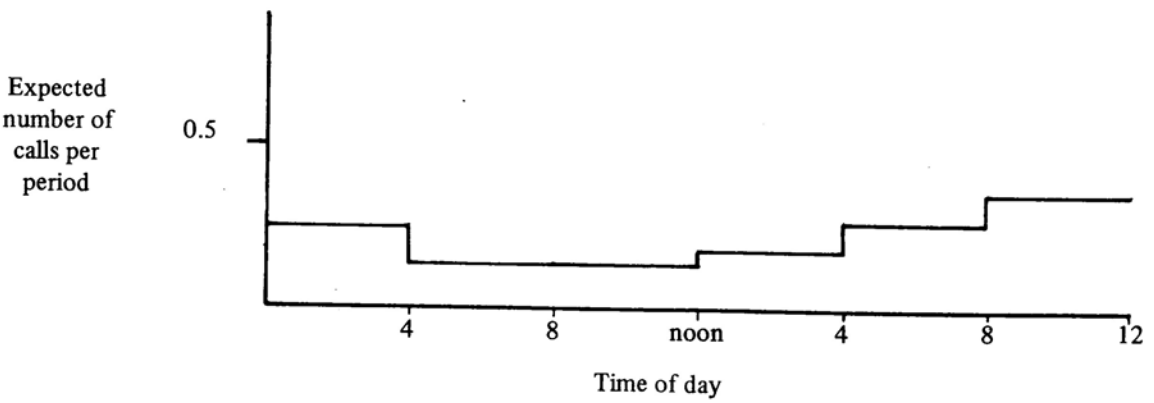


Figure 2.12

An Average Day for Heart Calls

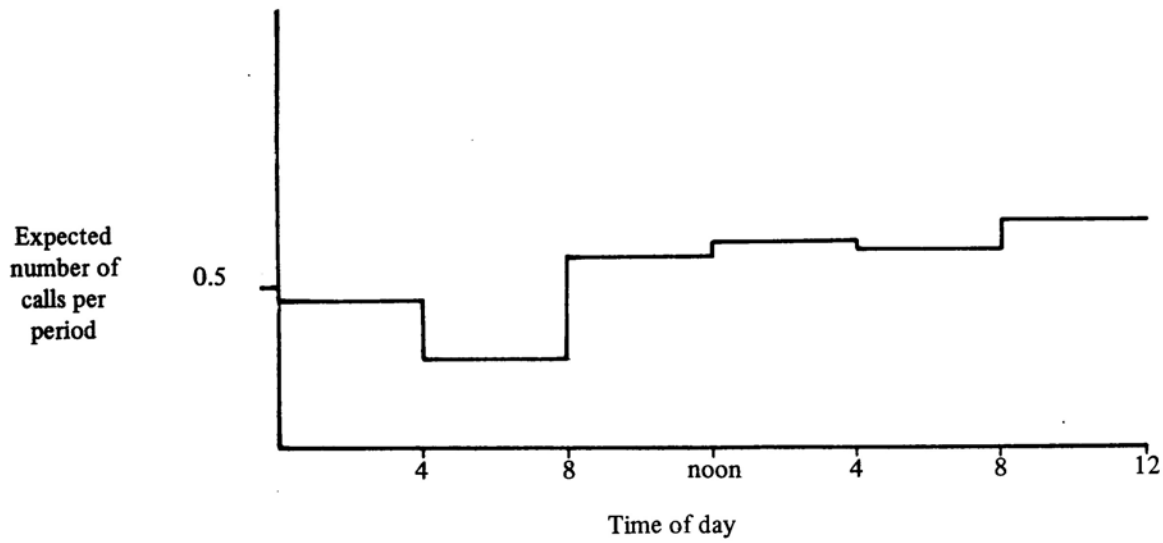


Figure 2.13

An Average Day for Seizure Calls

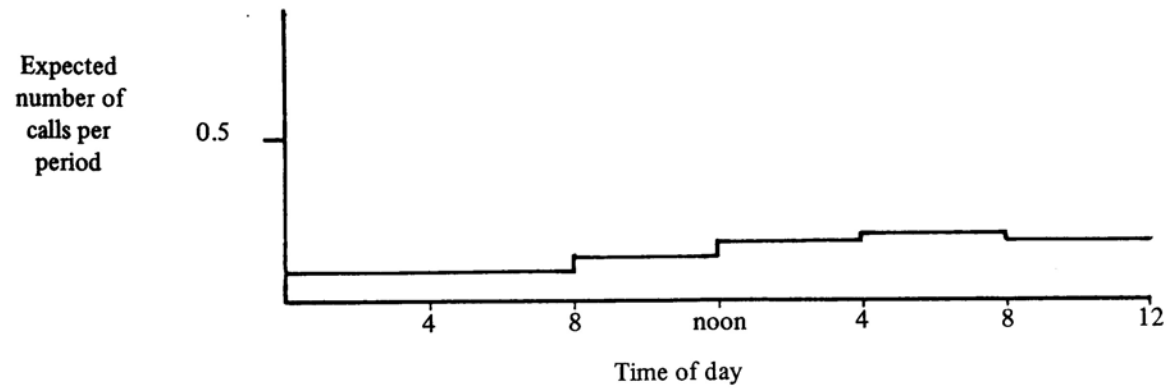


Figure 2.14

An Average Day for Stroke Calls

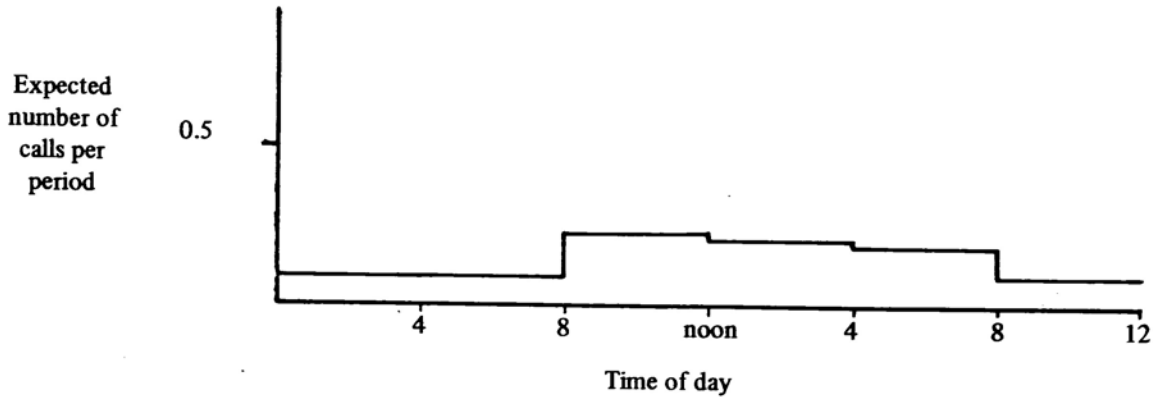


Figure 2.15

An Average Day for Calls Related to Violence

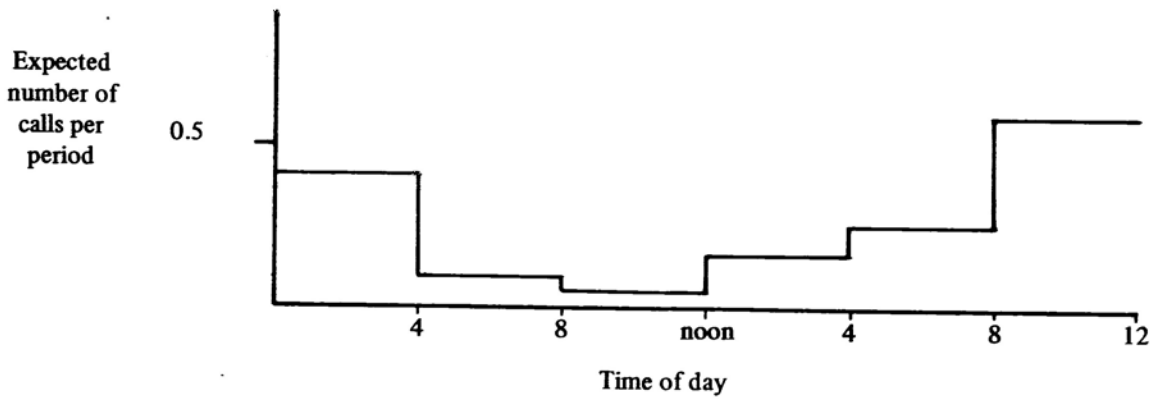


Figure 2.16
An Average Day for All Other Calls

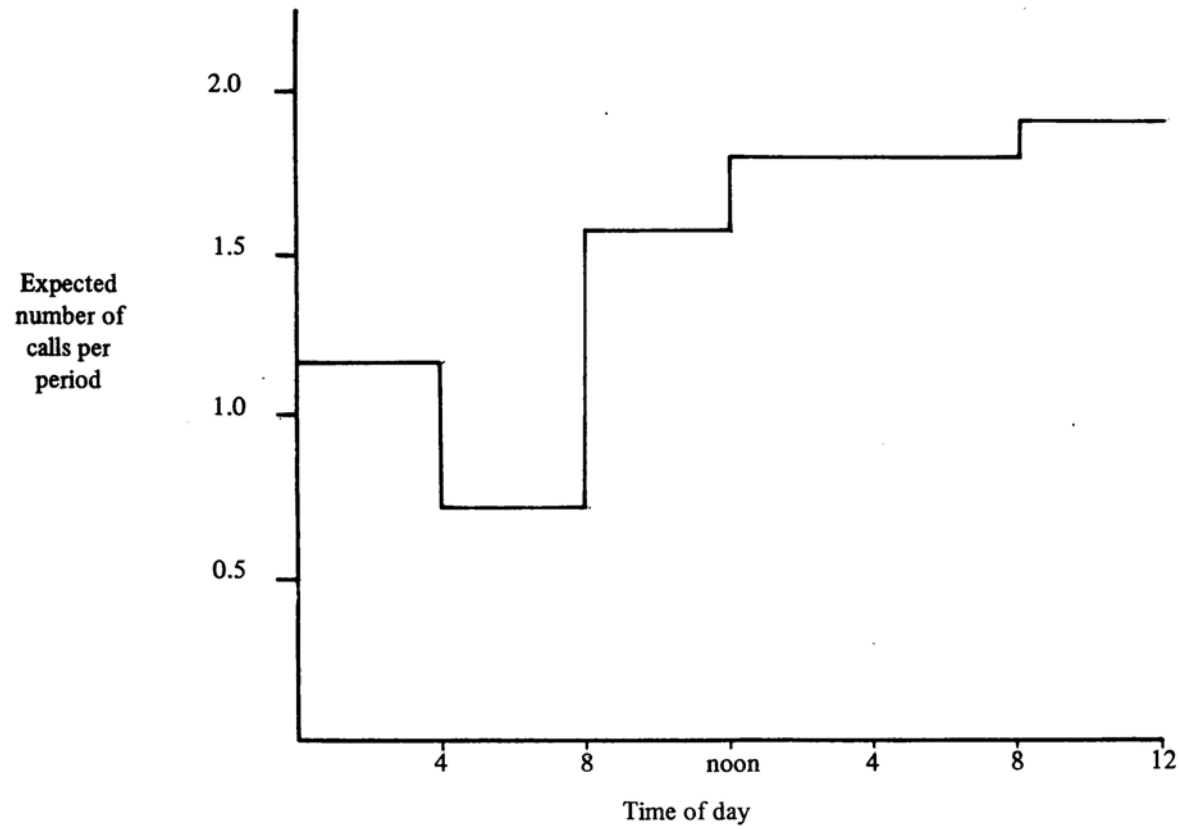


Table 2.10

Calls by Call Type and Season

Call Type	*Summer*	*Winter*	*Totals*
Auto	625 (63.5)	360 (36.5)	985
Drug	147 (72.1)	57 (27.9)	204
Violence	175 (73.5)	63 (26.5)	238
Accidental injury	396 (72.4)	151 (27.6)	547
Heart	336 (65.6)	176 (34.4)	512
Seizure	93 (64.7)	45 (32.6)	138
Stroke	78 (59.1)	54 (40.9)	132
Totals	1,850	906	2,756

Figure 2.17

Calls by Call Type and Season

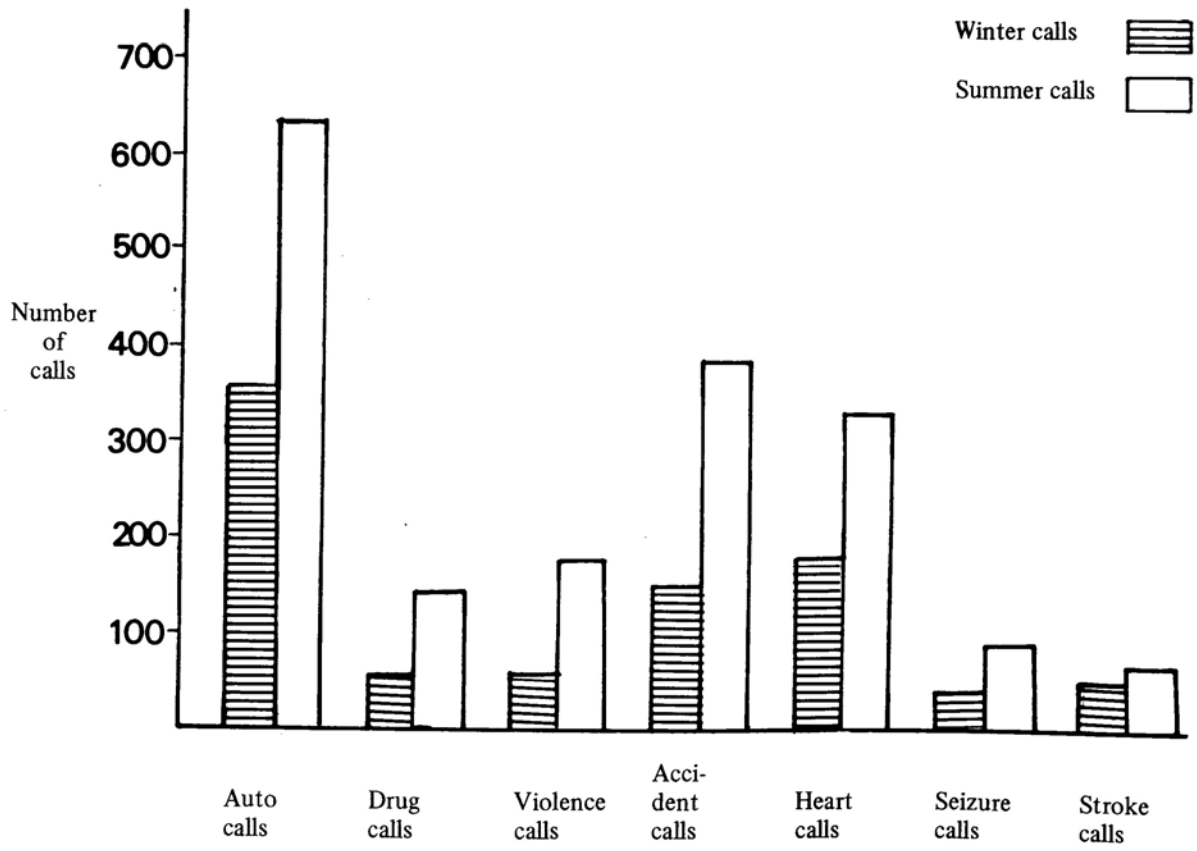


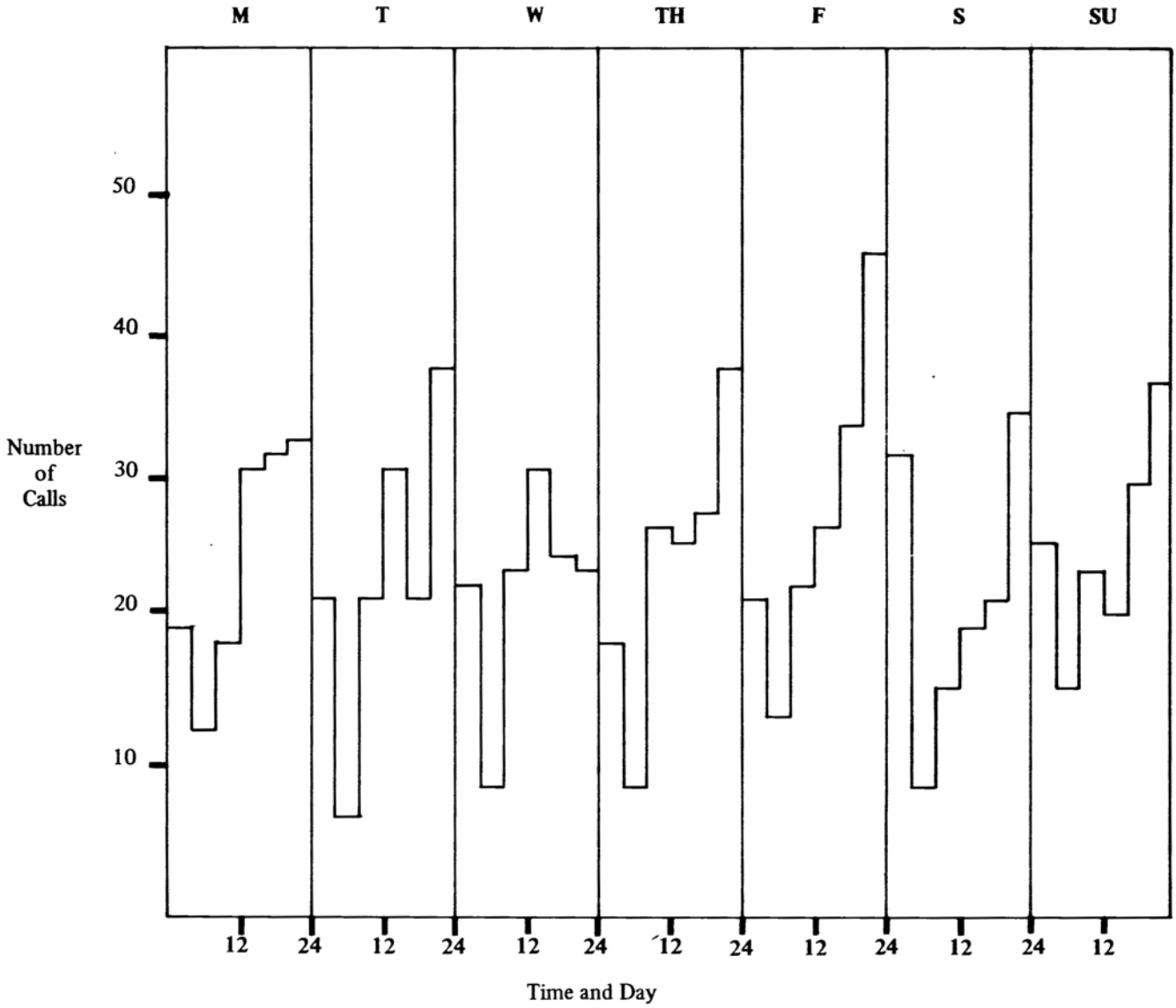
Table 2.11
Number of Critical Calls* by
Day of the Week and Time of the Day

Day	*Time Interval*	*Number of Calls*
Monday	12 - 4 a.m.	20
	4 - 8	13
	8 - 12	19
	12 - 4 p.m.	31
	4 - 8	32
	8 - 12	33
Tuesday	12 - 4 a.m.	22
	4 - 8	7
	8 - 12	22
	12 - 4 p.m.	31
	4 - 8	22
	8 - 12	38
Wednesday	12 - 4 a.m.	23
	4 - 8	9
	8 - 12	24
	12 - 4 p.m.	31
	4 - 8	25
	8 - 12	24
Thursday	12 - 4 a.m.	19
	4 - 8	9
	8 - 12	27
	12 - 4 p.m.	26
	4 - 8	28
	8 - 12	38
Friday	12 - 4 a.m.	22
	4 - 8	14
	8 - 12	23
	12 - 4 p.m.	27
	4 - 8	34
	8 - 12	46
Saturday	12 - 4 a.m.	32
	4 - 8	9
	8 - 12	16
	12 - 4 p.m.	20
	4 - 8	22
	8 - 12	35
Sunday	12 - 4 a.m.	26
	4 - 8	16
	8 - 12	24
	12 - 4 p.m.	21
	4 - 8	30
Total = 1,027	8 - 12	37

*Critical calls include all responses to unconscious patients and calls related to violence, strokes, or heart attacks.

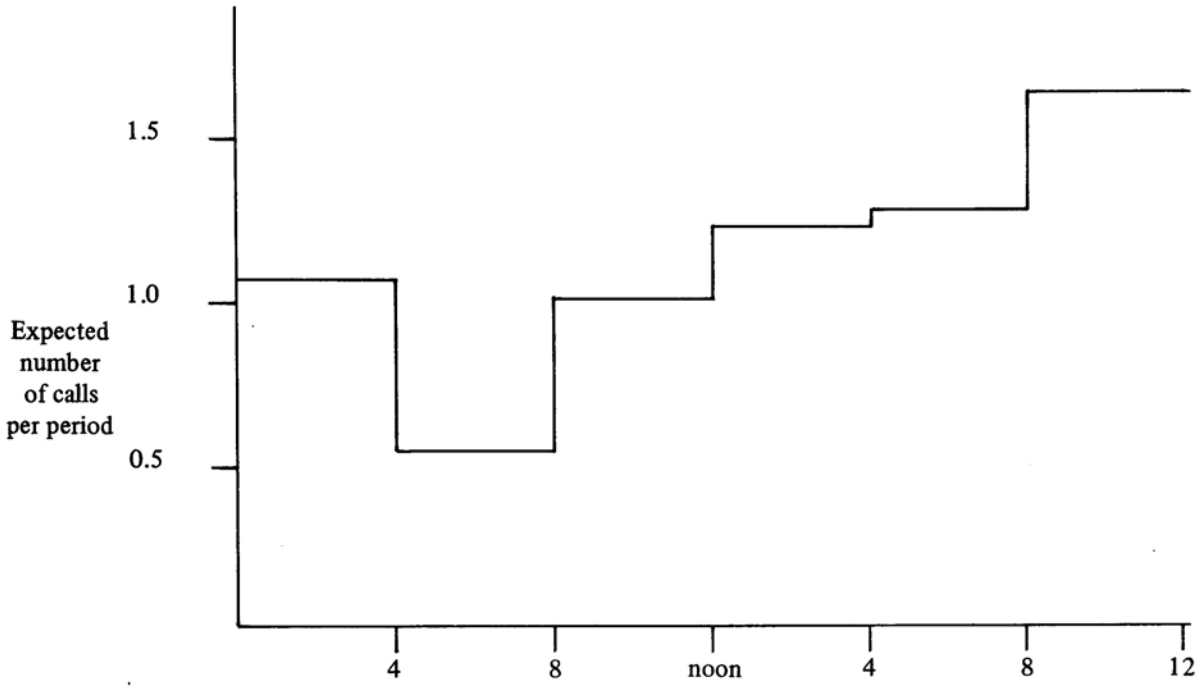
Figure 2.18

Total Number of Critical Calls* by Day of the Week and Time of the Day



*Critical calls include all responses to unconscious patients and calls related to violence, strokes, or heart attacks.

Figure 2.19
An Average Day for Critical Calls*



*Critical calls include all responses to unconscious patients and calls related to violence, strokes, or heart attacks.

Table 2.12

Number and Percentage of Critical* Calls Received by Each Ambulance

Ambulance Number	*Number of Critical Calls*	*Percent of all Critical Calls*
1	141	13.7
2	98	9.5
3	170	16.6
4	226	22.0
5	125	12.2
6	103	10.0
7	164	16.0
Total	1,027	100.0**

*Critical calls include all responses to unconscious patients and calls related to violence, strokes, and heart attacks.

**Figures do not sum to 100 due to rounding error.

Table 2.13

Relative and Cumulative Response Times of EMS Vehicles

Minutes	*Number of Calls*	*Relative Frequency*	*Cumulative Frequency*
1	228	.053	.053
2	517	.119	.172
3	896	.207	.379
4	929	.215	.593
5	712	.164	.758
6	453	.105	.862
7	263	.061	.923
8	148	.034	.957
9	90	.021	.978
10	39	.009	.987
11	15	.003	.991
12	13	.003	.994
13	10	.002	.996
14	5	.001	.997
15	3	.001	.998
16	3	.001	.998
17	0	.000	.998
18	3	.001	.999
19	1	.000	.999
20	1	.000	1.000
21	0	.000	1.000
22	0	.000	1.000
23	0	.000	1.000
24	0	.000	1.000
25	0	.000	1.000
26	0	.000	1.000
27	0	.000	1.000
28	0	.000	1.000
29	0	.000	1.000
30	0	.000	1.000
31	0	.000	1.000
32	0	.000	1.000
33	0	.000	1.000
34	0	.000	1.000
35	0	.000	1.000
36	0	.000	1.000
37	0	.000	1.000
38	0	.000	1.000
39	0	.000	1.000
40	0	.000	1.000
41	0	.000	1.000
42	0	.000	1.000

Total Calls = 4,331

Figure 2.20

Relative and Cumulative Response Times of EMS Vehicles

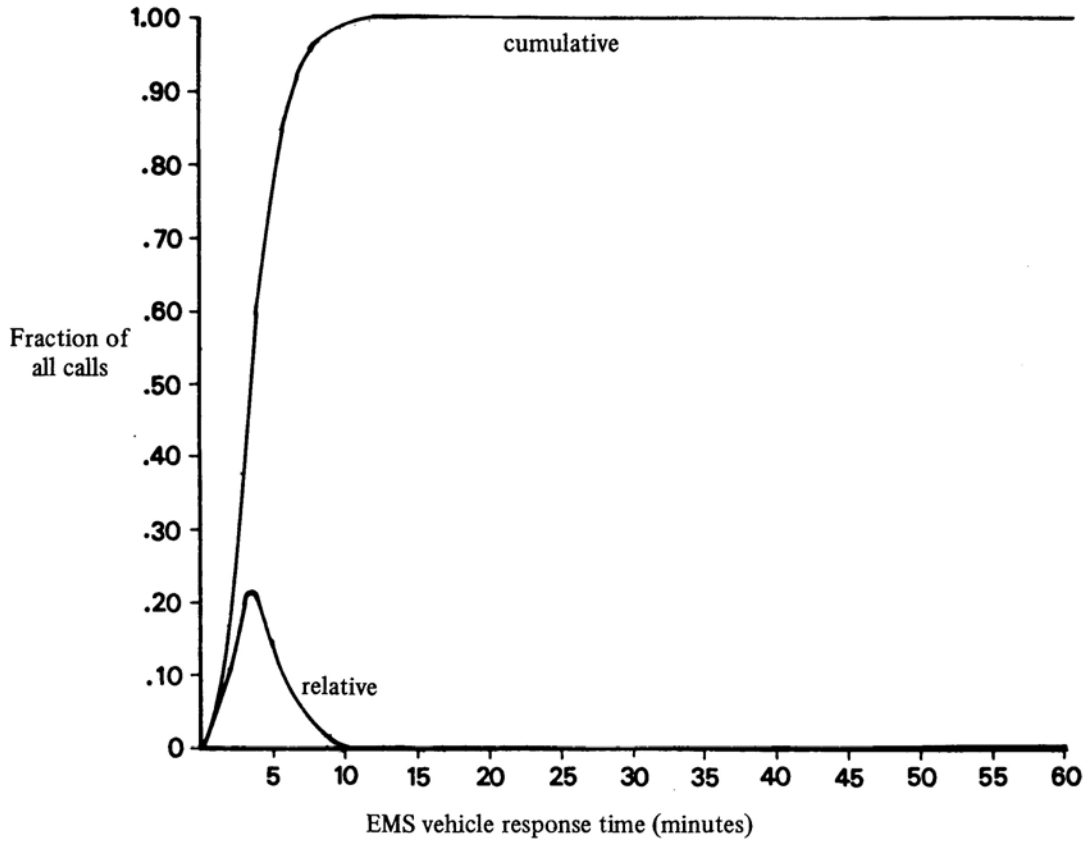


Table 2.14

Relative and Cumulative Time at Scene of EMS Vehicles

Minutes	*Number of Calls*	*Relative Frequency*	*Cumulative Frequency*
1	179	.041	.041
2	96	.022	.064
3	67	.015	.079
4	93	.021	.100
5	141	.033	.133
6	163	.038	.171
7	247	.057	.228
8	275	.064	.291
9	301	.070	.361
10	284	.066	.426
11	303	.070	.496
12	295	.068	.564
13	258	.060	.624
14	228	.053	.677
15	217	.050	.727
16	174	.040	.767
17	136	.031	.798
18	119	.027	.826
19	111	.026	.852
20	85	.020	.871
21	78	.018	.889
22	60	.014	.903
23	58	.013	.916
24	54	.012	.929
25	52	.012	.041
26	45	.010	.951
27	32	.007	.959
28	31	.007	.966
29	24	.006	.971
30	14	.003	.975
31	15	.003	.978

Table 2.14 (continued)

Minutes	*Number of Calls*	*Relative Frequency*	*Cumulative Frequency*
32	10	.002	.980
33	12	.003	.983
34	9	.002	.985
35	4	.001	.986
36	2	.000	.987
37	6	.001	.988
38	10	.002	.990
39	3	.001	.991
40	7	.002	.993
41	2	.000	.993
42	3	.001	.994
43	5	.001	.995
44	1	.000	.995
45	6	.001	.997
46	2	.000	.997
47	1	.000	.997
48	2	.000	.998
49	2	.000	.998
50	0	.000	.998
51	2	.000	.999
52	0	.000	.999
53	1	.000	.999
54	0	.000	.999
55	1	.000	.999
56	1	.000	.999
57	0	.000	.999
58	0	.000	.999
59	3	.001	1.000
60	0	.000	1.000

Total Calls = 4,330

Figure 2.21

Relative and Cumulative Time at Scene of EMS Vehicles

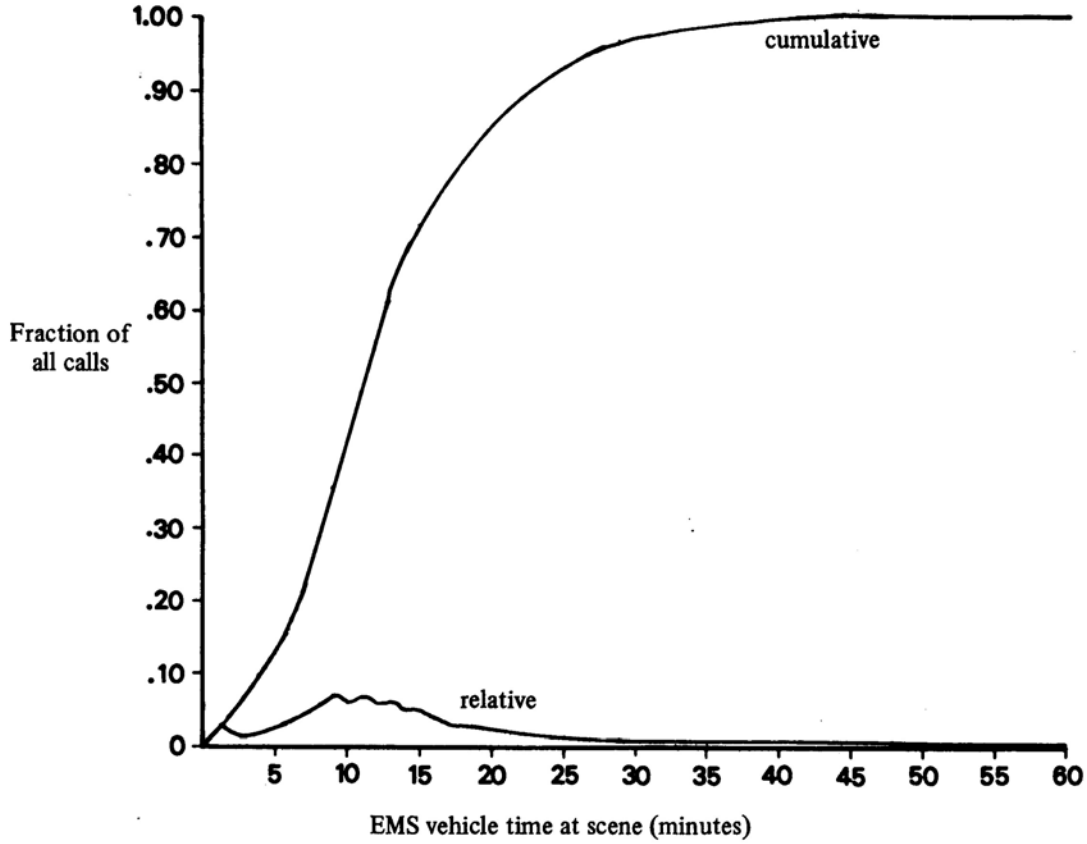


Table 2.15

Relative and Cumulative Transport Time of EMS Vehicles

Minutes	*Number of Calls*	*Relative Frequency*	*Cumulative Frequency*
1	20	.007	.007
2	92	.031	.037
3	176	.059	.096
4	232	.077	.174
5	252	.084	.258
6	272	.091	.348
7	257	.086	.434
8	256	.085	.520
9	267	.089	.609
10	232	.077	.686
11	188	.063	.749
12	167	.056	.804
13	139	.046	.851
14	117	.039	.890
15	86	.029	.919
16	51	.017	.936
17	43	.014	.950
18	40	.013	.963
19	27	.009	.972
20	16	.005	.978
21	8	.003	.980
22	8	.003	.983
23	11	.004	.987
24	6	.002	.989
25	7	.002	.991
26	2	.001	.992
27	4	.001	.993
28	2	.001	.994
29	2	.001	.994
30	1	.000	.995
31	2	.001	.995
32	2	.001	.996
33	0	.000	.996
34	0	.000	.996
35	1	.000	.996
36	0	.000	.996
37	2	.001	.997
38	0	.000	.997
39	0	.000	.997
40	3	.001	.998
41	1	.000	.998
42	0	.000	.998
43	2	.001	.999
44	1	.000	.999
45	0	.000	.999
46	0	.000	.999
47	0	.000	.999
48	1	.000	1.000
49	0	.000	1.000
50	0	.000	1.000
51	1	.000	1.000

Total Calls = 2,997

Figure 2.22
Relative and Cumulative Transport Time of EMS Vehicles

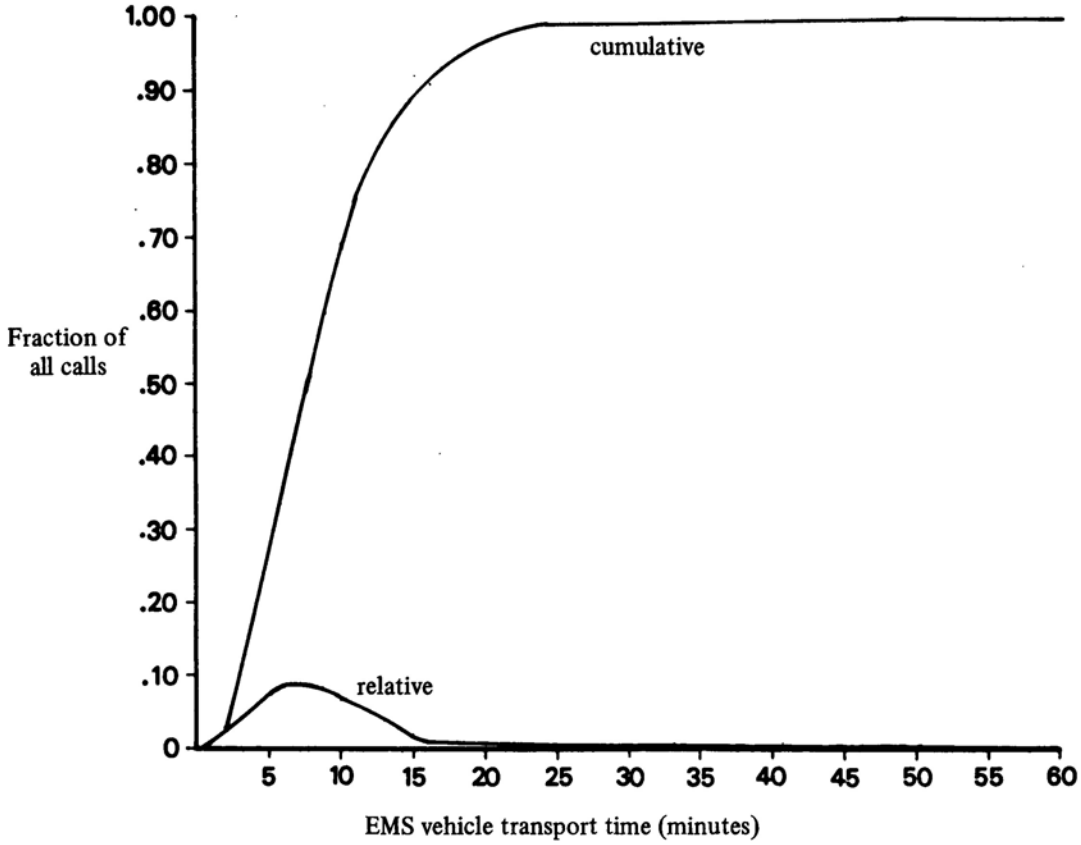


Table 2.16

Relative and Cumulative Time at Hospital of EMS Vehicles

Minutes	*Number of Calls*	*Relative Frequency*	*Cumulative Frequency*
1	7	.002	.002
2	6	.002	.004
3	18	.006	.010
4	20	.007	.017
5	26	.009	.026
6	36	.012	.038
7	45	.015	.053
8	55	.018	.071
9	82	.027	.098
10	76	.025	.124
11	79	.026	.150
12	115	.038	.189
13	105	.035	.224
14	106	.035	.259
15	118	.039	.298
16	108	.036	.334
17	141	.047	.381
18	137	.046	.427
19	143	.048	.475
20	129	.043	.518
21	113	.038	.556
22	125	.042	.597
23	131	.044	.641
24	111	.037	.678
25	90	.030	.708
26	101	.034	.742
27	78	.026	.768
28	82	.027	.795
29	59	.020	.815
30	61	.020	.835
31	53	.018	.853
32	42	.014	.867
33	43	.014	.881
34	44	.015	.896
35	44	.015	.911
36	30	.010	.921
37	30	.010	.931
38	25	.008	.939
39	28	.009	.948
40	14	.005	.953
41	17	.006	.959
42	19	.006	.965
43	12	.005	.969
44	17	.006	.975
45	8	.003	.977
46	5	.002	.979
47	5	.002	.981
48	4	.001	.982
49	6	.002	.984
50	11	.004	.988
51	8	.003	.990
52	6	.002	.992
53	7	.002	.995
54	1	.000	.995
55	0	.000	.995
56	3	.001	.996
57	9	.003	.999
58	2	.001	1.000
59	1	.000	1.000
60	0	.000	1.000

Table 2.16 (continued)

Total Calls = 2,997

Figure 2.23

Relative and Cumulative Time at Hospital of EMS Vehicles

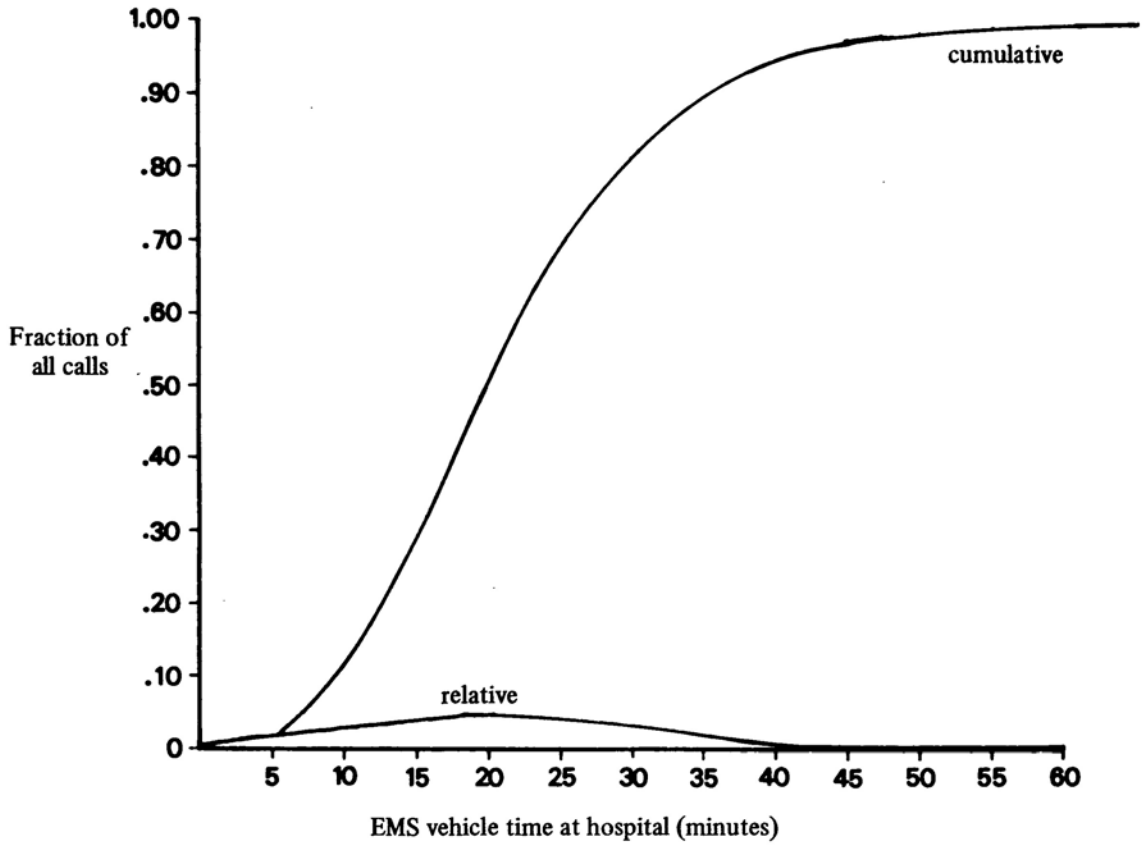


Table 2.17

EMS System Performance for Transport and Nontransport Calls

	Transport Calls	*Nontransport Calls*	*All Calls*
Number of Calls	2,817	1,513	4,330
Percent of Calls	65.07	34.93	100.00
Calls Per Day	18.29	9.82	28.11
Vehicle Utilization (percent of day)	8.7	1.5	10.2
Average Service Time (minutes)	47.930	15.172	36.492
Standard Deviation of Service Time (minutes)	14.654	9.517	20.374

Table 2.18

Number and Percentage of Transport Calls for Each EMS Vehicle

Vehicle	*Number of Transport Calls*	*Number of Transport Calls/Day*	*Percentage of all Calls Transported*
1	433	2.81	68.30
2	302	1.96	65.51
3	484	3.14	68.75
4	637	4.14	71.90
5	386	2.51	69.55
6	316	2.05	70.54
7	436	2.83	68.77
Total	2,994	19.44	69.27

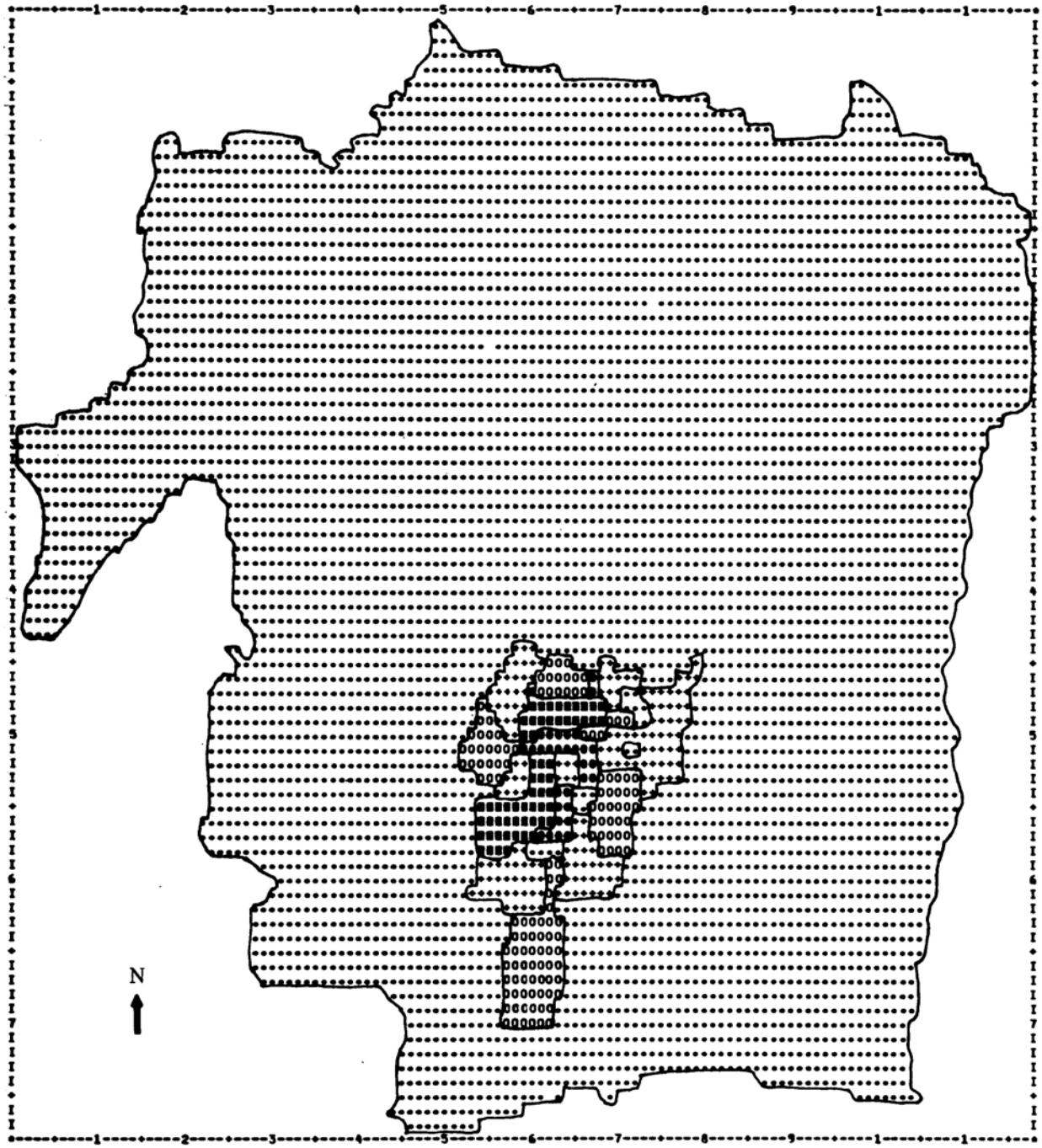
Table 2.19

Number and Percentage of Nontransport Calls for Each EMS Vehicle

Vehicle	*Number of Non-transport Calls*	*Number of Non-transport Calls/Day*	*Percentage of All Calls Not Transported*
1	201	1.30	31.70
2	159	1.03	34.49
3	220	1.43	31.25
4	249	1.62	28.10
5	169	1.10	30.45
6	132	0.86	29.46
7	198	1.28	31.23
Total	1,328	8.62	30.73

Figure 2.24

Two-Dimensional Map of Service Area of
EMS Vehicle 1



Number of Calls	1-4	5-10	11-16	17-22	23-28
Symbol	.	+	0	●	■
Frequency	312	21	13	6	6

Figure 2.25
Three-Dimensional Map of Service Area of EMS Vehicle 1
(from a perspective of 25 degrees)

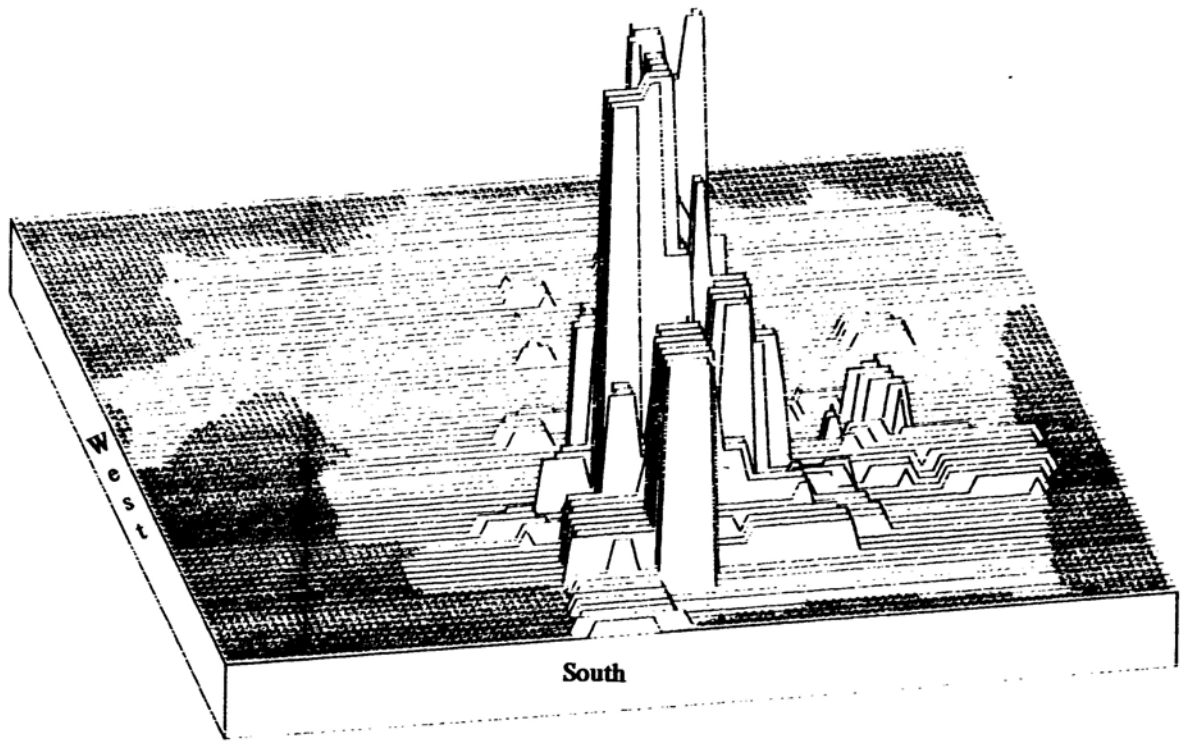


Figure 2.26
Two-Dimensional Map of Service Area of EMS Vehicle 2

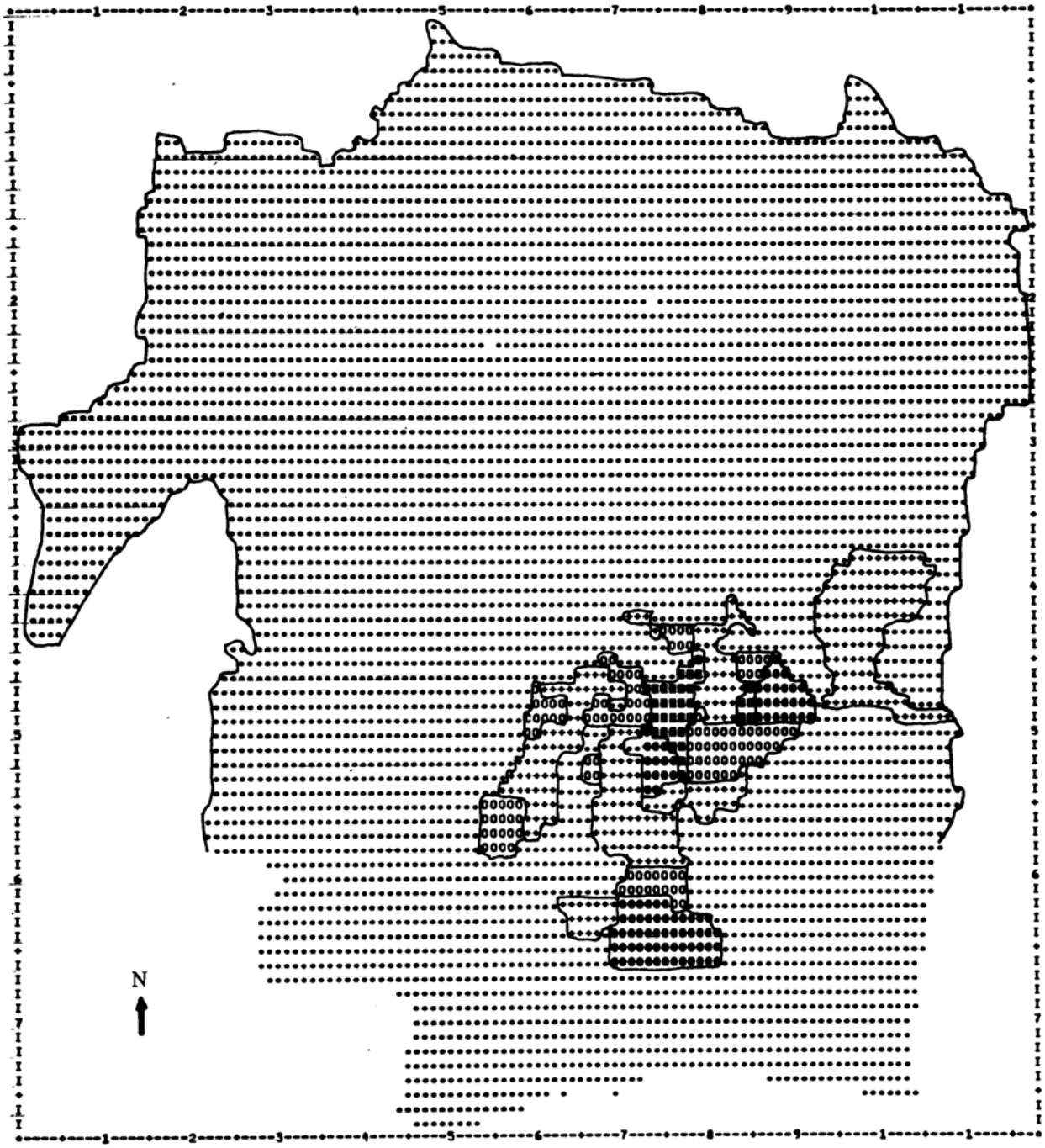


Figure 2.27
Three-Dimensional Map of Service Area of EMS Vehicle 2
(from a perspective of 25 degrees)

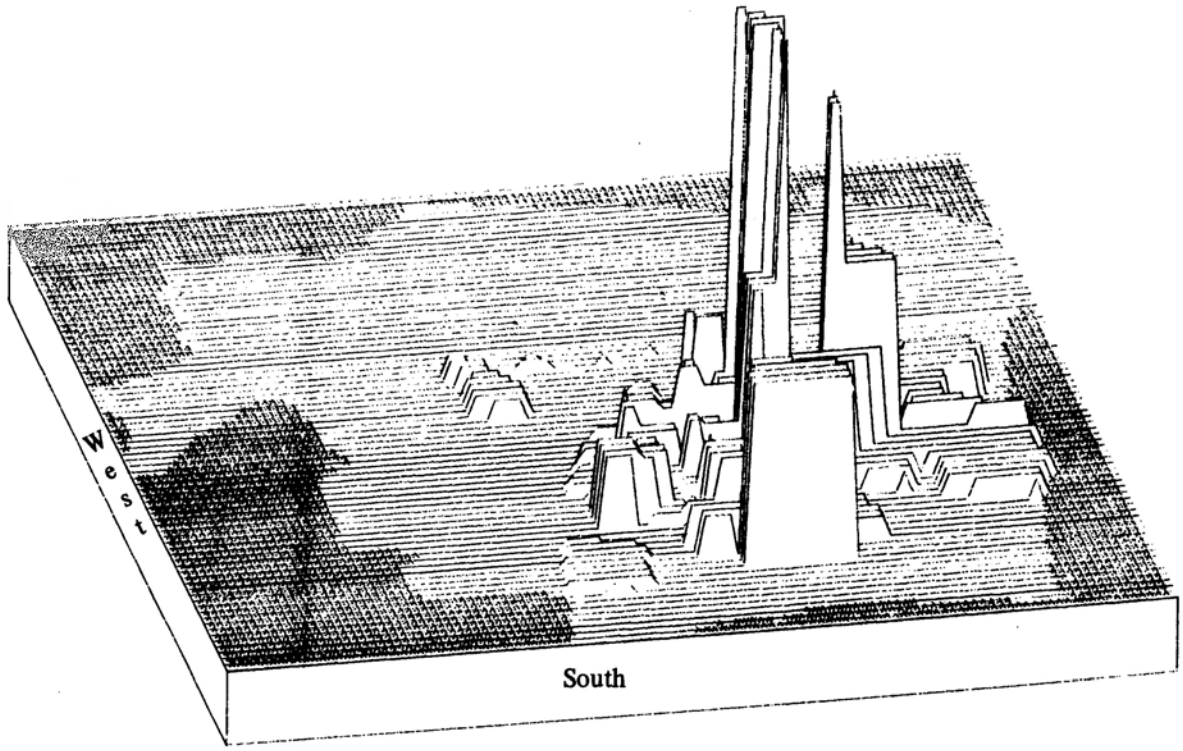
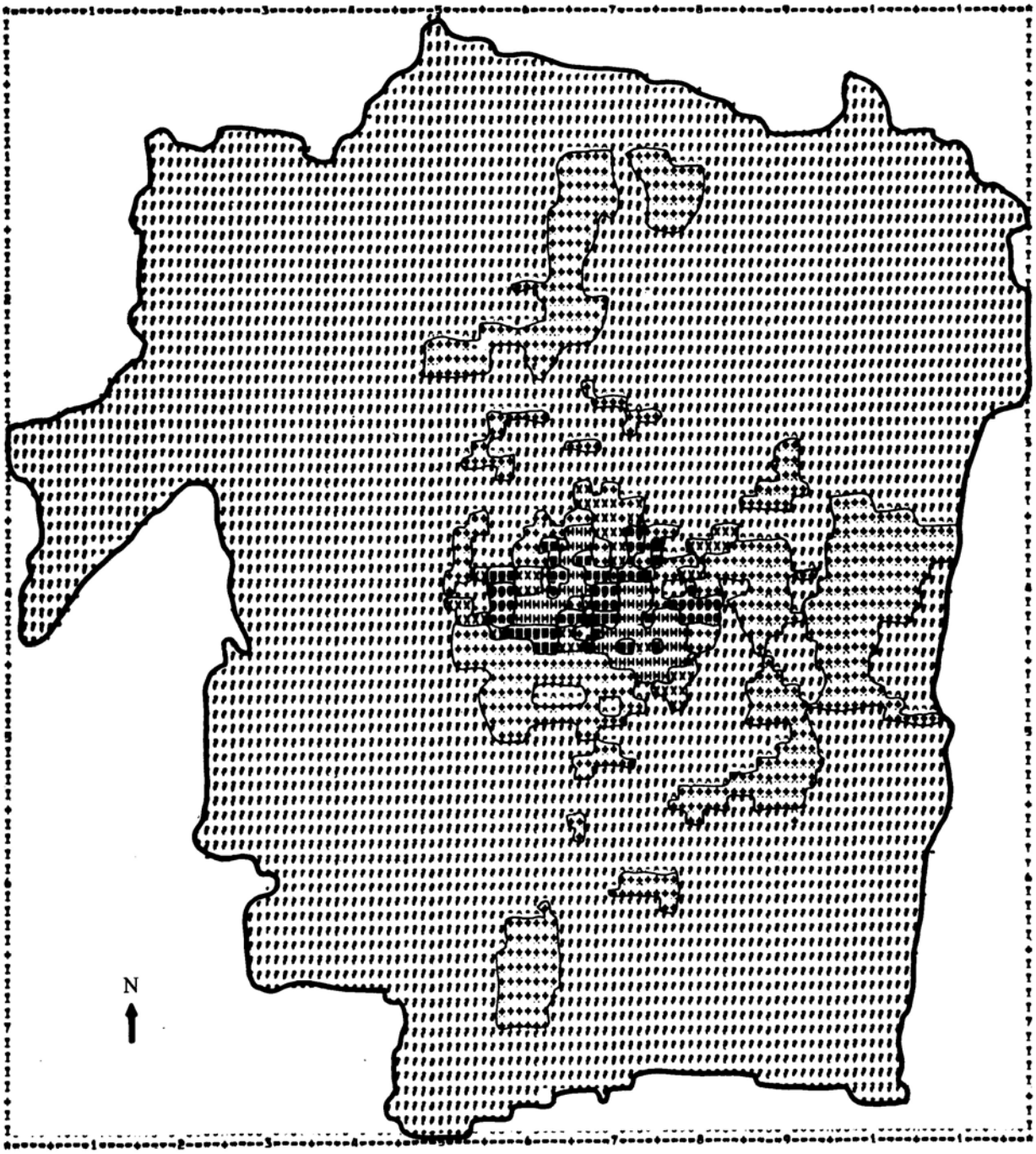


Figure 2.28

Two-Dimensional Map of Service Area of EMS Vehicle 3



Number of Calls	0	1-2	3-4	5-6	7-8	9-10	11-27
Symbol							
Frequency	213	75	19	12	10	8	21

Figure 2.29

Three-Dimensional Map of Service Area of EMS Vehicle 3
(from a perspective of 25 degrees)

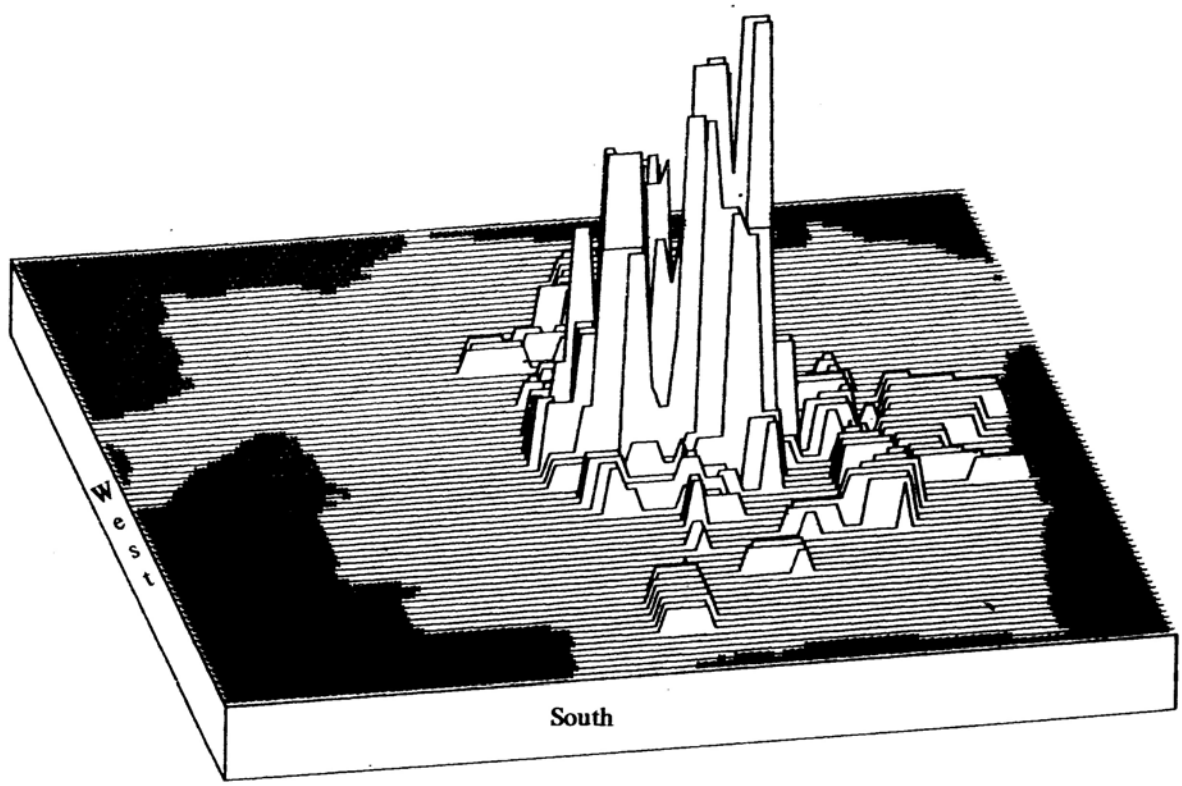
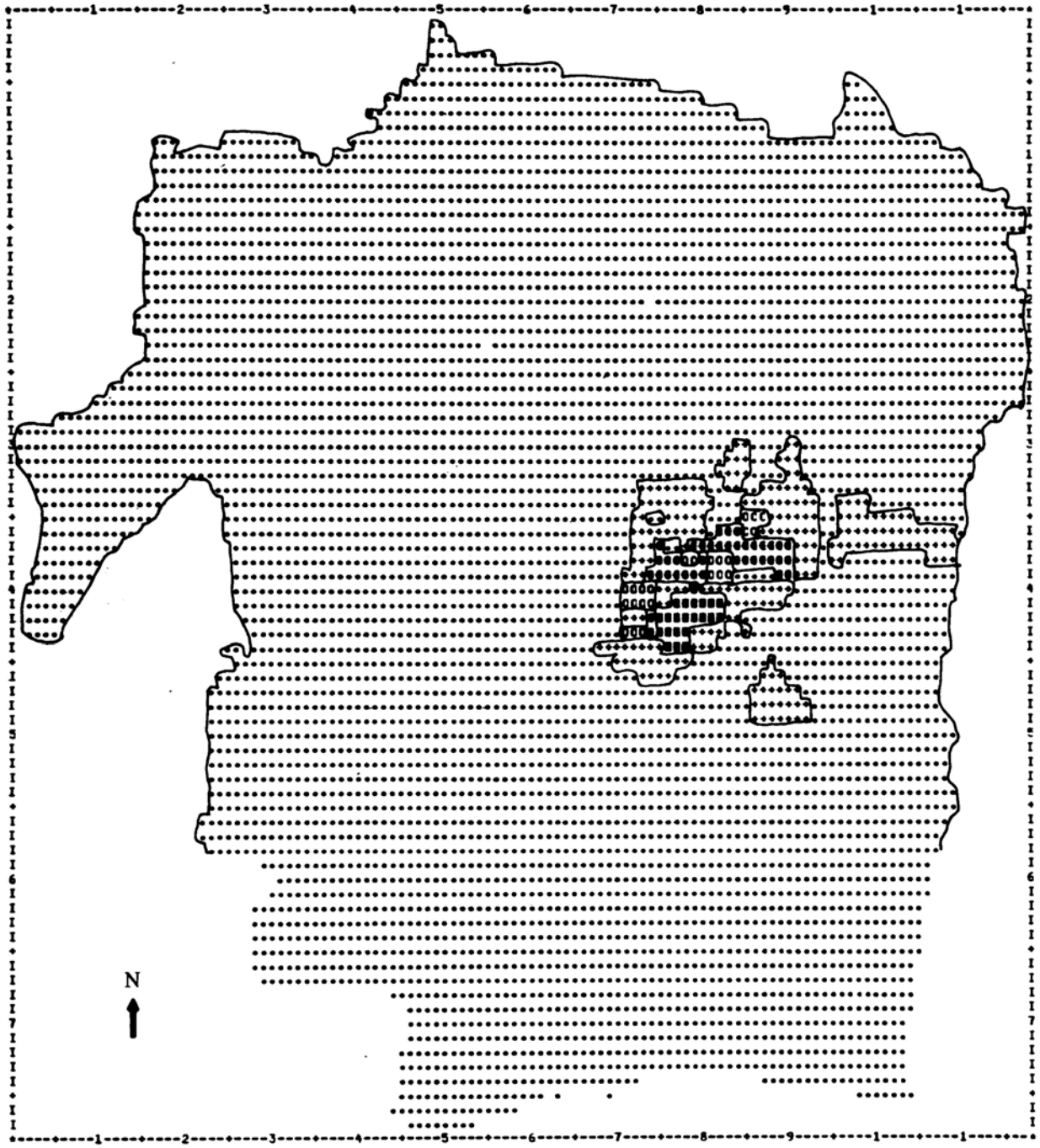


Figure 2.30

Two-Dimensional Map of Service Area of EMS Vehicle 4



Number of Calls	1-5	6-14	15-23	24-32	33-41
Symbol	.	+	0	8	5
Frequency	307	32	7	8	4

Figure 2.31
Three-Dimensional Map of Service Area of EMS Vehicle 4
(from a perspective of 25 degrees)

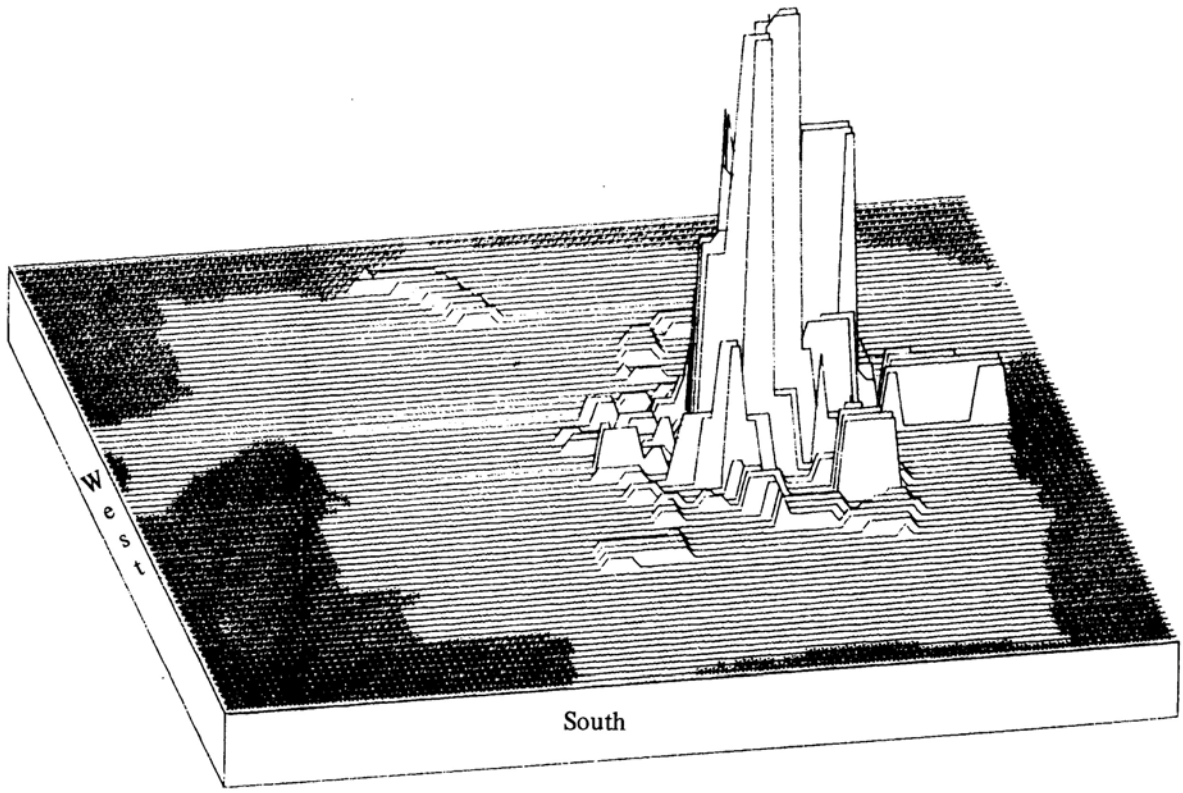
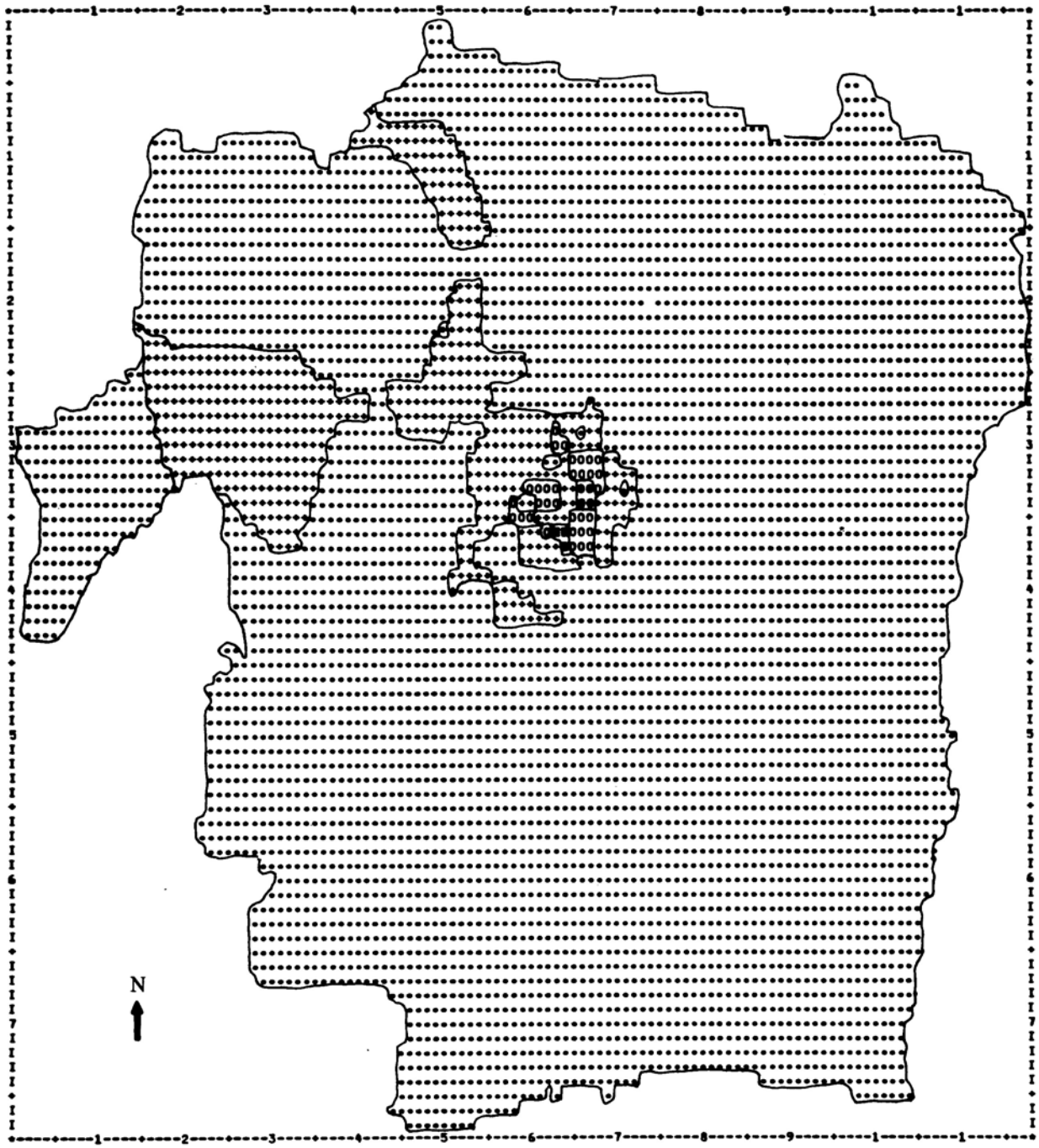


Figure 2.32
Two-Dimensional Map of Service Area of EMS Vehicle 5



Number of Calls	1-4	5-12	13-20	21-28	29-36
Symbol	.	+	0	8	5
Frequency	308	41	7	1	1

Figure 2.33
Three-Dimensional Map of Service Area of EMS Vehicle 5
(from a perspective of 25 degrees)

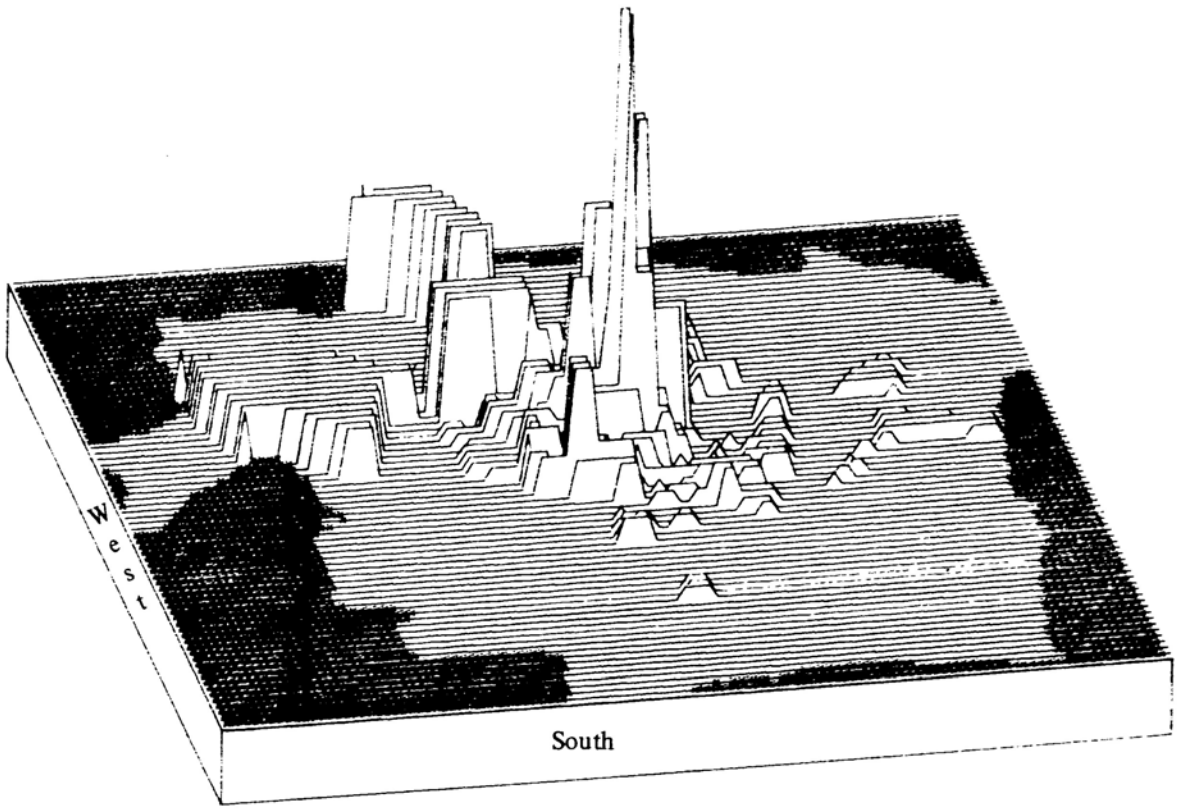
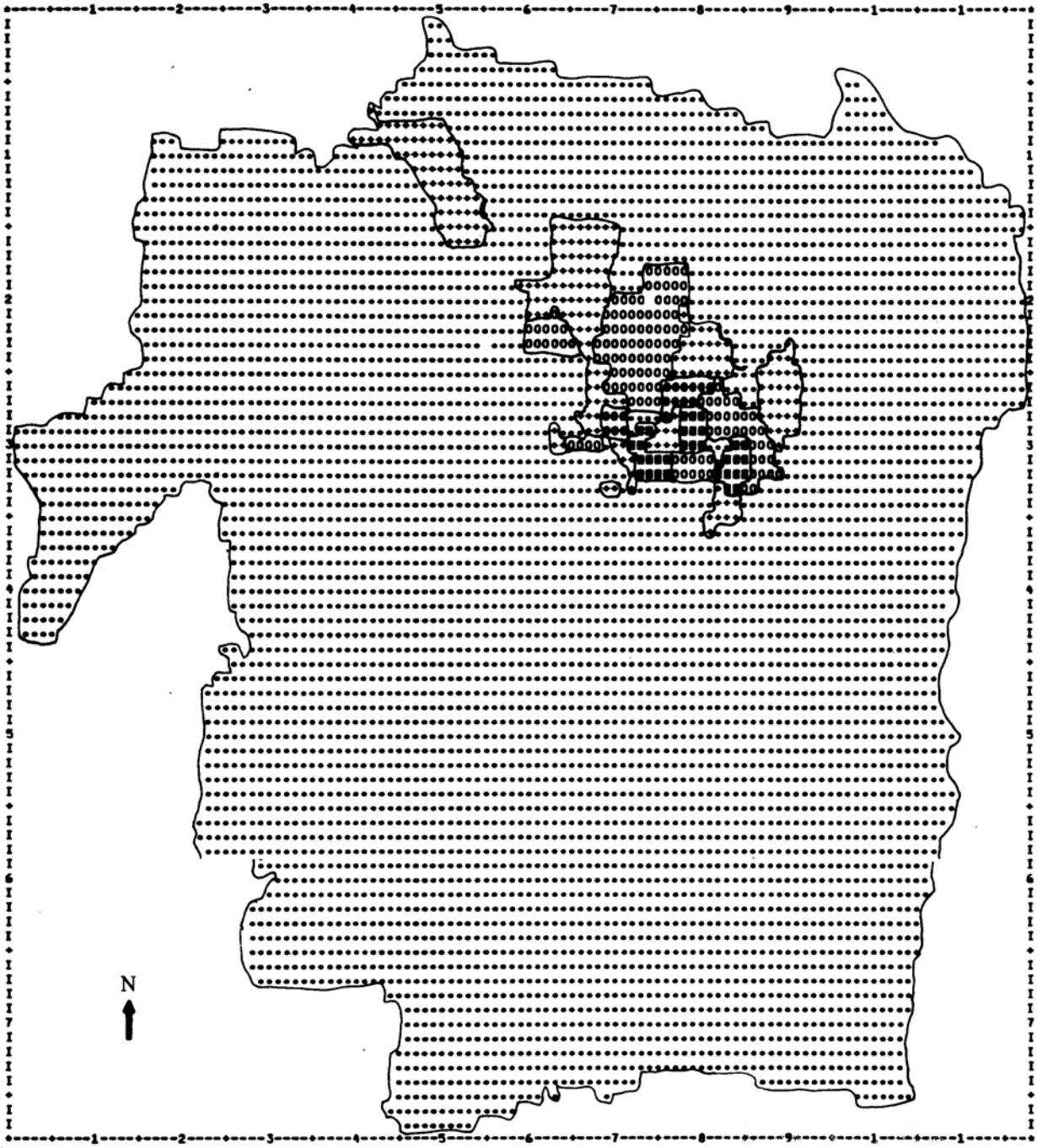


Figure 2.34
Two-Dimensional Map of Service Area of
EMS Vehicle 6



Number of Calls	1-4	5-10	11-16	17-22	23-28
Symbol	.	+	0	@	#
Frequency	326	16	10	2	4

Figure 2.35
Three-Dimensional Map of Service Area of EMS Vehicle 6
(from a perspective of 25 degrees)

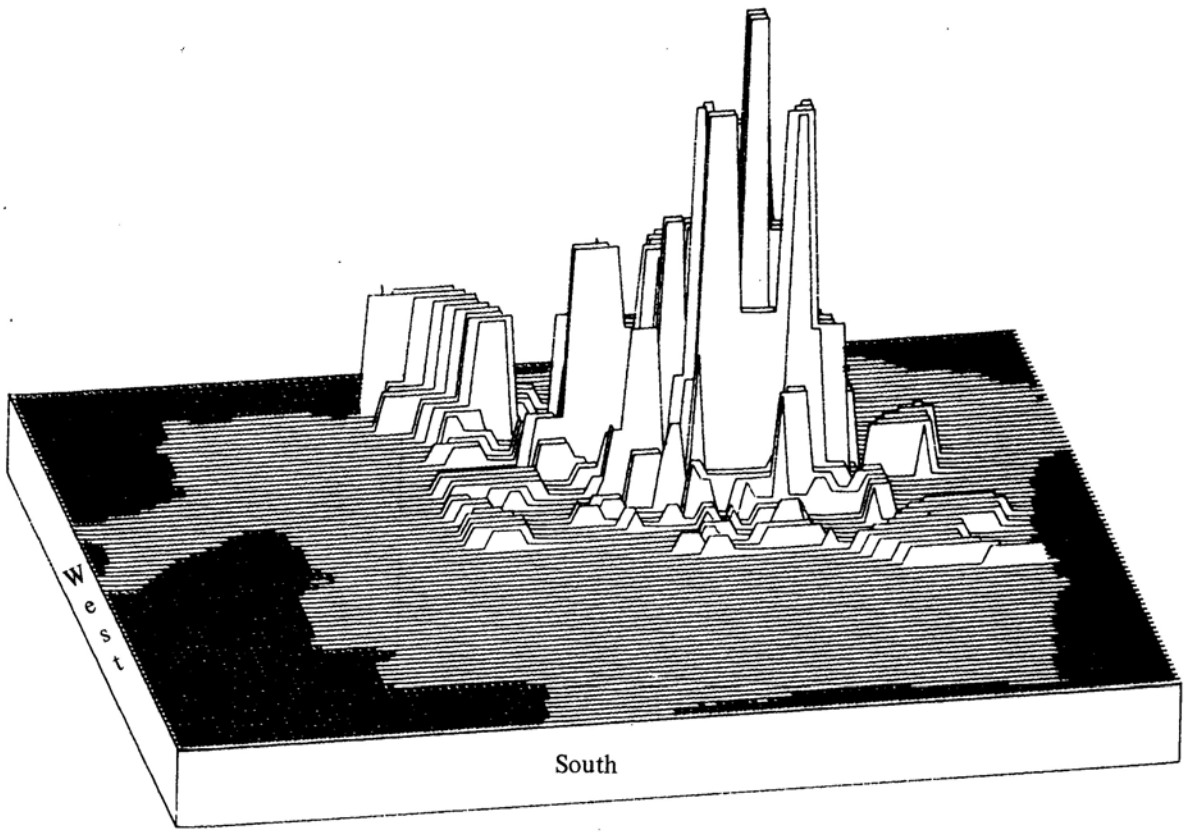
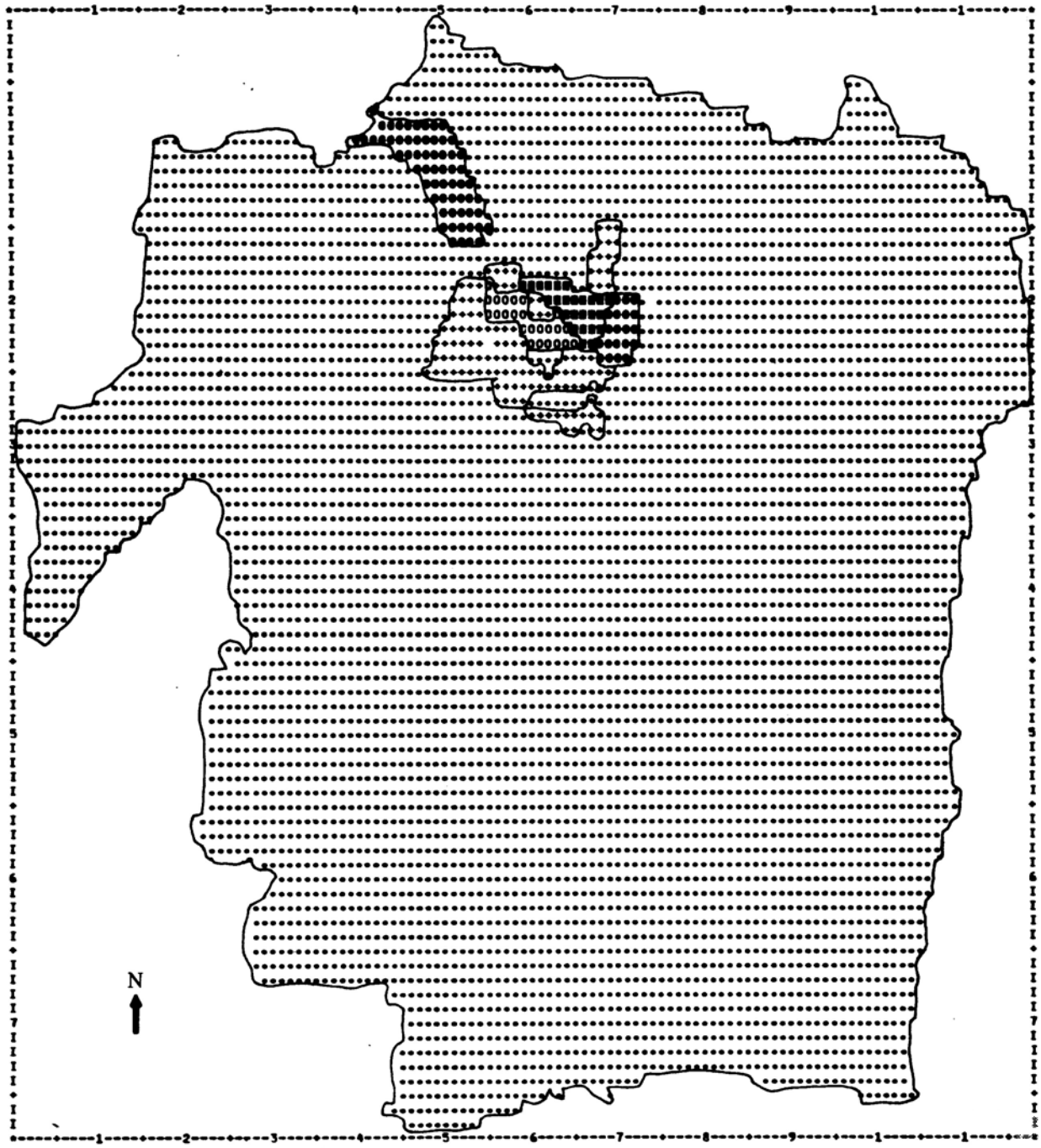


Figure 2.36

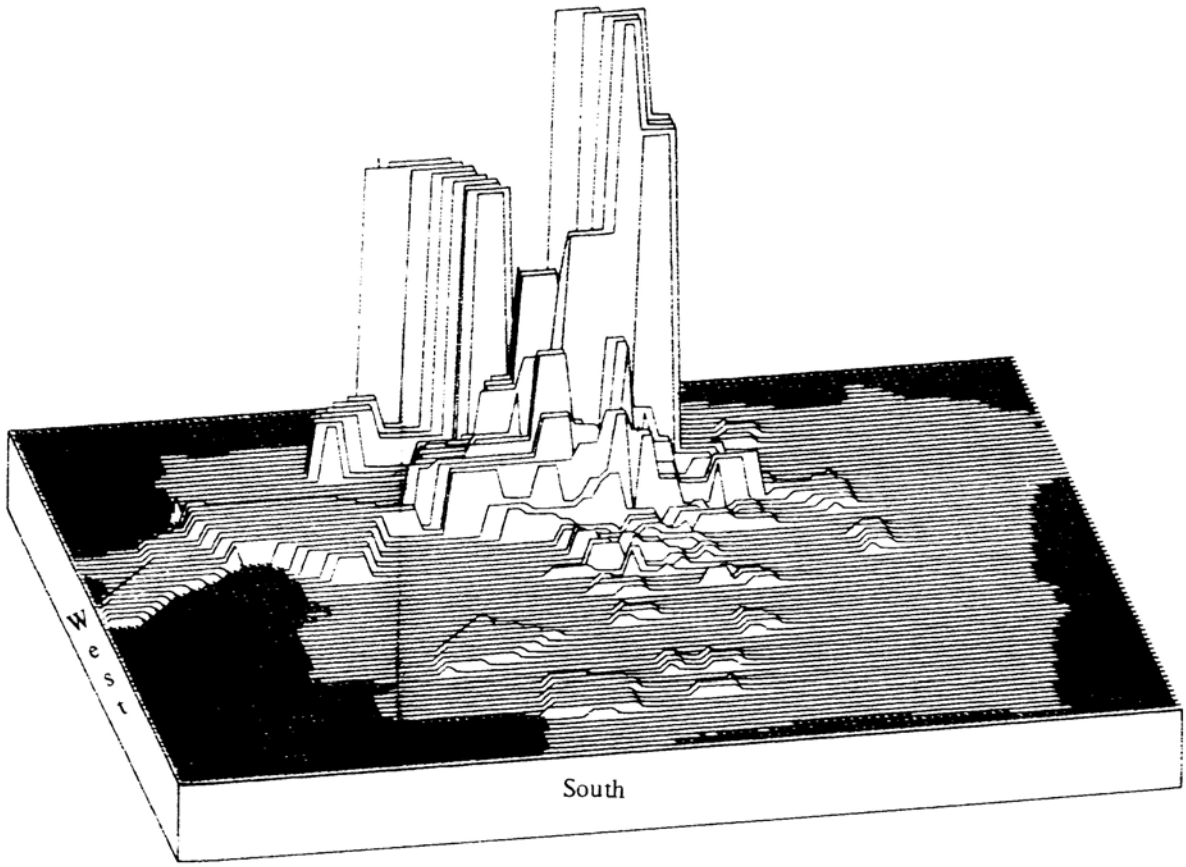
Two-Dimensional Map of Service Area of EMS Vehicle 7



Number of Calls	1-9	10-22	23-24	36-48	49-61
Symbol	.	+	0	3	5
Frequency	338	15	2	2	1

Figure 2.37

Three-Dimensional Map of Service Area of EMS Vehicle 7
(From a perspective of 25 degrees)



Chapter 3
Mapping Results

Visual representations of EMS call patterns and demographic information can be useful in EMS planning because a manager can identify the areas of a city with high or low demand. Knowledge of the types of calls that are likely to occur in an area may allow EMS personnel to anticipate and prepare for the kinds of emergencies they may encounter. This chapter contains maps of the geographical distribution of EMS calls and population groups in the city of Austin. The maps were generated by SYMAP and SYMVU, two computer mapping programs.

The SYMAP program was used to create two-dimensional maps which show call frequencies or population data within specific ranges or values associated with the 358 serial zones in the city. A different shading pattern or symbol is used to represent each value range. The SYMVU program produces three-dimensional illustrations for the same value ranges; the relative altitude (height) of each zone is used to differentiate between zone values.

Table 3.1

EMS Call Types

Category	*Calls Related to:*
Accident	Accidental injuries
Auto	Automobile accidents
Drug	Drug overdoses
Heart	Heart attacks
All other	All other calls
Seizure	Problems related to seizures
Unconscious	Unconscious persons
Violence	Gunshot, stabbing, or beating victims

EMS call data generated from the Call History Analysis Package (CHAP) were used as input to the mapping programs to produce maps which show the distribution of call types throughout the city. SYMAP and SYMVU were prepared for all call types combined, as well as for the eight call categories listed in Table 3.1.

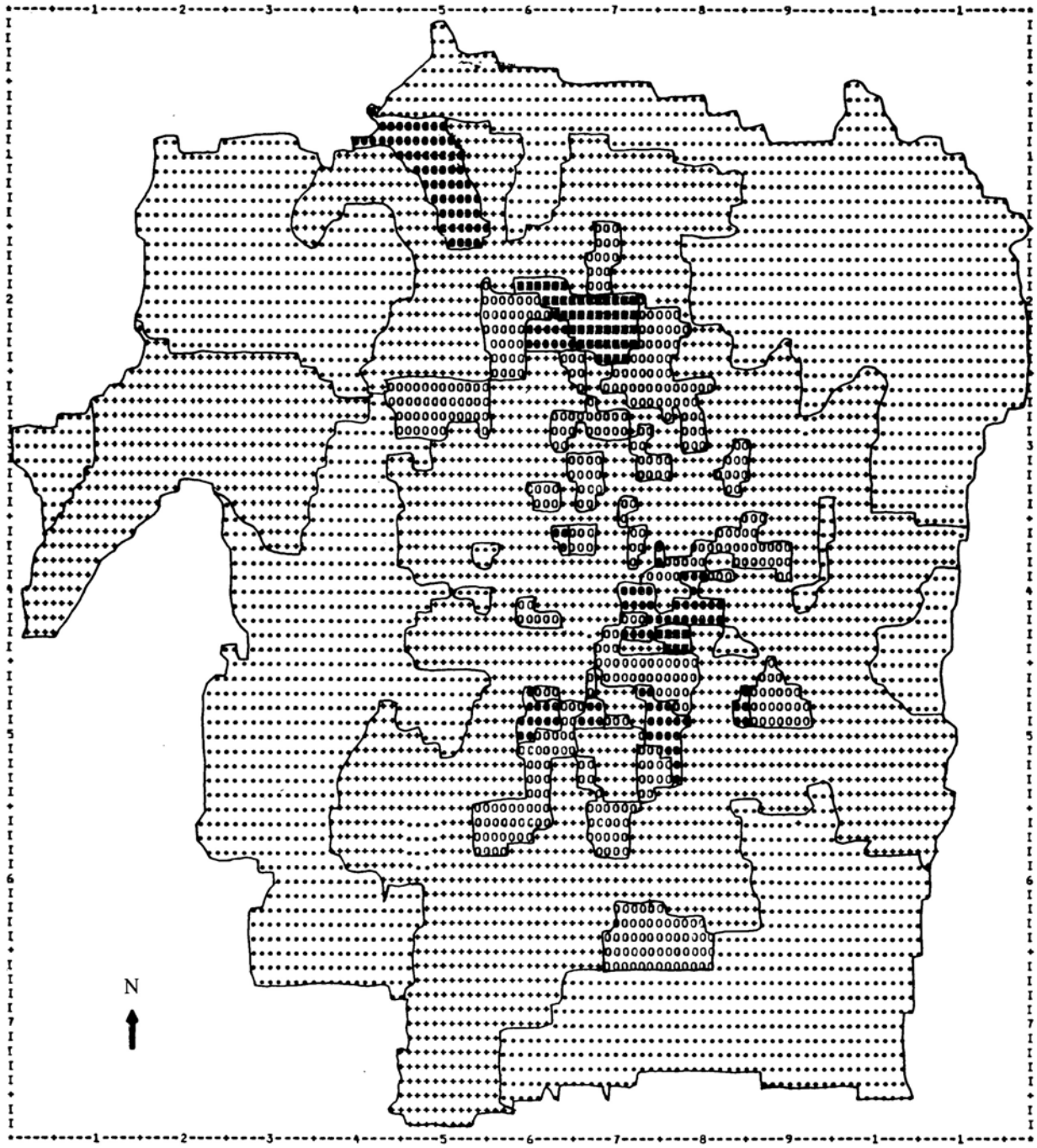
SYMAPs and SYMVUs for these call types appear as Figures 3.1 through 3.18.

Maps were also created for certain groupings of call types. One subset, called critical calls, includes heart attacks, strokes, unconscious persons, and violence-related calls. Critical calls generally require advanced paramedic skills and transport to the hospital. Figures 3.19 through 3.21 map the distribution of critical calls in serial zones in Austin. Maps of the geographical occurrence of noncritical calls appear in Figures 3.22 and 3.23. Calls can also be grouped according to whether or not transport to the hospital was required. The geographical distribution of transported and nontransported calls are depicted in Figures 3.24 through 3.27.

The remaining maps show the distribution of total population in Austin (Figures 3.28 and 3.29) as well as concentrations of minority (Spanish-surnamed persons and Blacks), Black, Spanish-surnamed, and Anglo populations (Figures 3.29 through 3.37). The areas of residence of elderly persons (62 years of age and older) and young persons (18 years old and younger) are shown in Figures 3.38 through 3.41, respectively.

Figure 3.1

Two-Dimensional Map of All Call Types



Number of Calls	0-1	2-19	20-37	38-55	56-73
Symbol	.	+	O	0	5
Frequency	44	217	57	17	3

Figure 3.2
Three-Dimensional Map of All Call Types
(from a perspective of 25 degrees)

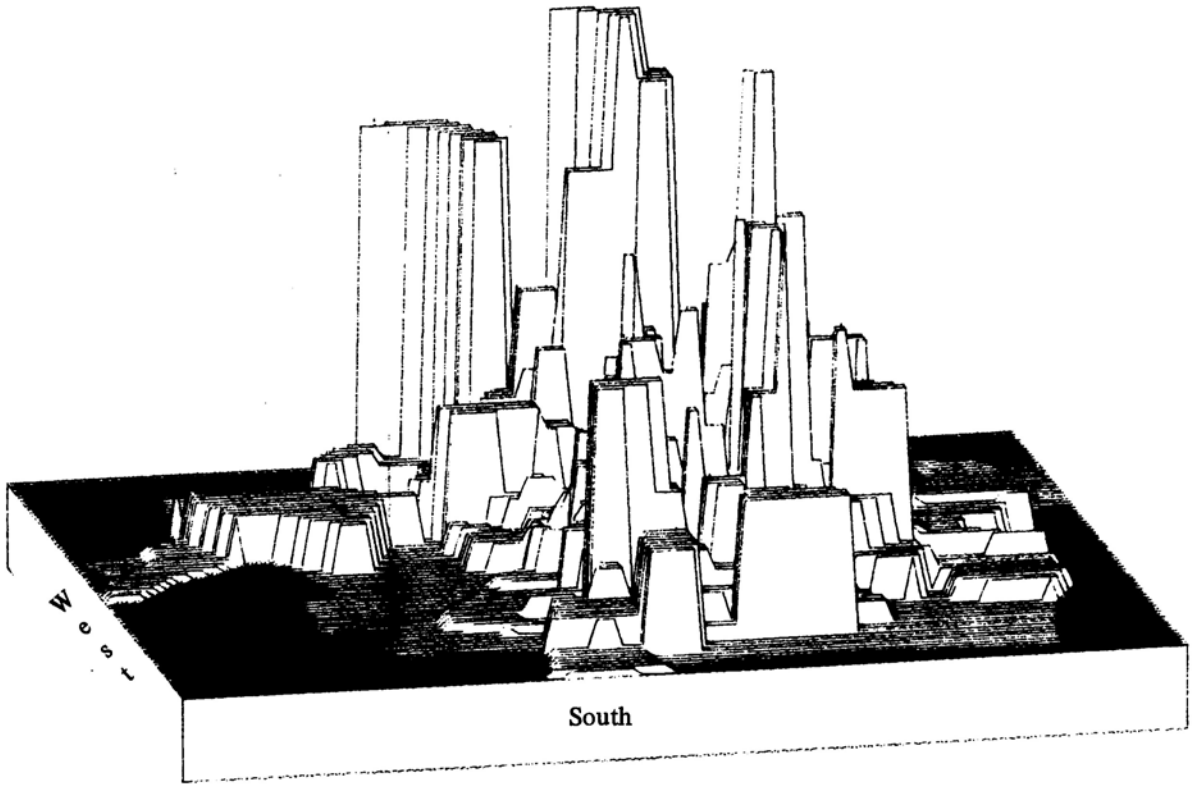
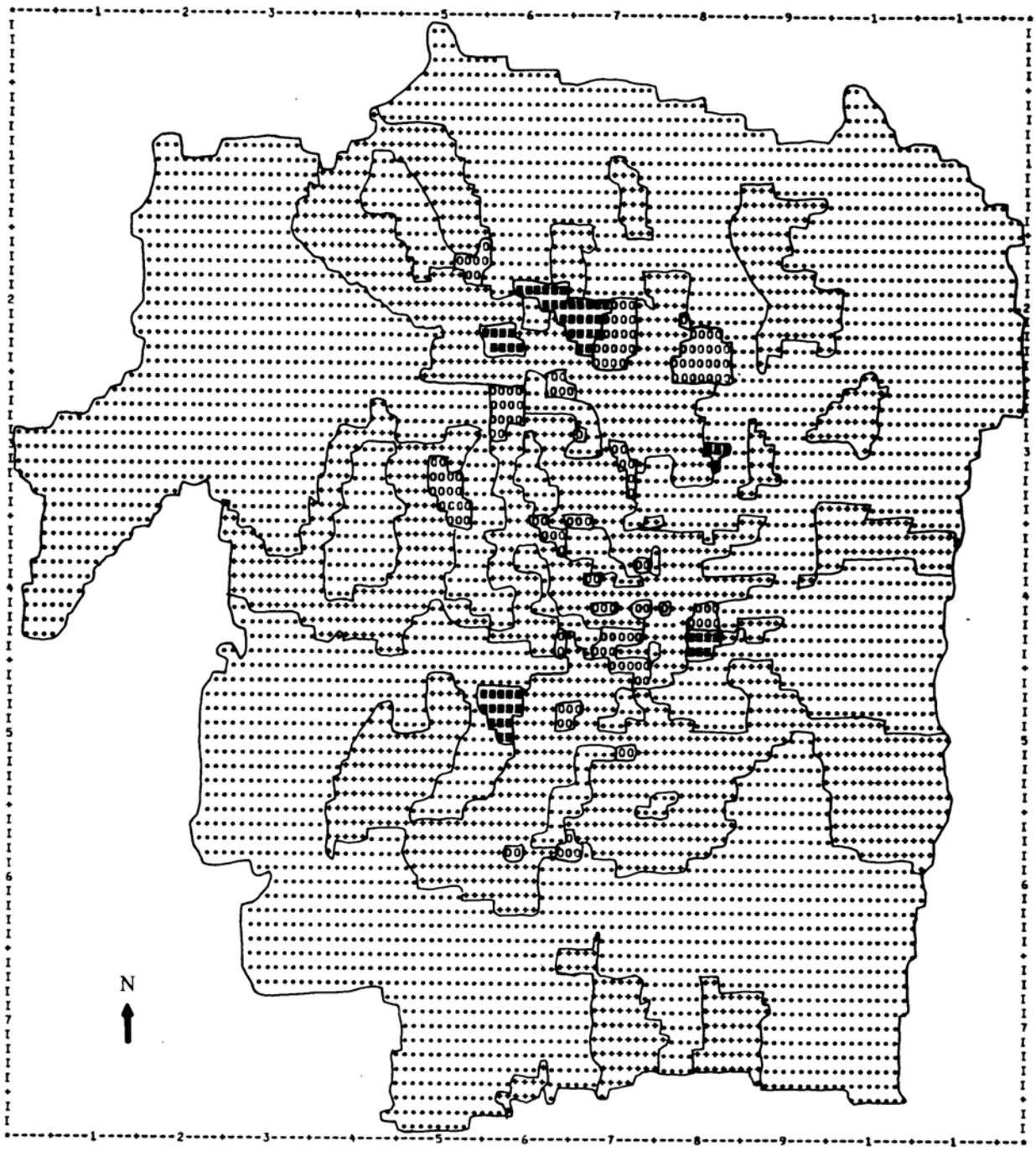


Figure 3.3

Two-Dimensional Map of Accident Calls



Number of Calls	0-1	2-4	5-8	9-12
Symbol	.	+	0	■
Frequency	154	168	31	5

Figure 3.4

Three-Dimensional Map of Accident Calls
(from a perspective of 25 degrees)

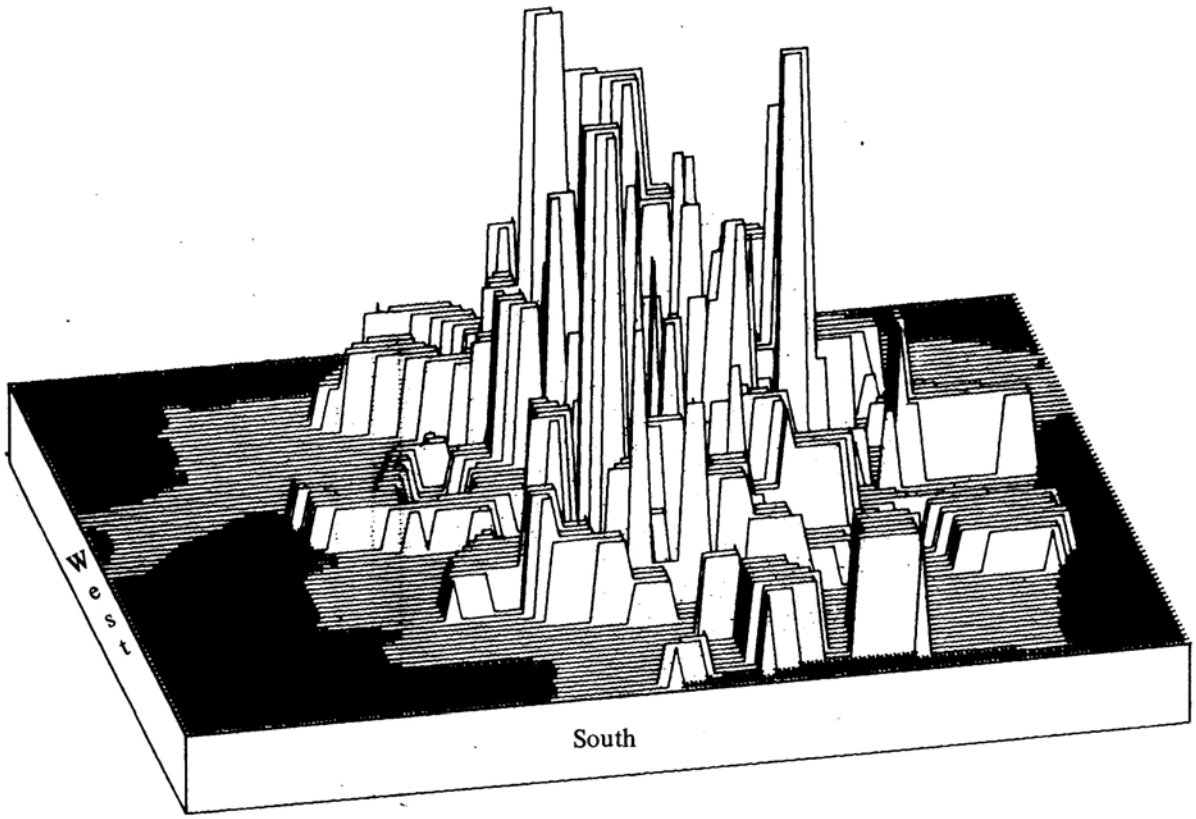
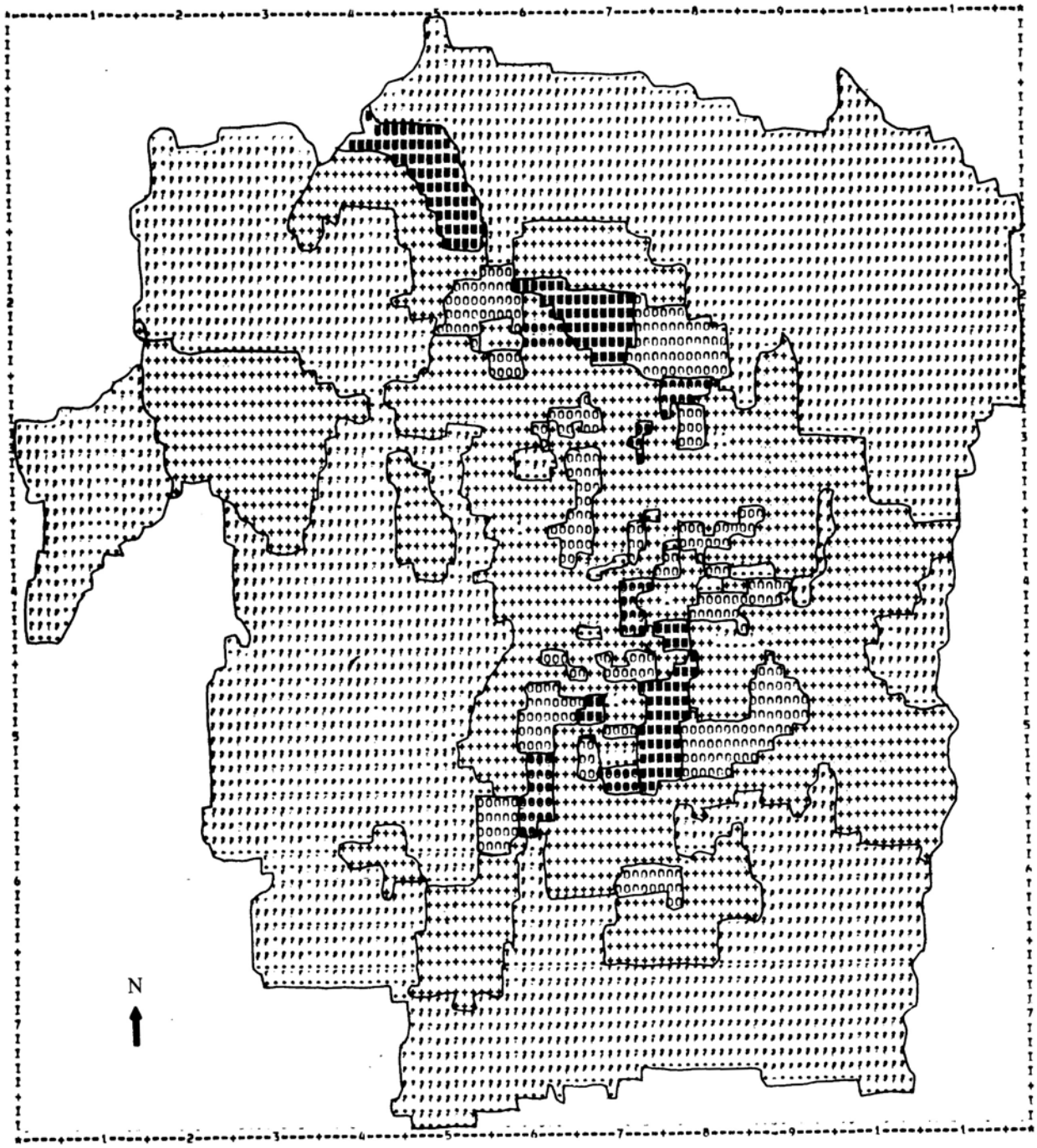


Figure 3.5

Two-Dimensional Map of Auto Calls



Number of Calls	0-1	2-66	7-11	12-16	17-21
Symbol					
Frequency	113	184	44	9	8

Figure 3.6
Three-Dimensional Map of Auto Calls
(from a perspective of 25 degrees)

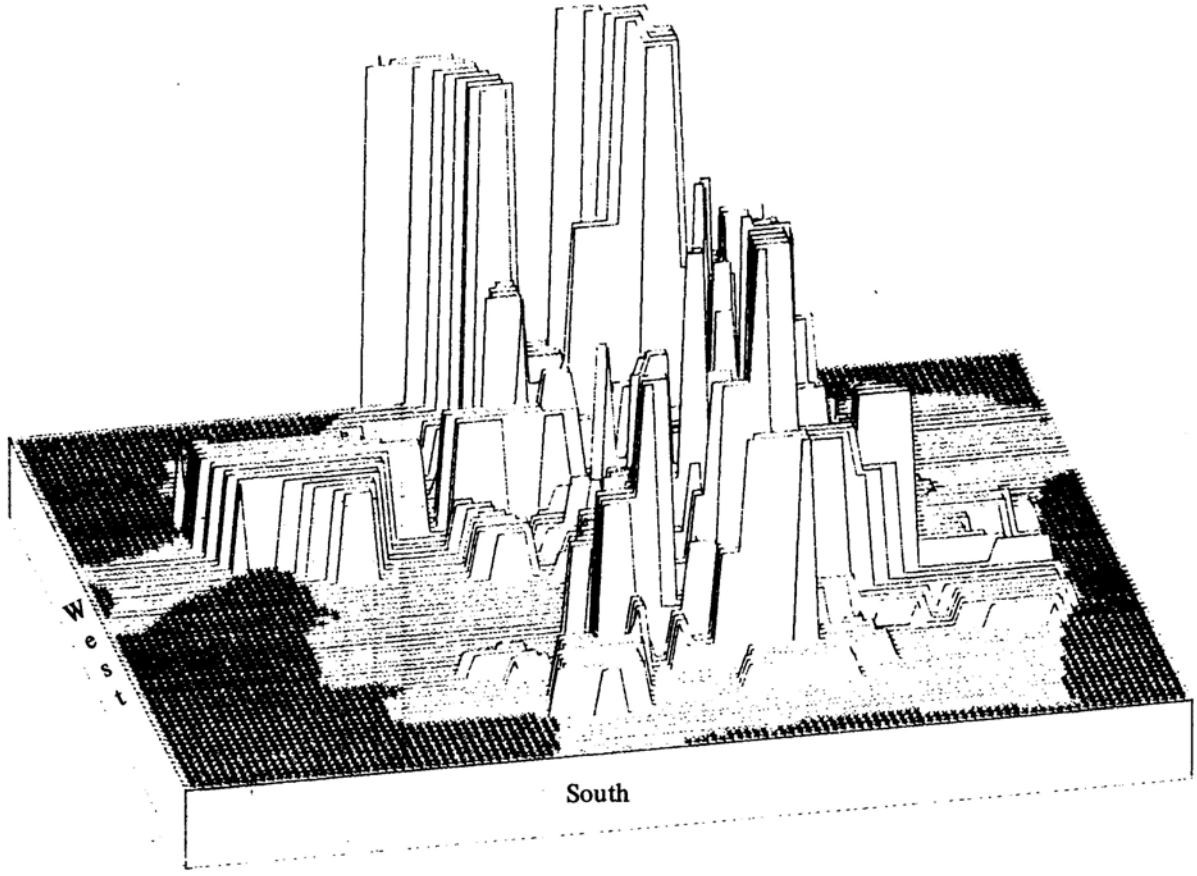
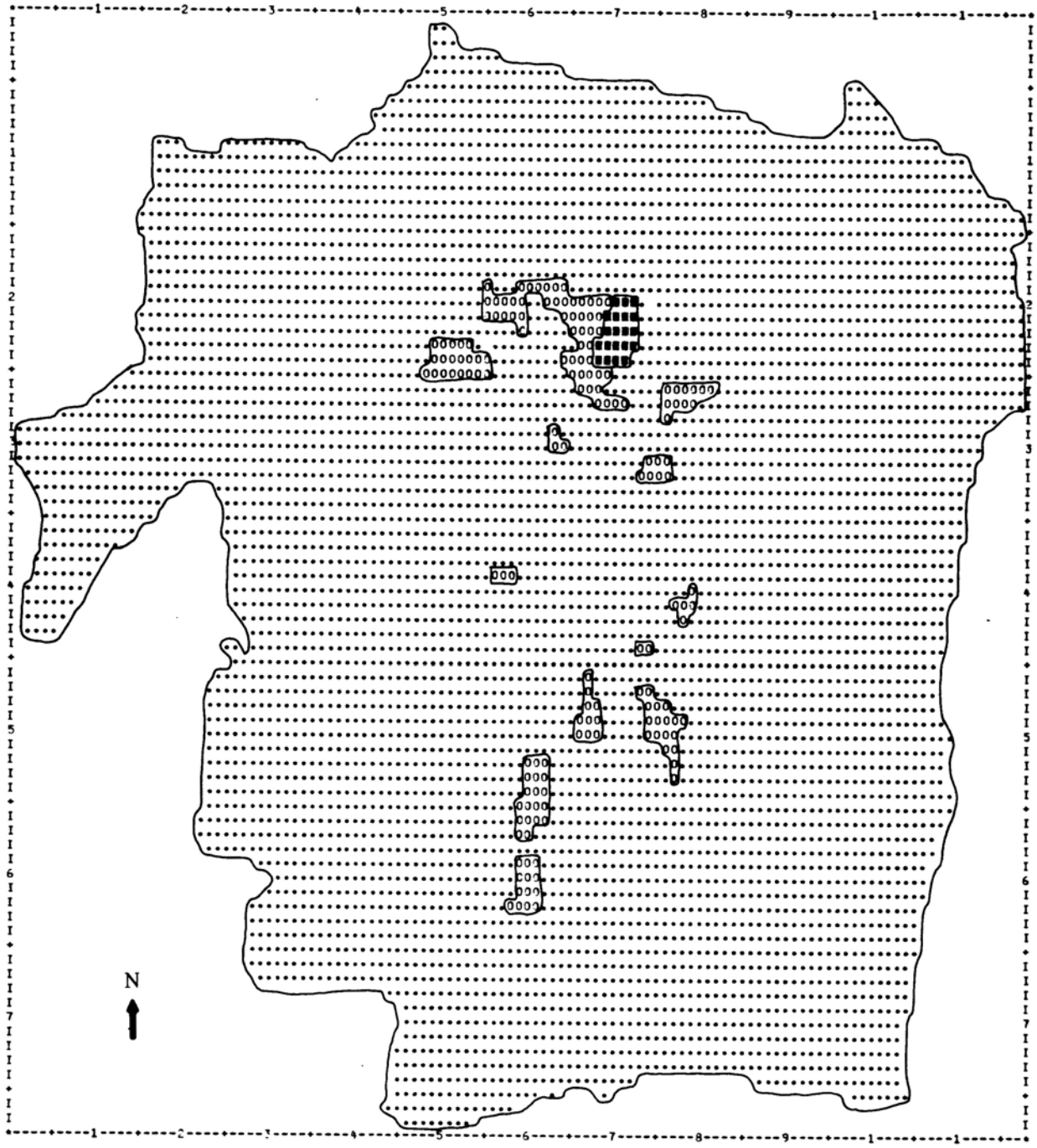


Figure 3.7

Two-Dimensional Map of Drug Calls



Number of Calls	0-3	4-6	7-9
Symbol	.	0	■
Frequency	338	19	1

Figure 3.8

Three-Dimensional Map of Drug Calls
(from a perspective of 25 degrees)

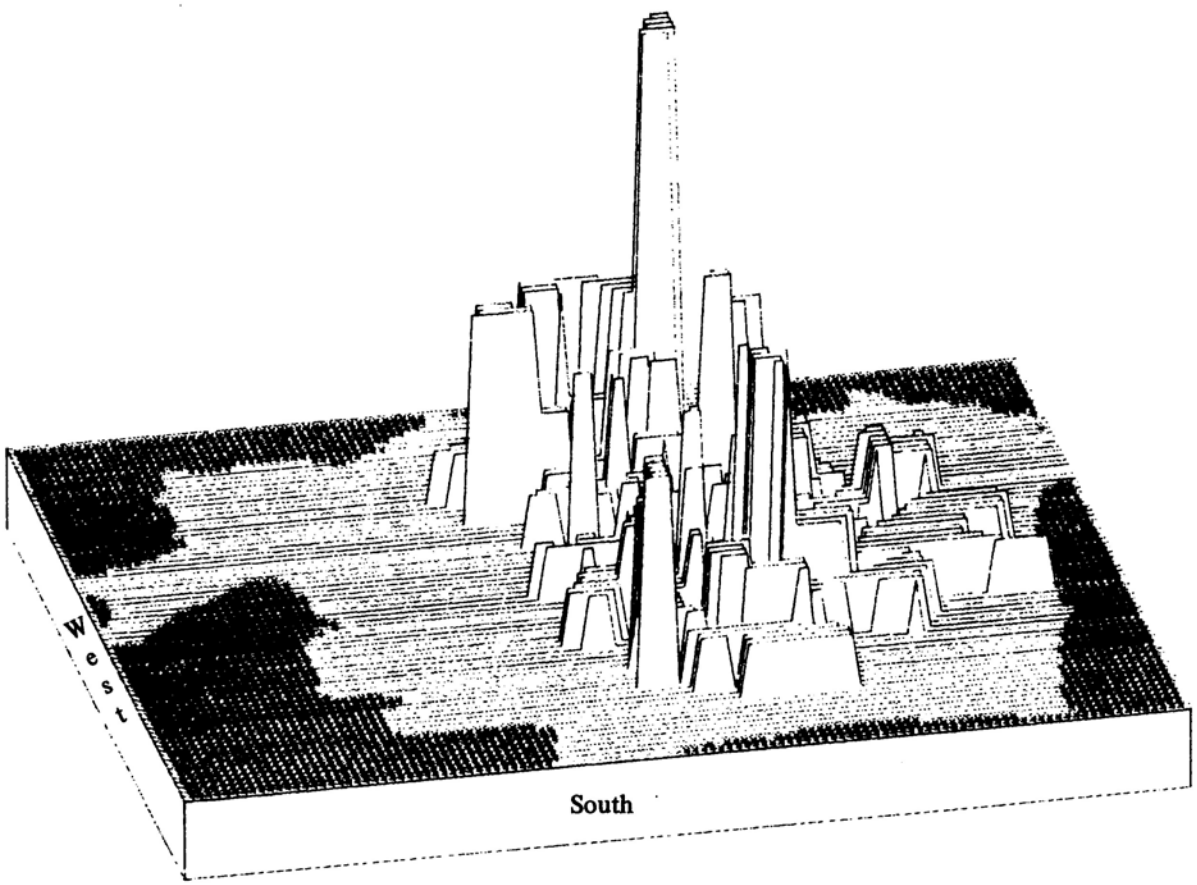
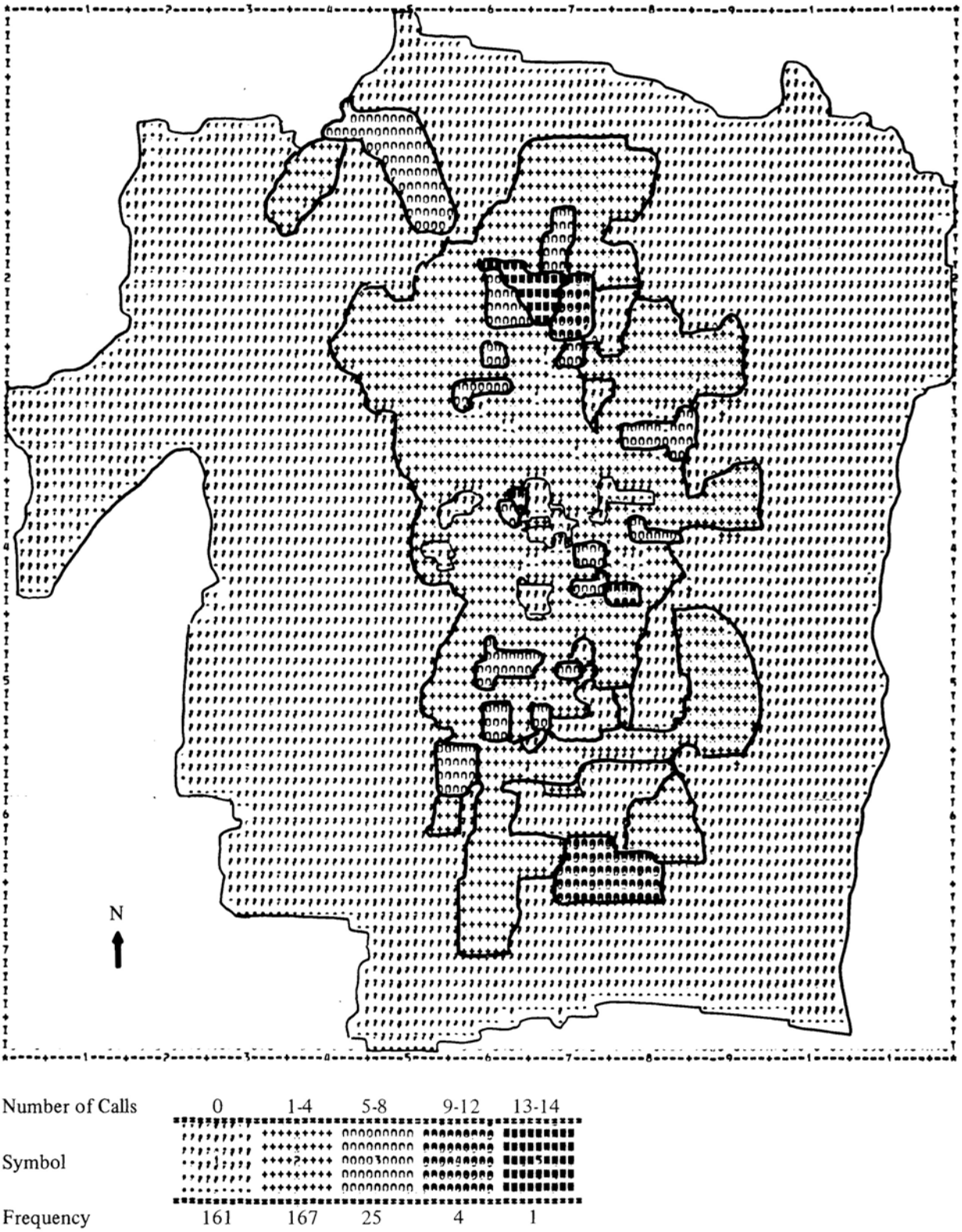


Figure 3.9

Two-Dimensional Map of Heart Calls



Number of Calls	0	1-4	5-8	9-12	13-14
Symbol					
Frequency	161	167	25	4	1

Figure 3.10
Three-Dimensional Map of Heart Calls
(from a perspective of 25 degrees)

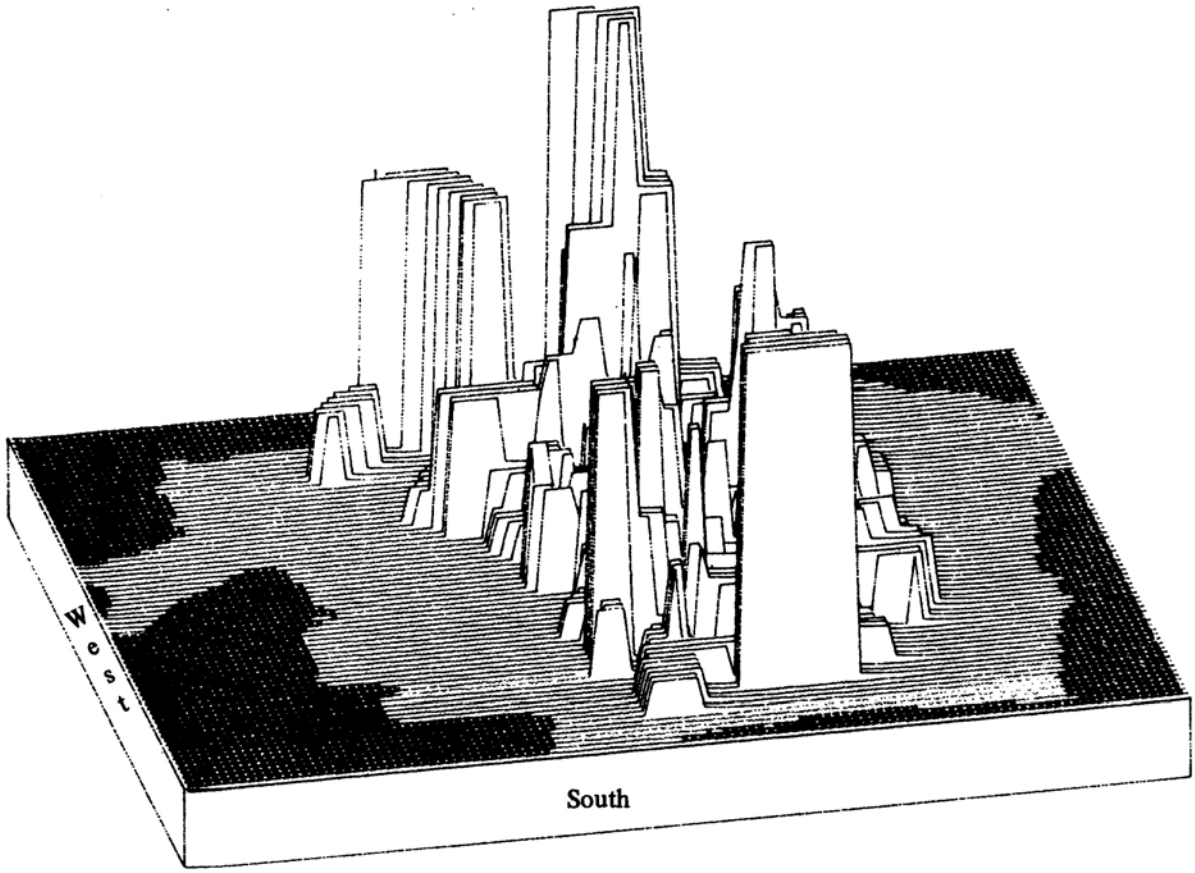
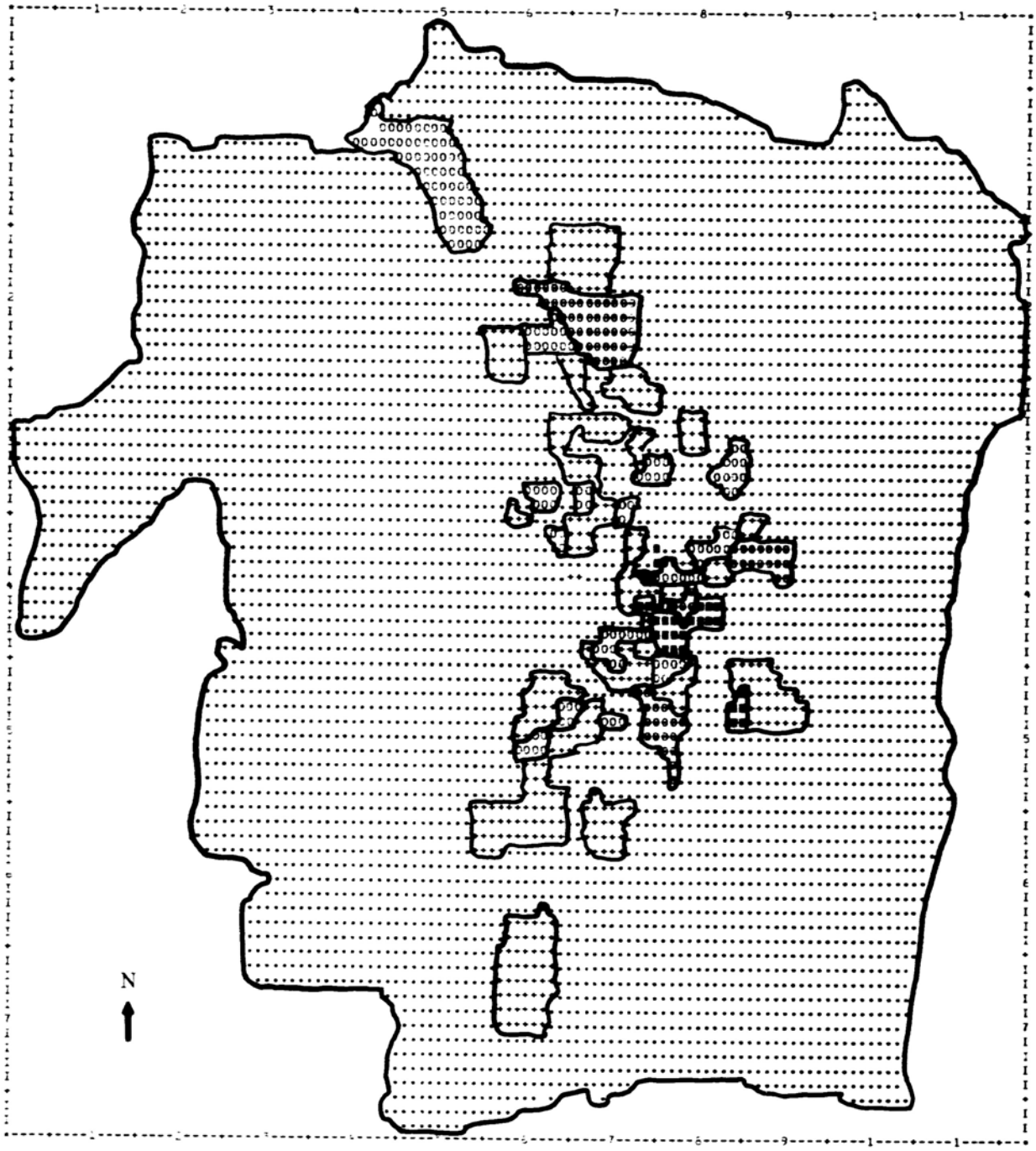


Figure 3.11

Two-Dimensional Map of All Other Calls



Number of Calls	0-5	6-10	11-15	16-20	21-26
Symbol					
Frequency	274	51	20	7	6

Figure 3.12

Three-Dimensional Map of All Other Calls
(from a perspective of 25 degrees)

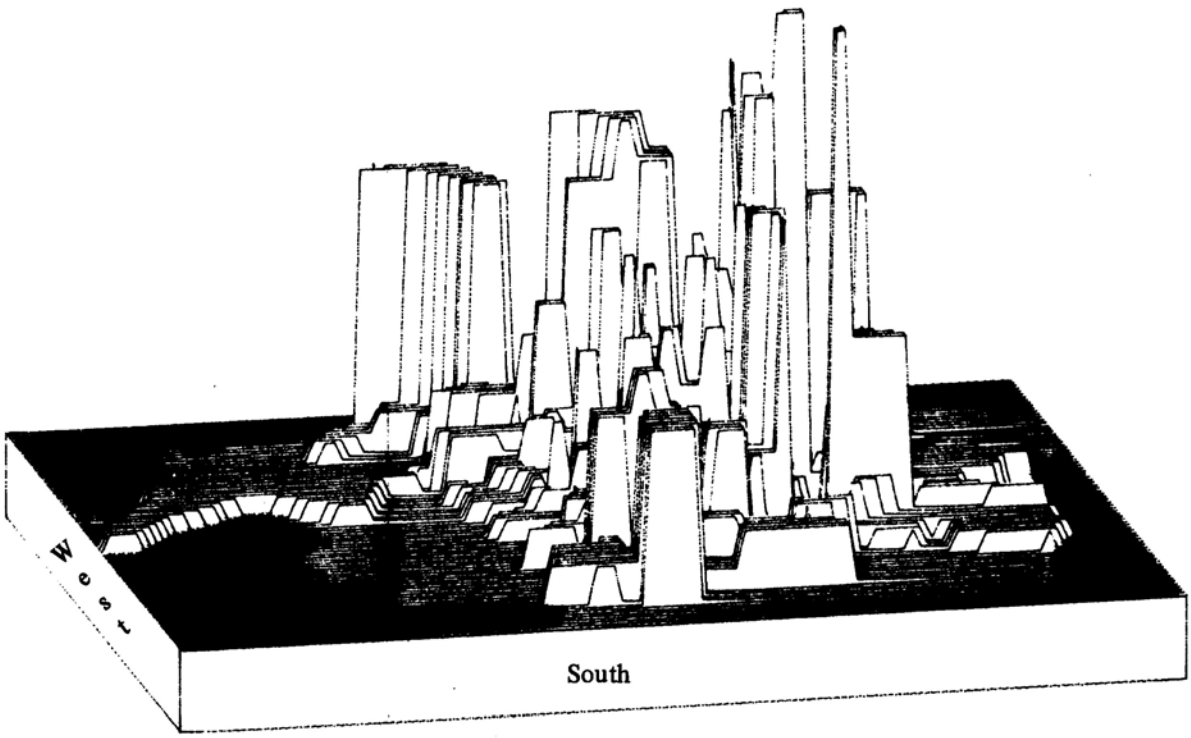
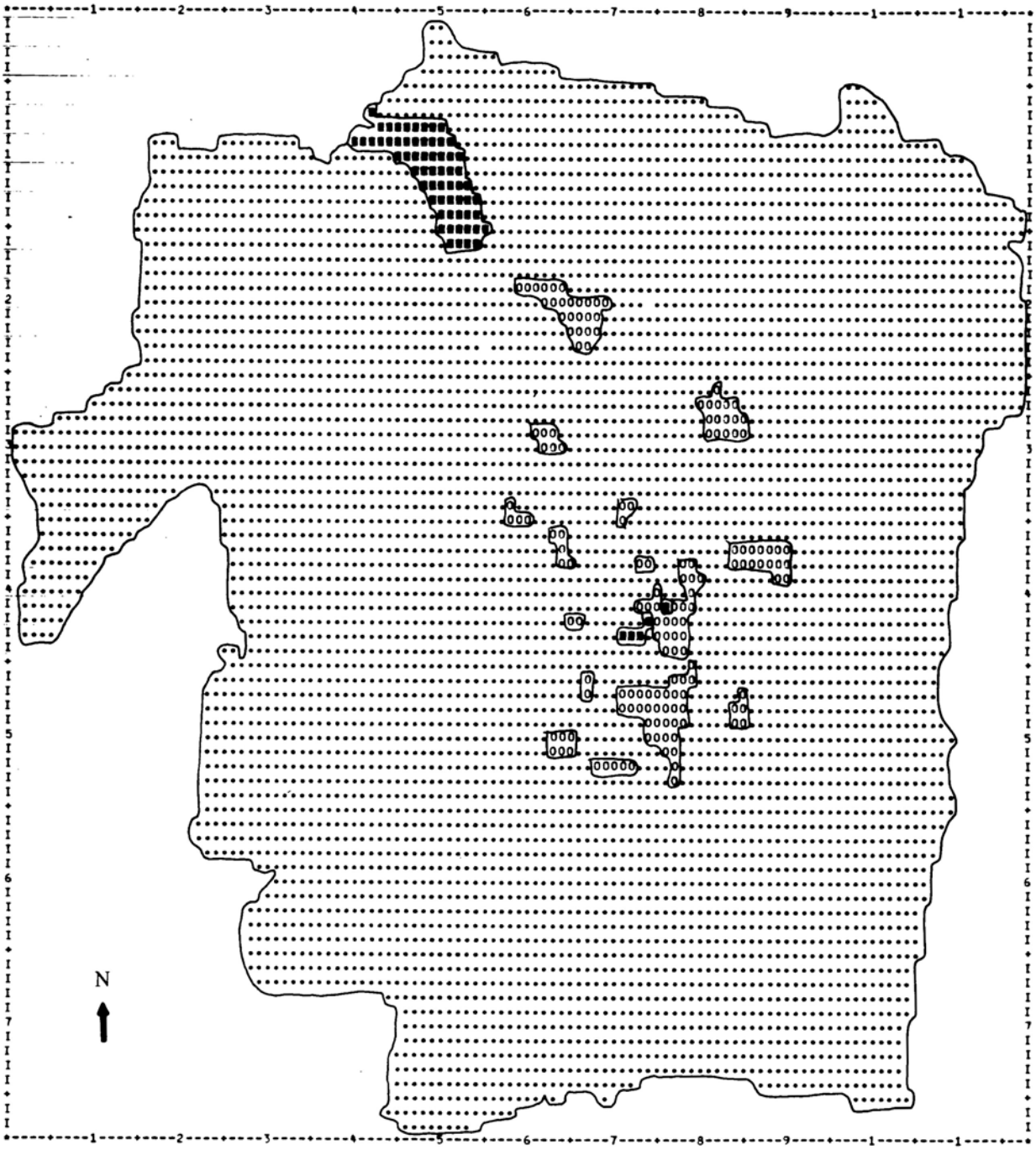


Figure 3.13

Two-Dimensional Map of Seizure Calls



Number of Calls	0-1	2	3-4
Symbol	.	0	■
Frequency	326	26	6

Figure 3.14
Three-Dimensional Map of Seizure Calls
(from a perspective of 25 degrees)

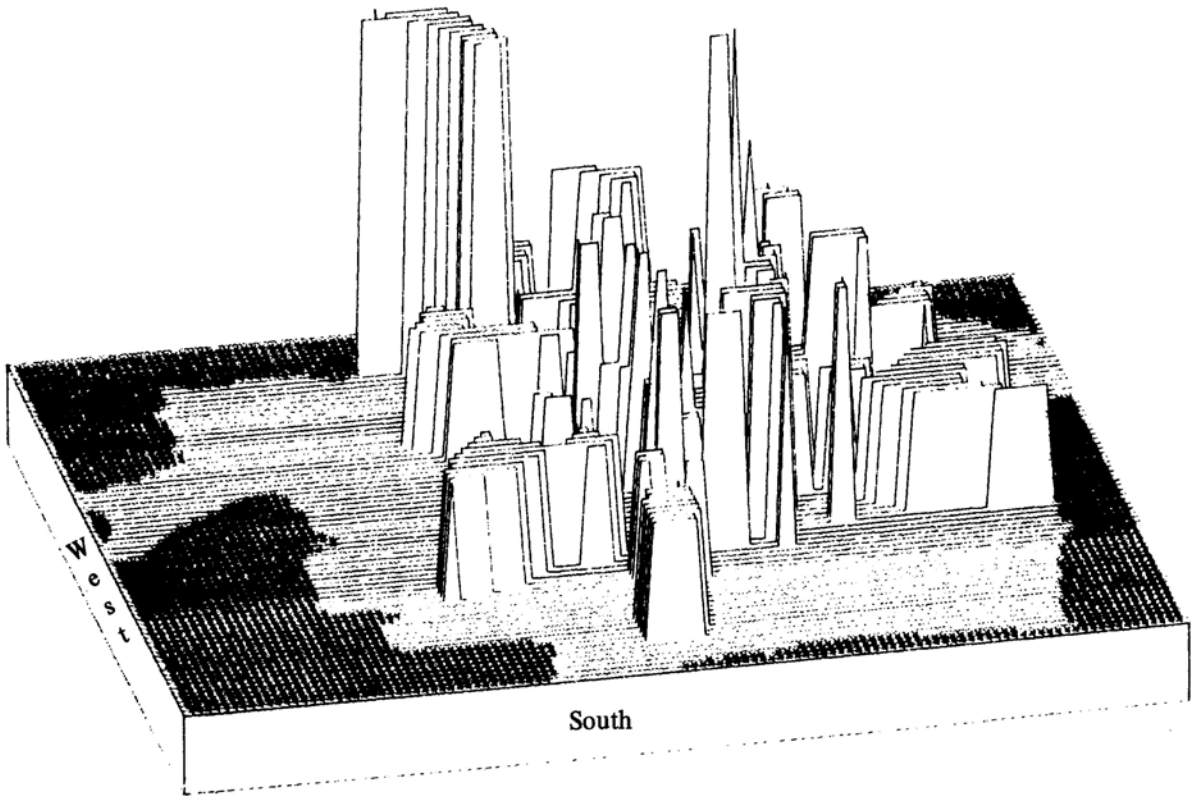
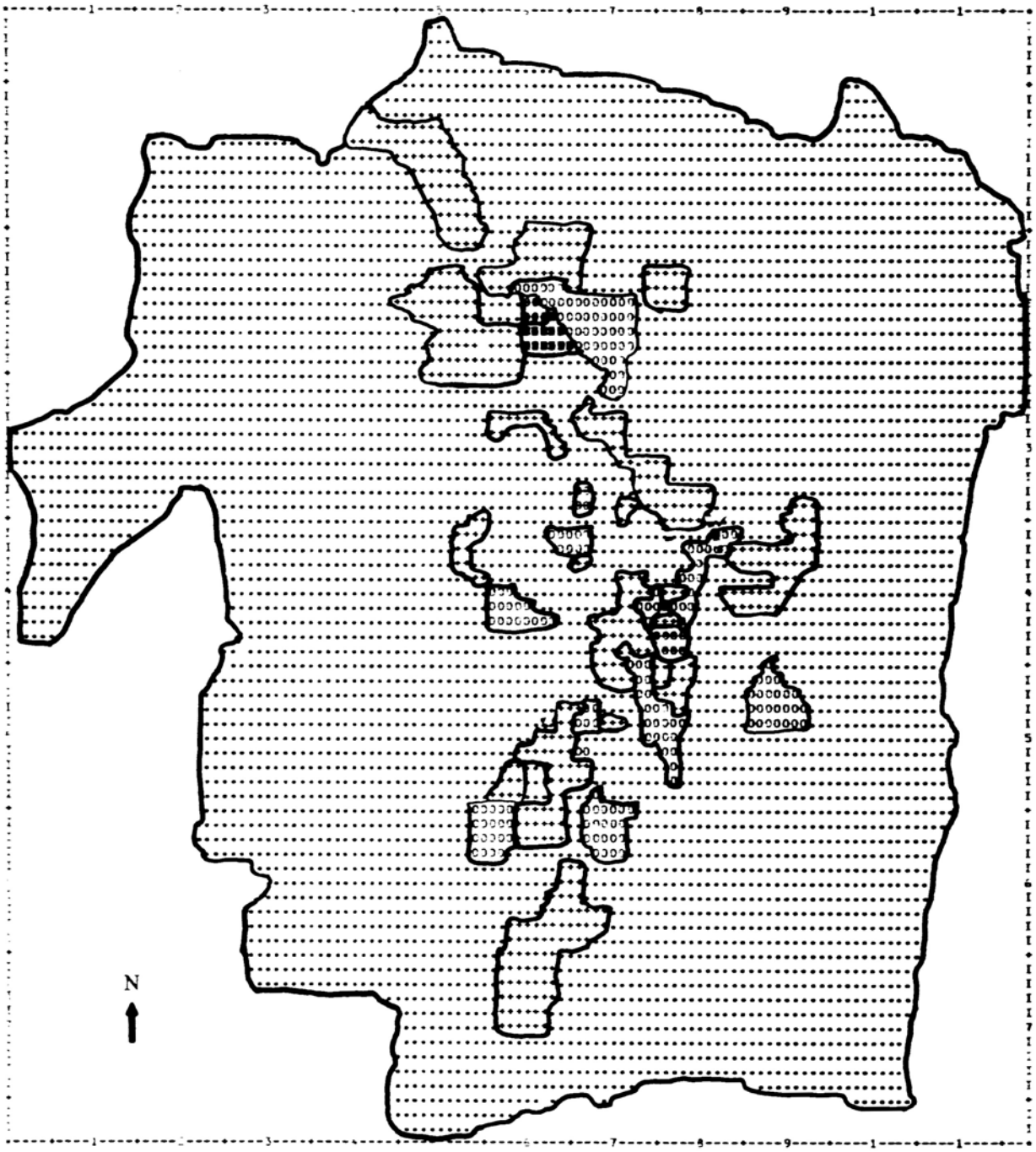


Figure 3.15

Two-Dimensional Map of Unconscious Calls



Number of Calls	0	1	2	3	4
Symbol					
Frequency	275	56	23	3	1

Figure 3.16

Three-Dimensional Map of Unconscious Calls
(from a perspective of 25 degrees)

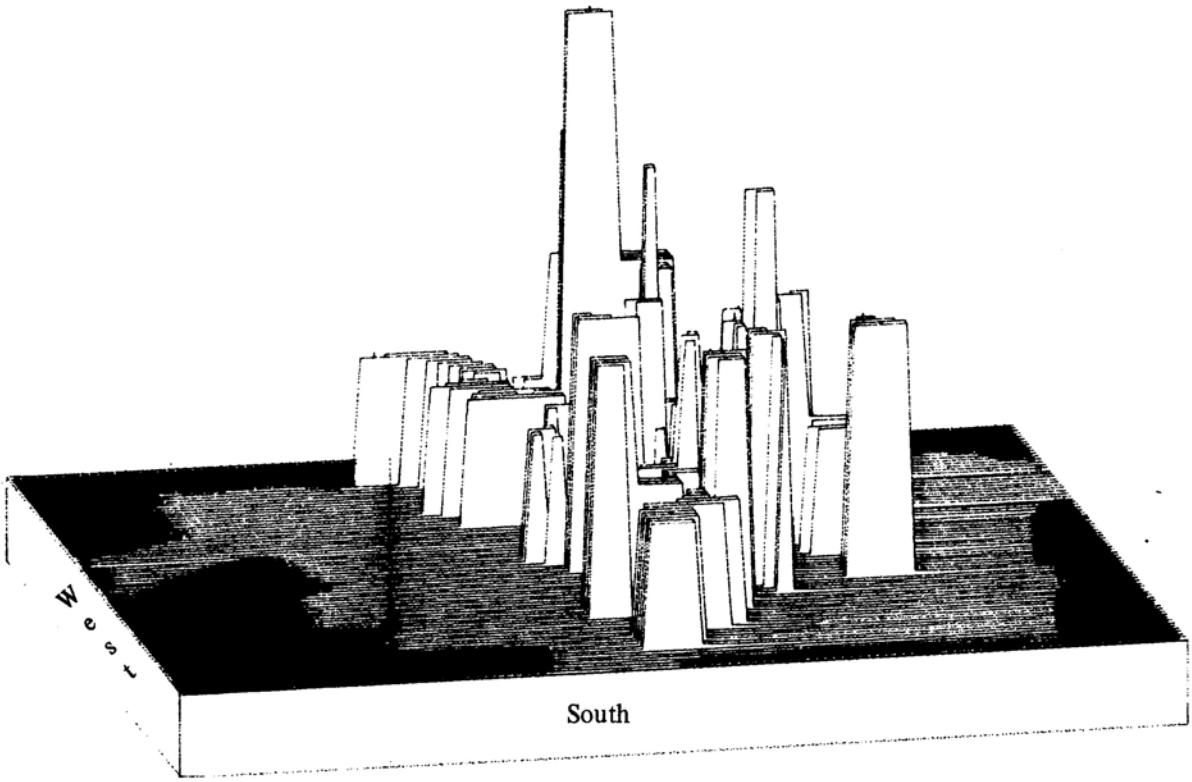
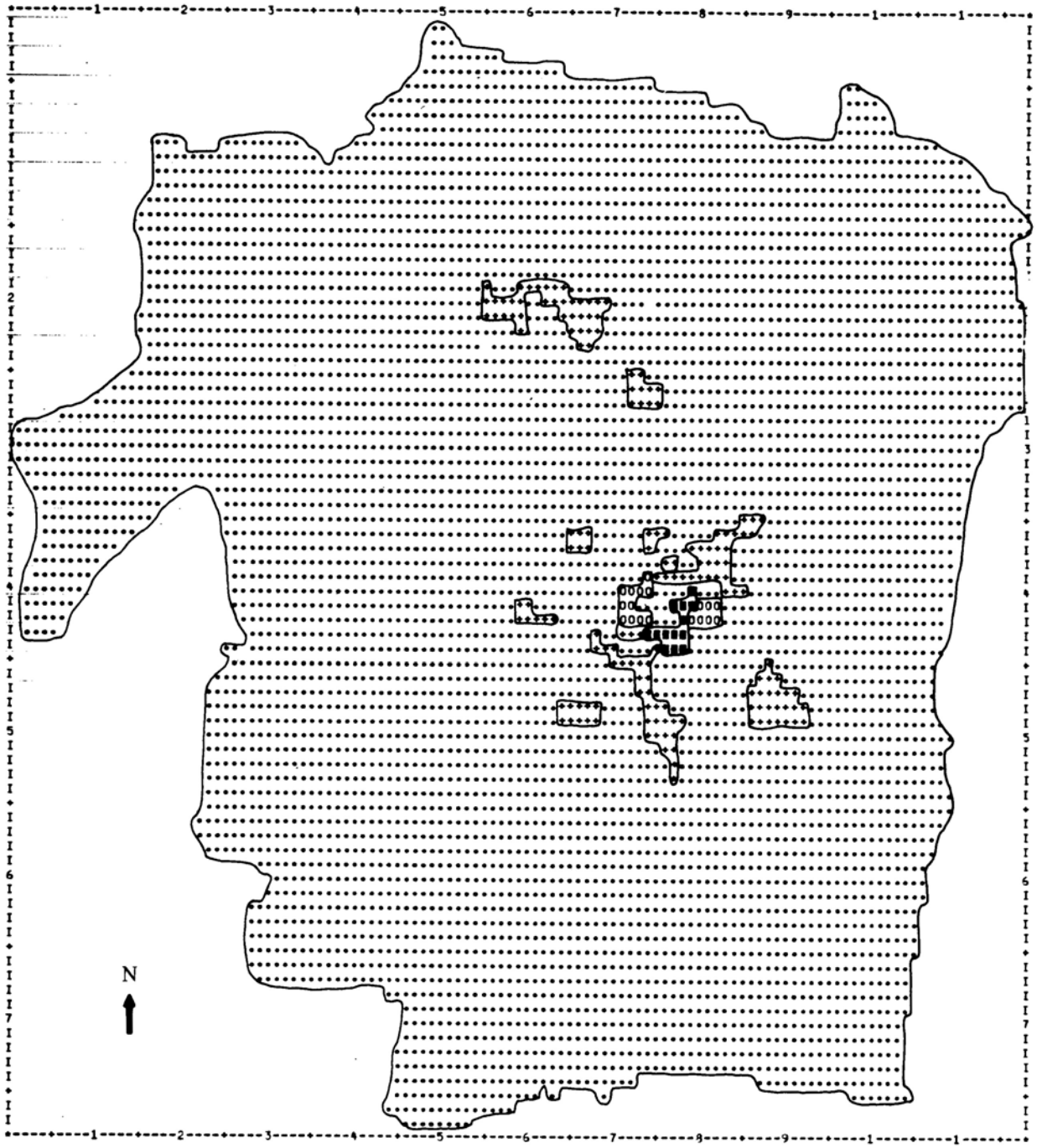


Figure 3.17

Two-Dimensional Map of Violence-Related Calls



Number of Calls	0-2	3-6	6-8	9-11
Symbol	.	+	0	■
Frequency	326	24	5	3

Figure 3.18

Three-Dimensional Map of Violence-Related Calls
(from a perspective of 25 degrees)

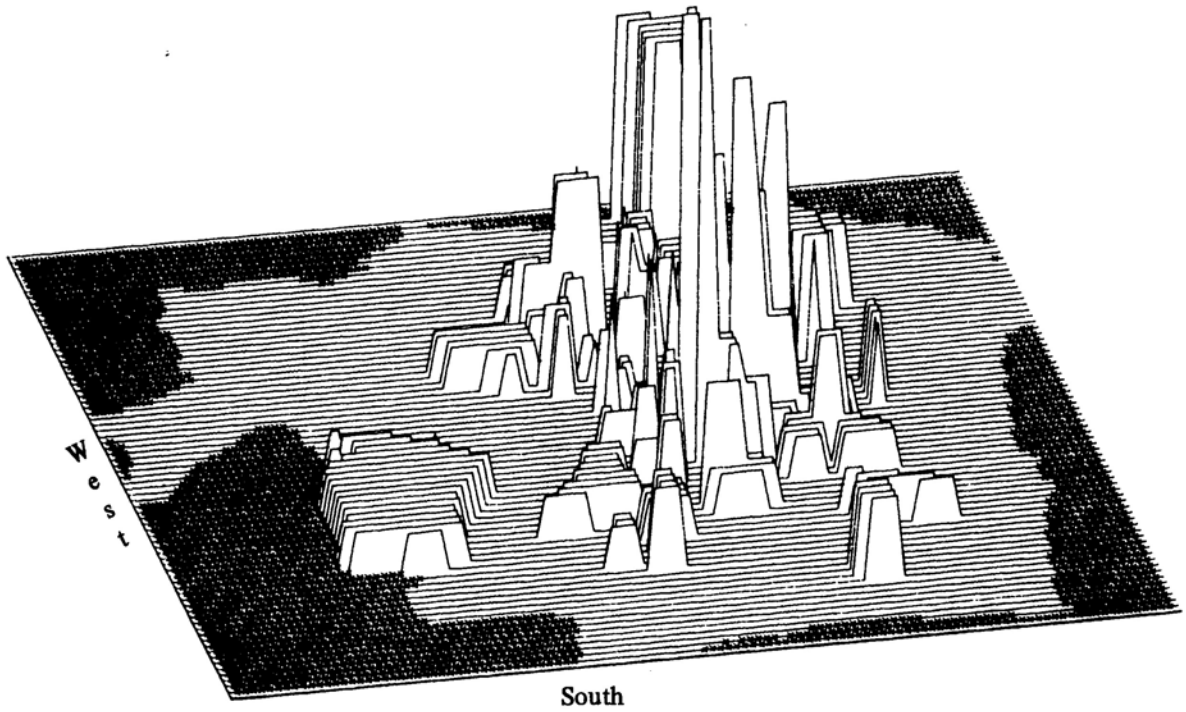
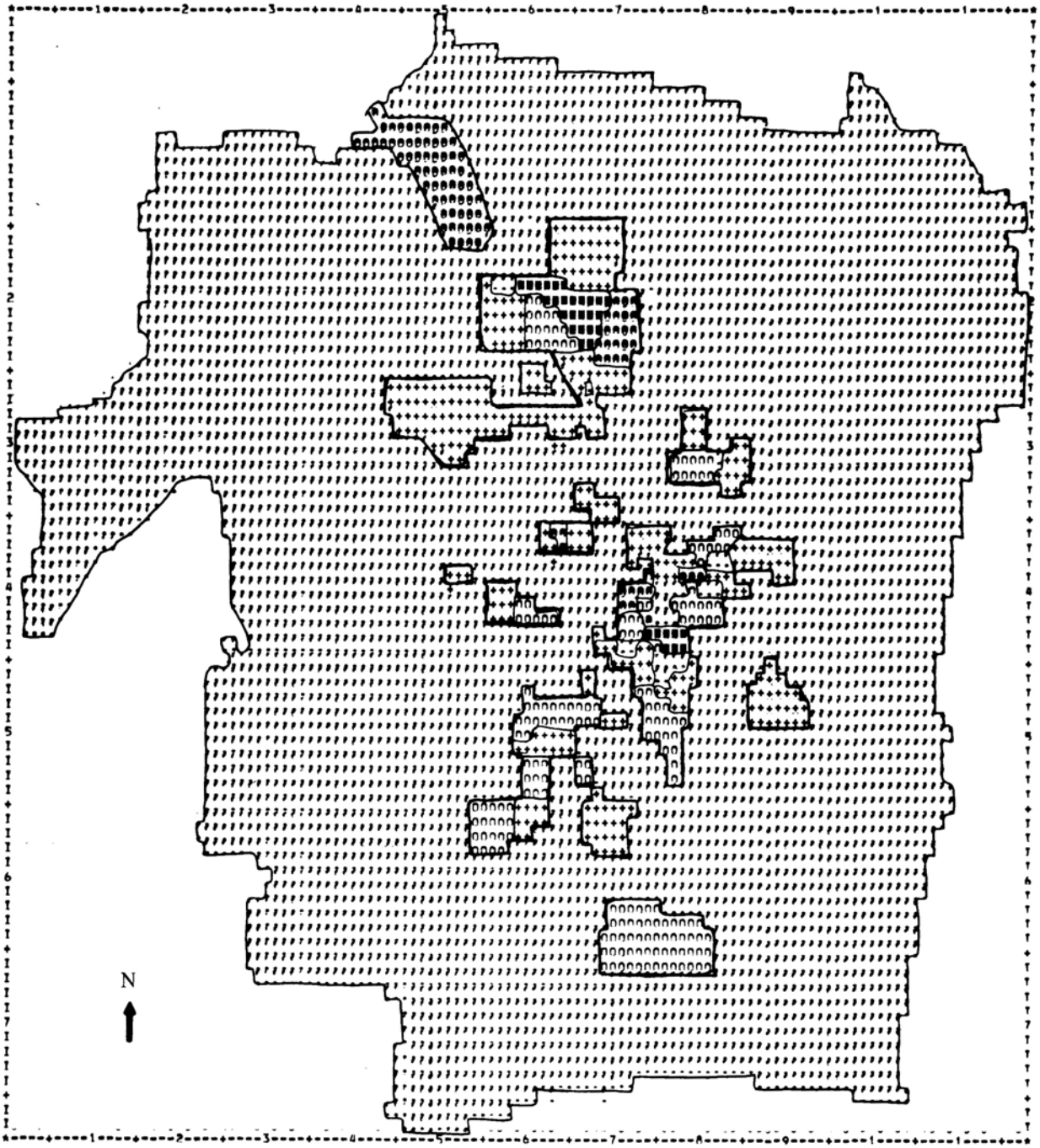


Figure 3.19
Two-Dimensional Map of Critical Calls



Number of Calls	0-4	5-8	9-12	13-16	17-25
Symbol	.	+	0	8	5
Frequency	282	47	20	6	3

Figure 3.20
Three-Dimensional Map of Critical Calls
With an Altitude of 3 Units
(from a perspective of 25 degrees)

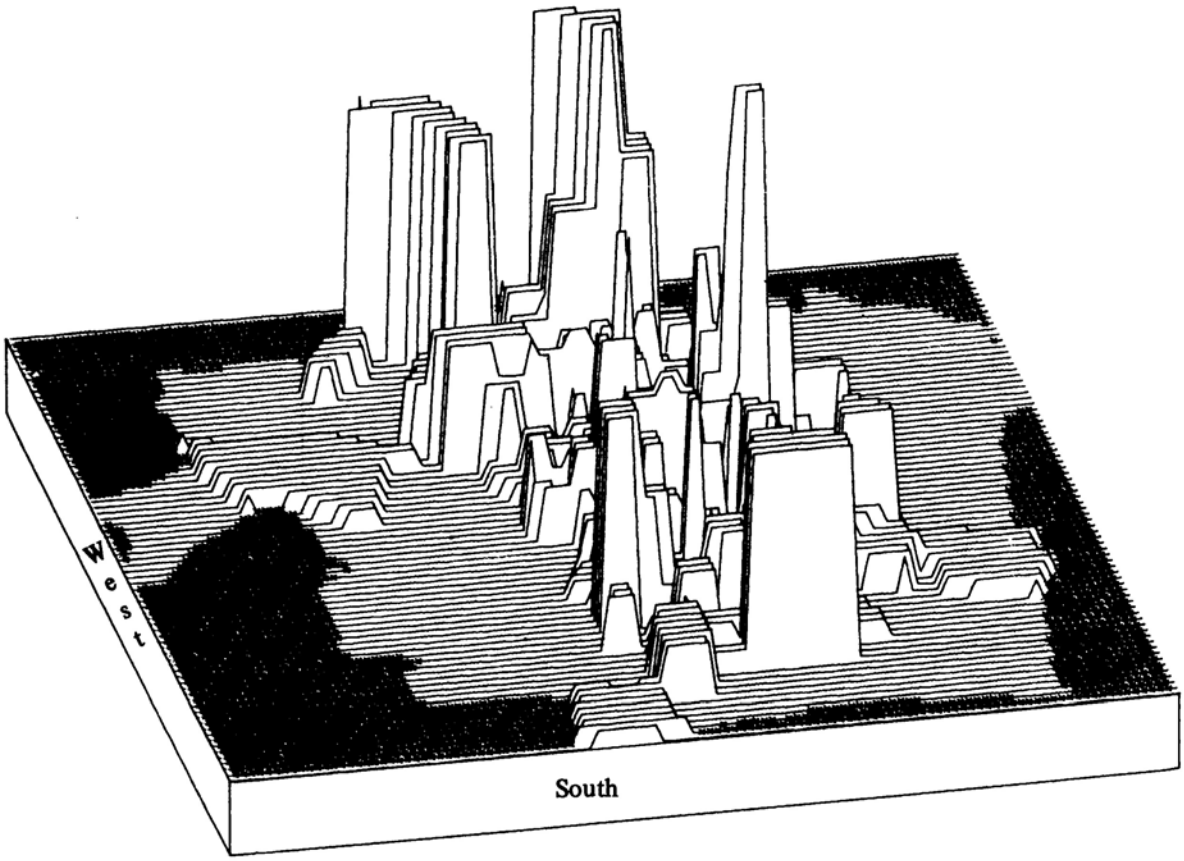


Figure 3.21

Three-Dimensional Map of Critical Calls

With an Altitude of 1 Unit

(from a perspective of 25 degrees)

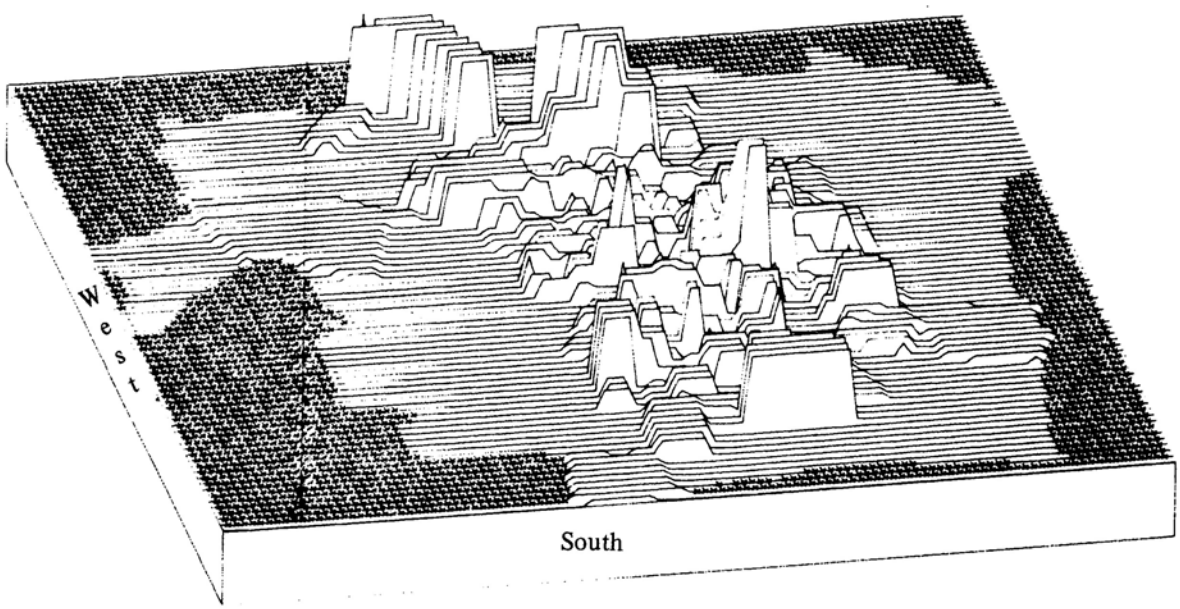
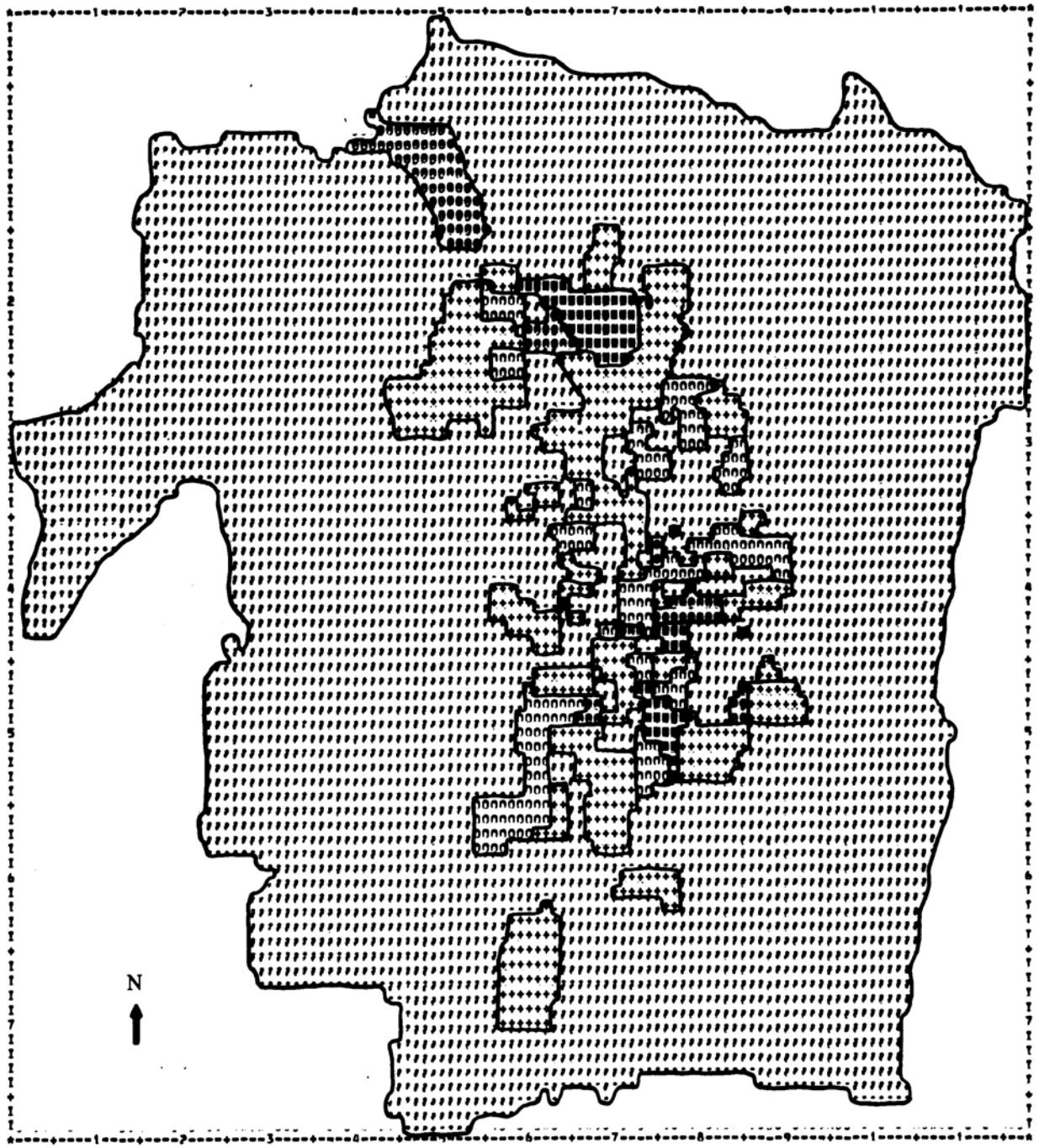


Figure 3.22

Two-Dimensional Map of Noncritical Calls



Number of Calls	0-10	11-20	21-30	31-40	41-51
Symbol					
Frequency	237	76	32	9	4

Figure 3.23
Three-Dimensional Map of Noncritical Calls
(from a perspective of 25 degrees)

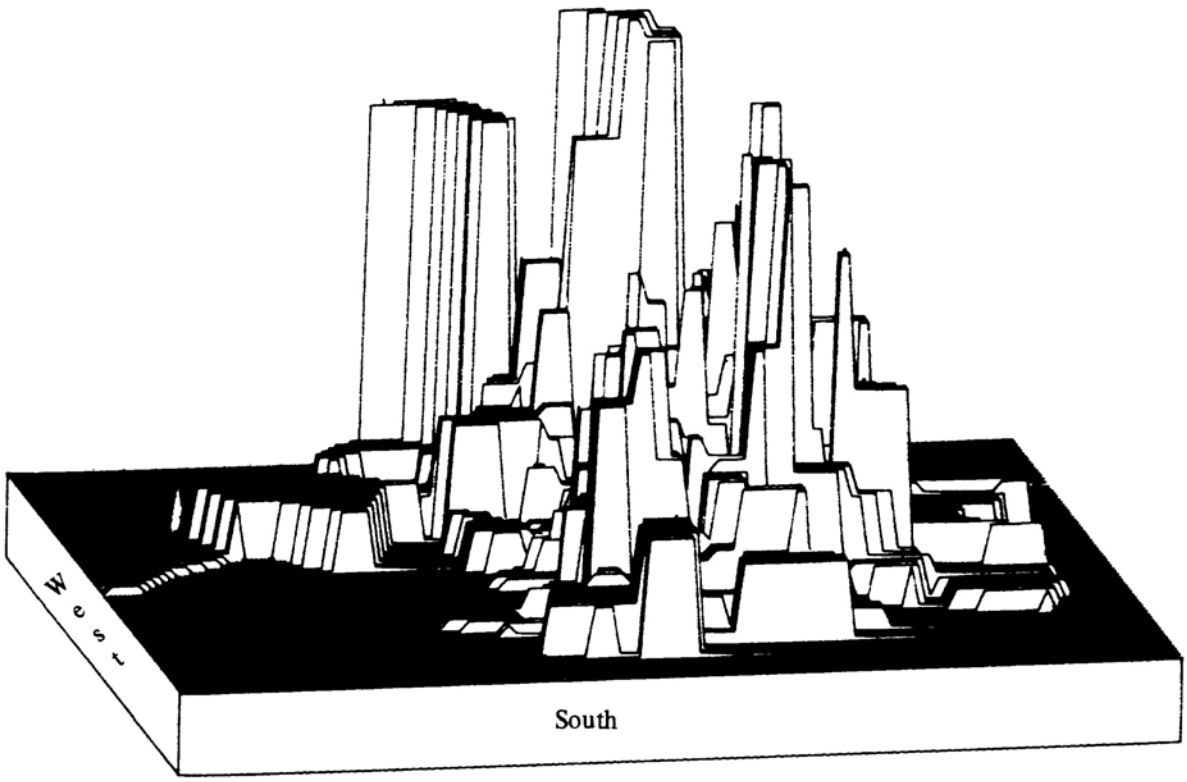
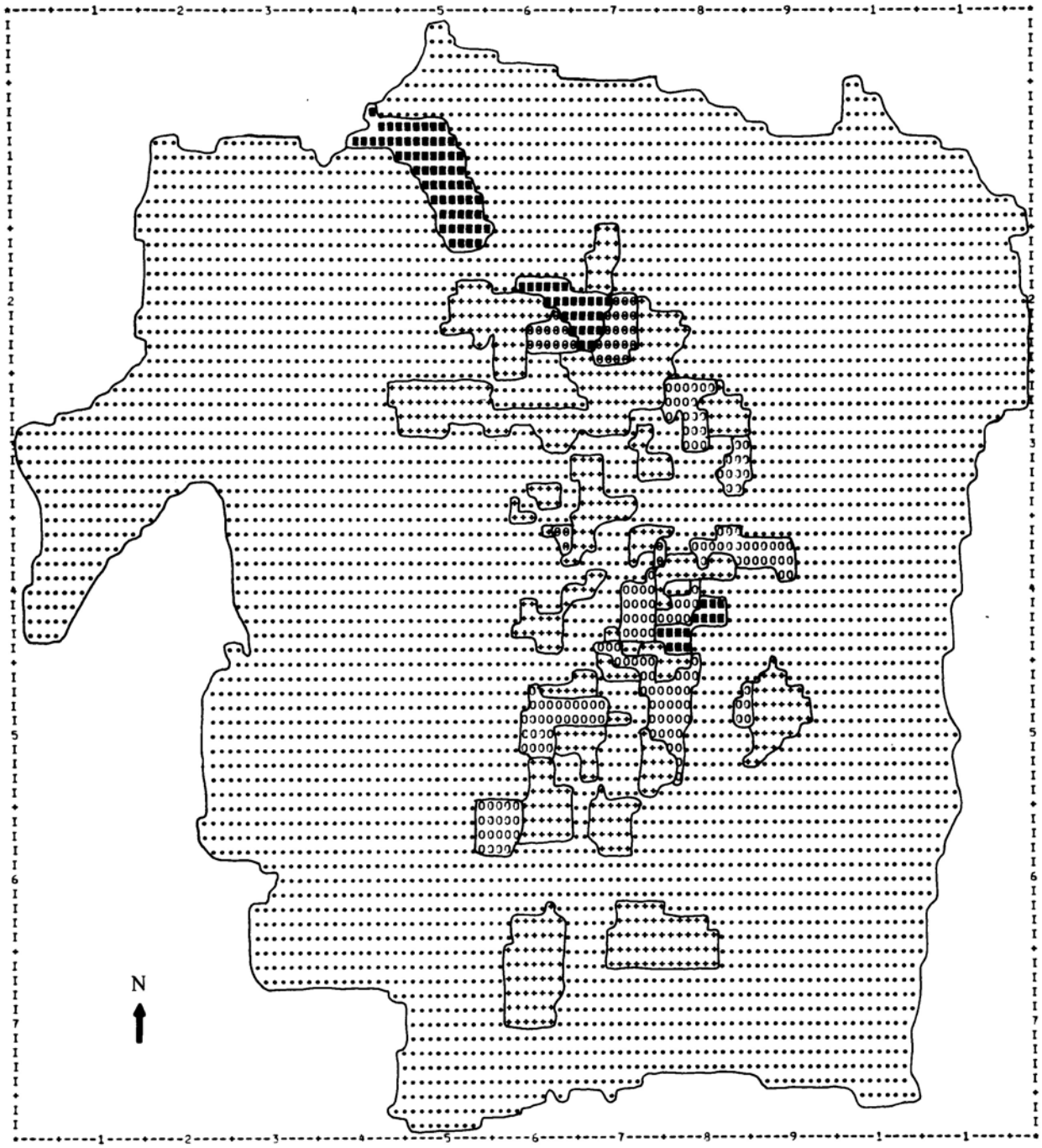


Figure 3.24

Two-Dimensional Map of Transport Calls



Number of Calls	1-10	11-20	21-31	32-41	42-52
Symbol	.	+	0	8	■
Frequency	252	73	25	4	4

Figure 3.25
Three-Dimensional Map of Transport Calls

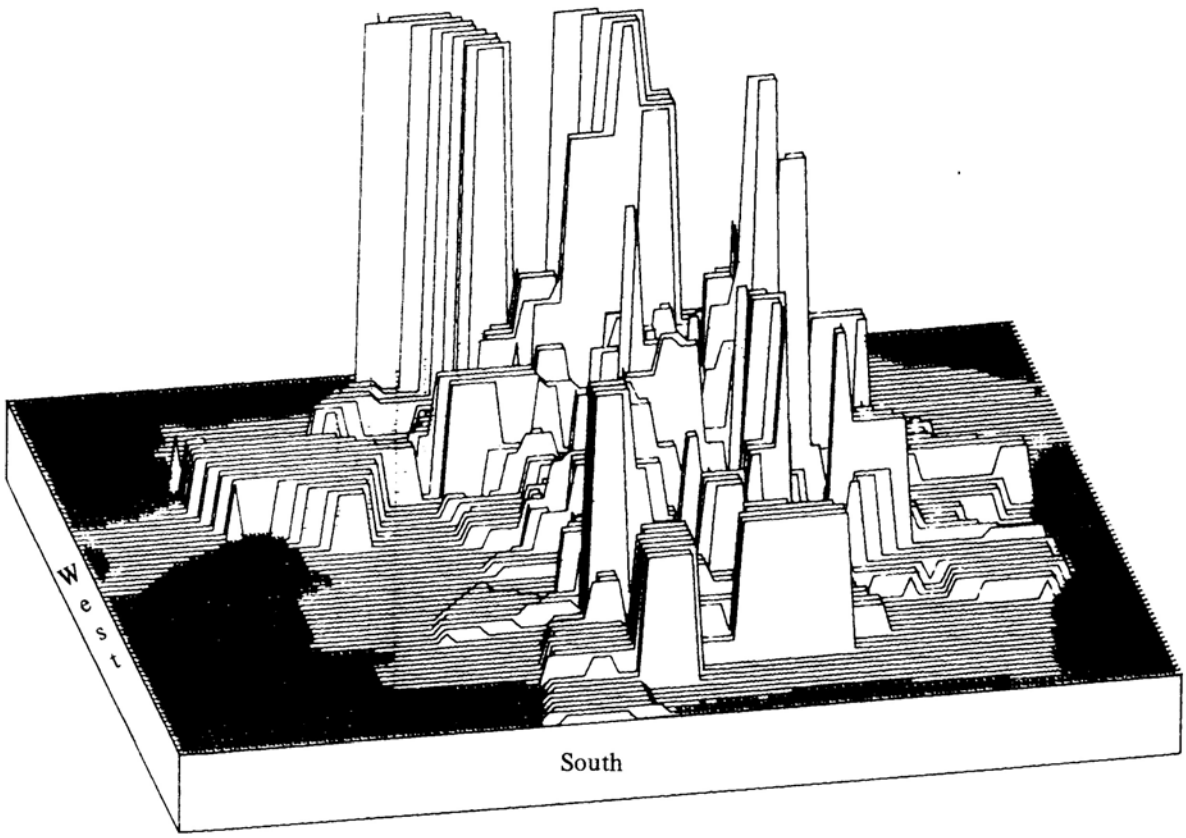
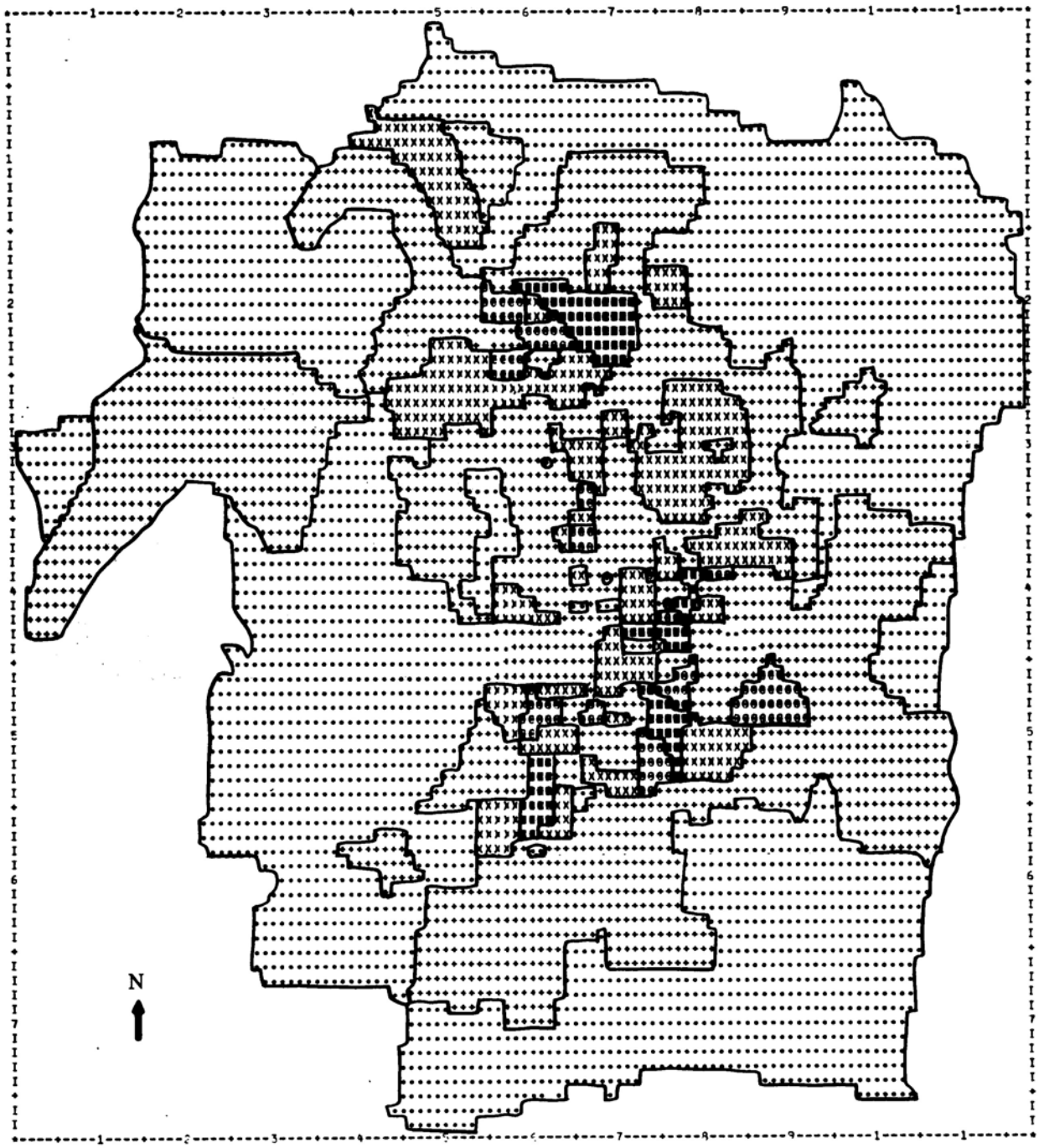


Figure 3.26

Two-Dimensional Map of Nontransport Calls



Number of Calls	0	1-5	6-10	11-15	16-20	21-25
Symbol	.	+	X	@	■	■
Frequency	54	117	62	15	6	4

Figure 3.27
Three-Dimensional Map of Nontransport Calls
(from a perspective of 25 degrees)

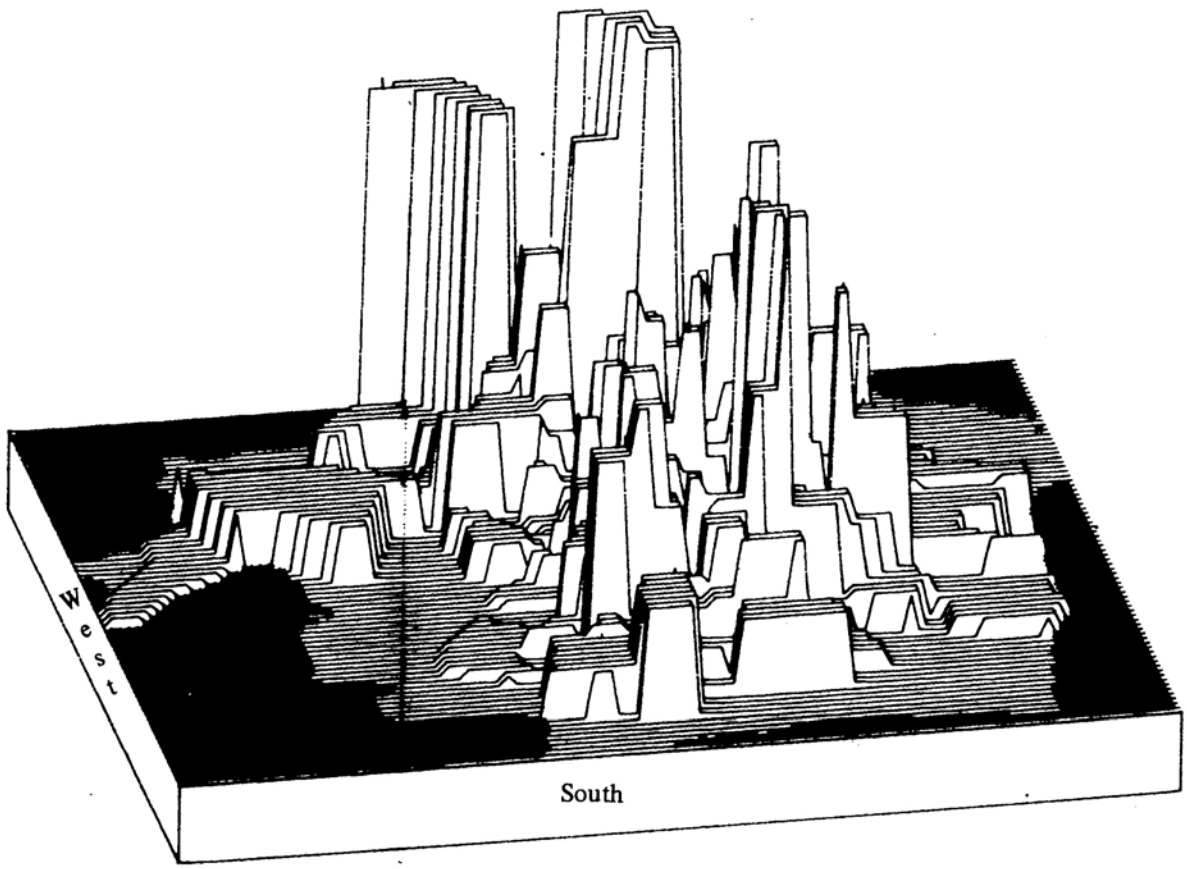
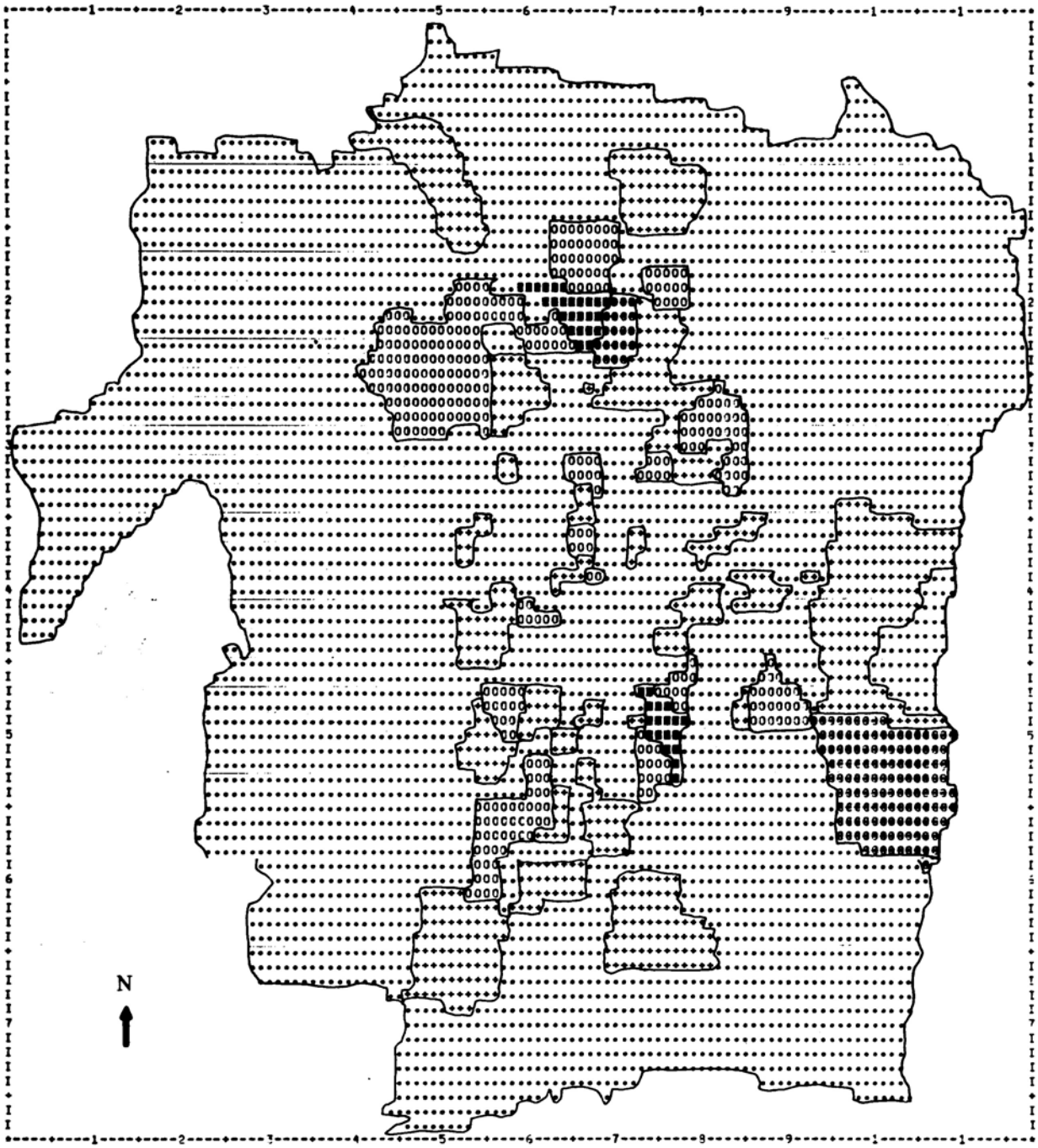


Figure 3.28

Two-Dimensional Map of Total Population



Number of Calls	0-1371	1371-2743	2743-4114	4114-5486	5486-6858
Symbol	.	+	0	#	■
Frequency	275	54	25	2	2

Figure 3.29
Three-Dimensional Map of Total Population
(from a perspective of 25 degrees)

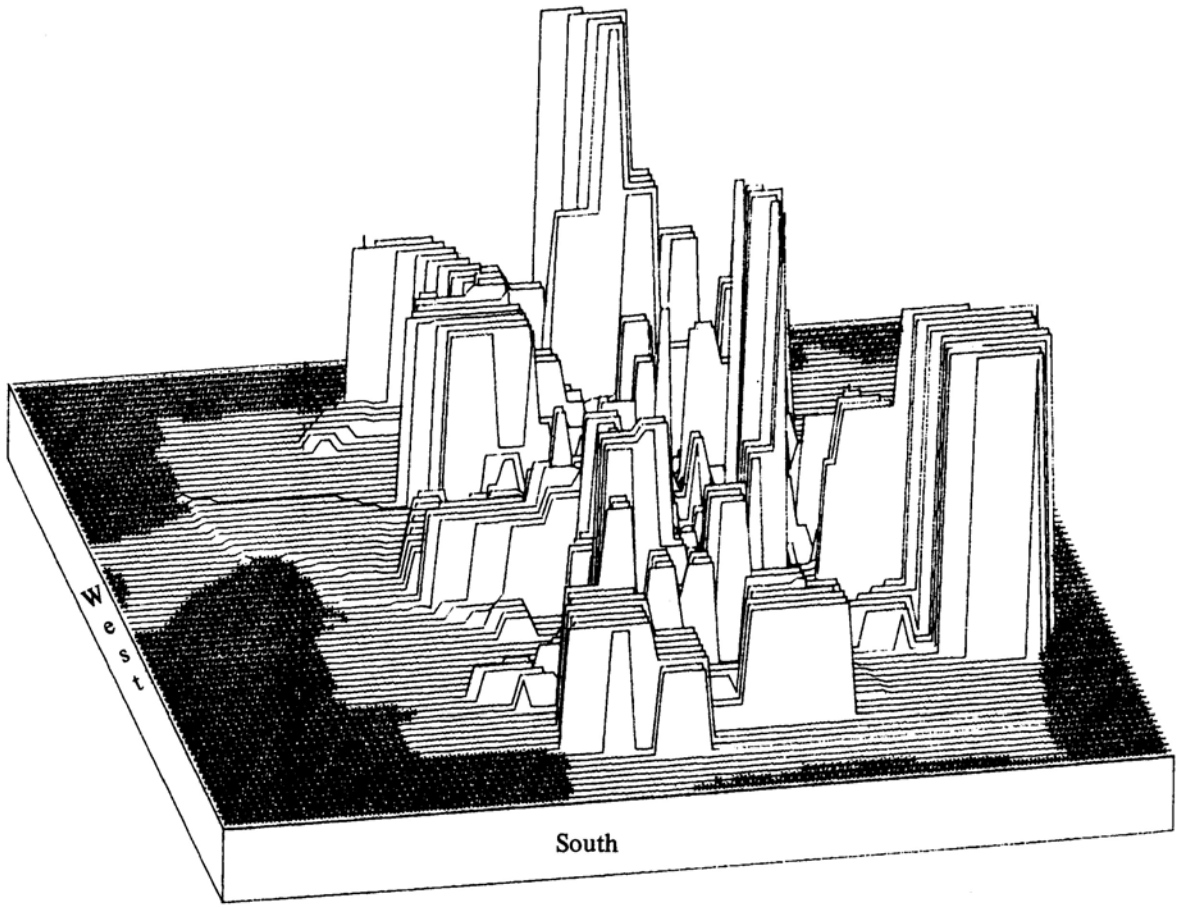
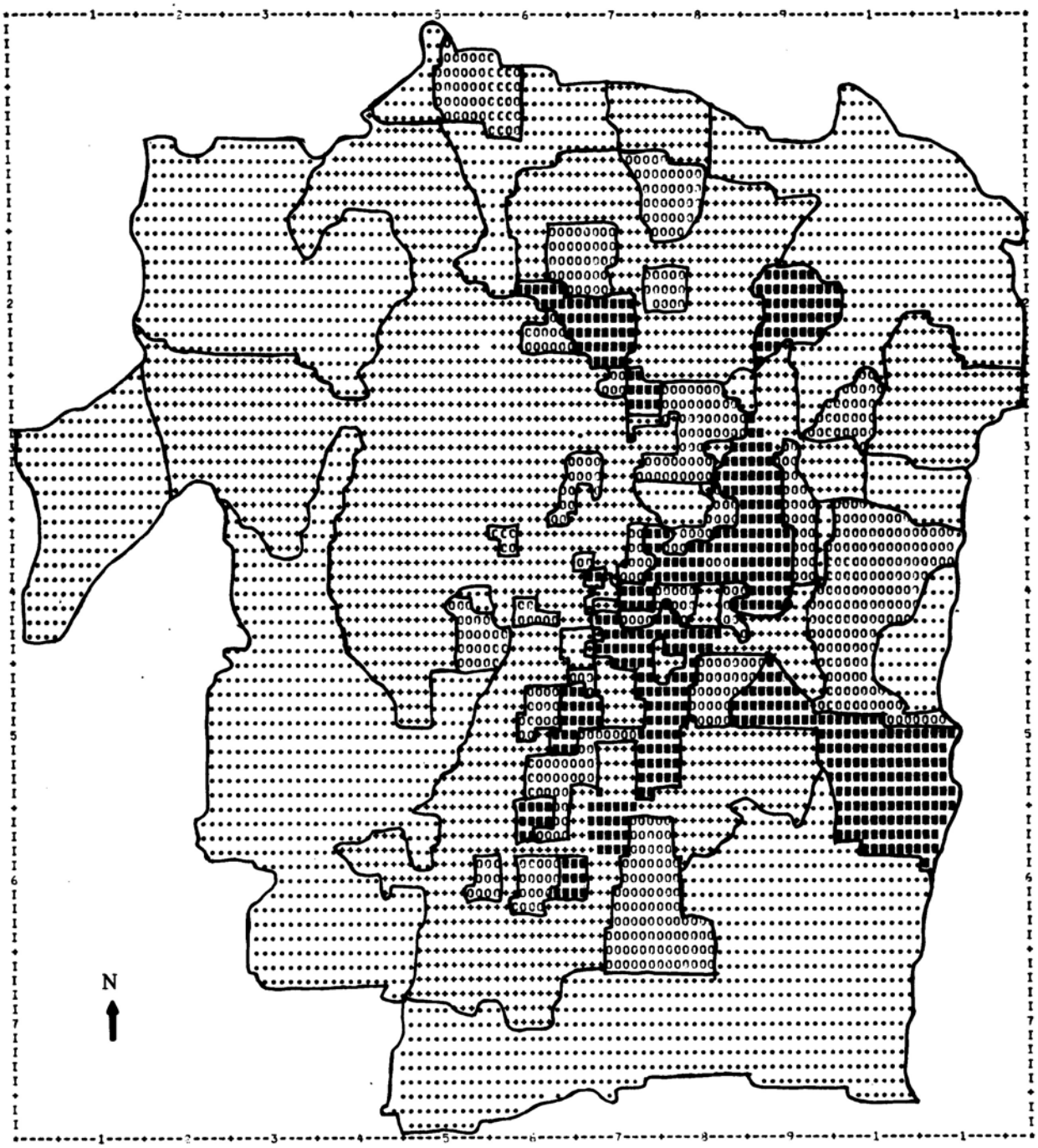


Figure 3.30

Two-Dimensional Map of Minority Population*

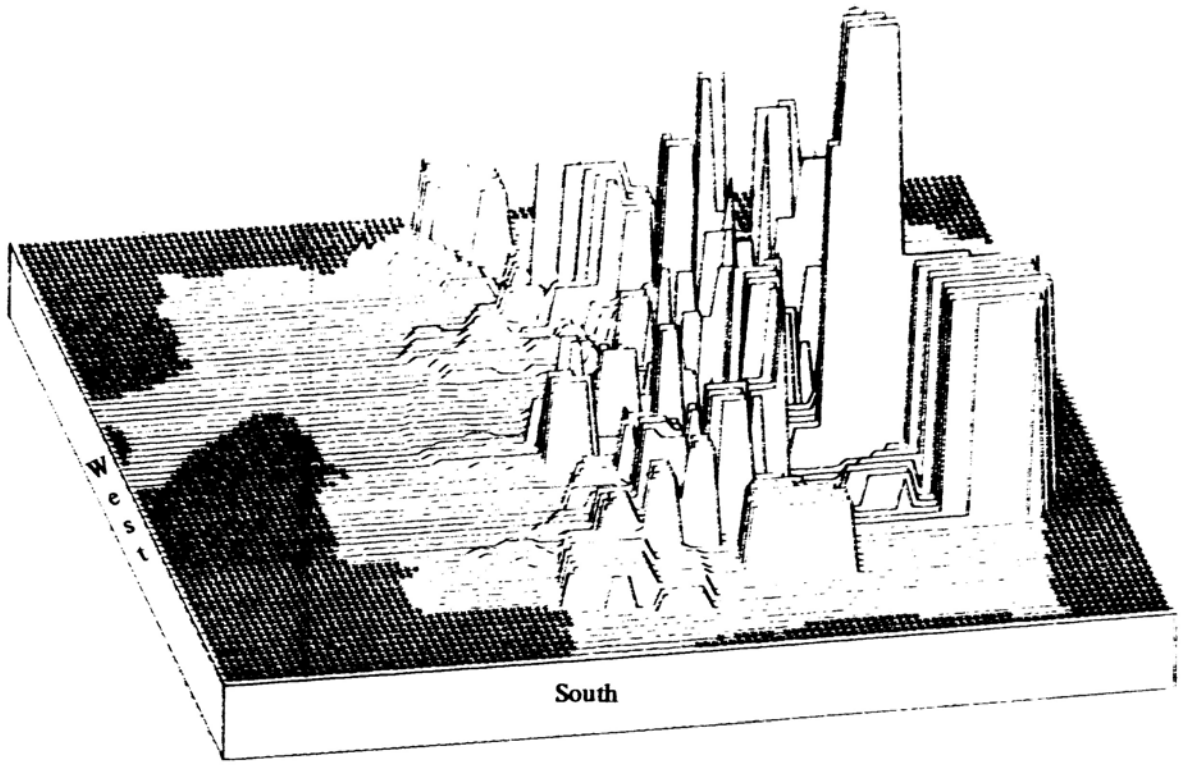


Population	0-1	2-262	263-667	668-2857
Symbol	.	+	O	■
Frequency	74	179	57	48

*Black and Spanish-surnamed persons are the minority population in Austin.

Figure 3.31

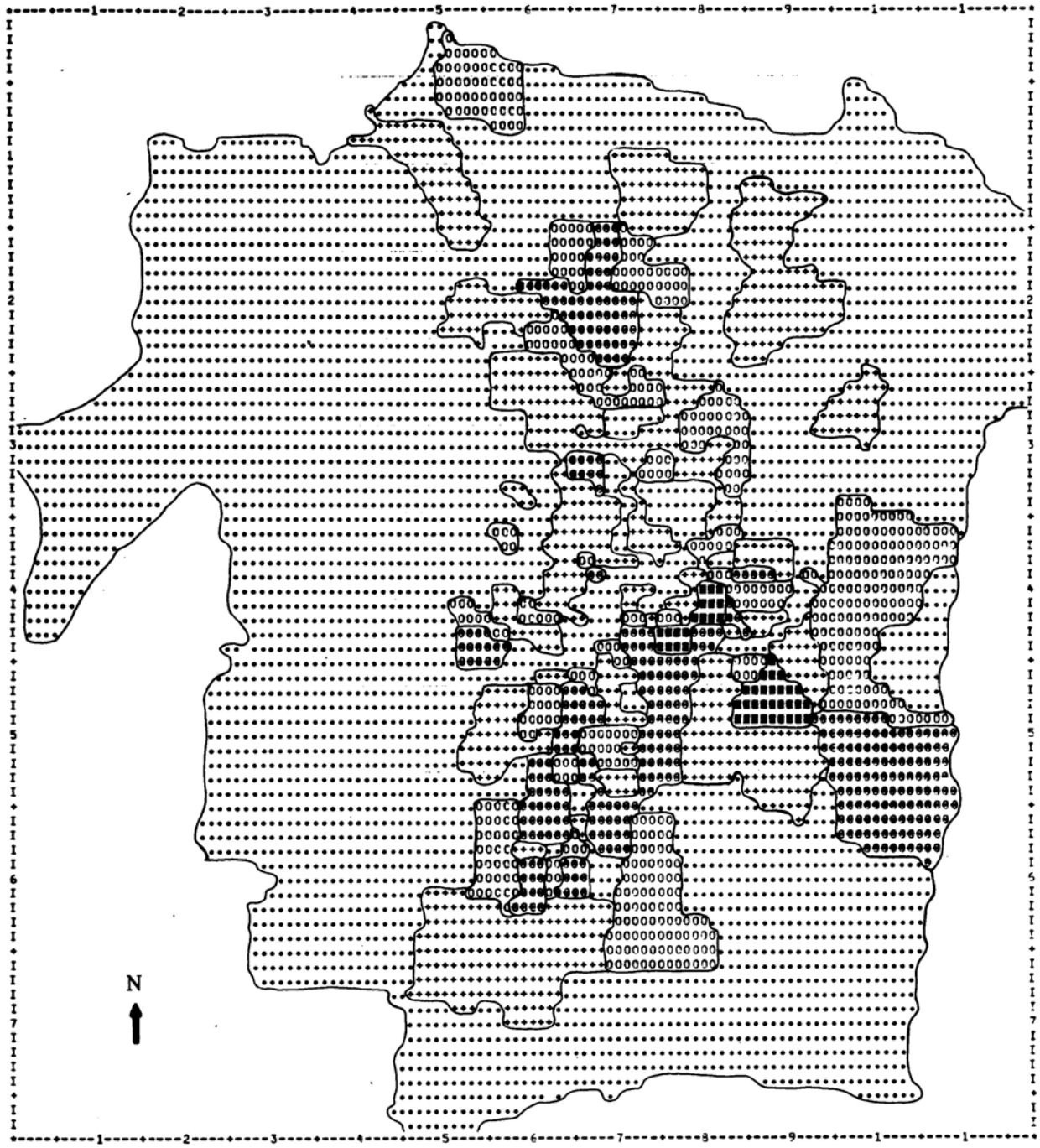
Three-Dimensional Map of Minority Population*
(from a perspective of 25 degrees)



*Black and Spanish-surnamed persons are the minority population in Austin.

Figure 3.32

Two-Dimensional Map of Spanish-Surname Population



Population	1-50	50-200	200-400	400-1000	1000-2441
Symbol	.	+	0	@	#
Frequency	181	96	45	30	6

Figure 3.33

Three-Dimensional Map of Spanish-Surname Population
(from a perspective of 25 degrees)

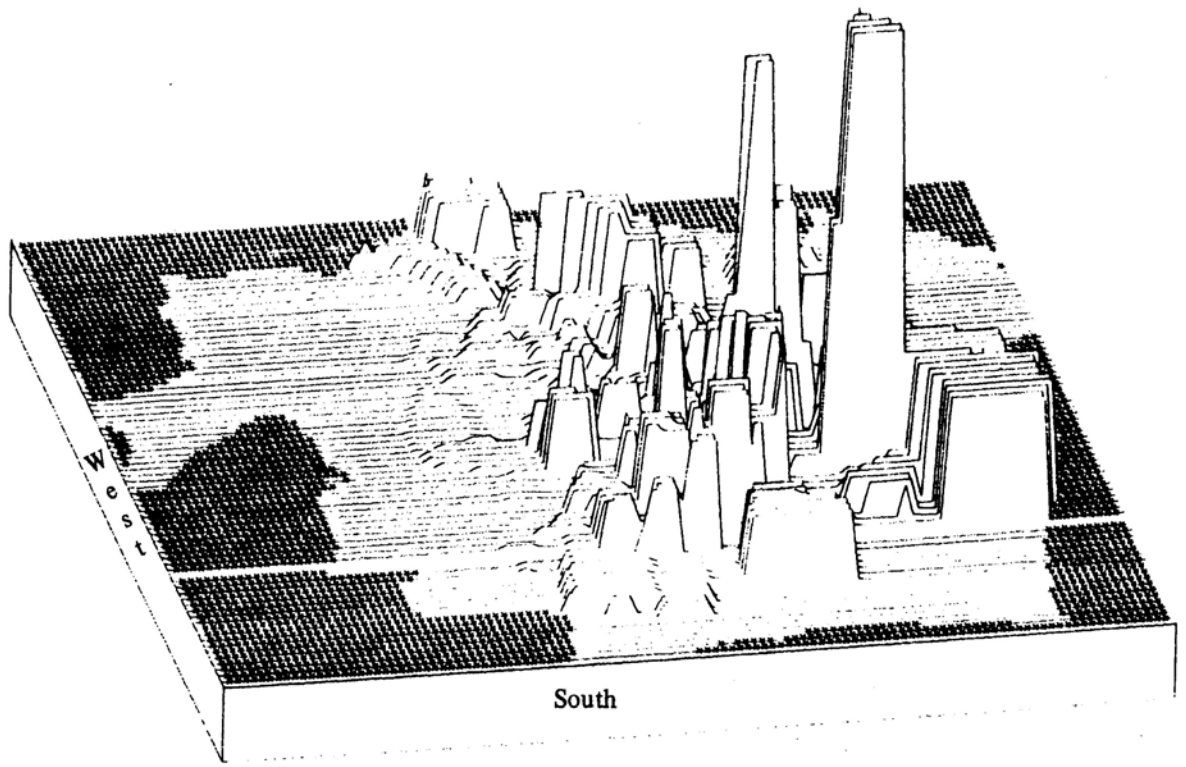
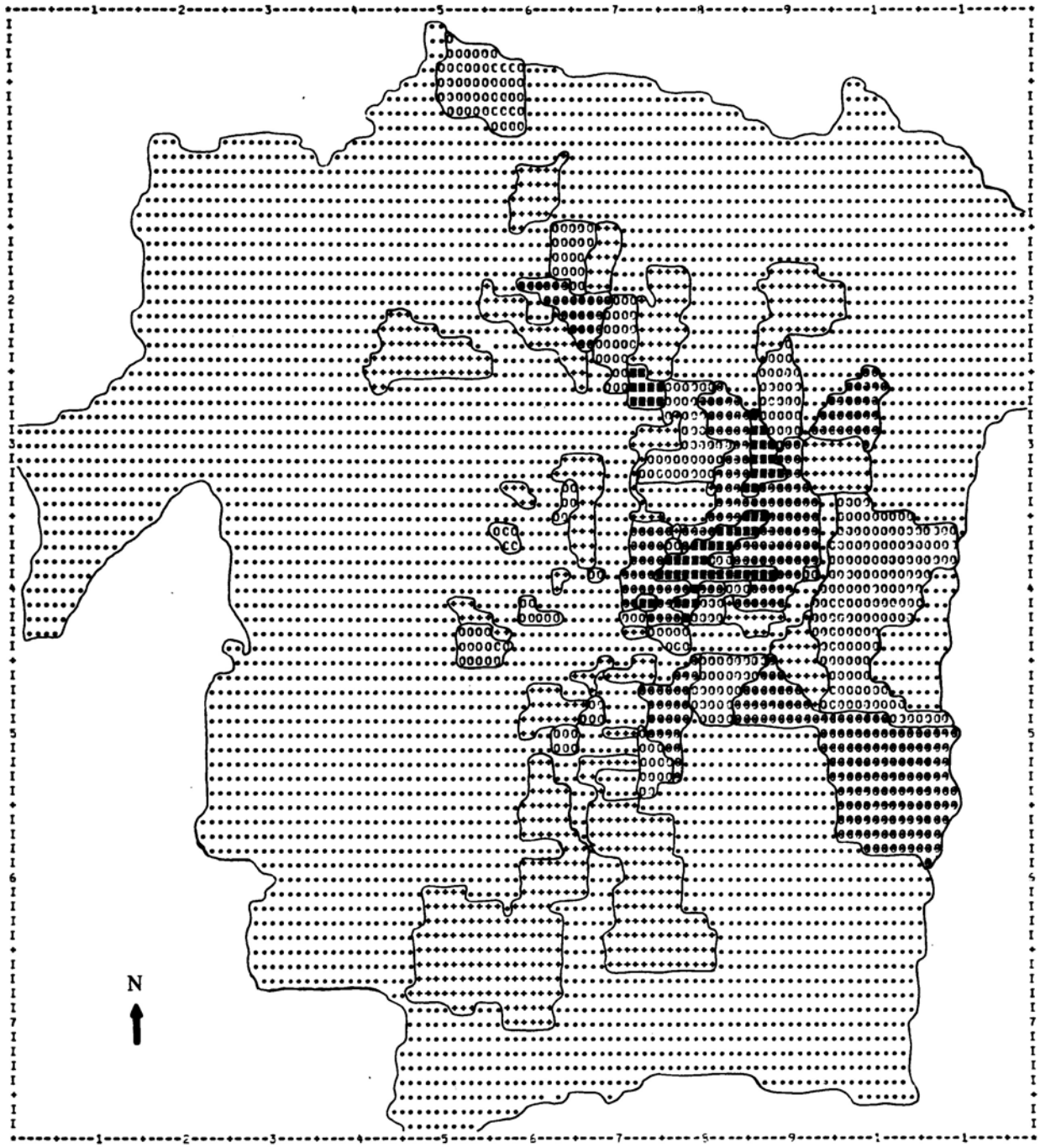


Figure 3.34

Two-Dimensional Map of Black Population



Population	0-25	25-125	125-300	300-800	800-1634
Symbol	.	+	C	@	■
Frequency	233	55	29	30	11

Figure 3.35

Three-Dimensional Map of Black Population
(from a perspective of 25 degrees)

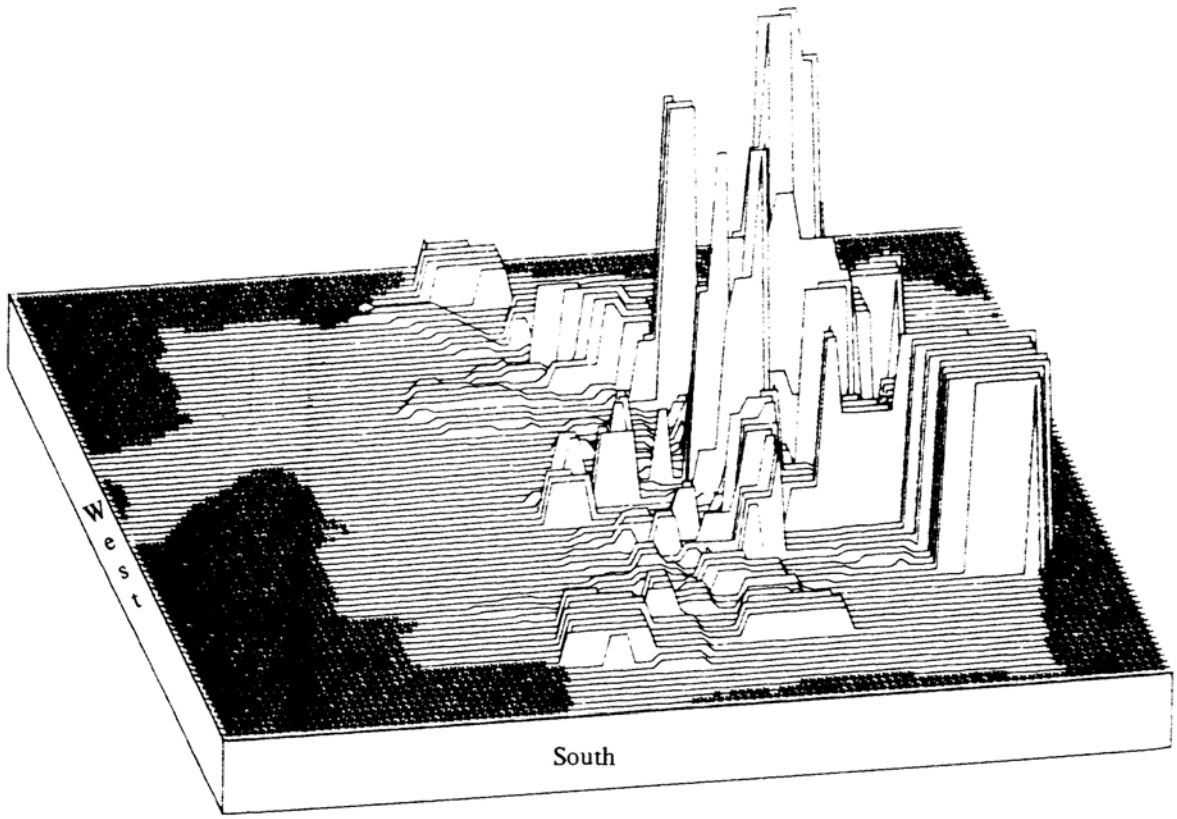
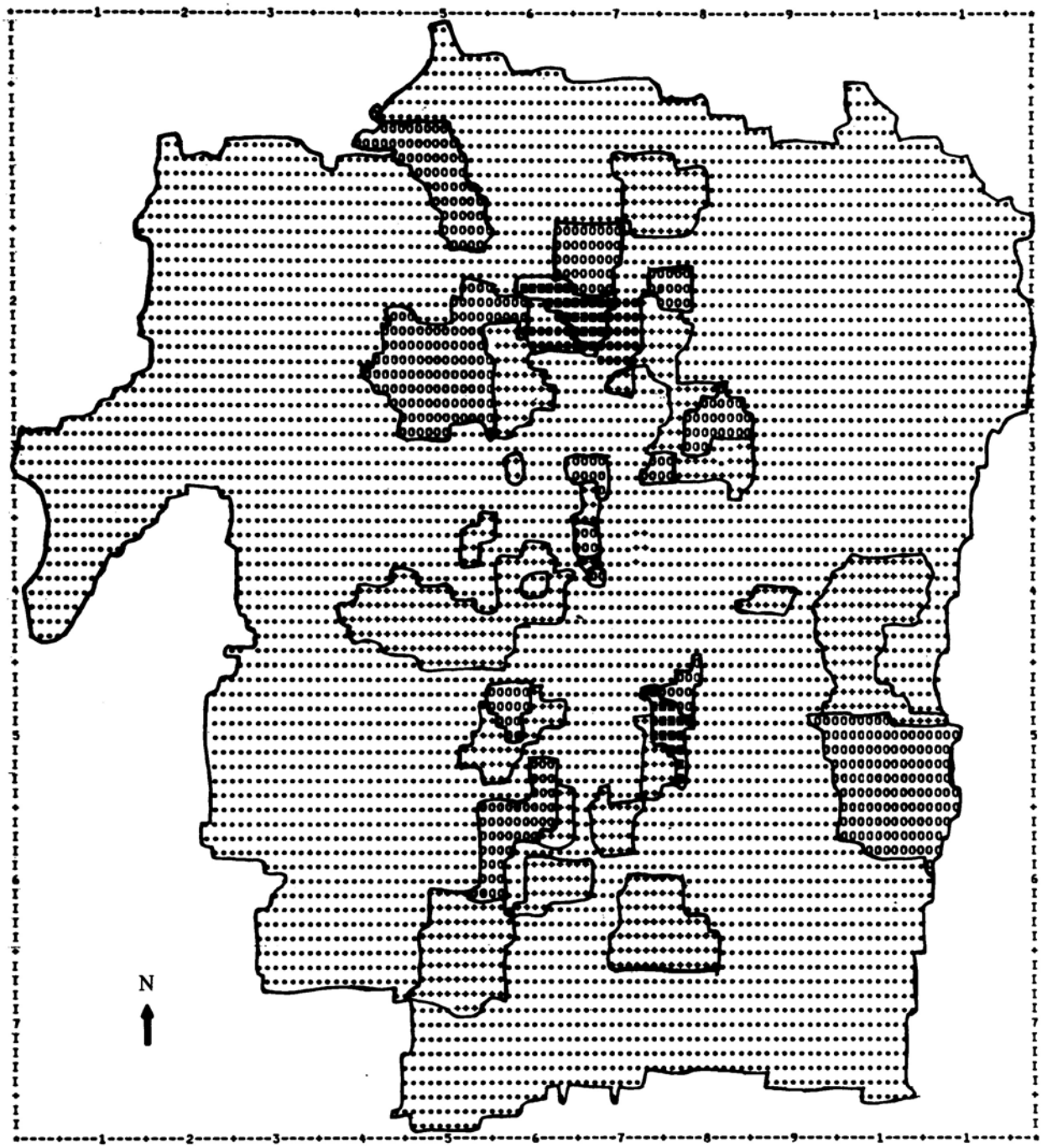


Figure 3.36

Two-Dimensional Map of Anglo Population



Population	1-1175	1176-2352	2353-3528	3529-4704	4705-5881
Symbol	.	+	0	3	5
Frequency	286	46	22	2	2

Figure 3.37

Three-Dimensional Map of Anglo Population
(from a perspective of 25 degrees)

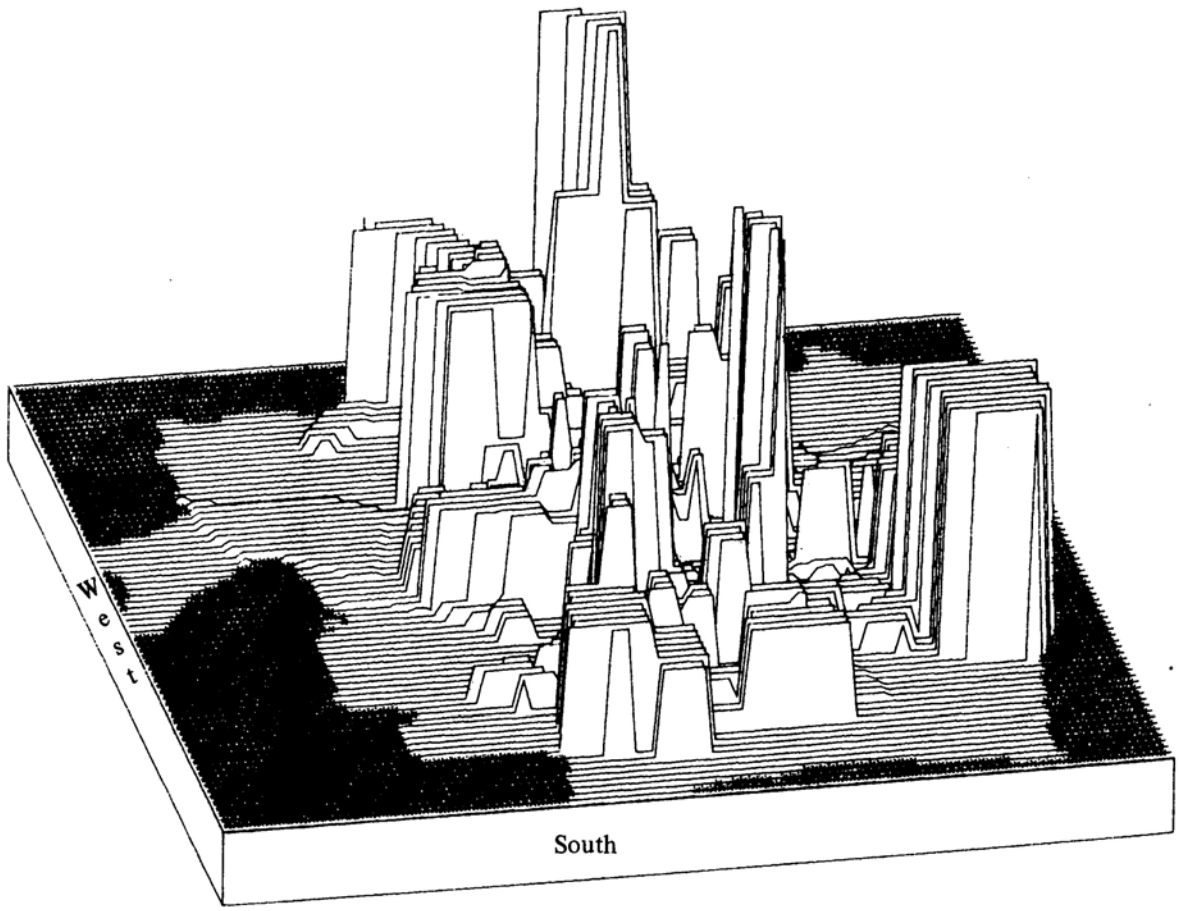
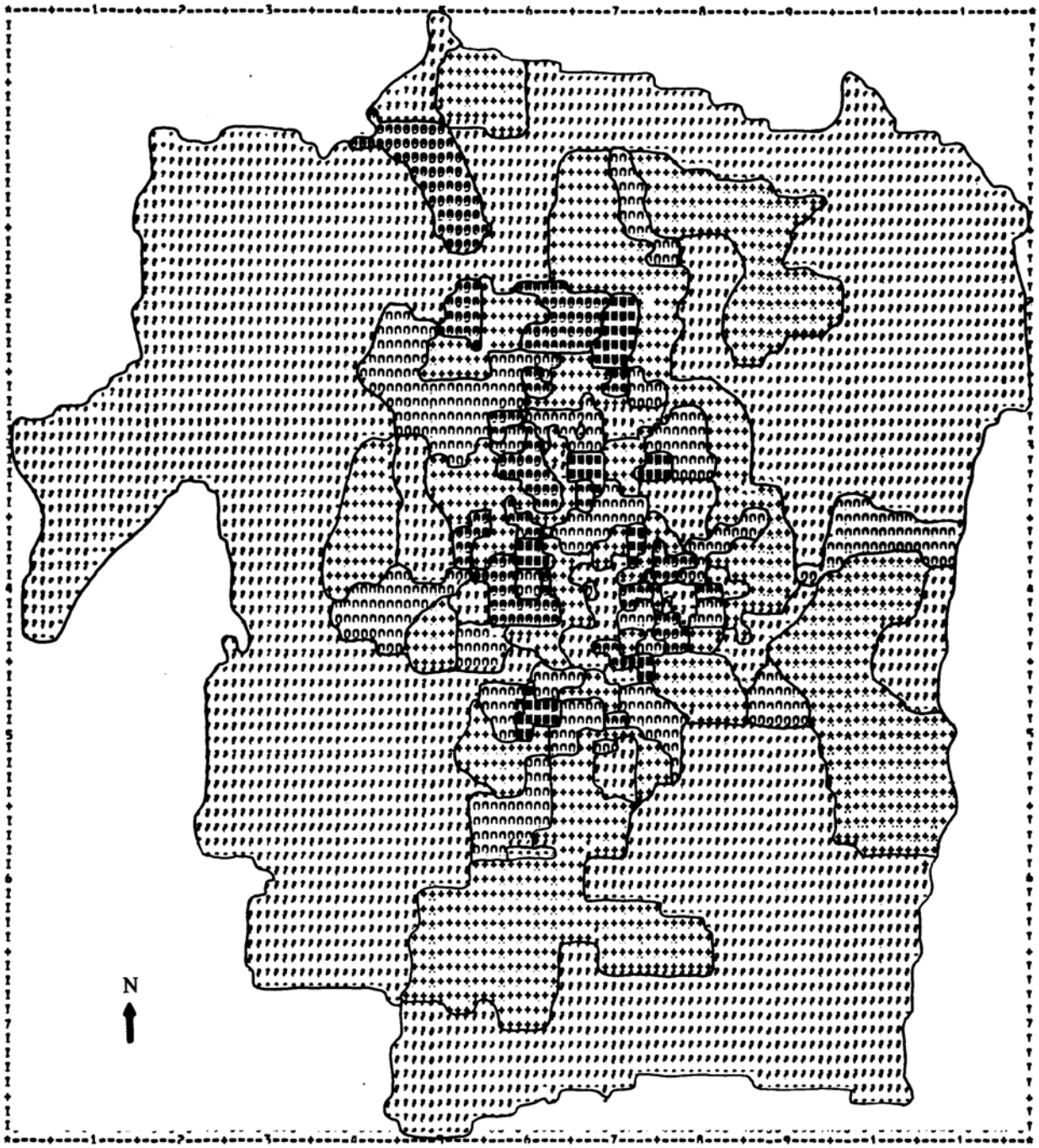


Figure 3.38

Two-Dimensional Map of Population over 62



Population	0-36	37-125	126-214	215-303	304-486
Symbol					
Frequency	155	106	60	30	7

Figure 3.39
Three-Dimensional Map of Population over 62
(from a perspective of 25 degrees)

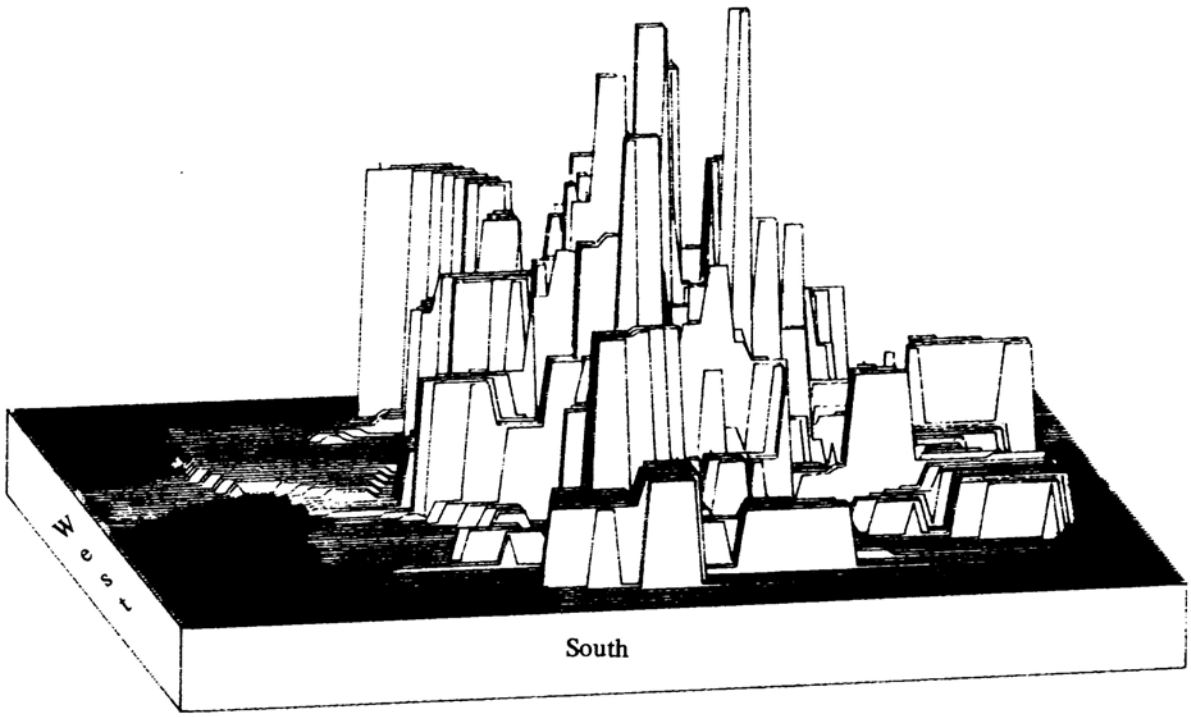


Figure 3.40

Two-Dimensional Map of Population under 18

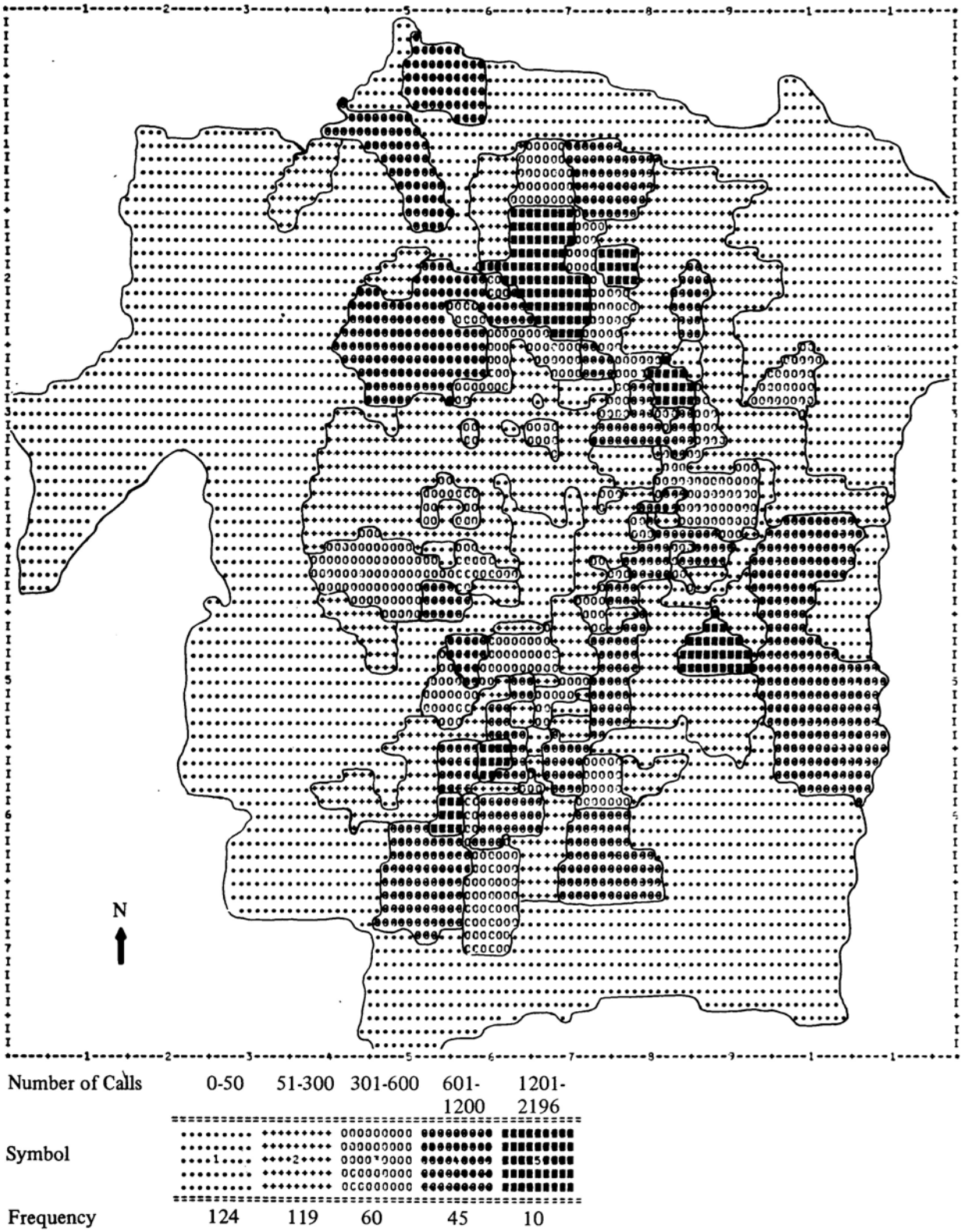
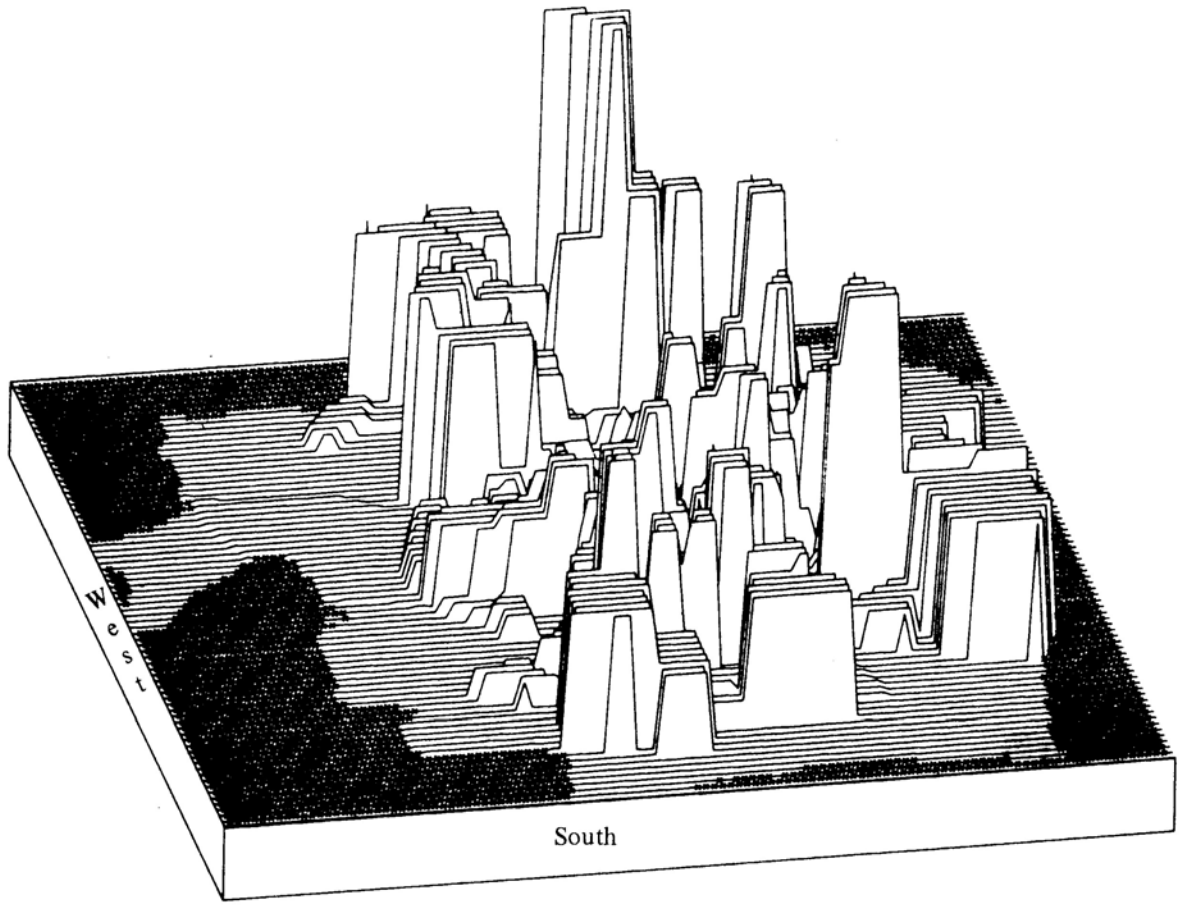


Figure 3.41
Three-Dimensional Map of Population under 18
(from a perspective of 25 degrees)



Chapter 4
Initial EMS Vehicle Site Analysis

It is not an easy task to select the "best" set of emergency medical vehicle sites for Austin because different people evaluate alternative sites differently. One way to assist in developing a vehicle deployment plan is to see how changes in the definition of EMS system demand and performance measures affect site location. The GAS program finds the set of P sites that cover the largest fraction of EMS demand (however defined) in some maximum response time S, where the parameters P and S can vary (1). This section presents the results of GAS computer runs that locate EMS vehicle bases to serve different surrogates for EMS demands. The reader ought to study carefully the detailed assumptions of the GA and GAS programs, as these results were the primary source of information behind the final Austin vehicle deployment plan. Chapter 1 of this volume and Volume II of this report provide additional details concerning these methods.

Project members first used the GAS program to calculate how changes in the time standard (a surrogate for the effectiveness of EMS response) affect vehicle deployment. Response time to an EMS call is represented by an estimate of the average travel time from the closest vehicle base to the demand site (2). Figures 4.1 through 4.5 and Tables 4.1 through 4.5 show how the GA program allocates EMS vehicles to serve the geographical distribution of all historical EMS calls as the maximum service time is changed from four to eight minutes in one minute increments.

Project members then analyzed how the need to respond to different types of calls, user ethnic groups, and age groups affects vehicle deployment. Call types include total calls, critical calls, and transport calls. Total calls include all calls for EMS assistance placed from each serial zone during five months of 1976-1977 (3). Critical calls are those which involve an unconscious person, a victim of violence, a heart attack, or a stroke. Transport calls are those which required transport from the scene to a hospital emergency room. Population data for the total population, Spanish-surnamed persons, Blacks, and persons older than 62 years were derived from a 1976 special census of Travis County (4). Figures 4.6 through 4.11 and Tables 4.6 through 4.11 show vehicle deployments assuming a maximum service time of five minutes using total population, Black population, Spanish-surnamed population, persons over 62, total calls, critical calls, and calls requiring transport to the hospital as surrogates for the demand.

Table 4.12 and Figure 4.12 illustrate the sites selected by the GAS algorithm rather than the GA algorithm to respond to total EMS calls. Table 4.13 and Figure 4.13 illustrate the GAS-selected sites for transport calls. These illustrations should be compared with GA results listed in Table 4.2 and Figure 4.2 and Table 4.11 and Figure 4.11, respectively.

Each table shows the site selected in each iteration, the total percent of coverage, and the marginal increase in coverage. The pattern of sites selected on each run is illustrated on a map of Austin. The numbers appearing on Figures 1 through 11 indicate the order of site selection. Figures 12 and 13, the GAS solutions, illustrate the set of sites selected by the fourth, sixth, and eighth iterations. These runs were produced on UT Austin's CDC Cyber 750 computer system. An average GAS run using the FASGAS version to solve for 12 vehicles required 5.7 seconds of CPU time on the University of Texas at Austin CDC CYBER 70 system. A FASGAS 33-vehicle solution used 4 seconds of CPU time.

(1) Richard L. Church and Charles S. ReVelle, "The Maximal Covering Location Problem," *Papers of the Regional Science Association* 32, no. 101 (Fall 1974): 108-18.

(2) Emergency Medical Services Policy Research Project, *Location Techniques for Emergency Medical Service Techniques for Emergency Medical Service Vehicles, Volume II: Travel Time Data–Descriptions and Assumptions* (Austin, Texas: LBJ School of Public Affairs, The University of Texas at Austin, 1979).

(3) Ibid., *Volume III: Emergency Medical Service Calls in Austin–Description and Assumptions.*

(4) Ibid., *Volume IV: Austin Population and Housing Data–Description and Assumptions.*

Table 4.1

GA Selected Sites to Serve Total EMS Calls
(4 minutes maximum service time)

Iteration	Site Selected (Index Number)	Cumulative Coverage (Percent)	Marginal Increase In Coverage (Percent)
1	166	26.67	26.67
2	255	38.17	11.50
3	100	49.32	11.15
4	76	57.77	8.45
5	189	65.39	7.62
6	116	69.75	4.36
7	264	73.54	3.97
8	26	76.19	2.65

Table 4.2

GA Selected Sites to Serve Total EMS Calls
(5 minutes maximum service time)

Iteration	Site Selected (Index Number)	Cumulative Coverage (Percent)	Marginal Increase In Coverage (Percent)
1	9	37.40	37.40
2	99	54.17	16.77
3	190	63.96	9.79
4	258	72.85	8.89
5	118	77.33	4.48
6	41	81.30	3.99
7	155	85.20	3.90
8	222	89.01	3.81

Table 4.3

GA Selected Sites to Serve Total EMS Calls
(6 minutes maximum service time)

Iteration	Site Selected (Index Number)	Cumulative Coverage (Percent)	Marginal Increase In Coverage (Percent)
1	166	50.47	50.47
2	99	70.68	20.21
3	231	80.10	9.42
4	268	84.71	4.61
5	200	89.24	4.53
6	155	92.50	3.26
7	38	94.20	1.70
8	123	95.17	0.97

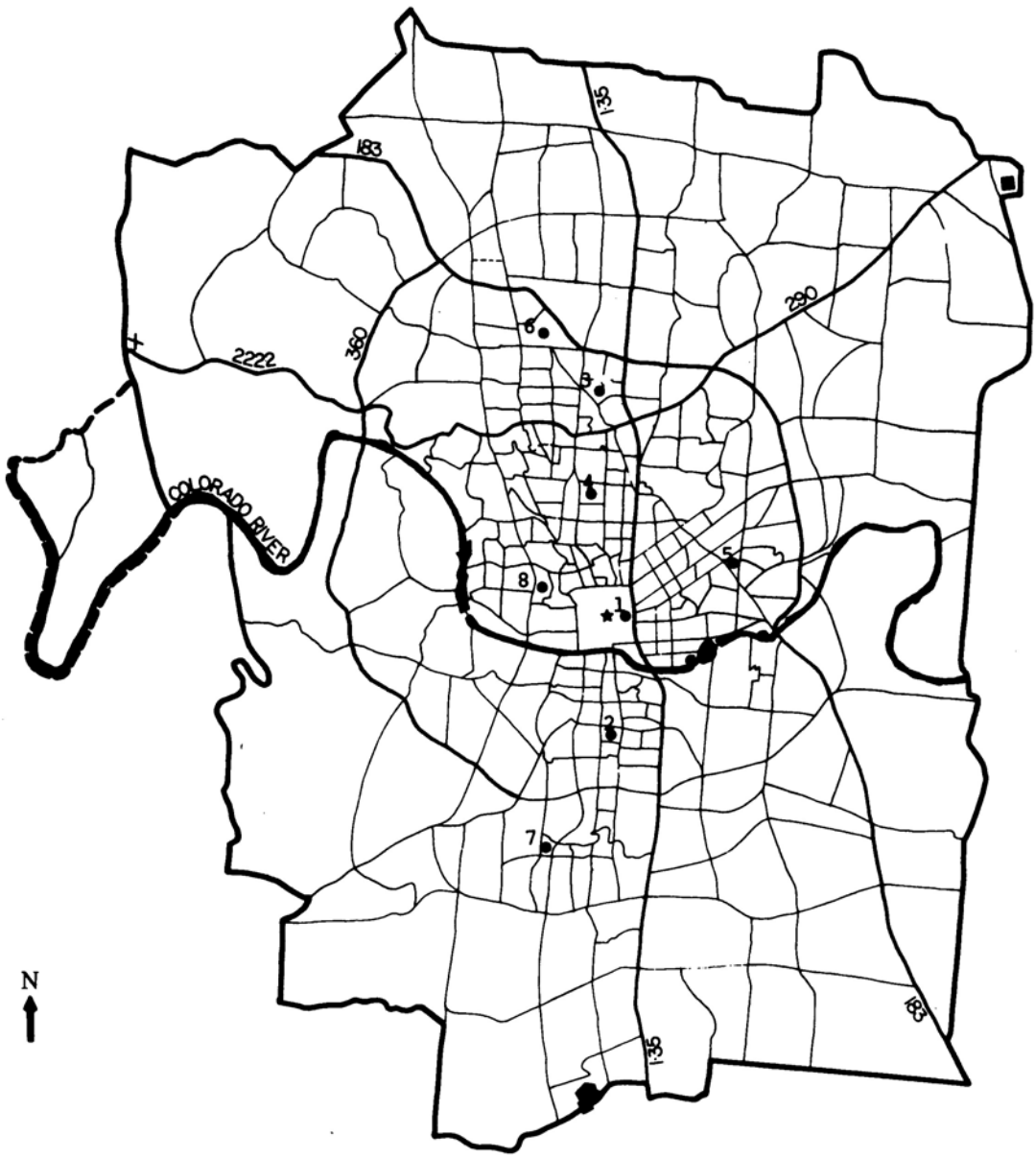
Table 4.4

GA Selected Sites to Serve Total EMS Calls
(7 minutes maximum service time)

Iteration	Site Selected (Index Number)	Cumulative Coverage (Percent)	Marginal Increase In Coverage (Percent)
1	54	58.95	58.95
2	113	77.79	18.84
3	231	87.39	9.60
4	200	91.64	4.25
5	300	94.71	3.07
6	264	96.12	1.41
7	155	97.44	1.32
8	37	98.43	.99

Figure 4.1

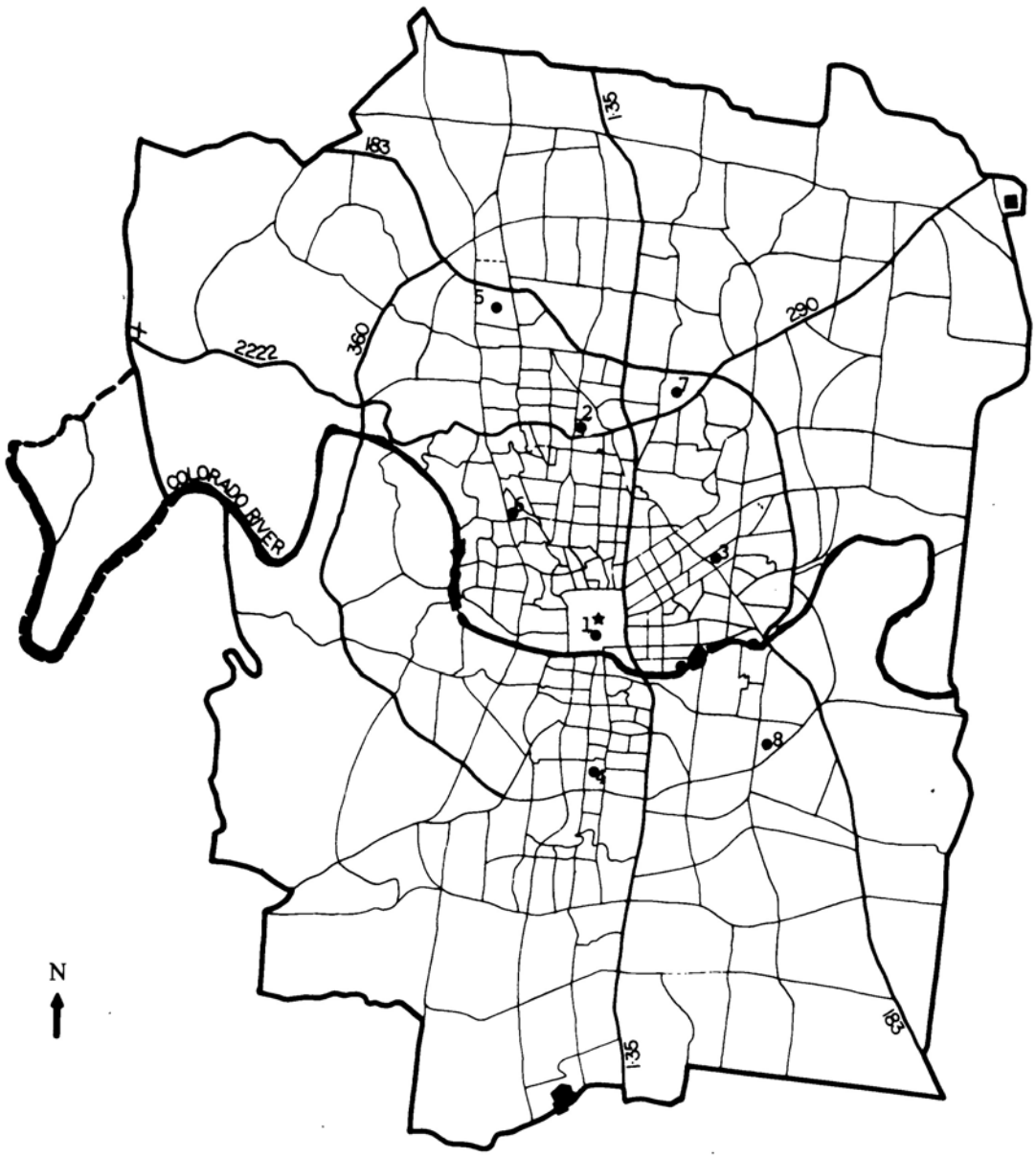
GA Selected Sites to Serve
Total EMS Calls
(4 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.2

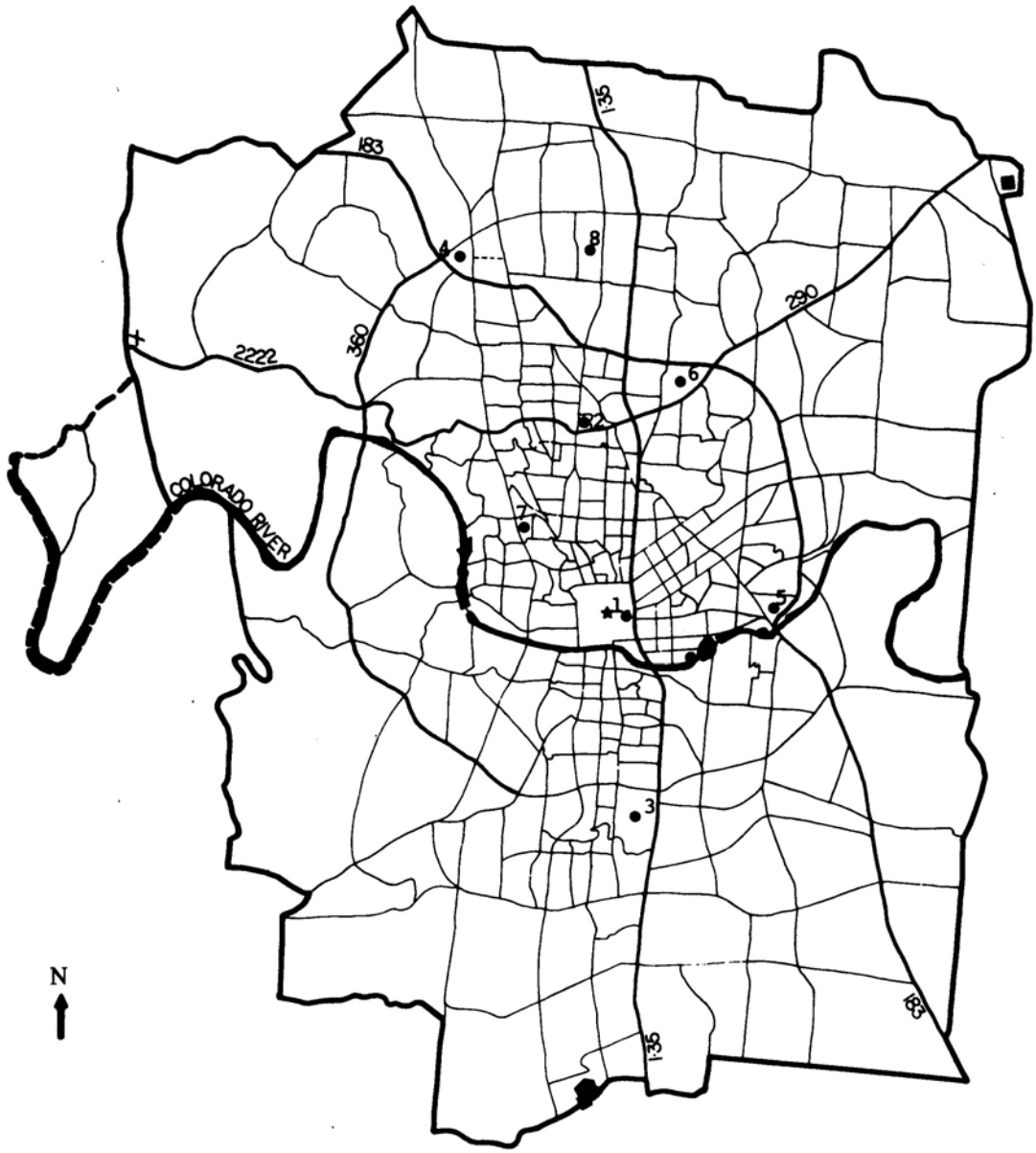
GA Selected Sites to Serve
Total EMS Calls
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

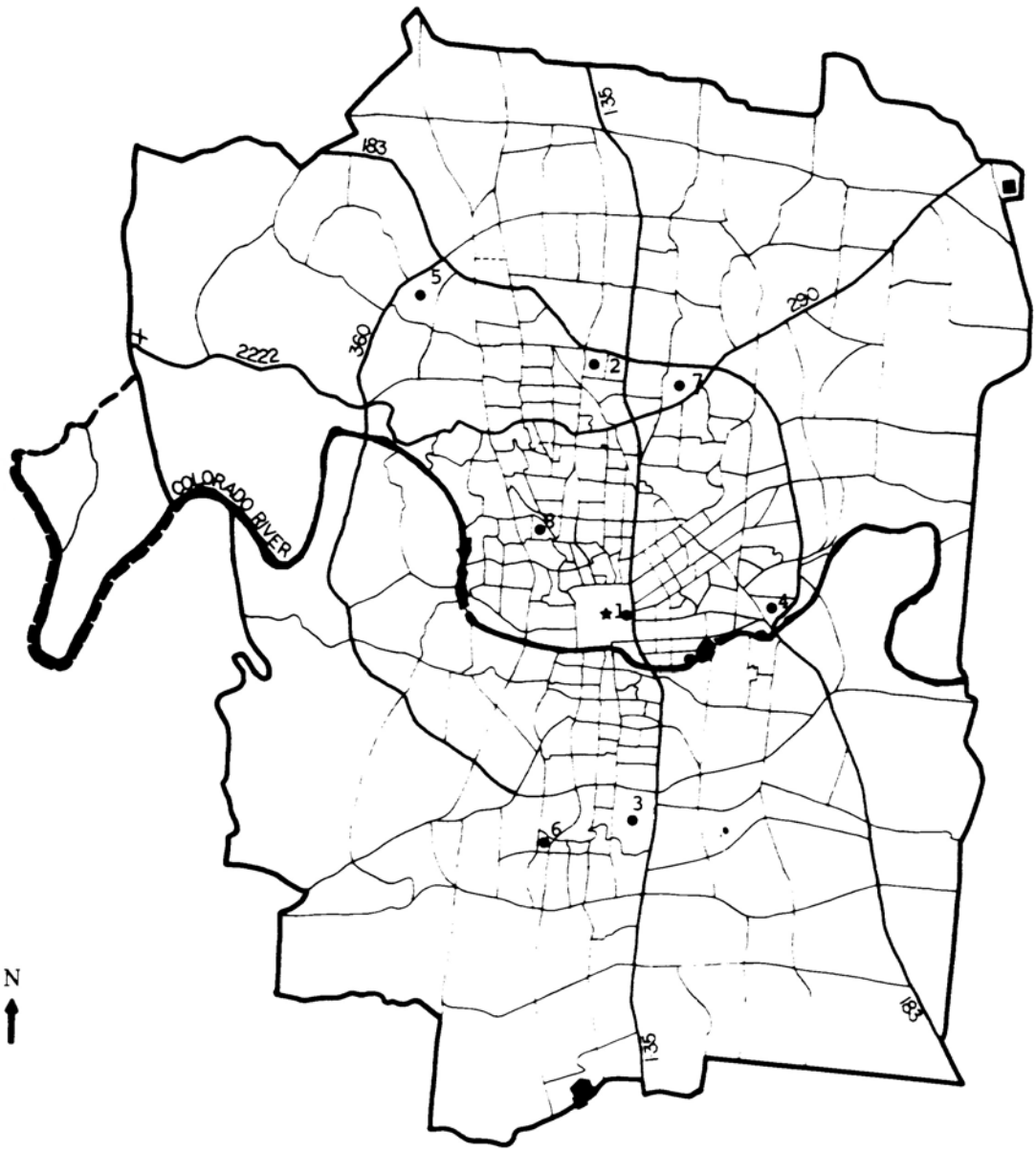
Figure 4.3

GA Selected Sites to Serve
Total EMS Calls
(6 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.4
GA Selected Sites to Serve
Total EMS Calls
(7 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Table 4.5

GA Selected Sites to Serve Total EMS Calls
(8 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	54	65.62	65.62
2	112	83.10	17.48
3	231	92.45	9.35
4	268	95.84	3.39
5	196	98.04	2.20
6	265	98.57	.53
7	28	98.94	.37
8	269	99.10	.16

Table 4.6

GA Selected Sites to Serve Total Population
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	9	20.35	20.35
2	99	35.99	15.64
3	260	47.05	11.06
4	140	54.47	7.42
5	155	60.19	5.72
6	267	65.25	5.06
7	38	69.74	4.45
8	218	73.93	4.19

Table 4.7

GA Selected Sites to Serve Black Population
(5 minutes maximum service time)

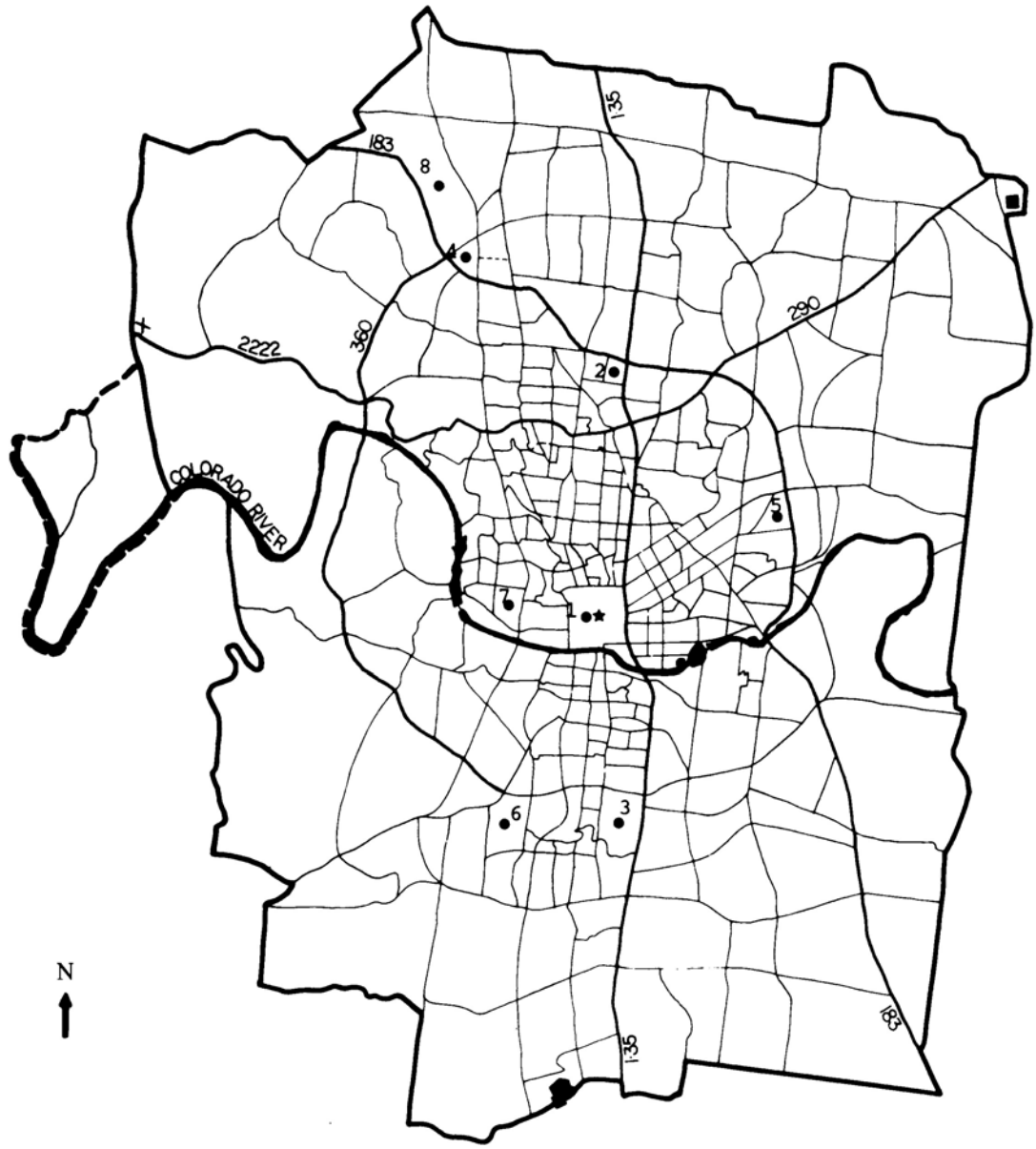
Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	190	59.26	59.26
2	155	71.68	12.42
3	15	78.80	7.12
4	149	83.37	4.57
5	219	87.28	3.91
6	258	89.67	2.39
7	78	91.80	2.13
8	225	92.60	0.80

Table 4.8

GA Selected Sites to Serve Spanish-Surnamed Population
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	18	33.73	33.73
2	219	47.20	13.47
3	260	59.95	12.75
4	135	70.41	10.46
5	114	77.16	6.75
6	190	81.84	4.68
7	86	85.04	3.20
8	215	87.52	2.48

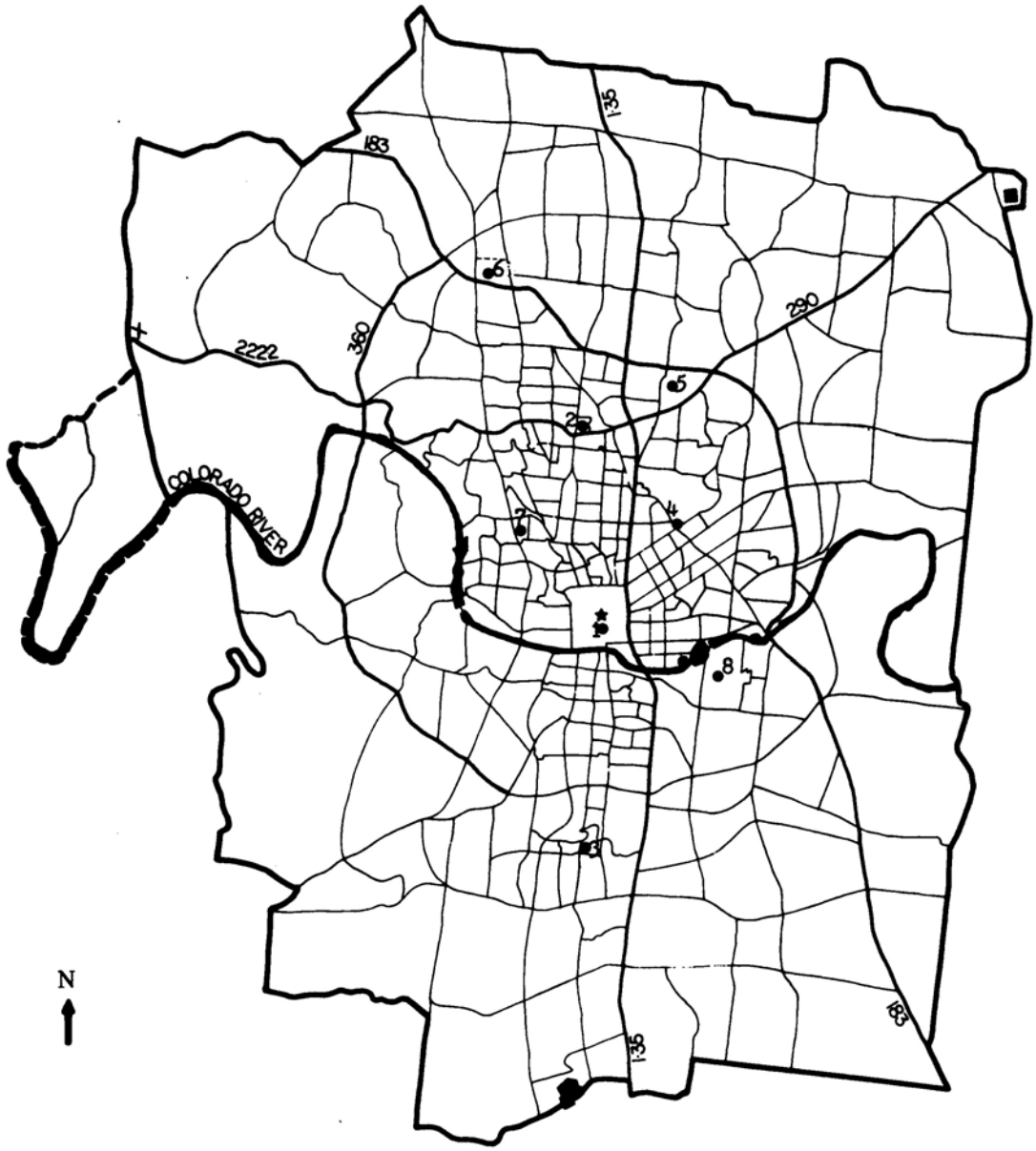
Figure 4.5
GA Selected Sites to Serve
Total EMS Calls
(8 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.6

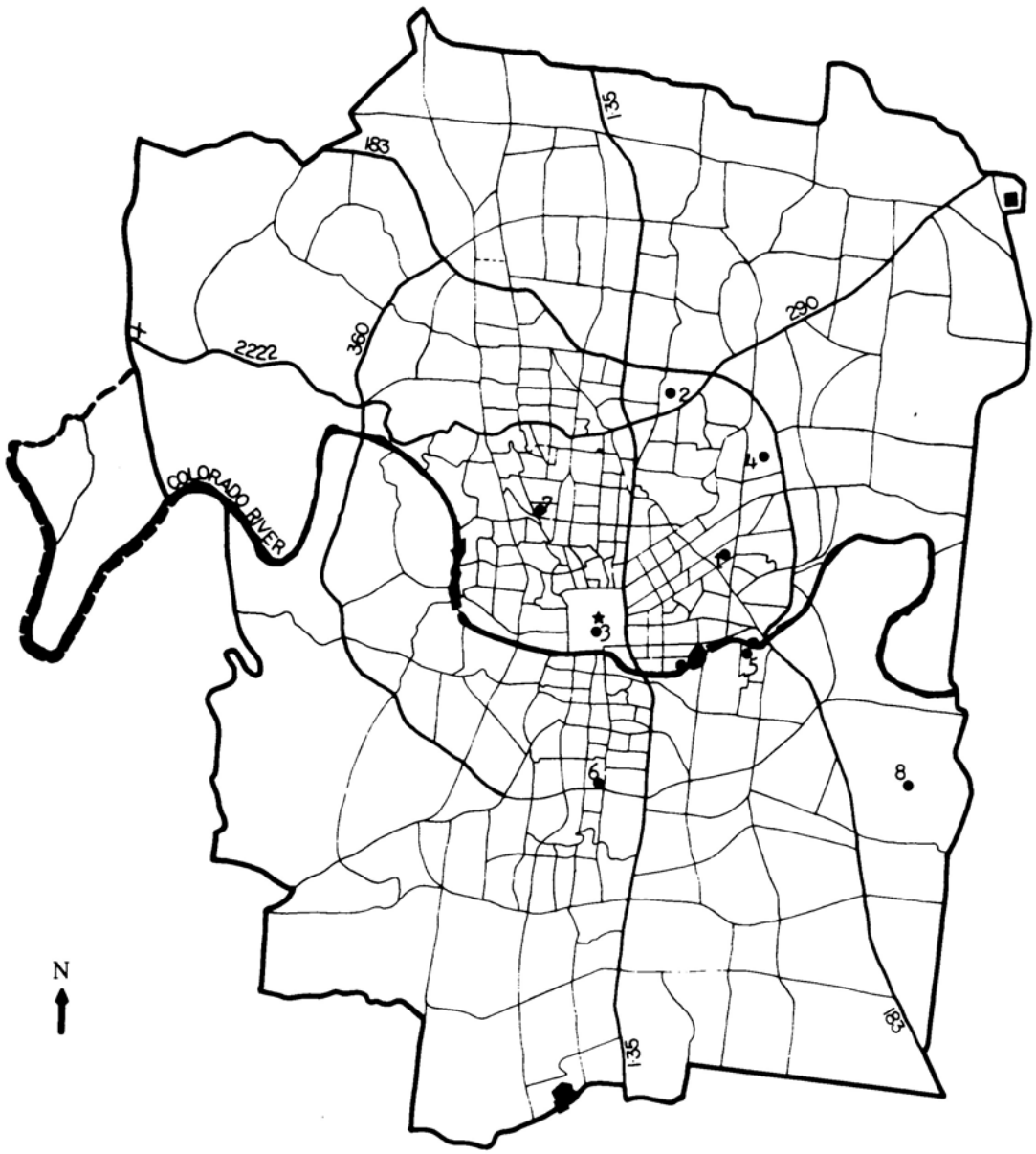
GA Selected Sites to Serve
Total Population
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.7

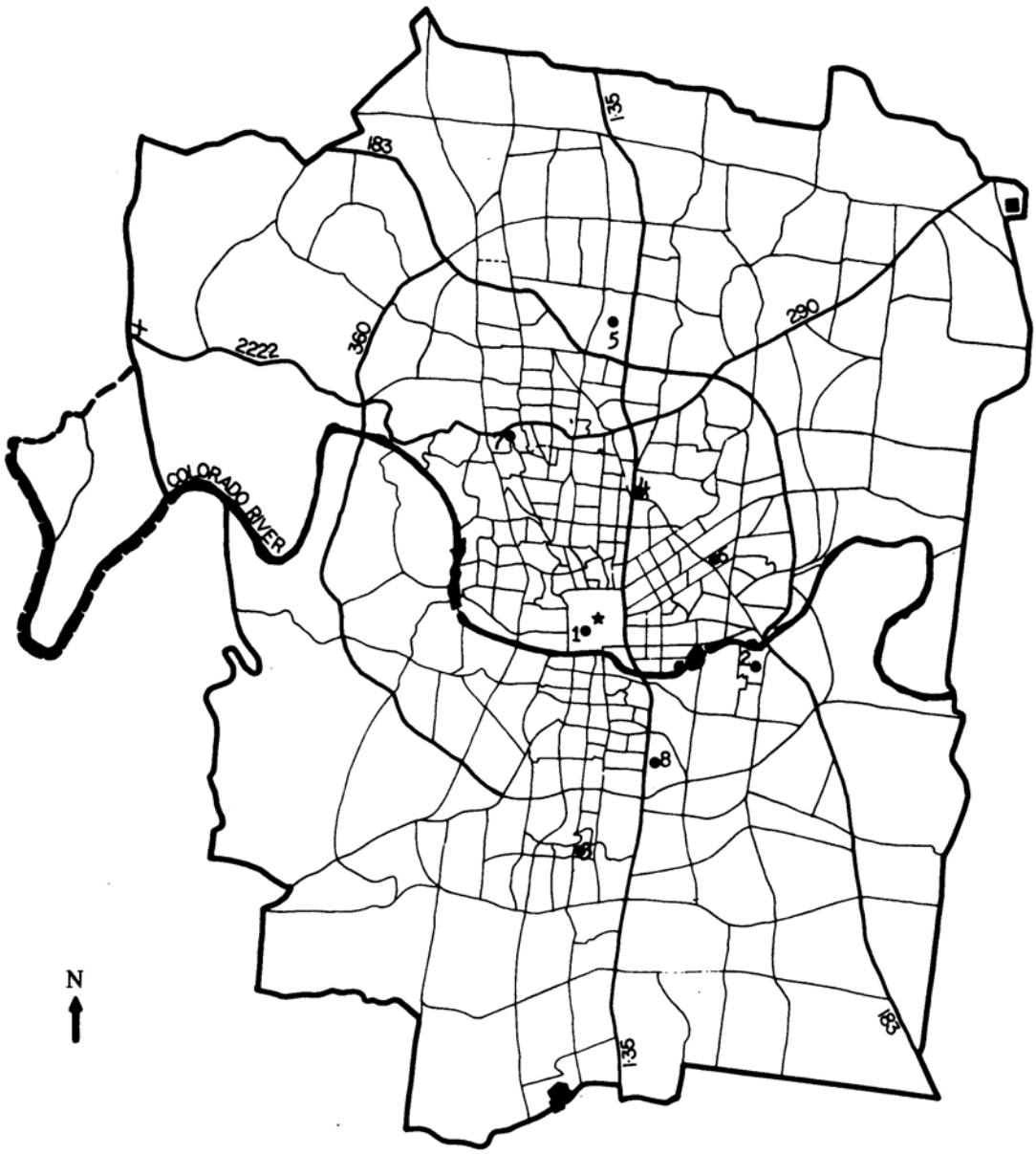
GA Selected Sites to Serve Black Population
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.8

GA Selected Sites to Serve
Spanish-Surnamed Population
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Table 4.9

GA Selected Sites to Serve Persons over 62 Years of Age
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	166	30.25	30.25
2	99	52.03	21.78
3	41	62.88	10.85
4	258	72.14	9.26
5	192	76.31	4.17
6	158	80.09	3.78
7	143	83.52	3.43
8	267	86.85	3.06

Table 4.10

GA Selected Sites to Serve Critical Calls
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	9	39.03	39.03
2	99	54.86	15.83
3	190	65.05	10.19
4	258	73.19	8.14
5	37	77.71	4.52
6	118	82.13	4.42
7	146	85.14	3.01
8	222	88.24	2.83

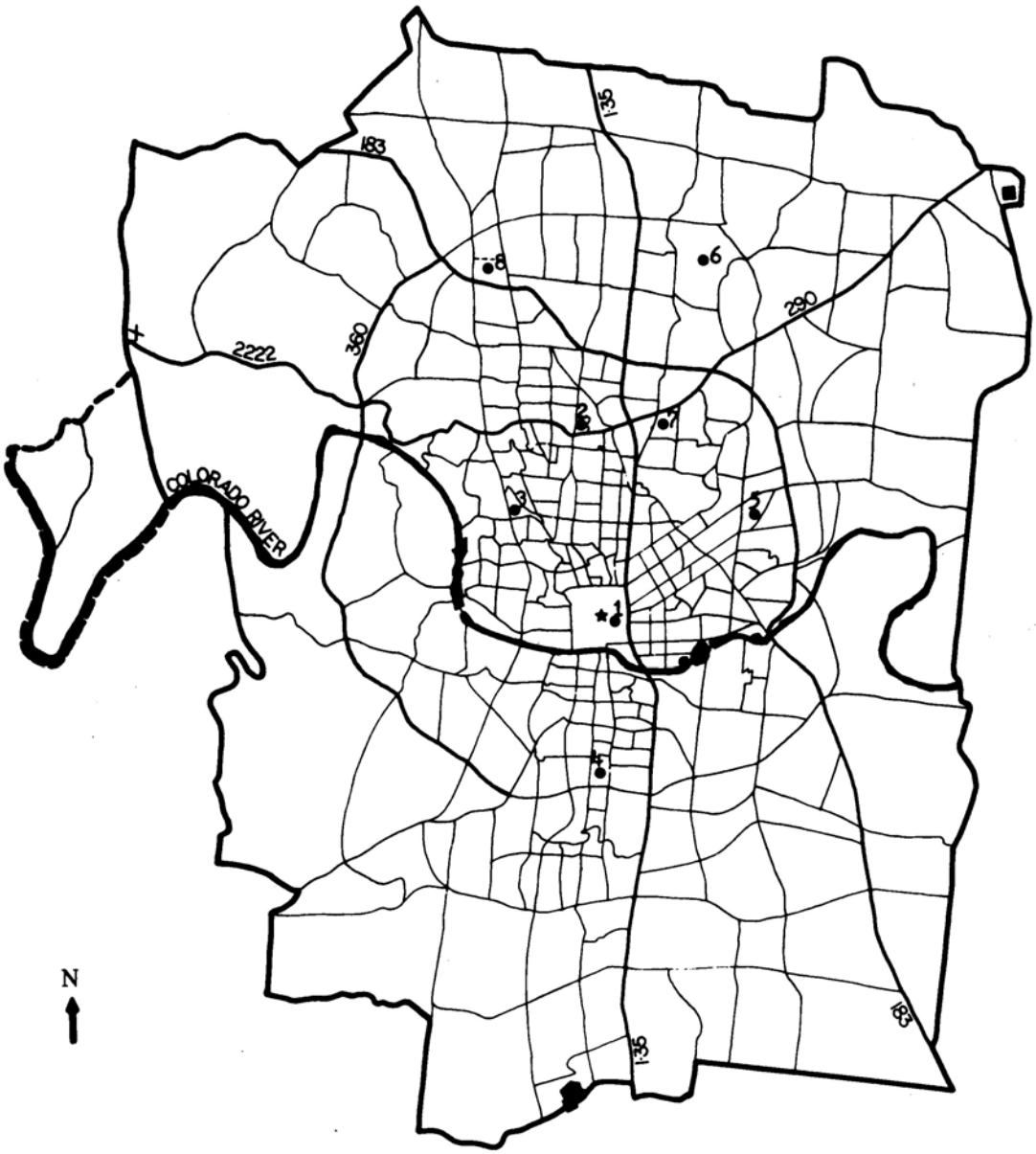
Table 4.11

GA Selected Sites to Serve Transport Calls
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	166	37.93	37.93
2	99	55.99	18.06
3	258	66.68	11.69
4	192	72.22	5.54
5	37	76.69	4.47
6	118	81.00	4.31
7	219	84.91	3.91
8	155	88.51	3.60

Figure 4.9

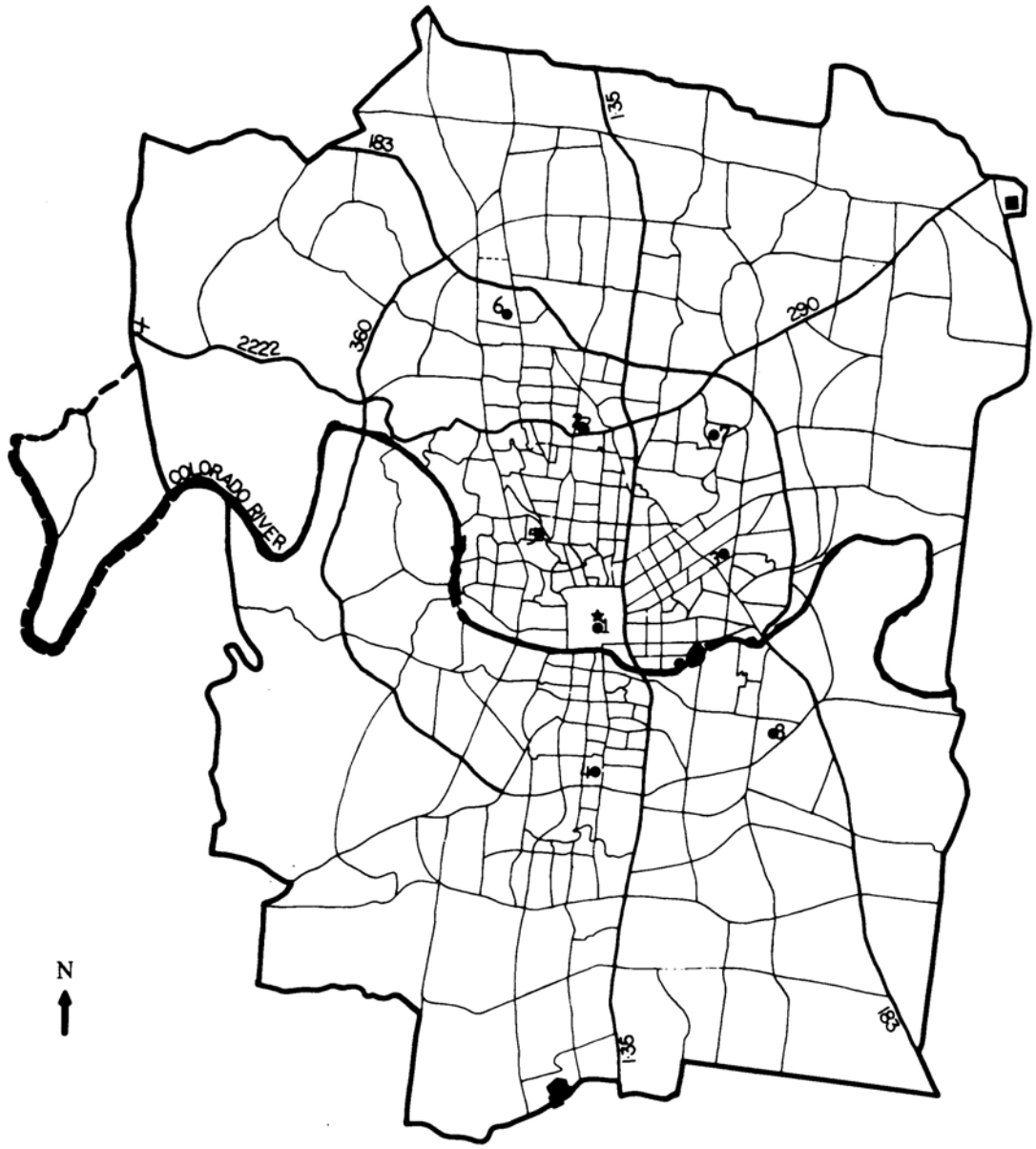
GA Selected Sites to Serve
Persons over 62 Years of Age
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.10

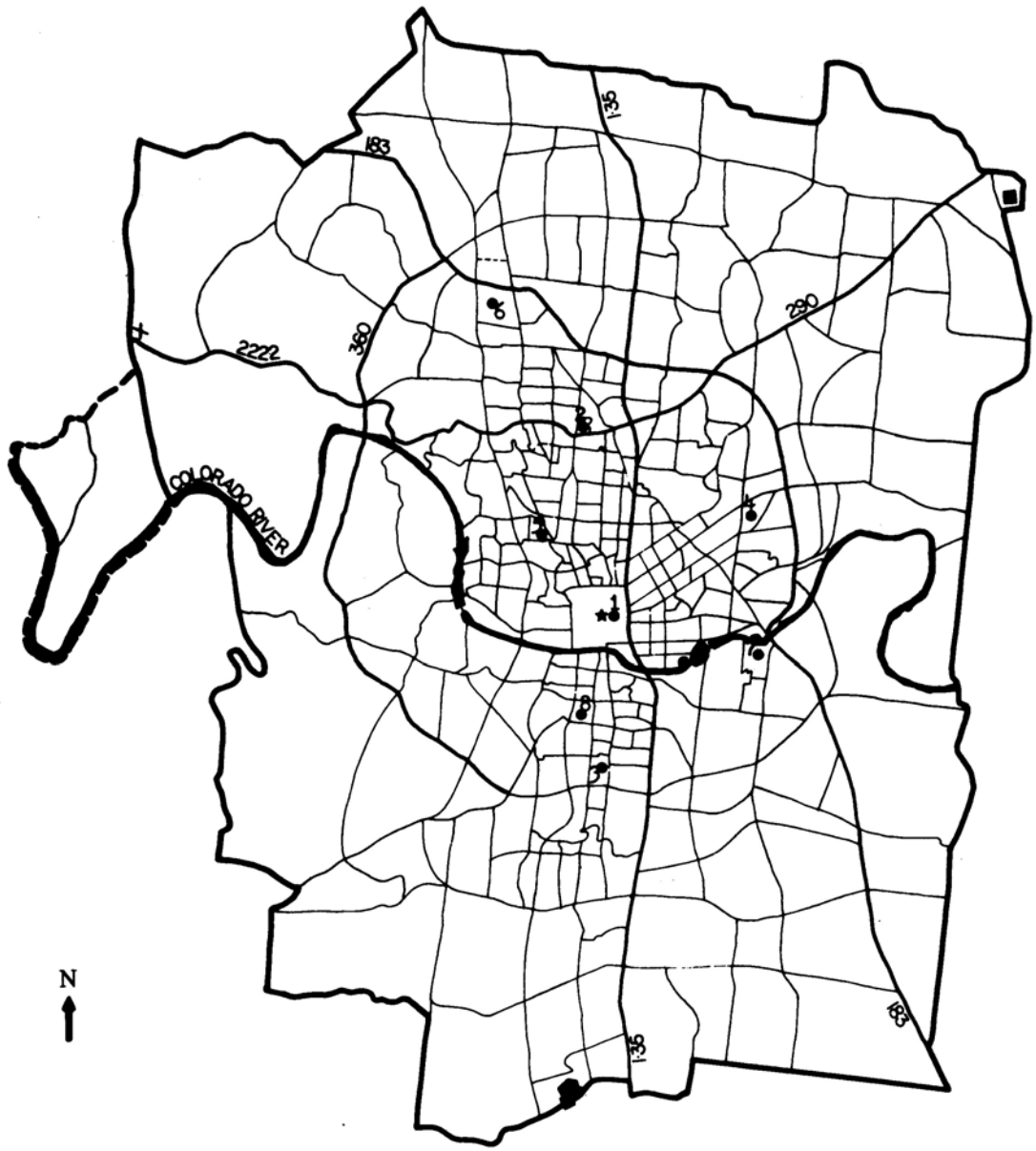
GA Selected Sites to Serve
Critical Calls
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Figure 4.11

GA Selected Sites to Serve
Transport Calls
(5 minutes maximum service time)



Numbers indicate the order in which the GA program selected the sites.

Table 4.12

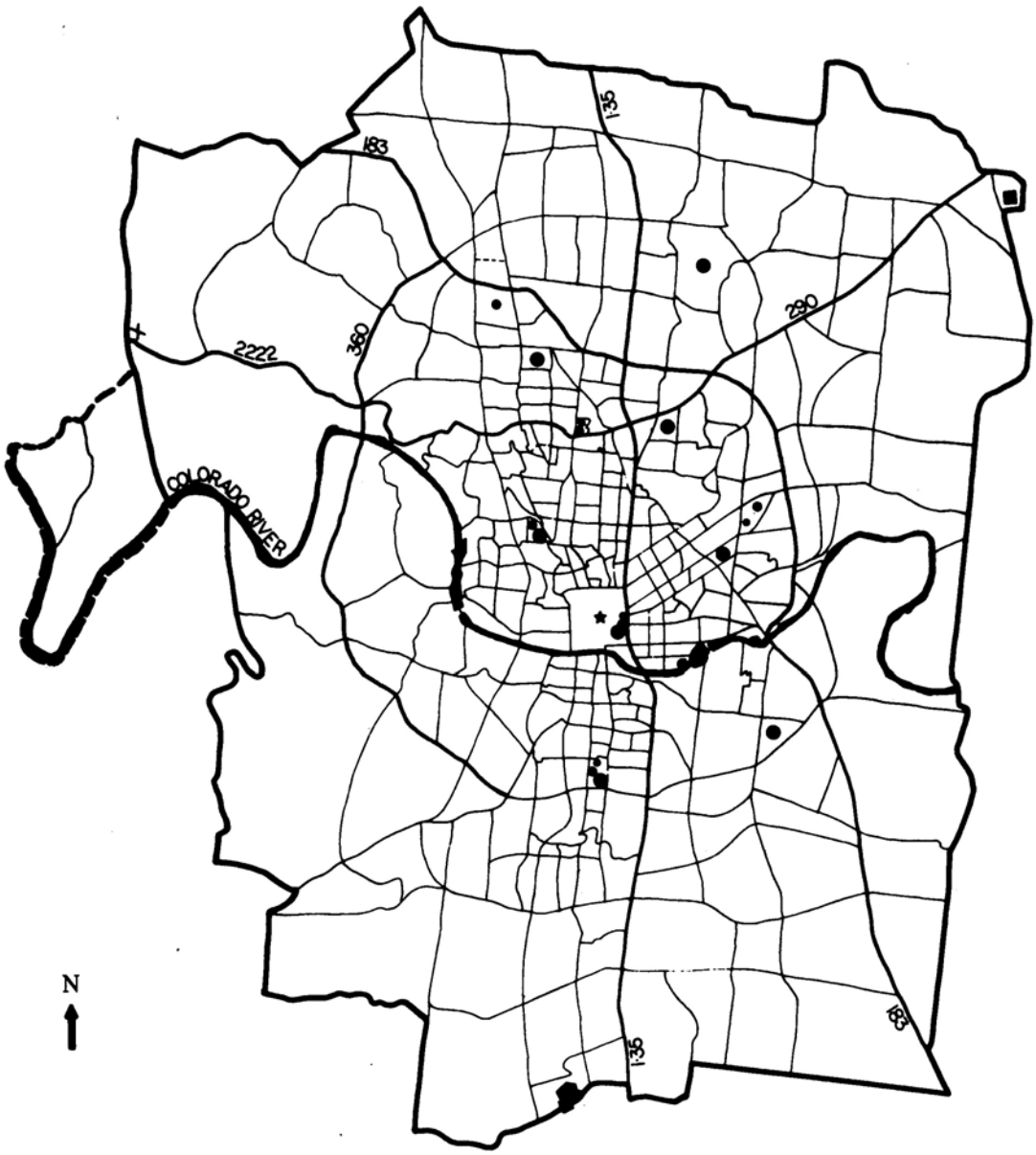
GAS Selected Sites to Serve
Total EMS Calls
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	9	37.40	37.40
2	9,99	54.17	16.77
	166,99	54.49	.32
3	166,99,258	66.61	12.12
4	166,99,258,192	72.29	5.68
5	166,99,258,192,118	76.77	4.48
6	166,99,258,192,118,37	80.84	4.07
	7,99,258,192,118,37	81.76	.92
	7,97,258,192,118,37	82.50	.74
	7,97,258,190,118,37	82.66	.16
	7,97,258,190,111,37	83.68	1.02
	167,97,258,190,111,37	84.90	1.22
	167,143,258,190,111,37	85.36	.46
7	167,143,258,190,111,37,222	87.95	2.59
	7,143,258,190,111,37,222	87.95	0.00
8	7,143,258,190,111,37,222,158	89.96	2.01

An underlined index number indicates a substitution

Figure 4.12

GAS Selected Sites to Serve
Total EMS Calls
(5 minutes maximum service time)



• 4 VEHICLE SITE SOLUTION
● 6 VEHICLE SITE SOLUTION
● 8 VEHICLE SITE SOLUTION

Table 4.13

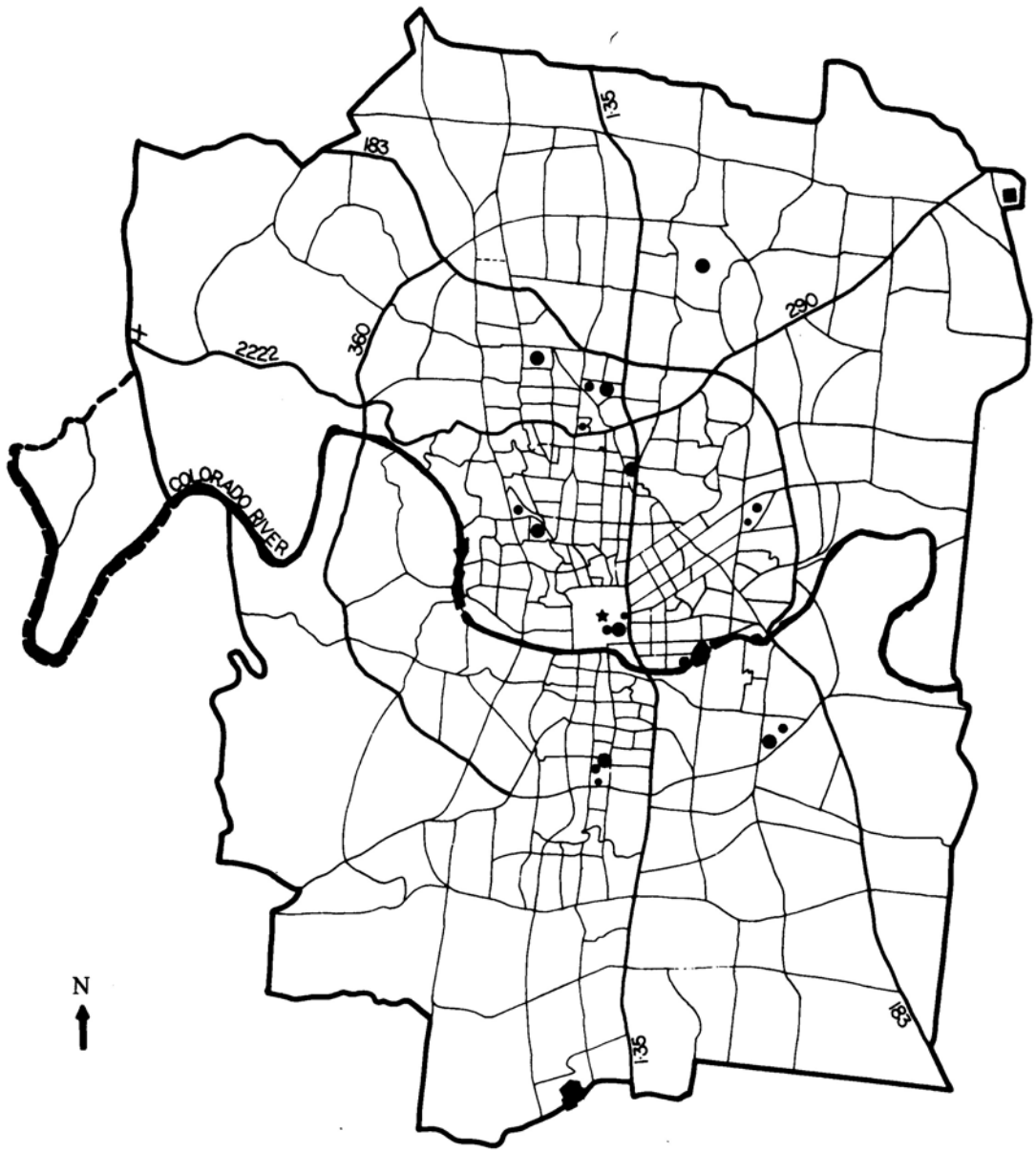
GAS Selected Sites to Serve Transport Calls
(5 minutes maximum service time)

Iteration	*Site Selected (Index Number)*	*Cumulative Coverage (Percent)*	*Marginal Increase In Coverage (Percent)*
1	166	37.93	37.93
2	166,99	54.99	17.06
3	166,99,258	66.68	11.69
4	166,99,258,192	72.22	5.54
5	166,99,258,192,37	76.69	4.47
	7,99,258,192,37	77.43	.74
	7,100,258,192,37	78.83	1.40
	7,100,258,192,41	79.60	.77
6	7,100,258,192,41,222	83.04	3.44
7	7,100,258,192,41,222,118	86.14	3.10
	7,97,258,192,41,222,118	86.84	.70
	7,97,258,192,41,222,111	86.94	.10
	7,93,258,192,41,222,111	87.71	.77
	7,93,258,192,37,222,111	87.81	.10
8	7,93,258,192,37,222,111,158	89.88	2.07

An underlined index number indicates a substitution

Figure 4.13

GAS Selected Sites to Serve
Transport Calls
(5 minutes maximum service time)



• 4 VEHICLE SITE SOLUTION
● 6 VEHICLE SITE SOLUTION
● 8 VEHICLE SITE SOLUTION

Chapter 5
Additional EMS Vehicle Deployment Analyses

The EMS vehicle siting analyses made by Project members in September and October of 1979 addressed some issues but caused others to surface. Among the unanswered questions were (a) how the system's performance would change if some station sites were fixed, and (b) how restricting the set of potential sites would affect coverage. For example, suppose that certain fire stations were to be converted for joint use with EMS, or that vehicle bases had to be built on city property. How would such site restrictions affect EMS vehicle deployment?

Bill Bulloch, Director of the Emergency Medical Services Department of the City of Austin, asked Project members to examine these issues by running fourteen additional GAS analyses. Ten runs used call history as demand data and specified one or two fixed sites in the selection of an eight-site configuration. These ten runs included an "all site" and a "limited site" analysis for each of five fixed-zone problems. The Project fixed (a) zones 59 and 196; (b) zones 14 and 258; (c) zone 45; (d) zone 257; and (e) zone 44. The "all site" analyses fixed these designated zones but allowed GAS to select additional sites from among all other Austin serial zones. The "limited site" analyses permitted GAS to select additional EMS vehicle bases from among a set of sixteen serial zones specified by Mr. Bulloch. Figure 5.1 illustrates the location of these sites and Table 5.1 lists associated street addresses and the reason each was selected. The GAS-selected sites were used as input to CALL/CZSR to evaluate system operating statistics (1).

Table 5.2 lists all the additional runs, the associated assumptions, and related tables and figures. Table 5.3 and Map 5.2 demonstrate the results of an unconstrained eight-site GAS solution using call history as the demand surrogate. Tables 5.4 through 5.18 show the results of the ten GAS runs and list pertinent CALL/CZSR-generated statistics. Maps 5.3 through 5.12 pinpoint the selected sites on serial zone maps.

Four additional analyses investigated different demand data—transport, nontransport, critical, and noncritical calls. These runs were related to the proposed two-tiered EMS system. Mr. Bill Bulloch and Mr. Dennis Simmons, both of the Austin EMS Department, defined critical calls to include all requests for service involving heart attacks, strokes, violence, and unconscious patients; all other calls were defined as noncritical. Tables 5.19 and 5.20 and Maps 5.13 and 5.14 show the results of these runs. No CALL/CZSR statistics were generated for analyses of transport, nontransport, critical, and noncritical calls. CALL/CZSR could in principle use any relative call frequency distribution as the basis for a siting analysis. However, the algorithm multiplies the relative frequency of calls in a region by the total number of calls per day of a specific type. This value is used as the daily demand in the region. However, since the system will respond to other types of calls the product does not affect the total demand placed on the system by the region. The situation makes the CALL/CZSR output difficult to interpret.

For a thorough description of GAS and CALL/CZSR programs, the reader is referred to Volume II of this report. For the reader's convenience, however, Table 5.21 defines some of the statistical terms used in these tables.

(1) A typical CALL/CZSR four vehicle solution required 35-50 seconds of CPU time on The University of Texas at Austin CDC CYBER 70 system. Typical 8 and 12 vehicle solutions required 100-120 and 160 seconds, respectively.

Table 5.1

Additional Analyses: A List of Tables and Maps

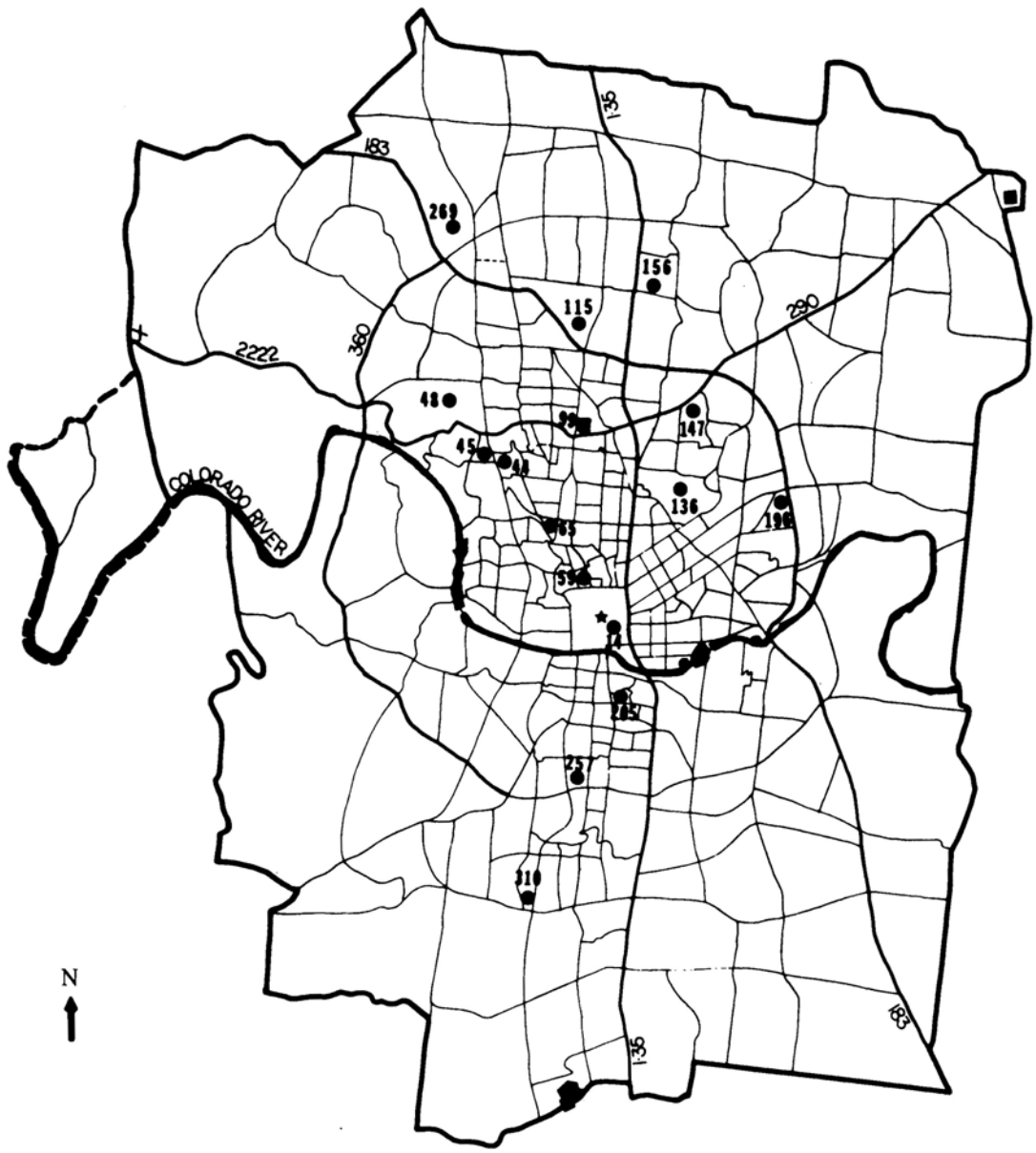
Figure/ Table	*Title*	*Fixed Site(s)*	*Mode(s) of Analysis*	*Demand Surrogate*	*Number of Zones Considered*	*Number of Vehicles Sited*
Figure 5.1	Sixteen Selected Sites Used in Additional City Runs	-	-	-	-	-
Table 5.2	Sixteen Selected Sites Used in Additional City Runs	-	-	-	-	-
Table 5.3	Unconstrained Eight-Site GAS Solution	None	GAS, CALL/ CZSR	Call History	All	8
Figure 5.2	Unconstrained Eight-Site GAS Solution	None	GAS	Call History	All	8
Table 5.4	Comparison of GAS Solutions for Fixed Sites 59 and 196	59, 196	GAS, CALL/ CZSR	Call History	All, 16	8
Figure 5.3	GAS Solution for Fixed Sites 59 and 196–All Zones Considered	59, 196	GAS, CALL/ CZSR	Call History	All	8
Table 5.5	GAS Solution for Fixed Sites 59 and 196–All Zones Considered	59, 196	GAS	Call History	All	8
Table 5.6	GAS Solution for Fixed Sites 59 and 196–16 Zones Considered	59, 196	GAS, CALL/ CZSR	Call History	16	8
Figure 5.4	GAS Solution for Fixed Sites 59 and 196–16 Zones Considered	59, 196	GAS	Call History	16	8
Table 5.7	Comparison of GAS Solutions for Fixed Sites 14 and 258	14, 258	GAS, CALL/ CZSR	Call History	All, 16	8
Table 5.8	GAS Solution for Fixed Sites 14 and 258–All Zones Considered	14, 258	GAS, CALL/ CZSR	Call History	All	8
Figure 5.5	GAS Solution for Fixed Sites 14 and 258–All Zones Considered	14, 258	GAS	Call History	All	8
Table 5.9	GAS Solution for Fixed Sites 14 and 258–16 Zones Considered	14, 258	GAS, CALL/ CZSR	Call History	16	8
Figure 5.6	GAS Solution for Fixed Sites 14 and 258–16 Zones Considered	14, 258	GAS	Call History	16	8
Table 5.10	Comparison of GAS Solutions for Fixed Site 45	45	GAS, CALL/ CZSR	Call History	All, 16	8
Table 5.11	GAS Solution for Fixed Site 45–All Zones Considered	45	GAS, CALL/ CZSR	Call History	All	8

Table 5.1 (continued)

Figure/ Table	*Title*	*Fixed Site(s)*	*Mode(s) of Analysis*	*Demand Surrogate*	*Number of Zones Considered*	*Number of Vehicles Sited*
Figure 5.7	GAS Solution for Fixed Site 45–All Zones Considered	45	GAS	Call History	All	8
Table 5.12	GAS Solution for Fixed Site 45–16 Zones Considered	45	GAS, CALL/ CZSR	Call History	16	8
Figure 5.8	GAS Solution for Fixed Site 45–16 Zones Considered	45	GAS	Call History	16	8
Table 5.13	Comparison of GAS Solutions for Fixed Site 257	257	GAS, CALL/ CZSR	Call History	All, 16	8
Table 5.14	GAS Solution for Fixed Site 257–All Zones Considered	257	GAS, CALL/ CZSR	Call History	All	8
Figure 5.9	GAS Solution for Fixed Site 257–All Zones Considered	257	GAS	Call History	All	8
Table 5.15	GAS Solution for Fixed Site 257–16 Zones Considered	257	GAS, CALL/ CZSR	Call History	16	8
Figure 5.10	GAS Solution for Fixed Site 257–16 Zones Considered	257	GAS	Call History	16	8
Table 5.16	Comparison of GAS Solutions for Fixed Site 44	44	GAS, CALL/ CZSR	Call History	All, 16	8
Table 5.17	GAS Solution for Fixed Site 44–All Zones Considered	44	GAS, CALL/ CZSR	Call History	All	8
Figure 5.11	GAS Solution for Fixed Site 44–All Zones Considered	44	GAS	Call History	All	8
Table 5.18	GAS Solution for Fixed Site 44–16 Zones Considered	44	GAS, CALL/ CZSR	Call History	16	8
Figure 5.12	GAS Solution for Fixed Site 44–16 Zones Considered	44	GAS	Call History	16	8
Table 5.19	Four-Site GAS Solutions for Transport/Nontransport Calls	None	GAS	Transport/ Nontransport Calls	All	4,4
Figure 5.13	Sites Selected by GAS Using Transport and Non-transport Calls as Demand Data	None	GAS	Transport/ Nontransport Calls	All	4,4
Table 5.20	Four-Site GAS Solutions for Critical/Noncritical Calls	None	GAS	Critical/ Noncritical Calls	All	4,4
Figure 5.14	Sites Selected by GAS Using Critical and Non-critical Calls as Demand Data	None	GAS	Critical/ Noncritical Calls	All	4,4
Table 5.21	Definitions of Terms	-	-	-	-	-

Figure 5.1

Sixteen Selected Sites Used in Additional City Runs



Numbers indicate serial zones designated by Mr. Bill Bulloch for analytical purposes as a set of potential EMS vehicle bases.

Table 5.2

Sixteen Selected Sites Used in Additional City Runs*

Zone Number	*Address*	*Rationale for Site*
310	6601 Manchaca Rd.	Fire Station No. 20
257	South First and South Center	City Service Area
205	1705 S. Congress Ave.	Fire Station No. 6
014	401 E. Fifth St.	Fire Station No. 1
059	506 W. Martin Luther King Blvd.	Fire Station No. 2
196	1201 Webberville Rd.	Fire Station No. 5
136	4305 Airport Blvd.	Fire Station No. 14
065	1201 W. 38th St.	Seton Hospital
044	45th St. and Bull Creek	Undeveloped State Property
099	Koenig and Lamar	City Service Area
045	5211 Balcones Dr.	Fire Station No. 19
147	6311 Berkman Dr.	Fire Station No. 18
115	8989 Research Blvd.	Fire Station No. 8
156	1330 E. Rundberg Ln.	Fire Station No. 23
269	5300 Duval Rd.	Fire Station No. 25
048	Balcones north of Northland	Undeveloped City Property

*These sites were designated by Mr. Bill Bulloch for analytical purposes as a set of potential EMS vehicle bases.

Table 5.3
Unconstrained Eight-Site GAS Solution

A. GAS Iterations

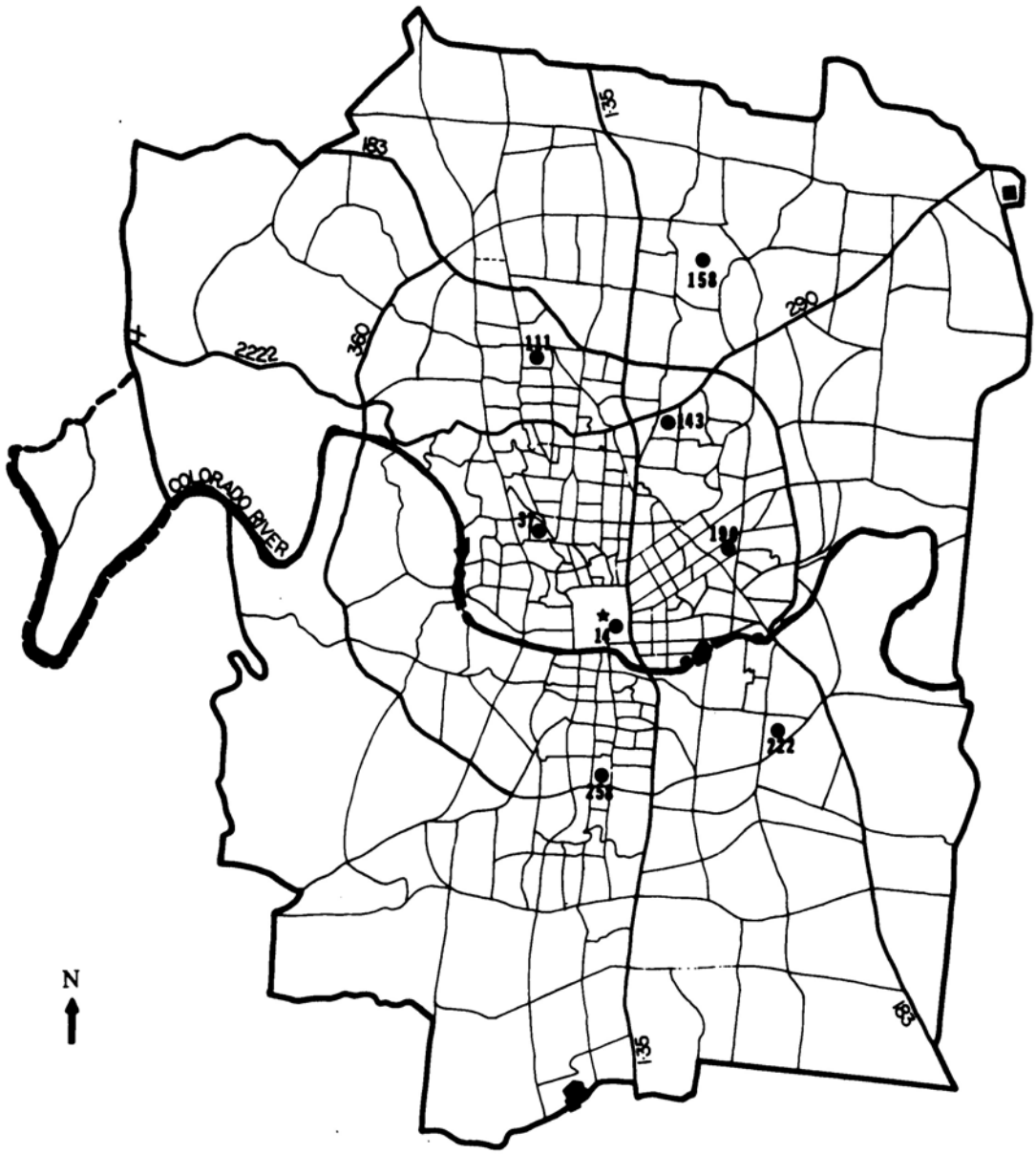
Iteration	*Sites Selected*	*Percent of Calls Covered in 5 Min.*
1	009	37.40
2	009, 099	54.17
	166, 099	54.19
3	166, 099, 258	66.61
4	166, 099, 258, 192	72.29
5	166, 099, 258, 192, 118	76.77
6	166, 099, 258, 192, 118, 037	80.84
	007, 099, 258, 192, 118, 037	81.76
	007, 097, 258, 192, 118, 037	82.50
	007, 097, 258, 190, 118, 037	82.66
	007, 097, 258, 190, 111, 037	83.68
	167, 097, 258, 190, 111, 037	84.90
	167, 143, 258, 190, 111, 037	85.36
7	167, 143, 258, 190, 111, 037, 222	87.95
	007, 143, 258, 190, 111, 037, 222	87.95
8	007, 143, 258, 190, 111, 037, 222, 158	89.96

B. CALL/CZSR System Performance Criteria

Vehicle Locations:	007, 143, 258, 190, 111, 037, 222, 158
System Mean Response Time (Min.):	4.439
Workload Range:	23.72
Cumulative Distribution of Response:	
5 Minutes:	.5593
10 Minutes:	.9633
15 Minutes:	.9974
Likelihood of All EMS Vehicles Idle:	.4861

Figure 5.2

Unconstrained Eight-Site GAS Solution



Numbers identify serial zones selected by GAS.

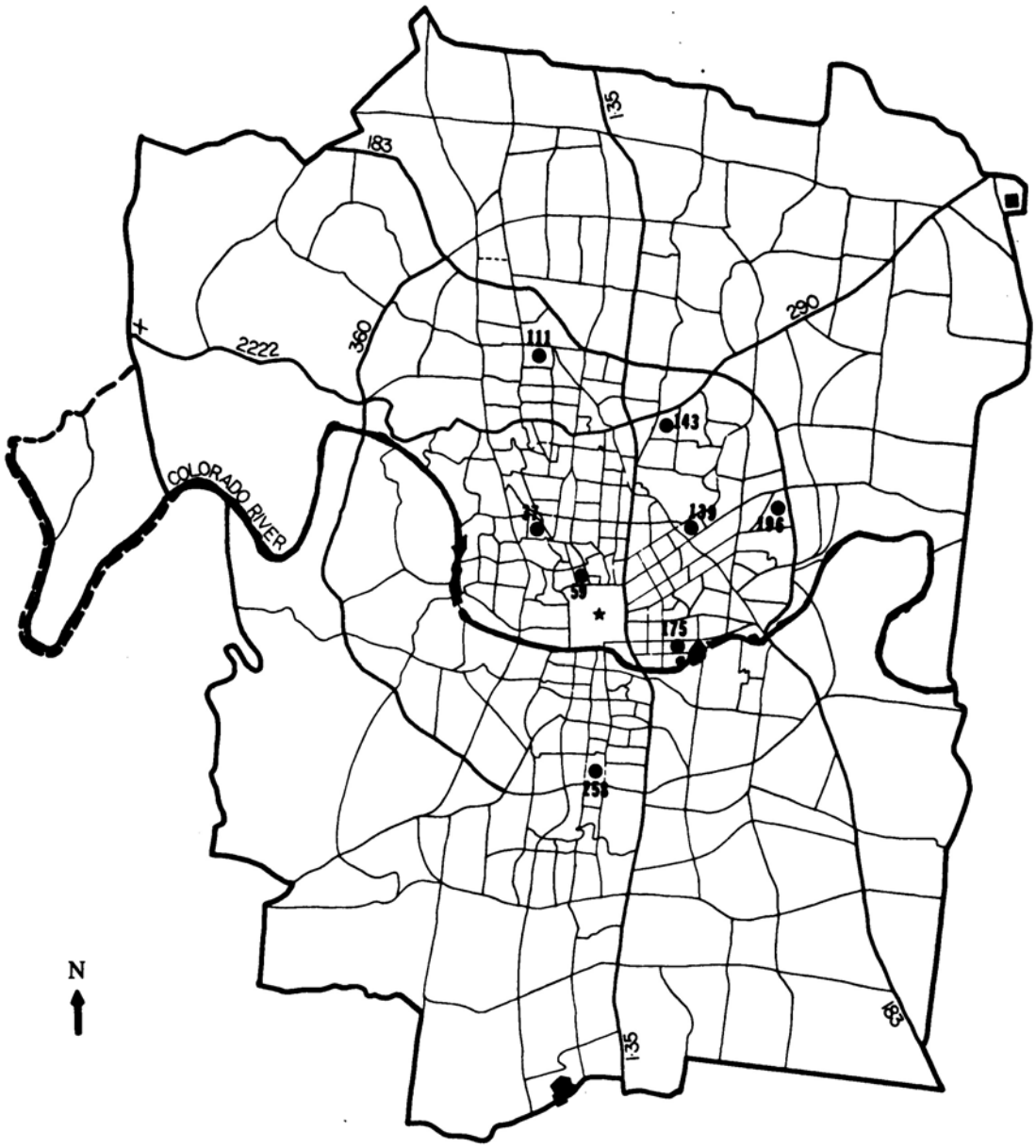
Table 5.4

Comparison of GAS Solutions for Fixed Sites 59 and 196

GAS Solution	*Sites*	*Percent Calls Covered in 5 Min. (GAS)*	*System Mean Response Time (CALL/CZSR)*	*Workload Range (CALL/CZSR)*	*Cumulative Distribution of Response (CALL/CZSR)*			*Likelihood of All Vehicles Idle (CALL/CZSR)*
					5 Min.	*10 Min.*	*15 Min.*	
Unconstrained	007, 143, 258, 190, 111, 037, 222, 158	89.96	4.439	23.72	.5593	.9633	.9974	.4861
Fixed Sites 059 and 196								
All Zones Considered	059, 196, 175, 111, 258, 143, 037, 139	85.78	4.726	17.49	.5451	.9522	.9967	.3858
16 Zones Considered	059, 196, 014, 099, 257, 136, 115, 147	80.14	4.475	16.61	.5138	.9498	.9949	.3844

Figure 5.3

**GAS Solution for Fixed Sites 59 and 196–
All Zones Considered**



Numbers indicate serial zones selected by GAS.

Table 5.5

GAS Solution for Fixed Sites 59 and 196– All Zones Considered

A. GAS Iterations

Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	059, 196		31.93
1	••	015	48.13
2	••	015, 101	63.29
3	••	015,101,258	73.01
	••	166, 101, 258	74.19
4	••	166, 101, 258, 093	78.11
	••	175, 101, 258, 093	78.90
	••	175, 111, 258, 093	80.56
5	••	175, 111, 258, 093, 037	82.98
6	••	175, 111, 258, 093, 037, 140	85.34
	••	175, 111, 258, 143, 037, 140	85.78
	••	175, 111, 258, 143, 037, 139	85.78

B. CALL/CZSR System Performance Criteria

Vehicle Locations:	059, 196, 175, 111, 258, 143, 037, 139
System Mean Response Time (Min.):	4.726
Workload Range:	17.49
Cumulative Distribution of Response:	
5 Minutes:	.5451
10 Minutes:	.9522
15 Minutes:	.9967
Likelihood of All EMS Vehicles Idle:	.3858

Table 5.6

**GAS Solution for Fixed Sites 59 and 196–
16 Zones Considered**

A. GAS Iterations

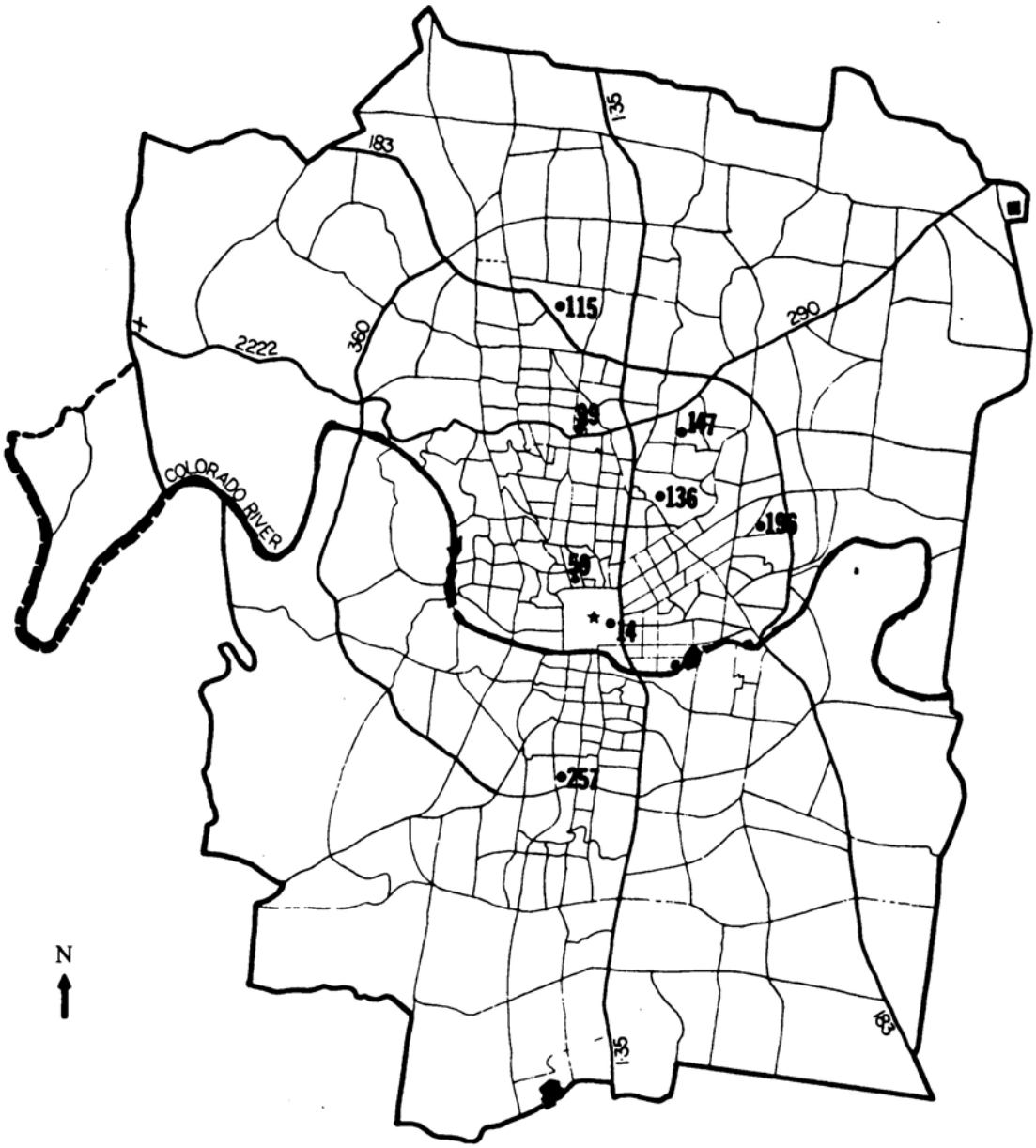
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	059, 196		31.93
1	"	014	47.36
2	"	014, 099	62.30
3	"	014, 099, 257	71.05
4	"	014, 099, 257, 136	75.46
5	"	014, 099, 257, 136, 115	78.73
6	"	014, 099, 257, 136, 115, 147	80.14

B. CALL/CZSR System Performance Criteria

System Mean Response Time:	4.475 min.
Workload Range:	16.61
Cumulative Distribution of Response:	
5 Minutes:	.5138
10 Minutes:	.9498
15 Minutes:	.9949
Likelihood of All EMS Vehicles Idle:	.3844

Figure 5.4

GAS Solution for Fixed Sites 59 and 196–
16 Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.7

Comparison of GAS Solutions for Fixed Sites 14 and 258

GAS Solution	*Sites*	*Percent Calls Covered in 5 Min. (GAS)*	*System Mean Response Time (CALL/CZSR)*	*Workload Range (CALL/CZSR)*	*Cumulative Distribution of Response (CALL/CZSR)*			*Likelihood of All Vehicles Idle (CALL/CZSR)*
					5 Min.	*10 Min.*	*15 Min.*	
Unconstrained	007, 143, 258, 190, 111, 037, 222, 158	89.96	4.439	23.72	.5593	.9633	.9974	.4861
Fixed Sites 014 and 258								
All Zones Considered	014, 258, 143, 190, 037, 222, 111, 158	89.96	4.584	20.12	.5409	.9590	.9967	.3873
16 Zones Considered	014, 258, 115, 257, 136, 065, 196, 099	79.34	4.804	16.05	.5023	.9607	.9975	.3842

Table 5.8

**GAS Solution for Fixed Sites 14 and 258–
All Zones Considered**

A. GAS Iterations

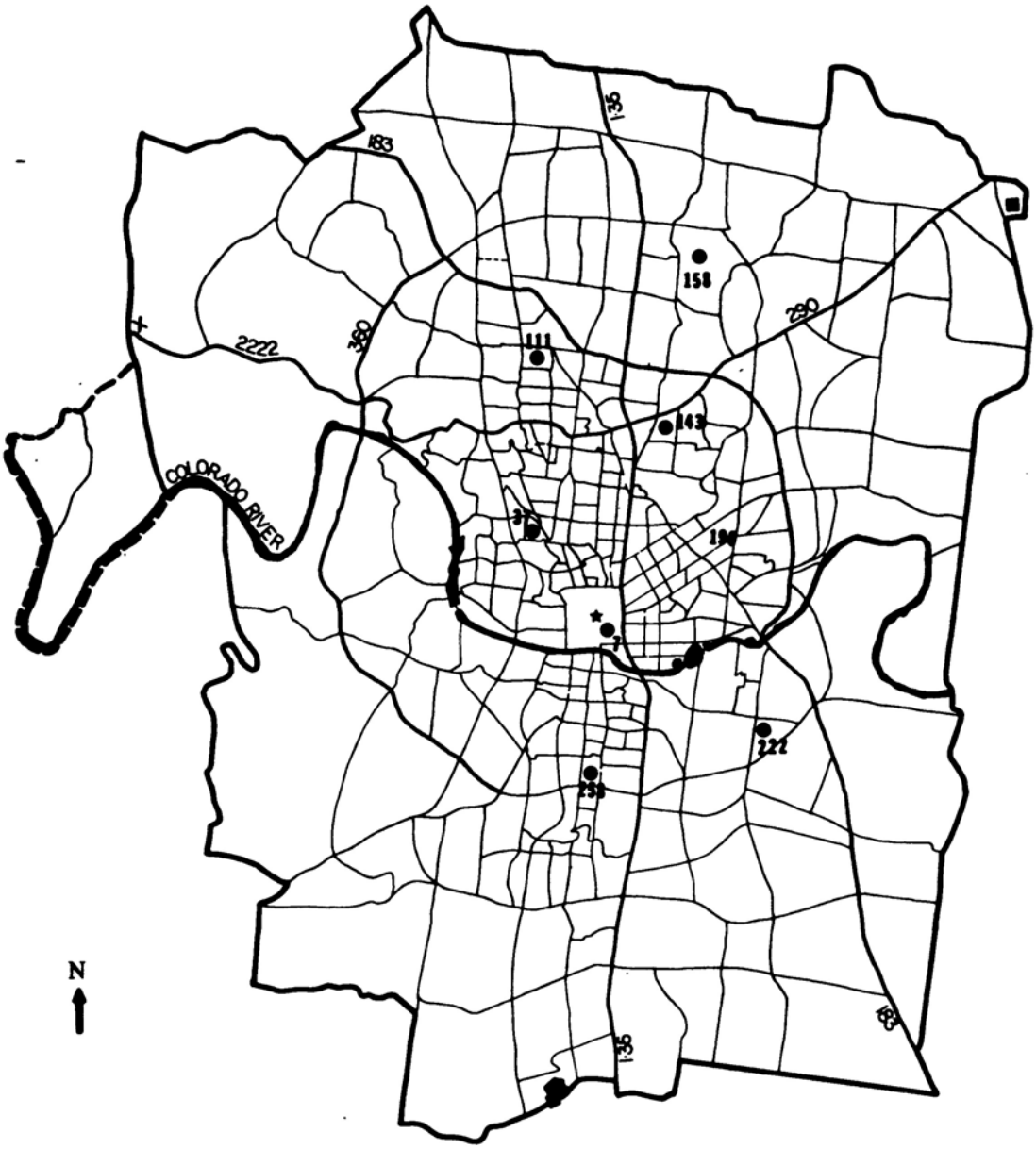
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	014, 258		45.28
1	••	099	63.06
2	••	099,190	72.11
3	••	099, 190, 037	77.46
	••	100, 190, 037	78.71
	••	100, 190, 041	79.40
4	••	100, 190, 041, 222	83.21
5	••	100, 190, 041, 222, 118	86.52
	••	097, 190, 041, 222, 118	87.16
	••	097, 190, 041, 222, 111	87.39
	••	143, 190, 041, 222, 111	87.85
6	••	143, 190, 037, 222, 111, 158	89.96

B. CALL/CZSR System Performance Criteria

Vehicle Locations:	014, 258, 143, 190, 037, 222, 111, 158
System Mean Response Time (Min.):	4.584
Workload Range:	20.12
Cumulative Distribution of Response:	
5 Minutes:	.5409
10 Minutes:	.9590
15 Minutes:	.9967
Likelihood of All EMS Vehicles Idle:	.3873

Figure 5.5

**GAS Solution for Fixed Sites 14 and 258–
All Zones Considered**



Numbers indicate serial zones selected by GAS.

Table 5.9

GAS Solution for Fixed Site 14 and 258–16 Zones Considered

A. Gas Iterations

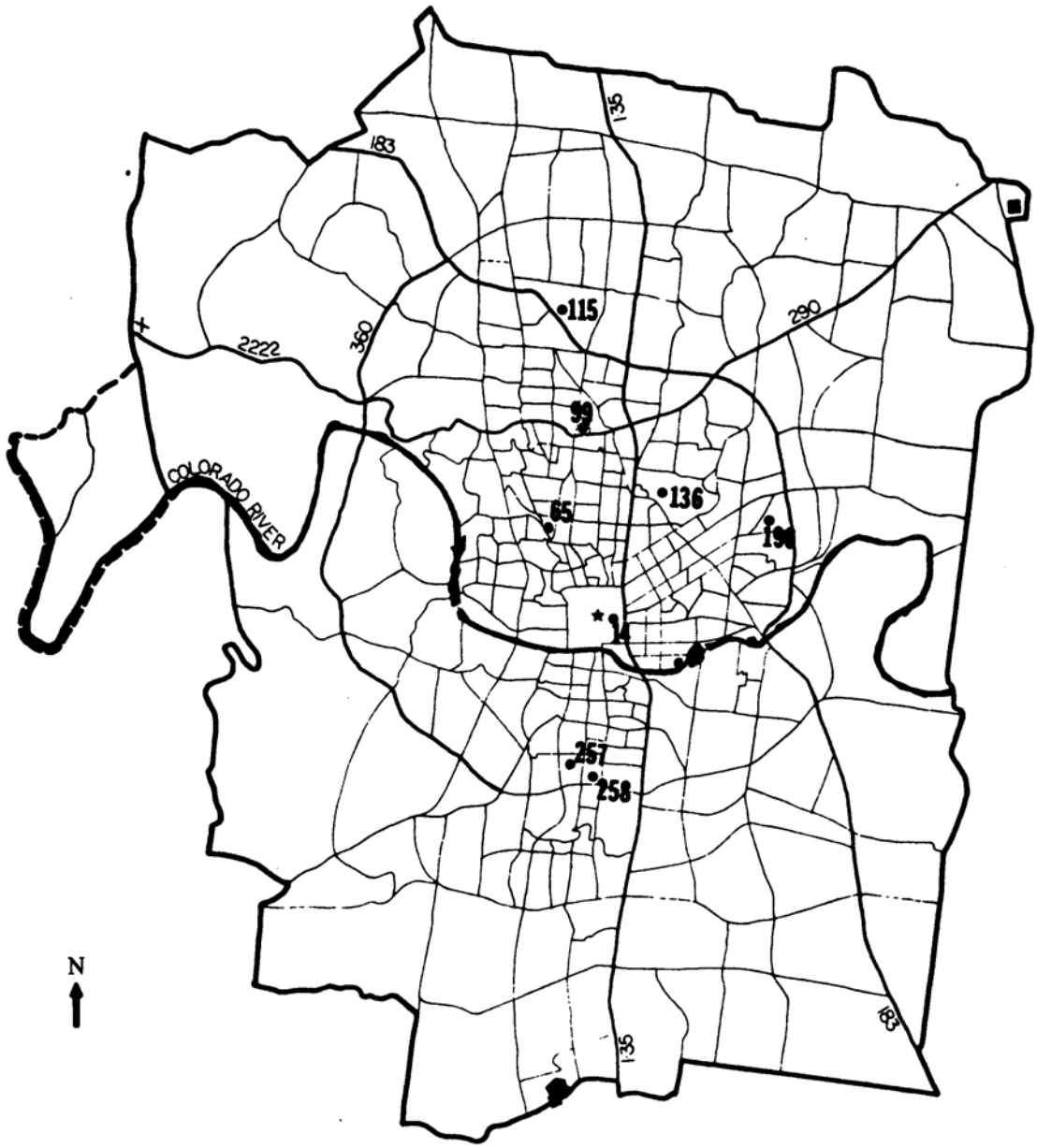
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	014, 258		35.65
1	"	099	53.43
2	"	099, 257	62.18
3	"	099, 257, 136	67.81
4	"	099, 257, 136, 065	72.02
	"	115, 257, 136, 065	72.43
5	"	115, 257, 136, 065, 196	76.47
6	"	115, 257, 136, 065, 196, 099	79.34

B. CALL/CZSR System Performance Criteria

System Mean Response Time:	4.804
Workload Range:	16.05
Cumulative Distribution of Response:	
5 Minutes:	.5023
10 Minutes:	.9607
15 Minutes:	.9975
Likelihood of All EMS Vehicles Idle:	.3842

Figure 5.6

GAS Solution for Fixed Sites 14 and 258–
16 Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.10

Comparison of GAS Solutions for Fixed Site 45

GAS Solution	*Sites*	*Percent Calls Covered in 5 Min. (GAS)*	*System Mean Response Time (CALL/CZSR)*	*Workload Range (CALL/CZSR)*	*Cumulative Distribution of Response (CALL/CZSR)*			*Likelihood of All Vehicles Idle (CALL/CZSR)*
					5 Min.	*10 Min.*	*15 Min.*	
Unconstrained	007, 143, 258, 190, 111, 037, 222, 158	89.96	4.439	23.72	.5593	.9633	.9974	.4861
Fixed Site 45								
All Zones Considered	045, 052, 095, 258, 190, 118, 218, 155	88.94	4.692	19.54	.4883	.9668	.9967	.3862
16 Zones Considered	045, 014, 065, 257, 115, 136, 196, 147	80.33	5.029	17.38	.4566	.9418	.9952	.3827

Table 5.11

**GAS Solution for Fixed Site 45–
All Zones Considered**

A. GAS Iterations

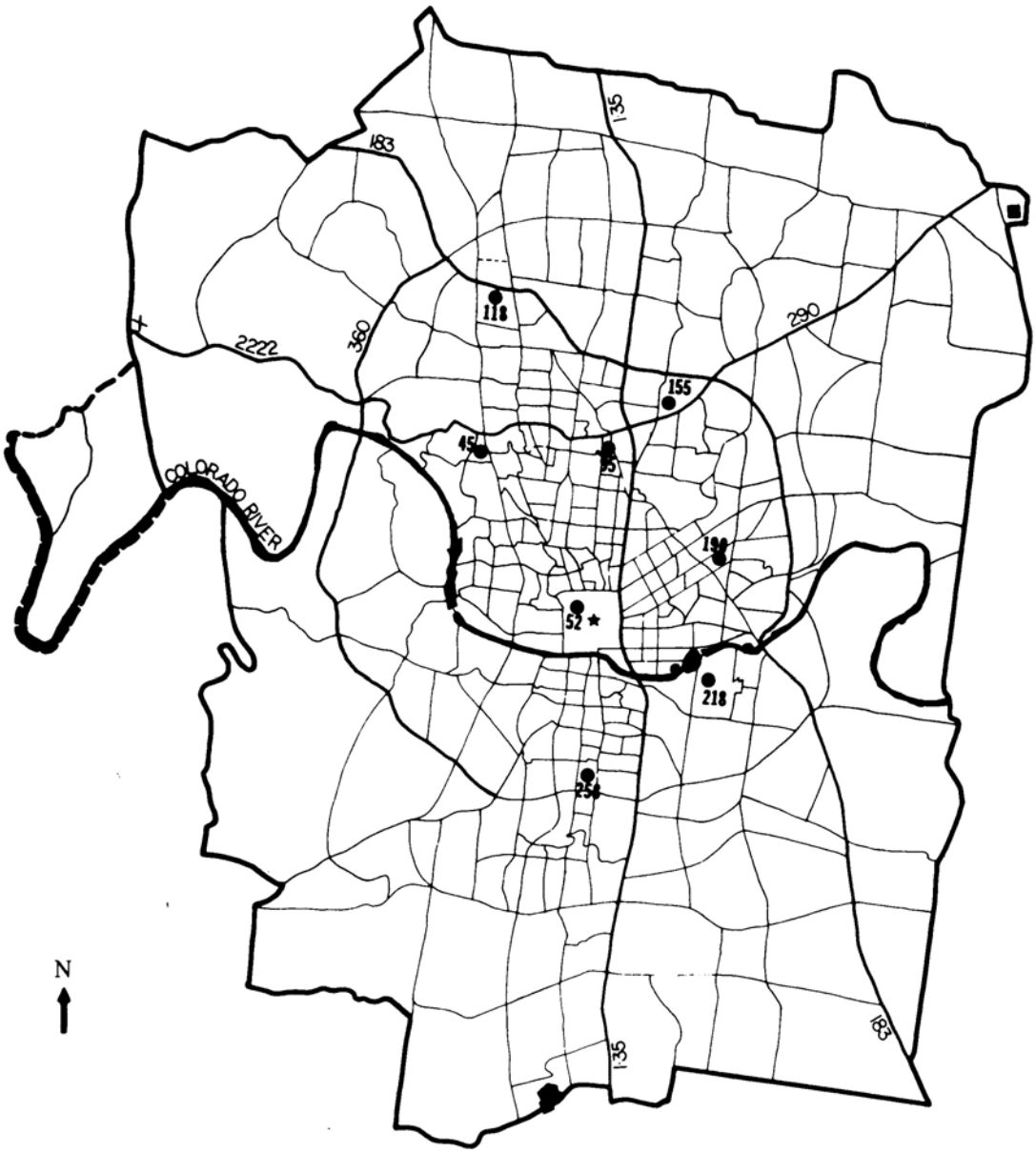
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	45		5.54
1	••	009	42.67
2	••	009, 097	57.63
3	••	009, 097, 258	66.80
	••	166, 097, 258	68.51
	••	166, 099, 258	68.69
4	••	166, 099, 258, 192	74.37
5	••	166, 099, 258, 192, 118	78.85
	••	166, 097, 258, 192, 118	79.17
	••	003, 097, 258, 192, 118	80.19
	••	003, 097, 258, 190, 118	81.81
6	••	003, 097, 258, 190, 118, 218	85.73
7	••	003, 097, 258, 190, 118, 218, 155	87.83
	••	003, 095, 258, 190, 118, 218, 155	88.73
	••	052, 095, 258, 190, 118, 218, 155	88.94

B. CALL/CZSR System Performance Criteria

Vehicle Locations:	045, 052, 095, 258, 190, 118, 218, 155
System Mean Response Time (Min.):	4.692
Workload Range:	19.54
Cumulative Distribution of Response:	
5 Minutes:	.4883
10 Minutes:	.9668
15 Minutes:	.9967
Likelihood of All EMS Vehicles Idle:	.3862

Figure 5.7

GAS Solution for Fixed Site 45–
All Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.12

GAS Solution for Fixed Site 45–
16 Zones Considered

A. GAS Iterations

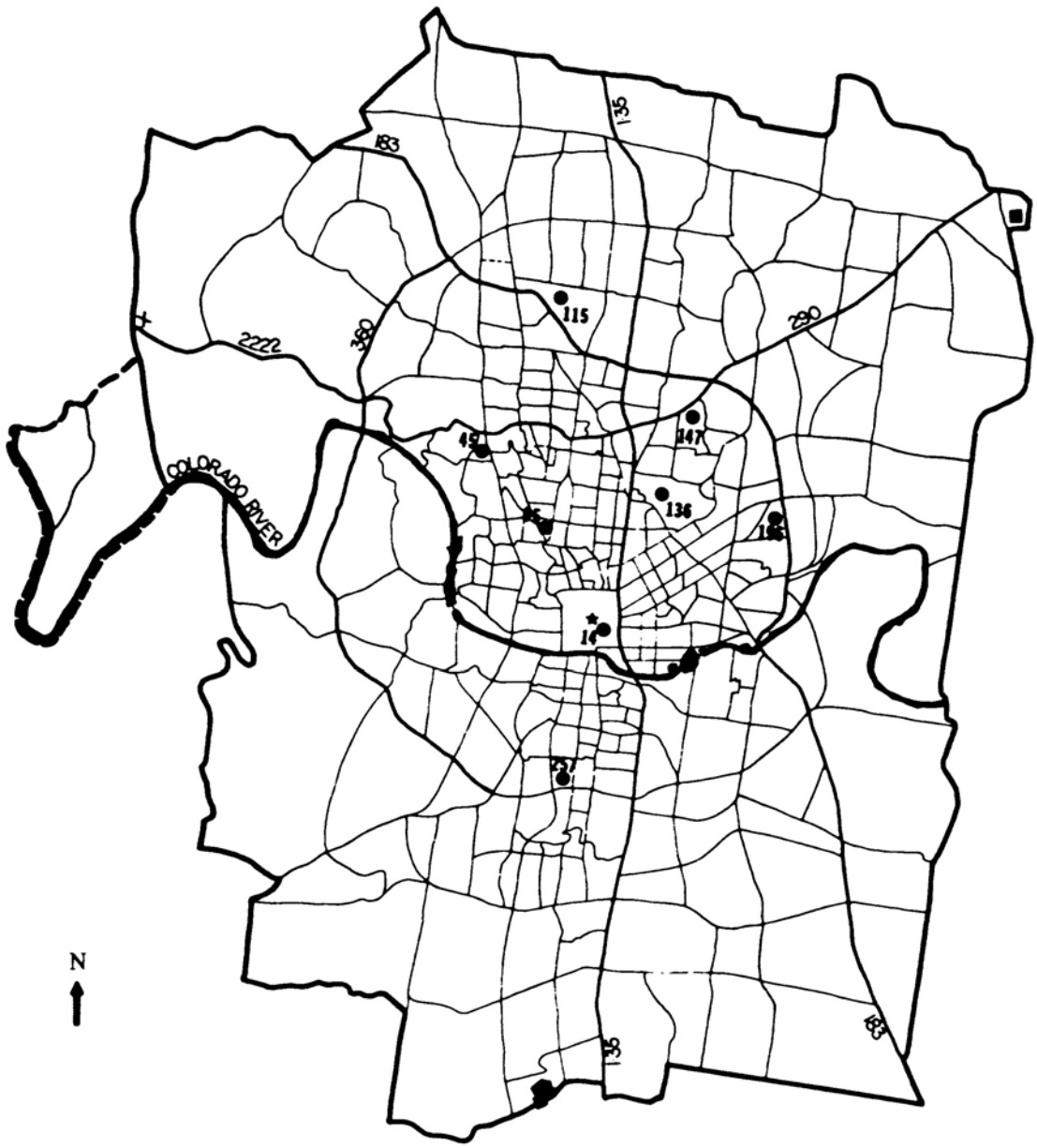
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	45		5.54
1	••	014	41.10
2	••	014, 088	51.67
3	••	014, 088, 257	60.42
4	••	014, 088, 257, 115	66.89
	••	014, 065, 257, 115	67.74
5	••	014, 065, 257, 115, 136	73.56
6	••	014, 065, 257, 115, 136, 196	77.60
7	••	014, 065, 257, 115, 136, 196, 147	80.33

B. CALL/CZSR System Performance Criteria

System Mean Response Time:	5.029
Workload Range:	17.38
Cumulative Distribution of Response:	
5 Minutes:	.4566
10 Minutes:	.9418
15 Minutes:	.9952
Likelihood of All EMS Vehicles Idle:	.3827

Figure 5.8

GAS Solution for Fixed Site 45–
16 Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.13

Comparison of Gas Solutions for Fixed Site 257

GAS Solution	*Sites*	*Percent Calls Covered in 5 Min. (GAS)*	*System Mean Response Time (CALL/CZSR)*	*Workload Range (CALL/CZSR)*	*Cumulative Distribution of Response (CALL/CZSR)*			*Likelihood of All Vehicles Idle (CALL/CZSR)*
					5 Min.	*10 Min.*	*15 Min.*	
Unconstrained	007, 143, 258, 190, 111, 037, 222, 158	89.96	4.439	23.72	.5593	.9633	.9974	.4861
Fixed Site 257								
All Zones Considered	257, 015, 143, 190, 111, 041, 222, 158	89.29	4.621	20.25	.5250	.9562	.9971	.3869
16 Zones Considered	257, 014, 115, 136, 065, 196, 048, 147	80.80	5.027	18.94	.4579	.9418	.9947	.3819

Table 5.14

**GAS Solution for Fixed Site 257–
All Zones Considered**

A. GAS Iterations

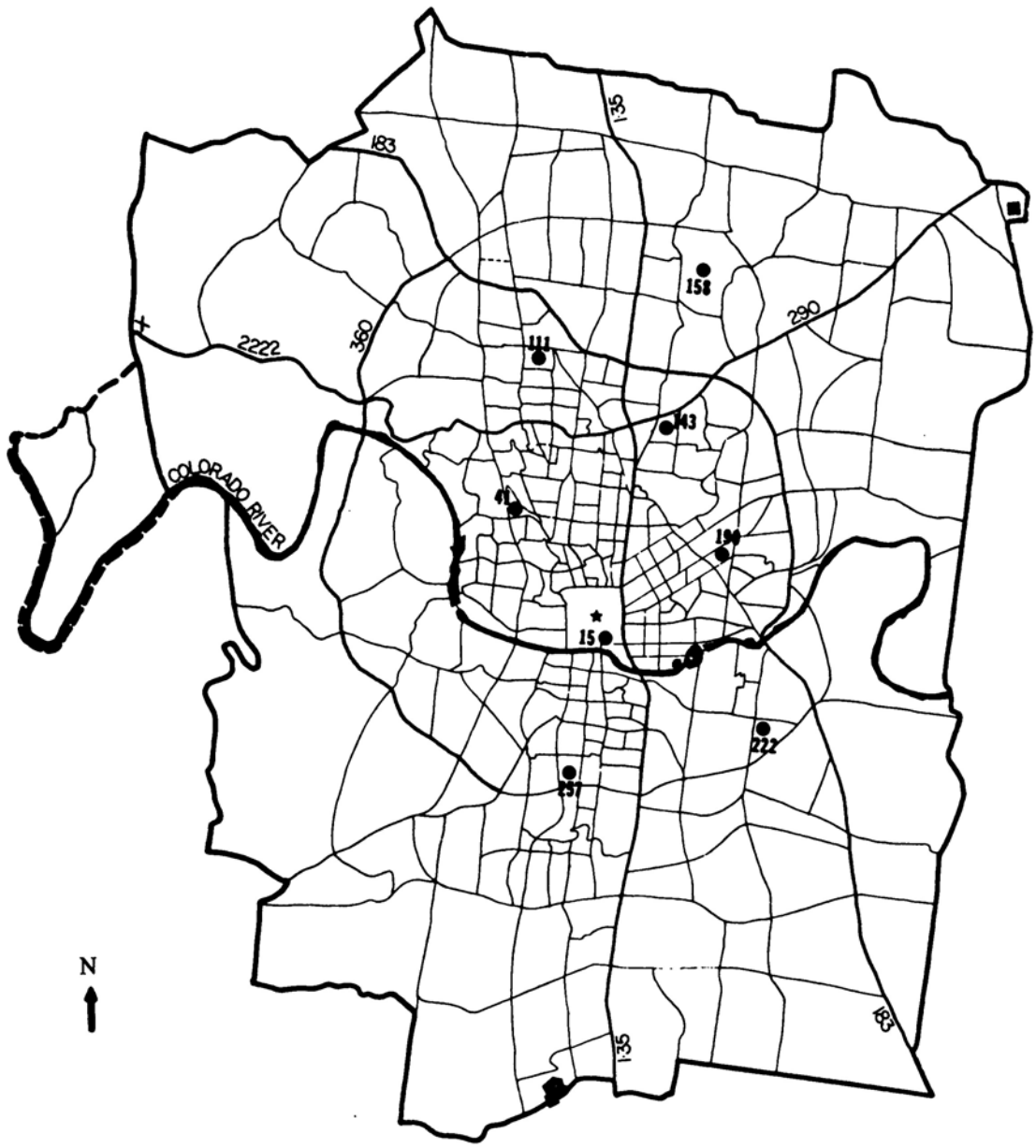
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	257		13.14
1	••	166	48.46
2	••	166, 099	65.92
3	••	166, 099, 192	71.60
4	••	166, 099, 192, 118	76.08
5	••	166, 099, 192, 118, 037	80.14
	••	007, 099, 192, 118, 037	80.79
	••	007, 097, 192, 118, 037	81.53
	••	007, 097, 190, 118, 037	81.69
	••	007, 097, 190, 111, 037	82.71
	••	007, 097, 190, 111, 041	82.89
	••	015, 097, 190, 111, 041	84.69
	••	015, 143, 190, 111, 041	84.69
6	••	015, 143, 190, 111, 041, 222	87.28
7	••	015, 143, 190, 111, 041, 222, 158	89.29

B. CALL/CZSR System Performance Criteria

Vehicle Locations:	257, 015, 143, 190, 111, 041, 222, 158
System Mean Response Time (Min.):	4.621
Workload Range:	20.25
Cumulative Distribution of Response:	
5 Minutes:	.5250
10 Minutes:	.9562
15 Minutes:	.9971
Likelihood of All EMS Vehicles Idle:	.3869

Figure 5.9

GAS Solution for Fixed Site 257–
All Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.15

GAS Solution for Fixed Site 257
16 Zones Considered

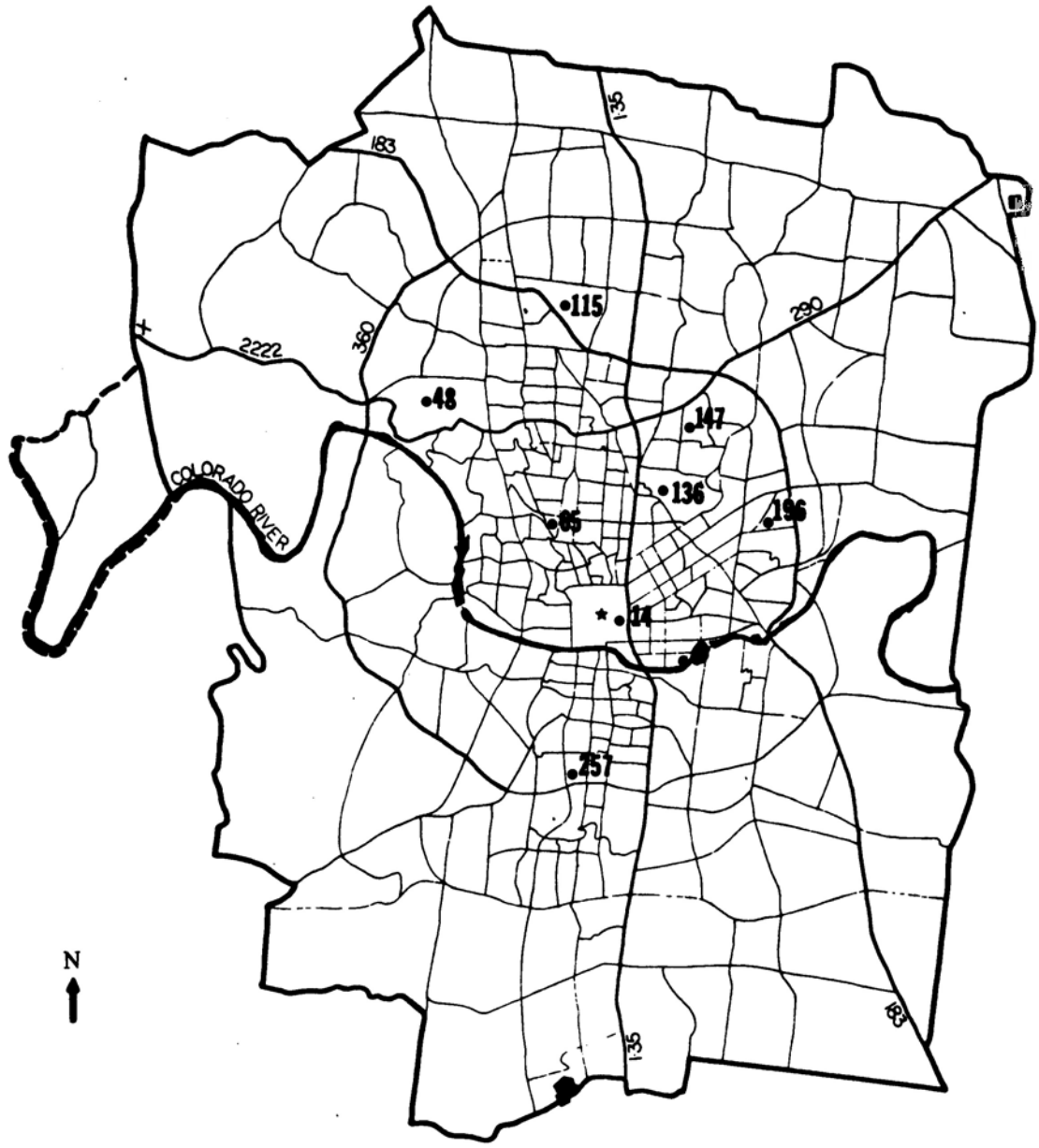
A. GAS Iterations

Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	257		13.14
1	"	014,	44.40
2	"	014, 099	62.18
3	"	014, 099, 136	67.81
4	"	014, 099, 136, 065	72.02
	"	014, 115, 136, 065	72.43
5	"	014, 115, 136, 065, 196	76.47
6	"	014, 115, 136, 065, 196, 099	79.34
7	"	014, 115, 136, 065, 196, 099, 147	80.74
		014, 115, 136, 065, 196, 048, 147	80.80

B. CALL/CZSR System Performance Criteria

System Mean Response Time:	5.027
Workload Range:	18.94
Cumulative Distribution of Response:	
5 Minutes:	.4579
10 Minutes:	.9418
15 Minutes:	.9947
Likelihood of ALL EMS Vehicles Idle:	.3819

Figure 5.10
GAS Solution for Fixed Site 257–
16 Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.16

Comparison of GAS Solutions for Fixed Site 44

GAS Solution	*Sites*	*Percent Calls Covered in 5 Min. (GAS)*	*System Mean Response Time (CALL/CZSR)*	*Workload Range (CALL/CZSR)*	*Cumulative Distribution of Response (CALL/CZSR)*			*Likelihood of All Vehicles Idle (CALL/CZSR)*
					5 Min.	*10 Min.*	*15 Min.*	
Unconstrained	007, 143, 258, 190, 111, 037, 222, 158	89.96	4.439	23.72	.5593	.9633	.9974	.4861
Fixed Site 44								
All Zones Considered	044, 010, 111, 258, 099, 155, 222, 190	88.16	4.527	15.91	.5669	.9614	.9967	.3878
16 Zones Considered	044, 014, 115, 257, 136, 059, 196, 147	79.80	4.829	17.60	.4865	.9493	.9960	.3848

Table 5.17

**GAS Solution for Fixed Site 44–
All Zones Considered**

A. GAS Iterations

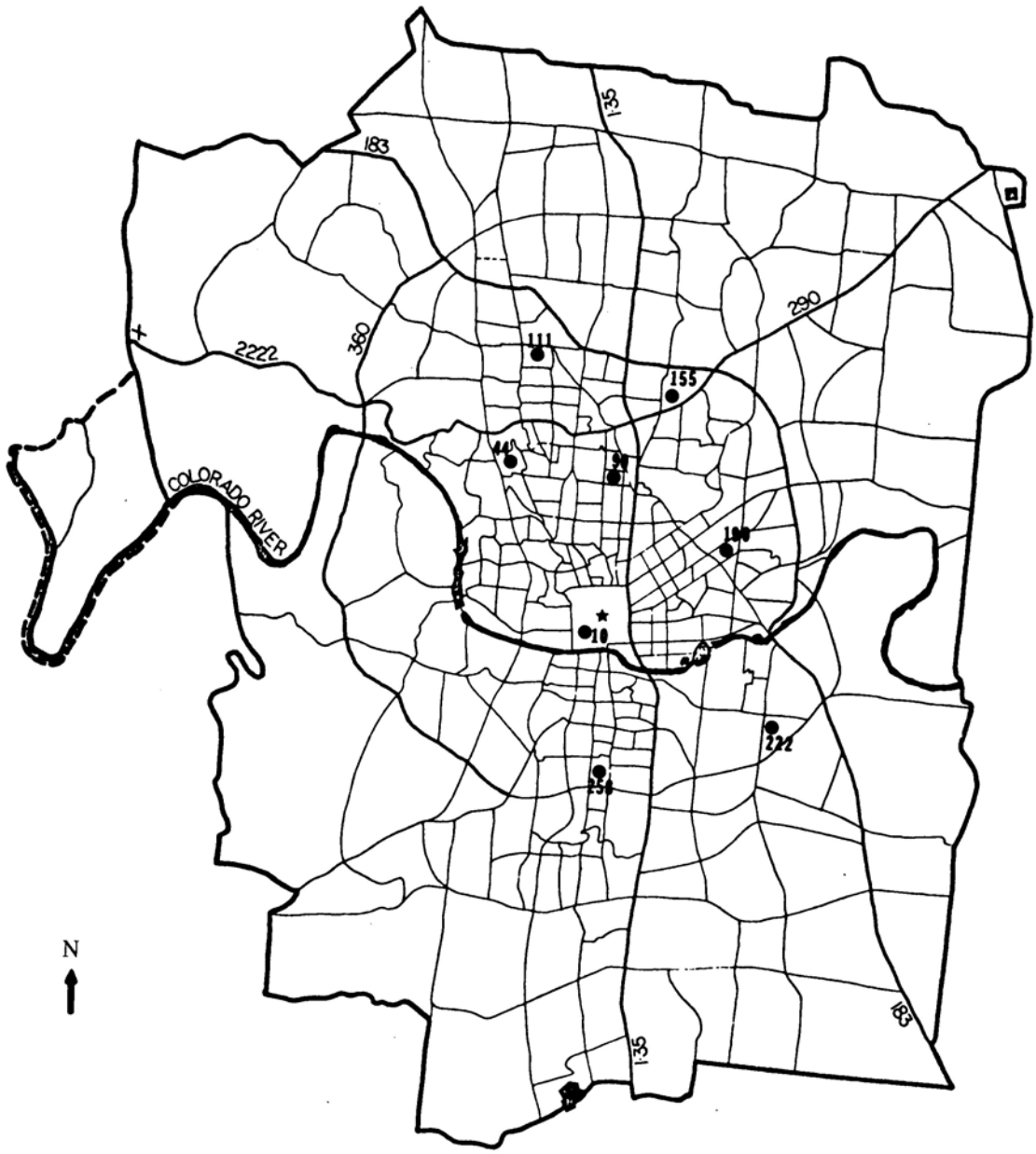
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	44		7.94
1	••	009	45.07
2	••	009, 097	57.65
3	••	009, 097, 258	66.82
	••	166, 097, 258	68.53
	••	166, 112, 258	68.88
4	••	166, 112, 258, 092	74.69
	••	007, 112, 258, 092	74.88
	••	007, 111, 258, 092	76.15
5	••	007, 111, 258, 092, 155	80.10
6	••	007, 111, 258, 092, 155, 222	83.91
7	••	007, 111, 258, 092, 155, 222, 190	87.14
	••	010, 111, 258, 092, 155, 222, 190	88.16
	••	010, 111, 258, 090, 155, 222, 190	88.16

B. CALL/CZSR System Performance Criteria

Vehicle Locations:	044, 010, 111, 258, 090, 155, 222, 190
System Mean Response Time (Min.):	4.527
Workload Range:	15.91
Cumulative Distribution of Response:	
5 Minutes:	.5669
10 Minutes:	.9614
15 Minutes:	.9967
Likelihood of All EMS Vehicles Idle:	.3878

Figure 5.11

GAS Solution for Fixed Site 44–
All Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.18

**GAS Solution for Fixed Site 44–
16 Zones Considered**

A. GAS Iterations

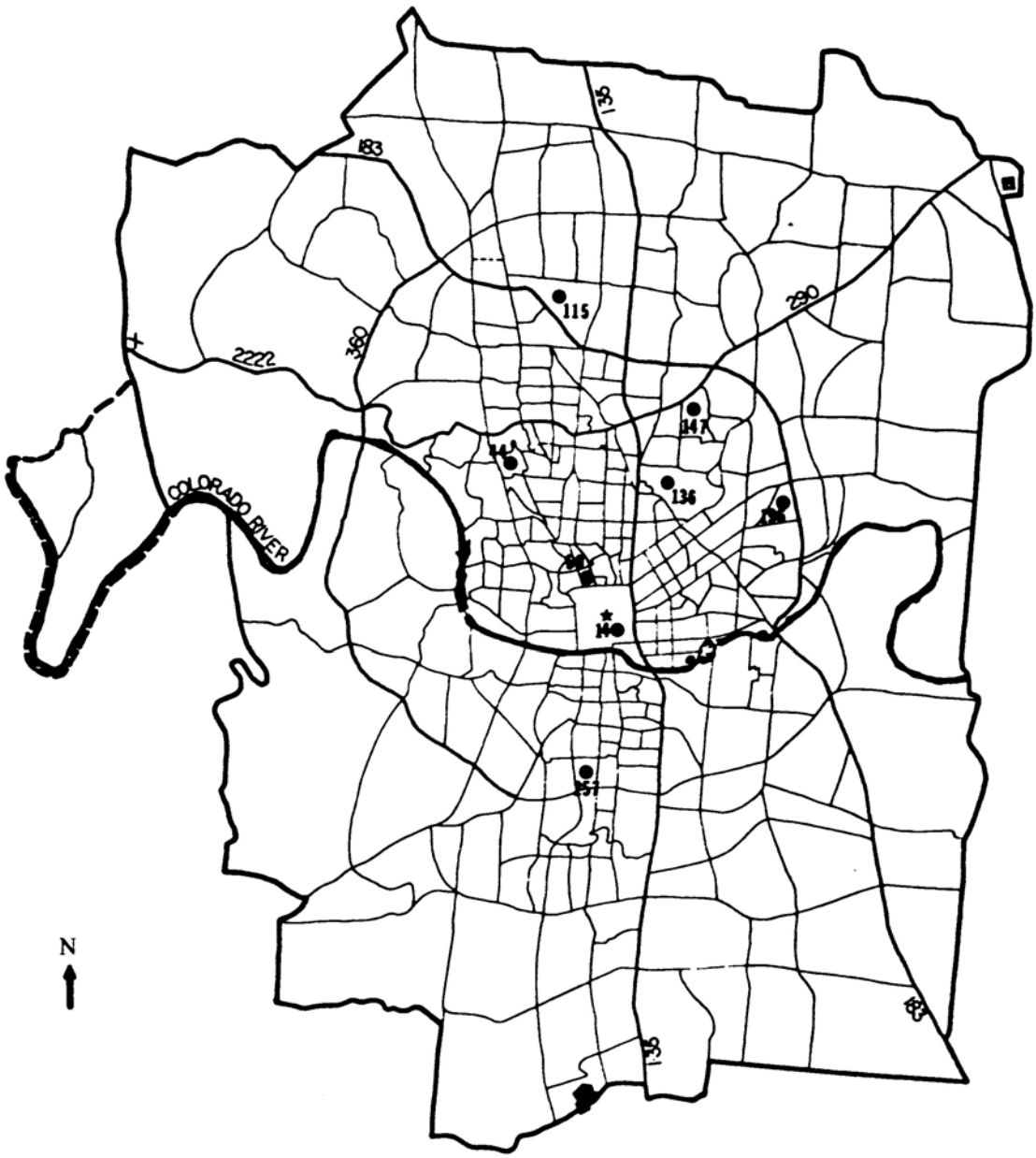
Iteration	*Fixed Sites*	*Additional Sites Selected*	*Percent of Calls Covered in 5 Min.*
Initial	44		7.94
1	••	014	43.50
2	••	014, 115	53.47
3	••	014, 115, 257	62.23
4	••	014, 115, 257, 136	68.51
5	••	014, 115, 257, 136, 059	73.03
6	••	014, 115, 257, 136, 059, 196	77.07
7	••	014, 115, 257, 136, 059, 196, 147	79.80

B. CALL/CZSR System Performance Criteria

System Mean Response Time:	4.829
Workload Range:	17.60
Cumulative Distribution of Response:	
5 Minutes:	.4865
10 Minutes:	.9493
15 Minutes:	.9960
Likelihood of All EMS Vehicles Idle:	.3848

Figure 5.12

GAS Solution for Fixed Site 44–
16 Zones Considered



Numbers indicate serial zones selected by GAS.

Table 5.19

Four-Site GAS Solutions for Transport/Nontransport Calls

A. GAS Iterations - Transport Calls as Demand Data

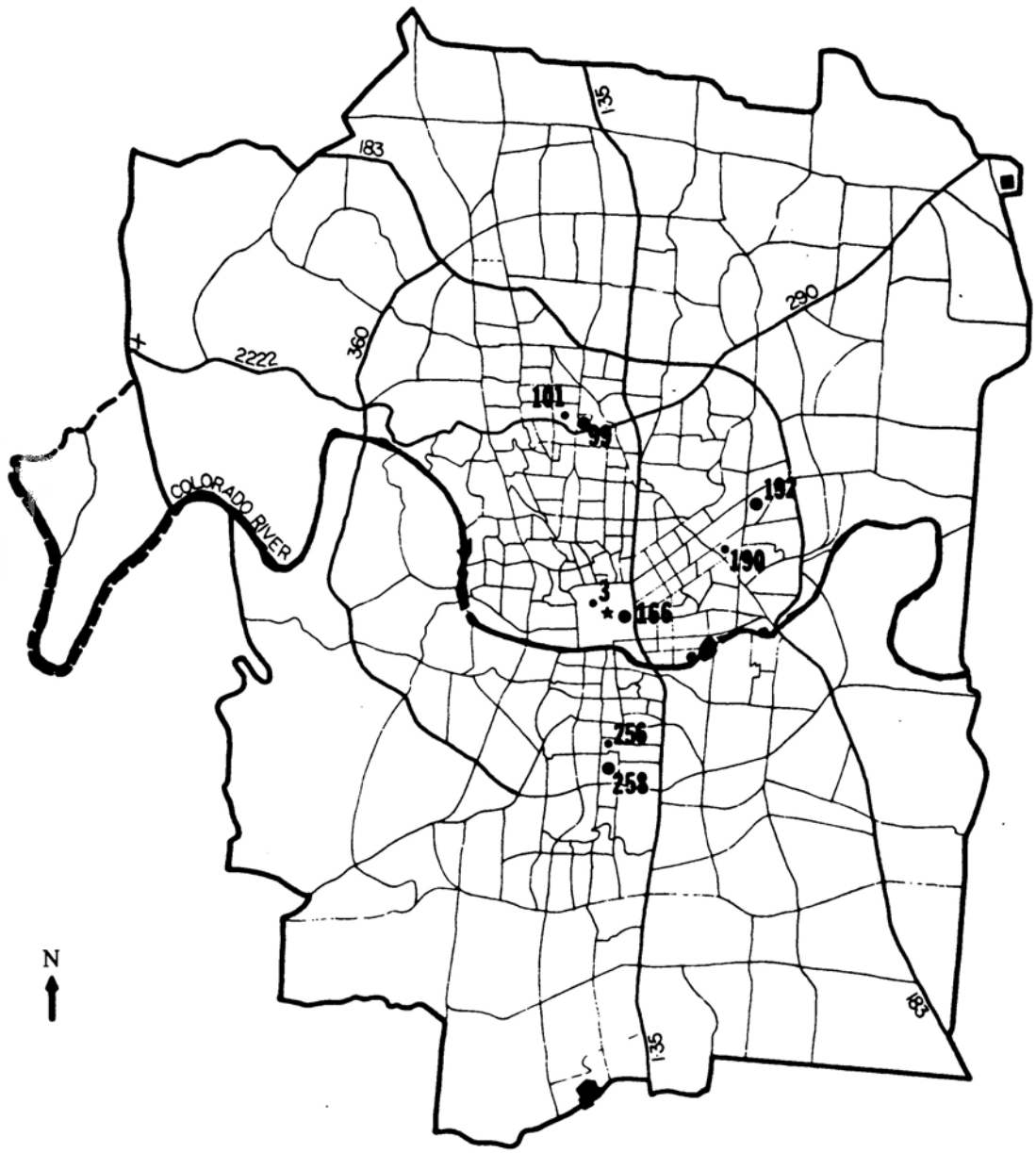
Iteration	*Sites Selected*	*Percent of Calls Covered in 5 Min.*
1	166	37.92
2	166, 099	54.97
3	166, 099, 258	66.66
4	166, 099, 258, 192	72.23

B. GAS Iterations - Nontransport Calls as Demand Data

Iteration		
1	009	36.64
2	009, 099	54.33
3	009, 099, 231	64.48
	055, 099, 231	64.94
	055, 099, 256	67.04
4	055, 099, 256, 190	74.04
	052, 099, 256, 190	74.64
	052, 101, 256, 190	74.79
	003, 101, 256, 190	75.09

Figure 5.13

Sites Selected by GAS Using Transport and Nontransport Calls as Demand Data



● Transport
• Nontransport

Numbers indicate serial zones selected by GAS.

Table 5.20

Four-Site GAS Solutions for Critical/Noncritical Calls

A. GAS Iterations - Critical Calls as Demand Data

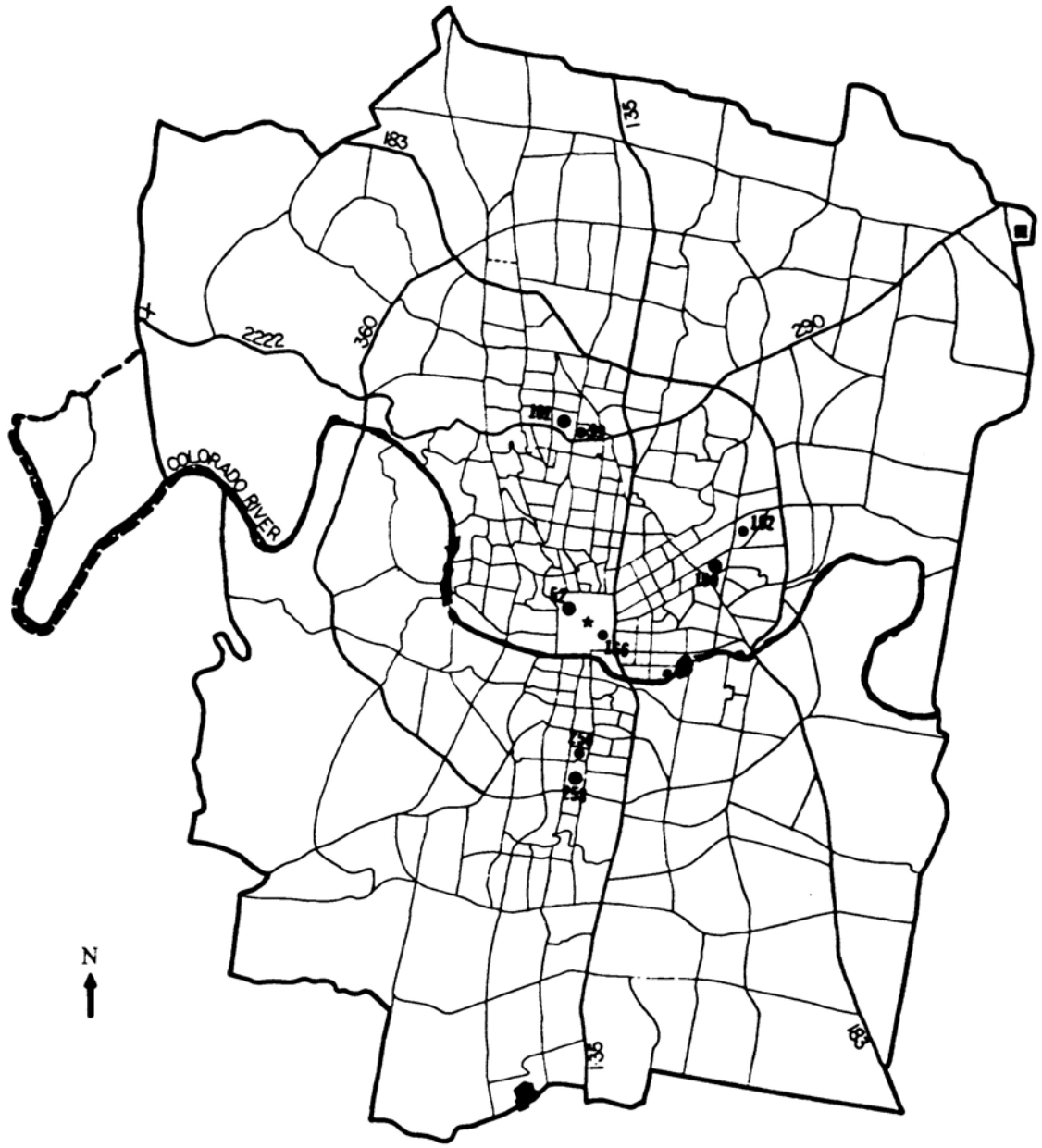
Iteration	*Sites Selected*	*Percent of Calls Covered in 5 Min.*
1	009	39.05
2	009, 101	55.11
3	009, 101, 190	65.14
	010, 101, 190	65.63
4	010, 101, 190, 258	74.20
	052, 101, 190, 258	74.78

B. GAS Iterations - Noncritical Calls as Demand Data

Iteration	*Sites Selected*	*Percent of Calls Covered in 5 Min.*
1	166	36.81
2	166, 099	54.24
3	166, 099, 256	66.59
4	166, 099, 256, 192	72.16

Figure 5.14

Sites Selected by GAS Using Critical and Noncritical Calls as Demand Data



● Critical
• Noncritical

Numbers indicate serial zones selected by GAS.

Table 5.21

Definitions of Terms

Term	*Program*	*Definition*
Unconstrained run	GAS	Program in which all Austin serial zones may be considered as potential station sites.
Fixed sites	GAS	Number of serial zones in which initial station sites are designated in site selection process.
Percent of calls covered in 5 minutes	GAS	Percent of calls which could be reached within 5 minutes by nearest ambulance.
System mean response time	CALL/CZSR	Estimate of response time for entire system taking into account the likelihood of some ambulances being busy at times of calls.*
Workload range	CALL/CZSR	Difference between percent of total calls nearest the busiest ambulance and the percent of total calls nearest the least busy ambulance.
Cumulative distribution of response	CALL/CZSR	Proportion of calls which could be served within 5, 10, and 15 minutes, based on curve depicting response times for approximately 1,200 simulated calls.
Likelihood of all vehicles idle	CALL/CZSR	Percent of the time all vehicles are expected to be at EMS stations.

*Based on a sample of approximately 1,000 simulated calls.

Appendices

Appendix A consists of two memoranda from Bill Bulloch, Director of the EMS Department, to the Quality Assurance Team members. The memoranda summarize the study results and describe the proposed EMS vehicle station locations. The proposal was approved unanimously by the Quality Assurance Team.

After review by the Planning Commission of the City of Austin, this proposal was submitted by Assistant City Manager Andrea Beatty to the Austin City Council. Her statement of transmittal is Appendix B. The Council unanimously adopted the plan.

A forthcoming LBJ School report (1) will provide additional details on the process of the EMS study, from problem formulation to plan implementation. That report also describes how the results reported in this volume were used as a basis for selecting the EMS station locations.

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(1) Emergency Medical Services Policy Research Project, *A Plan for Emergency Medical Vehicle Deployment in Austin, Texas* (Austin, Texas: LBJ School of Public Affairs, The University of Texas at Austin, forthcoming in 1981).

Appendix A

MEMORANDUM

January 8, 1980

TO: Emergency Medical Services
Quality Assurance Team Members

FROM: Bill Bulloch, Director
Emergency Medical Services Department

SUBJECT: Status of Station Location Study

The LBJ School of Public Affairs has completed their station location analysis, and nine (9) locations (Attachment 1) have been identified, as follows:

Primary Sites

1. South 1st/Ben White Boulevard
2. Koenig/North Lamar
3. East 12th/Springdale Road
4. Downtown (adjacent to I.H. 35)

Secondary Sites

5. Seton Hospital Area
6. Burnet Road/U.S. 183
7. Riverside Drive/Pleasant Valley Road
8. U.S. 290/Berkman Drive
9. East Rundberg Lane/Cameron Road

In addition, I am recommending that two (2) additional sites be considered due to growth, response time, and changing call volume patterns:

1. William Cannon Drive/Manchaca Road
2. U.S. 183/Duval Road

While analyzing these locations with an eye toward the operation of the tiered system, there appeared to be a need to consider additional location alternatives in the north-central area. A review of transport data (Attachment 2) for the last fiscal year reveals that 44% (3,030 out of 6,893) of all EMS transports to a medical facility were made by Medics 3 and 4, operating in the central area of the City. The predominance of activity in this area is expected to continue.

Because of this, an alternative to the site in the Seton Hospital area is recommended. Instead of placing one (1) unit in this location, it is recommended that two (2) units be used, one (1) downtown, and one (1) in the vicinity of MoPac Boulevard and Northland Drive. This arrangement will provide better coverage for the central area with the tiered system, and also provide needed coverage in the north-central area, taking advantage of the major transportation facilities, MoPac Boulevard and Northland Drive.

The results of the Station Location Study, coupled with the two (2) staff recommendations in the developing areas and the one (1) alternative in the north-central area, provide the following proposed station locations (Attachment 3) to be used in conducting detailed site analysis:

Priority	*Location*	*Type of Unit*
1.	South 1st/Ben White Boulevard	Medic
2.	Koenig/North Lamar	Medic
3.	East 12th/Springdale Road	Aid
4./5.	Downtown (two locations)	Medic/Aid
6.	MoPac/Northland Drive	Aid
7.	Burnet Road/U.S. 183	Medic
8.	Manchaca Road/William Cannon Drive	Aid
9.	U.S. 183/Duval Road	Aid
10.	Riverside Drive/Pleasant Valley Road	Aid
11.	U.S. 290/Berkman Drive	Aid
12.	East Rundberg Lane/Cameron Road	Aid

The staff is now involved in analyzing particular sites that will satisfy each of the previously mentioned locations. This alternative analysis is based upon three (3) major policies:

1. Council Goals and Objectives with respect to Joint Use (Attachment 4);
2. Consistency with the Five Year Annexation Plan; and,
3. The Proposed Roadway Plan (Attachment 3).

The present analysis is restricted to City facilities only, consistent with the Joint Use Policy, as seen in Attachment 5. It is anticipated that this analysis will be completed within thirty (30) days, and site specific recommendations including general costs, modifications required, and timing of implementation of each site will be developed.

Next month you will be asked to review the specific sites recommended and their associated development costs, then make recommendations to the Planning Commission concerning them. For your convenience, I have attached previous Quality Assurance Team discussions and recommendations concerning proposed station locations and funding, and the approved EMS Capital Improvements Program (Attachment 6).

Beside each location is also noted the type of unit that is proposed for operation. Also, each of the two (2) supervisors per shift will operate fully equipped advanced life support vehicles, without transport capability. One (1) supervisor will provide backup to the system north-central and north, and the other will provide backup to the system central and south.

Also, with respect to the implementation and expansion of the tiered system, each general location is numbered in order of priority, with the first eight priorities being proposed as EMS station locations this year. The remaining four (4) locations are proposed to be implemented over the next five (5) plus years as actual call volume and system operations dictate.

Please let me know if I can assist you in any way in the next thirty (30) days as you review this information.

(*original signed by Bill Bulloch*)
Bill Bulloch, Director
Emergency Medical Services Department

BB:kj
Attachment

Attachment 1

LBJ School
Station Location Study Results

Primary Sites

1. South 1st/Ben White Boulevard
2. Koenig/North Lamar
3. East 12th/Springdale Road
4. Downtown (adjacent to I.H. 35)

Secondary Sites

5. Seton Hospital Area
6. Burnet Road/U.S. 183
7. Riverside Drive/Pleasant Valley Road
8. U.S. 290/Berkman Drive
9. East Rundberg Lane/Cameron Road

Emergency Medical Services Department

STATION LOCATION STUDY

Proposed Projects

Priority	*Location*	*Proposed Sites*	*Type of Unit*	*Timing*	*Cost*	*Comment*
1	South First/Ben White Boulevard	Service Center South 1st/South Center	Medic	FY 79-80	$322,000	New Station
2	Koenig Lane/North Lamar	Service Center Koenig/Lamar	Medic	FY 80-81	$322,000	New Station
3	East 12th Street/Springdale Road	Fire Station 5 1201 Webberville Road	Aid	FY 79-80		
4	Downtown	Fire Station 1 401 East 5th Street	Medic	FY 79-80		
5	Downtown	Fire Station 2 505 West MLK	Aid	FY 79-80	$110,000	Modifications to existing Fire Stations
6	MoPac/Northland Drive	Fire Station 19 5211 Balcones	Aid	FY 79-80		
7	Burnet Road/U.S. 183	Fire Station 8 8989 Research Boulevard	Medic	FY 79-80		
8	Manchaca Road/William Cannon Dr.	Fire Station 20 6601 Manchaca Road	Aid	FY 79-80		
9	U.S. 183/Duval Road	Fire Station 25 5228 Duval Road	Aid	FY 80-81	$100,000	Add Bay
10	Riverside Drive/Pleasant Valley Road	Fire Station 22 5209 Riverside Drive	Aid	FY 83-84	$100,000	Add Bay
11	U.S. 290/Berkman Drive	Fire Station 18 6311 Berkman	Aid	Future	-	
12	East Rundberg Lane/Cameron Road	Fire Station 23 1330 East Rundberg Lane	Aid	Future	-	

City of Austin
Emergency Medical Services Department
Station Location Study

Initial Runs

Run No.	*Response Time*	*EMS Demand*	*Sites Selected*
1	4 min.	Expected call frequency	166, 255, 100, 76, 189, 116, 264, 26
2	5 min.	Expected call frequency	9, 99, 190, 258, 118, 41, 155, 222
3	6 min.	Expected call frequency	166, 99, 231, 268, 200, 155, 38, 123
4	7 min.	Expected call frequency	54, 113, 231, 200, 300, 264, 155, 37
5	8 min.	Expected call frequency	54, 112, 231, 268, 196, 265, 28, 269
6	5 min.	Total population	9, 99, 260, 140, 155, 267, 38, 218
7	5 min.	Black population	190, 155, 15, 149, 219, 258, 78, 225
8	5 min.	Chicano population	18, 219, 260, 135, 114, 190, 86, 215
9	5 min.	Over 63 population	166, 99, 41, 258, 192, 158, 143, 267
10	5 min.	Critical calls	9, 99, 190, 258, 37, 118, 146, 222
11	5 min.	Transport calls	166, 99, 258, 192, 37, 118, 219, 155
12	5 min.	Expected call frequency	7, 143, 258, 190, 111, 37, 222, 158
13	5 min.	Transport calls	7, 93, 258, 192, 37, 222, 111, 158
14	5 min.	Expected call frequency	166, 99, 258, 192
15	5 min.	Transport calls	166, 99, 258, 192
16	5 min.	Critical calls	52, 101, 190, 258
17	5 min.	Noncritical calls	99, 166, 192, 256

Special Runs

1	5 min.	Expected call frequency	59, 196, 175, 111, 258, 143, 37, 139
2	5 min.	Expected call frequency	14, 258, 143, 190, 37, 222, 111, 158
3	5 min.	Expected call frequency	44, 10, 111, 258, 90, 155, 222, 190
4	5 min.	Expected call frequency	45, 52, 95, 258, 190, 118, 218, 155

Note: Underlined Serial Zones were fixed sites.

City of Austin
Emergency Medical Services Department
Station Location Study

Frequency of Occurrence of Potential Sites

13	258
12	–
11	–
10	–
9	99, 190
8	–
7	166, 155, 37
6	222, 192
5	111
4	118, 158, 143
3	9, 231, 219
2	264, 268, 200, 38, 54, 260, 267, 218, 7, 52, 41
1	255, 100, 76, 189, 116, 26, 123, 113, 300, 112, 196, 255, 28, 269, 140, 15, 149, 78, 225, 18, 135, 114, 86, 215, 146, 93, 101, 256, 175, 139, 10, 90, 95

MEMORANDUM

February 15, 1980

TO: Emergency Medical Services
Quality Assurance Team Members

FROM: Bill Bulloch, Director
Emergency Medical Services Department

SUBJECT: EMS Station Location Study/Joint Use

Last month I briefed you on the EMS Station Location Study, and told you that I would return this month with specific proposals for sites that would satisfy each of the proposed EMS station locations identified. Based on City Council Goals and Objectives concerning joint use, City facilities only were reviewed.

Attached (Attachment 1) you will find information which details implementation of the proposed twelve EMS station locations by modifying ten (10) existing fire stations, and constructing two (2) new free-standing EMS stations on existing City property.

Based upon this information, I am recommending the attached (Attachment 2) funding proposals in order to implement these projects. With these funding proposals, the only current projects that will require new bonding authority will be the EMS station at Koenig and Lamar, and the EMS office project.

You are being requested to consider the following items:

1. Recommendation to the Planning Commission and City Council on the proposed Station Location Study;

2. Recommendation to the Planning Commission and City Council concerning the specific sites, projects, and proposed funding for these projects; and,

3. Recommendation concerning priorities for implementation of each of these station locations.

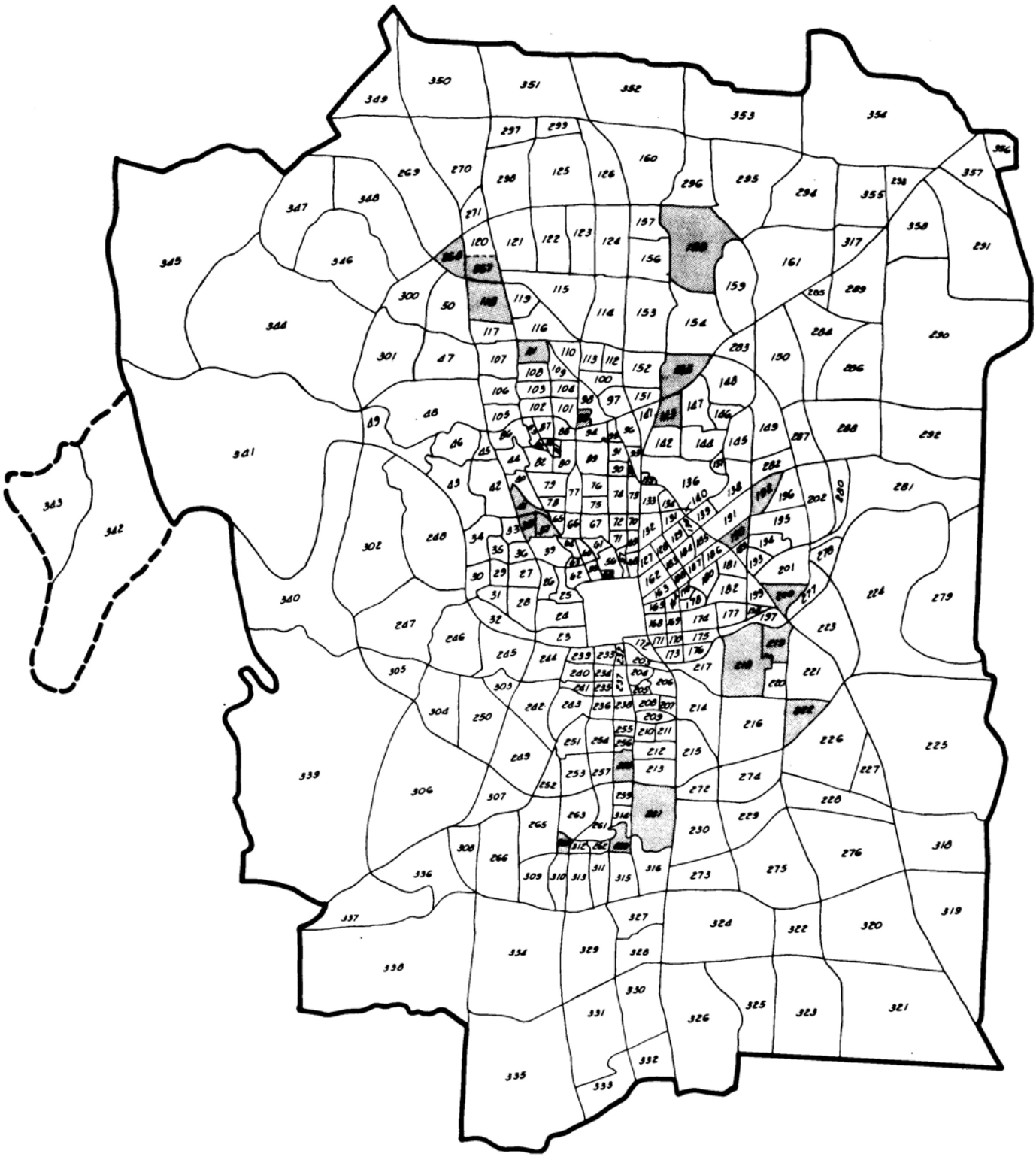
Please let me know if I can provide you with additional information.

(*original signed by Bill Bulloch*)
Bill Bulloch, Director
Emergency Medical Services Department

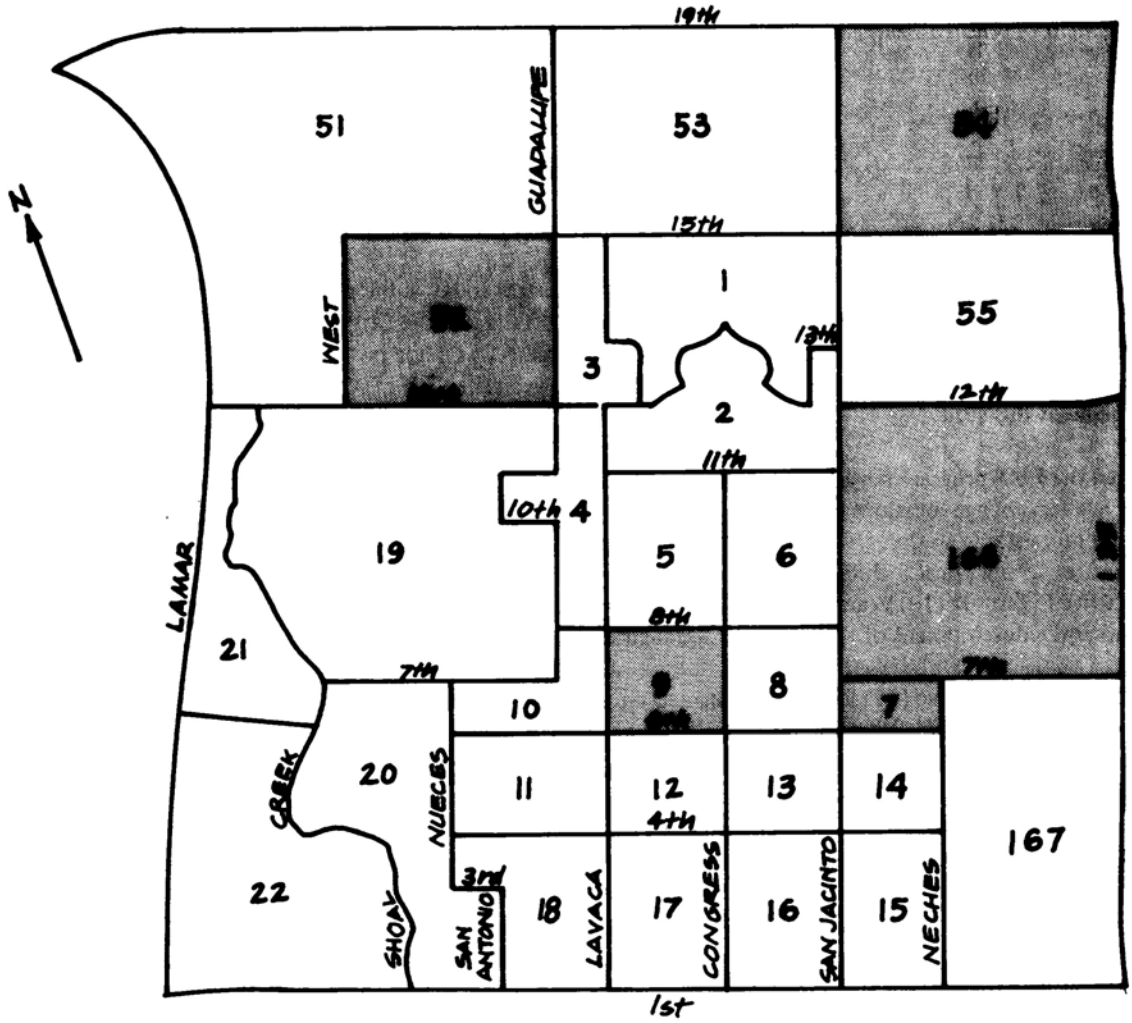
BB:kj

Attachments

Serial Zones Selected as Potential Sites in Austin



Serial Zones Selected as Potential Sites in Central Austin



Appendix B

Statement of Andrea Beatty, Assistant City Manager of Austin, to Austin City Council, March 27, 1980

Emergency Medical Services
Station Location Study
Introduction

The Station Location Study that you are being asked to review today is the result of almost two (2) years of cooperative study between the LBJ School of Public Affairs and the City of Austin, Emergency Medical Services and Fire Departments. This working relationship was made possible by the City Council in the summer of 1978 when you authorized a contract between the City of Austin and the LBJ School to implement this study.

When the EMS program began in 1976, the most appropriate stations were rented apartments, due to the need to change locations as system operations and experience dictated. Now it has become apparent that a more stable station arrangement is appropriate. This study has enabled the City of Austin to use quantitative analytical techniques to identify the best possible locations for EMS units now, and for the next five (5) to ten (10) years. The staff has also been able to respond directly to Council policy concerning the development of the City, and to maximize the use of joint use facilities where possible.

Ten (10) of the twelve (12) locations identified are joint use facilities, specifically existing Fire Stations, and all twelve (12) proposals utilize existing City property. This approach will save the City in excess of 2.8 million dollars by eliminating the need to construct separate stations at all twelve (12) sites identified.

One of the most critical elements of implementation of the study is the recognition of the needs of individual employees of the EMS and Fire Departments who actually deliver services to the public on a day-to-day, week-to-week, year-to-year basis. Due to the cooperation and open-mindedness of EMS, Fire, and the Office of Facilities Planning and Construction, we will be able to make a smooth transition this summer when implementing additional joint use facilities, allocating appropriate sleeping and study space to both Fire and EMS personnel through the proposed modifications that you are being asked to fund.

We will be able to improve the delivery of emergency medical services, and maximize the use of existing City facilities.

Related Publications of the Lyndon B. Johnson School of Public Affairs

Analysis of Emergency Medical Services in Austin, Texas, Volume II: Analytical Methods (1980). A collection of user manuals for each of the computer programs used in the study. Project directed by David Eaton and Mark Daskin. 110 pp.

Location Techniques for Emergency Medical Service Vehicles, 4 vols. (1979). Reports from a project developing procedures for EMS system planning. Project directed by David Eaton.

Volume I: An Analytical Framework for Austin, Texas. Describes use of cartographics, optimization, and statistical analyses in developing EMS vehicle siting alternatives for Austin, Texas. 150 pp.

Volume II: Travel Time Data—Description and Assumptions. 396 pp.

Volume III: Emergency Medical Service Calls in Austin—Description and Assumptions. 187 pp.

Volume IV: Austin Population and Housing Data—Description and Assumptions. 60 pp.

For additional information write the Office of Publications, LBJ School of Public Affairs, University of Texas at Austin, Austin, Texas 78712.

ISBN: 0-89940-641-6 (Volume I)
ISBN: 0-89940-643-2 (2 volume set)