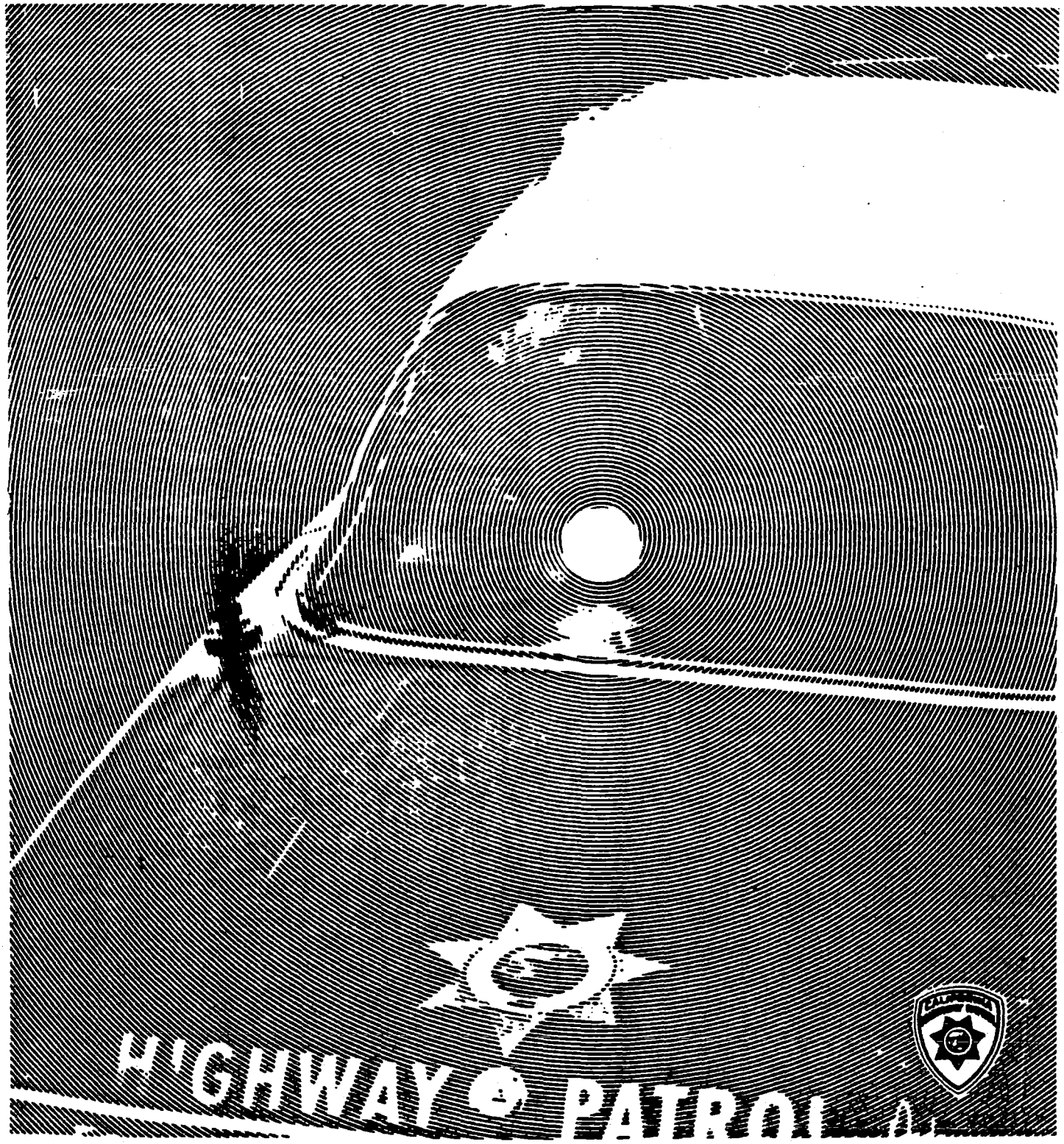
WARNING LIGHT STUDY



COMMISSIONER HAROLD W. SULLIVAN

JANUARY 1971

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WARNING LIGHT STUDY

A Study Of

The Effect On Driver Behavior

Of Operating Emergency Amber Lights

in cooperation with

California Division of Highways,
Department of Public Works

and

Department of Transportation
Federal Highway Administration
Bureau of Public Roads

JANUARY 1971

California Highway Patrol
Sacramento, California

REFERENCE: Warning Light Study, California Highway Patrol, August 1970, Research Project.

ABSTRACT: The study was conducted in cooperation with the California Division of Highways during the summer of 1969 to determine the effect of operating amber warning lights on driver behavior, with the main emphasis on traffic flow. Amber lights were operated on three types of vehicles; black and white enforcement, tow service truck, and Division of Highways Maintenance Pickup, for three levels of traffic volume. The amber light had little effect on traffic flow during the day. There was some slowing of traffic at night on the two lane, light volume road. The vehicle effect varied; the black and white vehicle had the greatest effect, the pickup the least effect. Experimental design, statistical methodology and analysis of findings are described in detail.

KEY WORDS: driver behavior, driver reaction, warning systems, emergency warning devices, lighting equipment, traffic flow pattern, traffic surveys, speed studies.

STATEMENT OF IMPLEMENTATION

The study was designed to investigate the effect on driver behavior of amber warning lights operated from emergency vehicles. The California Division of Highways participated in the study to determine the effect of specific vehicles on traffic flow. Although the study was designed to measure the effect of lighting, it was possible to infer the effect of specific vehicles by statistical analyses.

The effect of significant findings and possible recommendations are stated below:

Finding: Amber warning lighting has a small effect on multilane, lighted roadways.

Effect: Average speed reductions of one to two MPH occurred at night.

Action: None suggested unless the volume on the roadway nears capacity conditions. Then speed decreases of one to two MPH may reduce hourly volumes from 5-10% and could create hazardous, critical, traffic conditions.

Finding: Drivers react significantly to the warning light at night on unlighted, undivided, roadways.

Effect: Average speed reductions of 8-10 MPH occurred at night.

Action: Speed reductions reduce traffic flow. Level of volume and driver maneuverability would determine whether these conditions would be hazardous.

Finding: There is no significant difference in effect between the top mounted revolving light and deck light.

Effect: Speed reductions due to either light are comparable.

Action: It does not appear advantageous to replace existing deck mounted amber lighting equipment.

Finding: Drivers react noticeably to the presence of the black and white enforcement vehicle during the day.

Effect: Speeds were reduced from 2 1/2 - 6 1/2 MPH.

Action: Possible action depends on level of volume and the degree of reduced speed necessary for roadway safety.

Finding: During heavy volumes, traffic flow is constricted when drivers see either a black and white enforcement vehicle or tow service truck.

Effect: Maximum capacity is reached more quickly and queuing begins. Volumes were reduced 10% for the black and white vehicle, 7% for the tow truck.

Action: Enforcement and service stops probably should be made as inconspicuous and as safely as possible. Volume reductions of 7-10% for near capacity flow creates queuing which results in driver delay.

Finding: Drivers reaction to the maintenance pickup during heavy volumes is negligible.

Effect: Little or no change in traffic flow.

Action: None, unless vehicle restricts traffic flow, then usual precautions should be taken.

PREFACE

This study was conducted to determine the effect of Emergency warning lighting on driver behavior. The information and findings presented are based upon results of traffic surveys during July and August, 1969.

The study was designed and implemented by the California Highway Patrol, Operational Analysis Section, in cooperation with the Division of Highways, Traffic Department. Principal Investigator was Robert A. Bieber, Commander, Operational Analysis Section. Data were collected by personnel from the Division of Highways District III and Operational Planning and Analysis Division, California Highway Patrol, under the supervision of Dale Margroff. The data were reduced and analyzed by personnel from the Special Studies Unit, Operational Analysis Section; Lois Knobel, assisted by Elayne Henry and supervised by Anthony Moss, Jr.

The study would not have been possible without the advice and cooperation of Messrs. Moskowitz and Rooney of the Division of Highways Traffic Department. Also, an outstanding job was provided by Mr. Threlkeld and staff, of the Division of Highways District III during the data collection.

Although this study was a cooperative effort with the Division of Highways, this report reflects the views of the authors and not necessarily those of the Division of Highways.

This project was funded by the Bureau of Public Roads. The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Bureau of Public Roads or the California Department of Public Works, Division of Highways.

The study was done in cooperation with State of California, Business and Transportation Agency, Department of Public Works, Division of Highways.

and

U. S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads.

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SUMMARY OF FINDINGS

Generally, the amber light had no effect during the day. Although there was usually a nighttime effect, the magnitude was small (i.e., speed reductions of one to two miles per hour).

The amber light had the greatest effect at night on light volume roads. The greater the traffic volume, the less effect on speed.

The presence of test vehicles affected traffic to a greater extent than the amber light. However, the vehicle affect is primarily for daylight tests for all traffic volume levels.

Vehicles which suggest emergency conditions such as law enforcement and tow services have a greater affect than other vehicles (e.g., Division of Highways maintenance pickup).

There was a negligible difference between the top mounted revolving light and the deck mounted flashing amber light tested on the black and white enforcement vehicle.

INTRODUCTION

This study was conducted in response to a legislative inquiry regarding equiping highway patrol vehicles with roof mounted revolving amber lights. The effect upon traffic was uncertain and needed to be quantified so that the impact of such action could be anticipated. There are many factors to be considered, but this study primarily deals with the effect of the lights upon traffic flow.

The California Division of Highways also indicated an interest in studying the effect of the lighting on traffic flow and the project was undertaken as a cooperttive effort. Financing was provided by the Bureau of Public Roads.

Data were collected during seven surveys at four separate survey locations. Under various conditions, special vehicles with an amber warning light were placed by the side of the road. Speed, density, and volume of traffic were the basic data collected. The surveys were conducted during July and August, 1969, on State and Interstate Highways near Sacramento, California.

This publication is divided into two reports. The first report contains a brief, nontechnical description of the data collection and findings. The second report is a detailed version which is written in technical and statistical terms. A chapter on Bias explains study limitations and possible areas of bias. Tables and graphs, statistical methods, and special data adjustments are contained in the annexes.

THE PROBLEM

Amber warning lights are used on law enforcement and roadway service vehicles to alert drivers that an enforcement action or roadway service is in progress.

This study attempts to answer these questions:

1. Do drivers react to the amber light?
2. If they do, how do they react and to what extent?

The purpose of the study is to identify and measure changes in driver behavior which result from driver reaction to amber lighting on vehicles. Increases and decreases in speed and changes in traffic patterns are of particular interest. A desirable goal is to determine lighting systems which adequately warn motorists, cause minimal traffic disruptions, and maximize safety for these drivers involved. In addition, a brief evaluation of vehicle effect is included.

RELATIONSHIP BETWEEN MEASURES OF DRIVER BEHAVIOR

The driver and vehicle on the roadway are the controlling factors of the traffic pattern. There are several interrelated variables which form a traffic pattern; the number of vehicles using the road (volume), average speeds, concentration of vehicles (density), lane changes, and entrances to and exits from the roadway.

Although several variables collectively form the traffic pattern, the measures of volume, speed and density are those which generally reflect roadway conditions and driver behavioral changes. These variables are defined as follows:

Speed of vehicle - The speed in miles per hour (mph) at which a vehicle is traveling.

Traffic volume - The number of vehicles which pass by a specified point in a given period of time. This figure is then expanded to represent the number of vehicles per hour.

Traffic density - The number of vehicles occupying a section of the roadway at a given time. Density is a measure of vehicle concentration and is expressed as

vehicles per mile. It is possible to determine the average distance between successive vehicles from this measure.

Speed, volume, and density are interrelated and may be expressed mathematically.[1] This relationship holds if traffic is not constricted by other factors, i.e., control signals, blockage of lanes, and distraction by side of road. Any change in one variable may affect the others.

This affect is exemplified during peak hour commuter traffic. As the number of vehicles entering the roadway rapidly increases, speeds decrease and the distance between successive vehicles usually decreases.

The affect of a voluntary speed reduction on other traffic pattern variables is illustrated by the following example:

Several vehicles are traveling in one lane at comparable speeds. One driver arbitrarily reduces speed. Those following have these alternatives.

1. Change lanes and continue at same speed.
2. Maintain speed temporarily and reduce distance between successive vehicles.

[1] The mathematical formula is included and discussed in Annex C.

3. Decrease speed and either maintain or decrease distance between successive vehicles.

Regardless of the reaction by the following drivers, the traffic pattern changes.

CHART I

DESIGN OF SURVEY

Name of Site	Type of Road	Level of Volume*	Time of Day	Day of Week	Vehicles and Lights Tested
El Centro Road	2 lanes undivided	Light	Afternoon Evening Night	Sunday	Black and White Enforcement No light Deck light Revolving light Division of Highways Pickup No light Revolving light
Foothill Farms	4 lanes divided	Medium	Afternoon Evening Night	Sunday	Black and White Enforcement No light Deck light Revolving light Division of Highways Pickup No light Revolving light
Mace Boulevard	6 lanes divided	Medium	Afternoon Evening Night	Sunday	Black and White Enforcement No light Deck light Revolving light Division of Highways Pickup No light Revolving light
Elvas Avenue	6 lanes divided	Heavy (Peak hour traffic)	Afternoon	Weekdays	Black and White Enforcement No light Deck light Tow Service Truck No light Revolving light Division of Highways Pickup No light Revolving light No Test Vehicle

* Light Volume = 0 - 699 vehicles per hour by lane
Medium Volume = 700 - 1199 vehicles per hour by lane
Heavy Volume = 1200 + vehicles per hour by lane

Study Design

The study was designed to collect data measuring driver reactions to varied lighting test situations for light, medium, and heavy traffic volumes. Seven surveys were conducted at four test sites during the months of July and August, 1969.

The survey design for data collection is shown in Chart I. Site location, test situations, and data collection are explained in detail in the technical report.

Basically, the surveys were designed to answer the following questions:

1. How do drivers react when they see a black and white enforcement vehicle stopped by the side of the road
   a. Without a light operating?
   b. With the rear mounted deck light flashing?
   c. With the top mounted light revolving?

2. What effect does the Division of Highways pickup have
   a. Without a light operating?
   b. With the top mounted light revolving?

3. What effect does the tow service truck have (heavy volume, afternoon test only)

   a. Without a light operating?

   b. With the top mounted light revolving?

4. Do the reactions differ for light, medium, and heavy volume roads?

5. Is there a difference for day and night tests?

Data Collection

These data were collected:

Volumes per hour.

Average vehicle speeds in miles per hour.

Density in number of vehicles per mile.

Lane changes.

On and off ramp counts.

These methods were used to measure and collect the data:

Speeds - Radar devices and graphic recorders. The vehicle speeds were measured and automatically recorded at locations prior to, at, and after the test situation location.

Volumes - Vehicles were counted by traffic observers in two and one half minute time increments for the heavy volume site, Elvas Avenue. The counts were by five minute intervals elsewhere.

Density - The concentration of vehicles on the test roadway was recorded by aerial photography for five of the seven surveys. The photographs were taken at one to one and one-half minute intervals.

Lane changes, on and off ramp counts - These occurrences were observed and recorded by traffic observers.

Data Comparisons

The various data measurements were compared for two purposes;

1. To determine whether the measurements are reasonably accurate and
2. to analyze the results.

Since the variables of speed, volume, and density measures are interrelated, two were used to estimate the third. The estimated quantity was then compared with the measured figure. These cross checks were made on a random basis and the data measurements appeared reasonably accurate.

Analytic methods involved numerous data combinations and comparisons. The methods used are discussed in the section on analysis.

Data Analysis

Theoretically, an incident which occurs on or by a roadway may cause approaching drivers to modify their driving pattern. Various test situations were staged by the side of the selected roadways to determine driver reactions. If drivers reacted sufficiently, the result would be reflected in traffic pattern changes. These changes may involve differences in speed (increase or decrease), volumes (more or less vehicles per hour using the roadway), density (vehicles changing lanes or increasing or decreasing distances between successive vehicles).

Since the main purpose of the study was to measure the effect of lighting on driver behavior, it was felt that differences between variables measured prior to and at the test situation would reflect the significance and magnitude of change.

Vehicle volumes were counted at each test site to determine their magnitude and effect. Speed - volume graphs and calculation of coefficients of correlation were used to determine

the effect of volumes on speeds. Peak hour volumes, for the heavy volume surveys, were compared to determine whether certain test vehicles restricted traffic.

Other vehicle counts such as on and off ramp counts and lane changes indicated that these variables had negligible effect on traffic patterns. No further analyses are provided for these data.

Speeds were compared to detect differences which resulted from the lighting, vehicle, or a combination of vehicle and lighting. The differences between the pretest and test site speeds theoretically reflect differences due to the combined effect of vehicle and lighting. The differences between test site speeds reflect differences caused by the various type of lighting or vehicles. The speeds were statistically tested to determine if differences were significant.[2]

For example, average test site speeds were about ten and one-half miles per hour less than pretest speeds for the black and white vehicle, revolving light night time test at El Centro Road (light volume). Drivers reduced speeds less than one mph for this vehicle when no light was tested. These

[2] The Student t statistical tests at .05 level of significance were used. The methodology is discussed in Annex A.

results indicate that a major portion of the speed reduction in this case was caused by the lighting.

It was necessary to remove the affect of volumes on speeds prior to comparison of speeds for the heavy volume tests. The methodology is explained in Annex B. This mathematical adjustment was not required for data from low and medium volume sites.

Densities and speeds for the heavy volume tests were plotted on graphs and are shown in Figures 38 through 40, Annex F. The differences between densities for pretest - test site speeds are visually observable.[3] Densities and speeds were not correlated for the medium volume surveys and could not be treated statistically.

Density can be significantly affected by changes in speed. If there are 20 vehicles per mile of roadway traveling at 40 mph, (assume one lane) the road is handling a volume of 800 vehicles per hour. If these same drivers reduce speed to 30 mph and maintain the same distance between successive vehicles, volume is reduced to 600 vehicles. Even a small speed - density reduction can critically affect traffic flow when heavy volume roadways are involved.

[3] The methodology is discussed in Annex C.

Study limitations

The surveys were conducted on urban and rural freeways and on a rural state highway. City streets were not included. The test sites were limited to three types of roads; two lanes undivided, and four and six lanes, divided. Data were collected during hot and himid weather near Sacramento, California.

The scope and limitations of the survey methodology must be considered when attempting to project or relate the results of this study. Some technical difficulties occurred during the data collection and analysis. They are discussed in the section on bias.

CONCLUSIONS

This section contains a condensed summary of findings by level of volume. The analysis and findings are discussed in detail in the technical report.

Light Volume - (El Centro Road)

Roadway tested - Rural two lane state highway, two direction, undivided, unlighted.

Volumes were very light in both directions throughout the testing and appeared to have no effect on vehicle speeds. Drivers could usually increase or decrease speeds and pass other vehicles as desired. Vehicle speeds were the best available indicators of driver reactions at this test site.

Afternoon, daylight. Drivers reduced average speeds about six and one-half miles per hour (mph) for the revolving light, California Highway Patrol (CHP) black and white enforcement vehicle test. A major portion of the speed reductions appears due to the presence of the black and white vehicle. Drivers did not reduce speeds during the Division of Highways maintenance pickup test.

Night, unlighted roadway. Average speeds were reduced about eight mph for the CHP black and white vehicle flashing deck light test and approximately ten and one-half mph for the revolving light test. A greater portion of the speed reduction appeared due to the lighting as drivers did not reduce speeds when the light was off.

The test site speed reduction for the revolving light test was about two and one-half mph more than for the deck light test but the difference is not statistically significant. However, the speed of approaching traffic during the deck light test was approximately two mph greater and this may have caused an understatement of the true difference.

Speeds were reduced about three and one-fourth mph when the pickup was tested without lighting. This reduction apparently was due to the type and color of vehicle as drivers did not reduce speeds for the black and white vehicle test without lighting.

The speed reduction for the pickup, revolving light test was approximately ten and one-fourth mph. The reduction for both vehicle types is comparable. A greater portion of the reduction appears due to the visibility of the revolving light.

Medium Volume - (Foothill Farms)

Roadway tested - Rural four lane freeway, two direction, divided.

Several measures of data were collected for this test site. However, only average speeds appeared to be of value in the analysis. Volumes and density were insufficient to affect speeds.

Afternoon, daylight. Speeds were reduced about five mph for the CHP black and white vehicle with the revolving light operating. The reduction was slightly less than two mph for the pickup, with or without the light. The speed differences appeared due to the presence of the vehicles.

Night, lighted roadway. Speeds were reduced less than two mph for the black and white vehicle with the deck light operating. The reduction appeared mostly due to the vehicle.

Drivers did not appear to see the pickup when the revolving light was off. There was a speed reduction of about one and one-half mph when the light was operating, but this reduction is not significant statistically.

Medium Volume - (Mace Boulevard)

Roadway tested - Rural six lane freeway, two direction, divided.

Data were collected at this site as for the Foothill Farms, four lane site. Volumes and densities were insufficient to affect speeds.

Afternoon, daylight. Speeds were reduced about two and one-half mph for the CHP black and white vehicle, revolving light test. The reduction was partially due to the type of vehicle. The contribution by the operating light cannot be determined due to lack of data resulting from radar failure.

Night, lighted roadway. Speed reductions of about two and one-half mph were measured during the presence of either the CHP black and white or pickup test vehicles. The differences appeared due to the presence of the vehicle and the effect of the lighting was negligible.

Speed reductions also occurred when the black and white vehicle was on the opposite side of the road. Test site speeds were three mph less during the light-off test. The reduction was one and one-half mph for the deck light test. Since the lighting was either off or not visible to approaching drivers, the reductions apparently were due to the presence of the vehicle. There was no significant speed reduction measured during the revolving light test. This result is questionable and is discussed in detail in the technical report.

Heavy Volume (Elvas Avenue Site)

Roadway tested - Urban six lane freeway, two direction, divided; afternoon tests, daylight only.

Several measures of traffic patterns were collected at this site during four surveys. A different vehicle was tested for each survey. The testing consisted of alternating light-off, light-on intervals. The following vehicles were tested: CHP black and white enforcement vehicle, tow service truck, Division of Highways maintenance vehicle. No vehicle was tested during the last survey.

The results are analyzed by these methods:

1. Speeds-volumes, effect of lighting
2. Densities-speeds, effect of vehicle and lighting
3. Total volumes, effect of vehicle and lighting

Speeds-volumes. Speeds were strongly affected by volumes which approached or exceeded road capacity. The effect of volumes on speeds was removed prior to statistical comparisons. The methodology is described in Annex B.

Light-off and light-on test speeds were compared separately for each radar site. There was no significant difference in speeds between the light-off and light-on tests for the four surveys.

Densities-speeds. Densities were recorded for the first three surveys and reflected traffic patterns which may have been affected by vehicle type and lighting. Pretest and test site speeds were plotted on graphs by density per mile for each survey.

The data indicate that traffic density for a given speed was reduced at the test vehicle site until the roadway approached design capacity. At that point, it was no longer possible to measure the effect of the test situations. The effect of reduced density while maintaining constant speed results in a reduced traffic flow.

The greatest reduction between pretest and test site density was for the CHP black and white enforcement vehicle. The reduction for the tow service truck was slightly less than that for the CHP vehicle.

The difference between traffic densities for the maintenance pickup were comparable to that estimated for the no-vehicle survey. The reduction was probably due to roadway conditions or characteristics. Although the CHP black and white and tow service vehicles appeared to cause reduced density, the pickup did not.

Total volumes. The Division of Highways, Traffic Department has requested a brief analysis of traffic volumes. This analysis is based on data shown in Table XIII, page 26.

Although the experimentation was not designed to measure the effect of vehicle type on roadway capacity, some inferences can be drawn from the data. Since the count period represents the highest traffic volumes, there is maximum interaction between vehicles as a result of driver behavior. The data in Table XIII may be influenced by other factors. but the implication is that the CHP black and white enforcement vehicle and the tow truck had considerable effect while the Division of Highways pickup had no effect at all.

TABLE XIII

TRAFFIC COUNTS TAKEN AT THE S.P.O.C. ON THE ELVAS FREEWAY FROM 4:30 TO 4:45 PLUS 4:50 TO 5:05 PM

Date (July, 1969)	17th	23rd	29th	31st
Vehicle*	CHP	Tow	Hwys	None
Traffic Volume	2,543	2,632	2,822	2,827
Traffic Volume as a Percent of the 31st Volume	90%	93%	100%	100%

* CHP = CHP black and white enforcement vehicle

Tow = Tow service truck

Hwys = Division of Highways maintenance pickup

None = No vehicle present

TECHNICAL REPORT

DESIGN OF STUDY

The purpose of the study is to quantify the relationship between operating warning lights and driver behavior in actual traffic conditions. The study is specifically designed to measure vehicle speed, traffic volume, traffic density, and lane change activity in relation to various kinds of emergency vehicles using warning lights. These measures were statistically analyzed to identify and determine the magnitude of behavioral reactions to varied test situations and conclusions were formulated.

Statement of the Problem

Emergency lighting consists of an amber light which glows, flashes, or revolves from within or on the outside of the vehicle. It is used on law enforcement, highway maintenance, and roadway service vehicles to alert approaching motorists that an enforcement action or roadside service is taking place.

There is limited information available on the effect of the lighting on driver behavior. Reactions such as an increase or decrease in speed, lane changing, and an increase in the gap between vehicles effect traffic patterns and may effect

the safety of the driver. A desirable goal is to determine optimal emergency lighting systems which permit efficient roadway use and provide maximal safety for the user. The absence of lighting is also considered as a possible alternative.

Data Collection

The time, location, and method of data collection was determined by the type and availability of data required. It was necessary to measure any change in the traffic pattern which could result from driver reaction to test stimuli. Data were collected during seven surveys at four separate locations. These locations represent three levels of volume (vehicles per hour) and three types of roadway. The classification of sites within groups is by actual volumes rather than maximum capacity design.

Name of Site	Number of Lanes - Type of Road	Volume Type
El Centro Road	Two - Undivided	Light
Foothill Farms	Four - Divided	Medium
Mace	Six - Divided	Medium
Elvas	Six - Divided	Heavy

Volumes (vehicles per hour) were grouped as follows:

Volume Category	Actual Number of Vehicles Per Hour by Lane
Light	0 to 699
Medium	700 to 1199
Heavy	1200 and Over

These quantitative measures of driver reaction were selected for the study:

Increase or decrease in speed

Increase or decrease in vehicle gap (density)

Changing traffic lanes

Loading factor (number of vehicles entering or exiting roadway via on-off ramps)

Traffic volume

Notation of any other special occurrence which might affect traffic flow.

Collection methods varied by type of data. The following methods were used.

Speeds. Speeds were measured by radar devices and the readings were recorded automatically by graphic recorders. The equipment was located at three points; (1) prior to the test site (pretest), (2) at the test vehicle site and (3) after the test site (posttest).

Battery powered Muni-Quip Model 1200-C radars and Esterline Angus Model T171B graphic recorders were operated from vehicles at the speed collection sites. The equipment was concealed within the vehicle or at the side away from traffic. Every attempt was made to reduce the conspicuousness of the radar measuring heads and the pretest and posttest vehicles.

Speeds were recorded in miles per hour on graph paper at 60 milimeters per second for light volume traffic and 120 milimeters per second for heavy volumes. Radar operating personnel manually recorded beginning and ending test period times on the graphs.

Increase or decrease in vehicle gap (density). The distance between the rear of one vehicle and the head of the following vehicle is defined as vehicle gap. As traffic flow becomes more dense, vehicle gap decreases. The measure of the concentration of vehicles on the roadway which is used in this study is defined as density. More specifically, density is the number of vehicles occupying a section of a roadway at a given time and is expressed as vehicles per mile. Density as a percent of capacity varies by the number of lanes. For example, 2,000 vehicles per hour represents 50% of capacity for two lanes and 33 1/3%

for three lanes (assume maximum capacity of 2,000 vehicles per lane per hour).

Density was measured during five surveys by aerial photography. The test roadway section was photographed at altitudes ranging from 2500-3500'. Pictures were taken at approximately one to one and one-half minute intervals.

Density was not photographed during two surveys. The El Centro road site lies within the metropolitan airport flight plan and photography was not possible. The Elvas Avenue, no-test vehicle survey was added to the data collection schedule after aerial photograph arrangements had been completed.

Changing traffic lanes. The purpose of this count was to determine the frequency of lane changing. Trained traffic observers visually observed the traffic flow and counted the number of vehicles changing lanes. The final figures for the seven surveys indicated that the number of vehicle lane changes was very small.

Loading factor. This measurement is the number of vehicles which enter the roadway prior to the designated test portion and may affect traffic flow. The point of

access is usually an on ramp or intersection. The resulting numbers were small for the surveys and probably had little affect upon traffic.

Traffic volume (vehicles per hour). Traffic volume is the number of vehicles which pass by a specific point during a given period of time. The number is usually expanded and expressed in terms of vehicles per hour. Volumes were measured at one or two locations on the test roadway for a predetermined direction of traffic.

Special or unusual occurrences. Any nonordinary incident which occurred during a test period was recorded by the individual observing the incident. Notations were recorded by radar and count team personnel. In addition, the survey supervisor routinely drove over the test roadway and tape-recorded information such as time of day, estimated speed of vehicles, vehicles parked by the side of the road.

This information was used to determine whether radar speed readings were correct and to explain speed density changes caused by unusual occurrences.

Survey Site Locations

There were four site locations for the seven surveys.

El Centro Road

Elvas Avenue Overcrossing

Foothill Farms (Spruce) Overcrossing

Mace Boulevard Overcrossing

The survey dates, site locations, and data collection points are described for each site.

El Centro Road

Date of Survey: Sunday, July 20, 1969, 3:00-11:00 p.m.

Direction of traffic: Southbound

Weather: Hot and Humid

Site Description: The site is located on Route 99, Sacramento County, between Elkhorn Road and Elverta Road. The roadway is a two-lane, two-direction, undivided highway. It is a straight road and unlighted. Design capacity for this type of road is approximately 2,000 vehicles per hour for both directions.[1]

Radars measured speeds at three locations, one pretest and two at test vehicle sites. The southbound test site was

[1]Highway Research Board, Highway Capacity Manual-1965, Special Report No. 87, Publication 1328, Washington D.C.: National Research Council, National Academy of Sciences, 1965, pp 75-76.

approximately 1.78 miles south of the pretest radar at Elverta Road. The test vehicle was visible to drivers about one-half mile from the test site. The northbound test vehicle and radar site was about 2.01 miles north of Elverta Road. There was neither a southbound posttest site nor a pretest site for northbound traffic.

Vehicles per hour were counted for both north and southbound traffic. A map of the test road and location of data collection sites is included in Annex E.

Elvas Avenue Underpass. (Southern Pacific Overcrossing)

Dates of Surveys: July 17, 23, 29, and 31, 1969; 3:30-6:05 p.m.

Direction of Traffic: Eastbound

Weather: Hot and Humid

Site Description: The site is located on Interstate Highway 80, Sacramento County, from the "A" Street Overcrossing to a point just beyond the Elvas Underpass. The Southern Pacific Railway crosses over the highway at this point.

The roadway is a six-lane divided urban freeway and is approximately .683 miles in length. The roadway is divided by a double metal beam barrier with a headlight screen. Design capacity is about 2,000 vehicles per lane per hour, or 6,000 vehicles per hour.

for the eastbound three lanes.[2] A map of the test roadway and location of specific data collection points is included in Annex E.

Radars measured pretest speeds at two locations and test site speeds at one location. The first pretest radar and vehicle count location was approximately 550 feet east of "A" Street which was the beginning of the test roadway. The second pretest radar was on the Southern Pacific Overcrossing and the beam was aimed about 350 feet west of the test site. The test site radar was on the opposite side of the overcrossing. The radar beam was aimed at the test vehicle or vehicles which were located just east of the Elvas Underpass. This location marked the end of the test roadway.

Vehicles per hour were counted by two and one-half minute increments at two locations, the Southern Pacific Overcrossing and "A" Street.

The number of vehicles changing lanes was counted from the overcrossing. Since these data were collected during near capacity volumes, the changes were few and did not cause significant changes in traffic patterns.

[2] IBID

Density was recorded by aerial photographs which were taken of the test road from "A" Street to the Southern Pacific Overcrossing (0.658 miles). Photographs were taken on three survey dates, July 17, 23, and 29, 1969. The photographs were taken at an altitude of about 2500' the first two surveys, and about 3500' the last day. The time lapse between photos varied from about 1.1 to 1.5 minutes apart.

Foothill Farms Overcrossing (Spruce Avenue)

Date of Survey: Sunday, July 27, 1969; 3:00-11:00 p.m.

Direction of Traffic: Westbound

Weather: Hot and Humid

Site Description: The site is located at the Foothill Farms Pedestrian Overcrossing on Interstate Highway 80 between the Spruce Avenue and Madison Avenue Overcrossings. This location is in the northeastern part of Sacramento County and is a four-lane, divided rural freeway. The roadway was divided by an earth median planted with oleander shrubs. The median width was 42 feet including a 2 foot paved shoulder on both sides. Design capacity under ideal conditions is 4,000 vehicles per hour for each direction.[3]

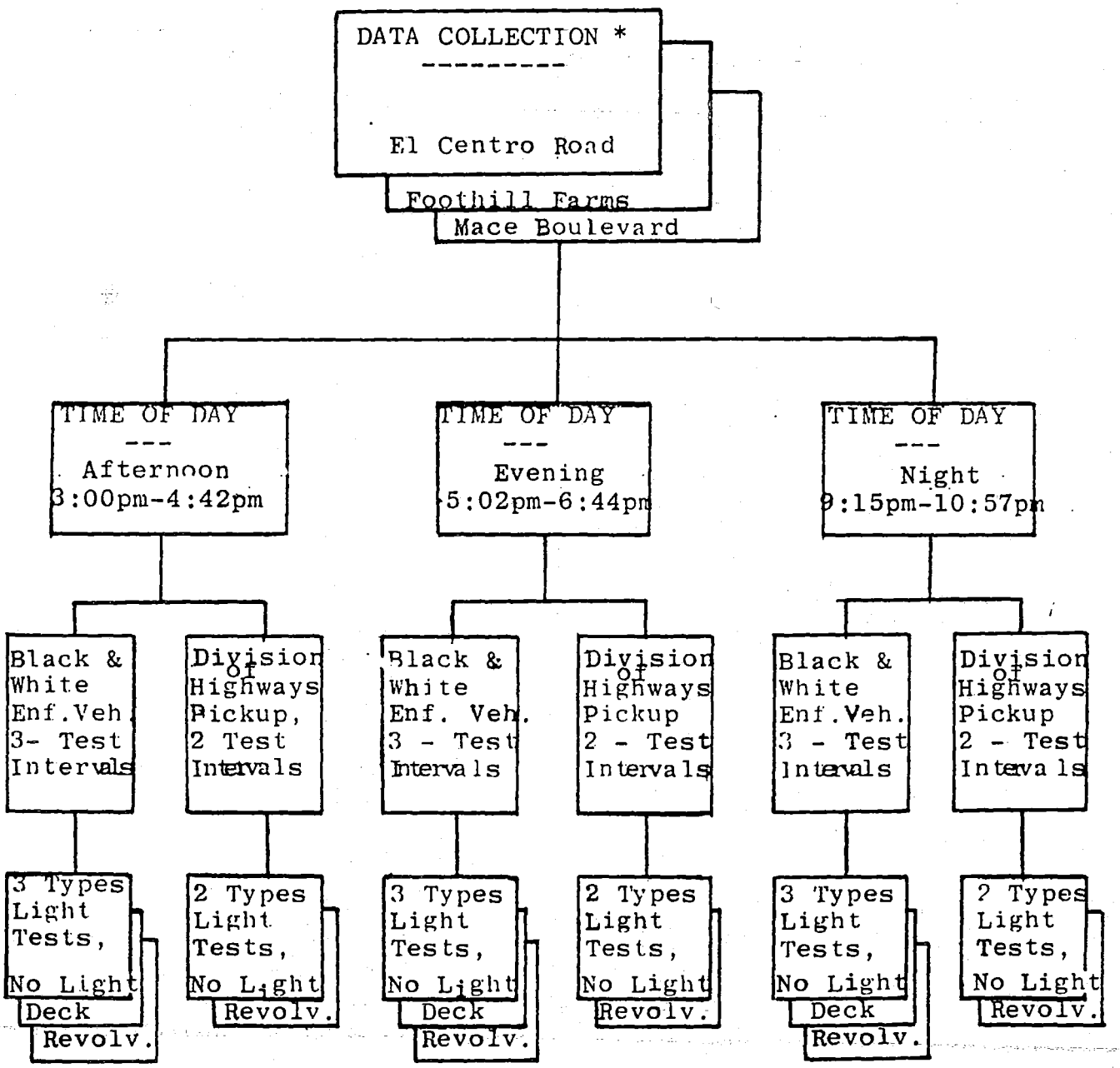
The length of the westbound test roadway (Sacramento bound) is about 1.35 miles and the eastbound roadway is 1.15 miles. The westbound test vehicle site was located at the pedestrian

[3] IBID

FIGURE 1

DATA COLLECTION SCHEDULE
OF TESTING

El Centro Road - Foothill Farms - Mace Boulevard

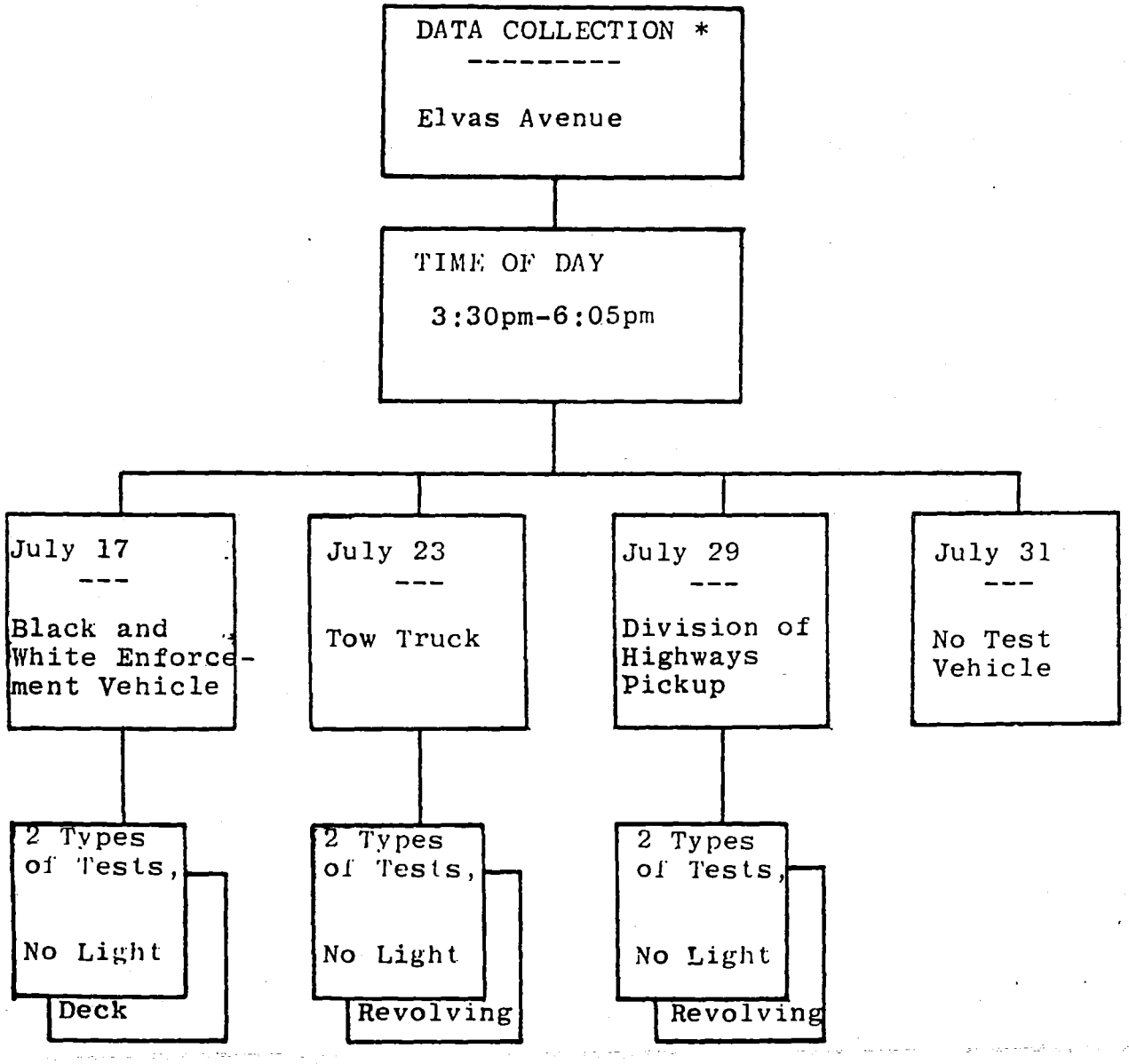


*Three Time of Day Cycles, each cycle comprised of five 15-minute Test Intervals plus breaks between tests.

FIGURE 2

DATA COLLECTION SCHEDULE
OF TESTING

Elvas Avenue



* One Cycle only, consisting of eight 15-minute testing intervals. Same schedule used for July 31, No Test Vehicle. Time cycle includes nontest intervals.

overcrossing which is approximately 0.62 miles west of the pretest radar site. The eastbound test site was on the opposite side of the road and is 0.69 miles east of the pretest radar site. A map of the test roadway and location of specific data collection points is included in Annex E.

Initially, radars were placed at six locations to measure both westbound and eastbound vehicle speeds. Although westbound traffic measurements were of primary interest, eastbound speeds were also measured. When radar failure occurred, eastbound collection was partially discontinued.

The following vehicle counts were made:

Type of Count	Direction	Location of Count
Vehicles Per Hour	East, Westbound	Foothill Farms Overcrossing
On Ramp	Eastbound	Spruce Avenue Overcrossing
Off Ramp	Eastbound	Spruce Avenue Overcrossing
Lane Changes	East, Westbound	Foothill Farms Overcrossing

Density was photographed for a 0.568 mile portion of the test roadway, approximately 0.246 mile prior to and 0.322 mile after the westbound test site. The photos were taken from an altitude of about 3500' at approximately 1.1 to 1.3 minutes apart during the daylight hours of 3:00 p.m. to 7:00 p.m.

Mace Boulevard Overcrossing

Date of Survey: Sunday, August 3, 1969; 3:00-11:00 p.m.

Direction of Traffic: Westbound

Weather: Hot and Humid

Site Description: The site is located at the Mace Boulevard Overcrossing on Interstate Highway 80 and is approximately twelve miles west of Sacramento, California. The roadway is a six-lane, divided rural freeway and under ideal conditions has a design capacity of about 6,000 vehicles per hour for each direction.[4] The roadway is divided by an earth median planted with oleander shrubs. The median was 48 feet including a 5 foot paved shoulder on each side.

The length of the westbound test roadway is about 0.73 mile and the test vehicle site is approximately 0.4 mile west of the pretest radar site. The eastbound test roadway length is about 0.8 mile and the test vehicle site is 0.46 mile east of the pretest radar site. A map of the test roadways and location of specific data collection points is in in Annex E.

Radars were placed at six locations to measure both eastbound and westbound vehicle speeds. Part of the eastbound collection was suspended due to radar failure.

[4]IBID

Vehicle count observers were located on the Mace Boulevard Overcrossing. The following counts were made for both westbound and eastbound traffic.

Traffic volumes

Vehicles entering from on ramps

Vehicles changing lanes

Density was photographed for a 0.516 mile portion of the test roadway, approximately 0.232 mile prior and 0.284 mile after the test site. Pictures were taken from an altitude of 3500' approximately one to one and one-half minutes apart during the daylight hours of 3:00 p.m. to 7:00 p.m.

Schedule of Testing

Data collection methods varied by type of data desired for a particular site. Figures 1 and 2 are flow charts of the collection schedule. The test situation was varied periodically according to a fixed, predetermined schedule.

The test situation and schedule of operation were identical for these three survey sites:

El Centro Road	July 20, 1969
Foothill Farms (Spruce)	July 27, 1969
Mace Boulevard Overcrossing	August 3, 1969

Collection at the Elvas Site was different and is explained separately.

El Centro Road, Foothill Farms, Mace Boulevard. Data collection consisted of three cycles of testing which began at 3:00 p.m. and ended at approximately 11:00 p.m. The cycles were:

Cycle	Time of Day
Afternoon	3:00 p.m. to 4:42 p.m.
Evening*	5:02 p.m. to 6:44 p.m.
Night	9:15 p.m. to 10:57 p.m.

Each cycle was divided into five fifteen-minute test intervals.

*This testing cycle is defined as "Evening" although it is a period of daylight at this time of the year.

Two types of test vehicles were used during each cycle.

1. A black and white enforcement vehicle and a grey unmarked passenger vehicle.
2. An orange Division of Highways maintenance pickup and a grey unmarked passenger vehicle.

The test vehicles were positioned sufficiently off the road so that vehicles approaching in the shoulder lane would have ample clearance. There was as little activity as possible at the site so that the effect on driver behavior would result from lighting rather than other factors.

Each cycle of testing consisted of five 15-minute test intervals, three test intervals for the black and white enforcement vehicle and two test intervals for the orange Division of Highways pickup.

The black and white enforcement vehicle and grey unmarked passenger vehicle were in test position for the first three test intervals. A different type of lighting was used for each interval:

1. No Light
2. Flashing Deck Light
3. Top-Mounted Revolving Light

No Light was tested during the first interval and the Flashing Deck Light was operated during the second interval. The Revolving Light was then mounted on the top of the vehicle during a five-minute break and operated during the third test interval. At the end of this test, the black and white vehicle was removed during a 15-minute break. The unmarked passenger vehicle remained at the test position until the cycle of testing was complete. The test vehicle was replaced by a Division of Highways maintenance pickup. The pickup was a half-ton pickup and Omaha Orange in color.

Two types of lighting were tested:

1. No Light
2. Top-Mounted Revolving Light

No Light was tested during the first fifteen minutes. The Revolving Light was operated during the second test interval. At the end of the Revolving Light test, both the pickup and unmarked vehicle were removed. These tests completed the testing cycle for a given time of day.

The three tests for the black and white vehicle and two tests for the Division of Highways pickup were repeated for each of the three Time of Day cycles. Data for the afternoon

cycle were collected for the direction of traffic which was of primary interest. The direction was westbound for Mace and Foothill Farms and south for El Centro Road. The evening testing was to measure the effect on drivers when the test vehicle was on the opposite side of the road. The night testing was conducted for the same direction of traffic as for the afternoon test.

Elvas Avenue. Data were collected for eastbound traffic on four separate days. The surveys were during peak hour traffic volumes on weekday afternoons from 3:30 to 6:05 p.m.

There was one test cycle which consisted of eight 15-minute alternating light-off, light-on test intervals. The test vehicle situation was different for each survey. The following test vehicles were used:

Type of Vehicle	Date of Survey
CHP Black and White Patrol Vehicle and brown Unmarked Pickup Unit.	July 17, 1969
Yellow Tow Truck and brown Unmarked Pickup Truck	July 23, 1969
Orange Division of Highways Pickup and Brown Unmarked Pickup Truck	July 29, 1969
No Test Vehicles	July 31, 1969

The lighting tested on the Black and White Enforcement Vehicle was the rear-mounted flashing deck light which is currently in use. The top-mounted revolving light was used on the yellow Tow Truck and the orange Division of Highways Pickup.

The brown Unmarked Pickup Truck was used with the Black and White Enforcement Vehicle and Tow Truck to better simulate an enforcement or service stop.

The vehicles were located sufficiently off the roadway to minimize potential hazards. Since the primary purpose of the study was to measure the effect of lighting, test site activity was minimized so that driver reactions would result from the test situation rather than other factors.

Data Reduction

There were tremendous volumes of data which were not machine reducible. Reduction methods varied by type of data collected. Data were reduced by professional and clerical staff personnel. Some of the data required special adjustments prior to analysis.

Radar speeds. Speed data were graphically recorded by machine. Each point on the graph usually represented the

speed for one vehicle. Speeds ranging from zero to 100 MPH were possible. Beginning and ending time periods, two and one-half and five-minute intervals, were manually recorded on the graph by radar personnel. Figure 41, page T-80 contains a sample of an actual radar recording.

The speed graphs were reduced by five or ten second intervals depending on the speed at which the graph was recorded. Graphs recorded at the 60mm per minute speed were reduced by ten second intervals and 120mm per minute speed by five second intervals. Speed reduction is also discussed in the section on bias.

Speeds for each five or ten second interval were averaged to the nearest whole miles per hour, with accuracy to $\pm$ one-half mile. Illegible and questionable readings were excluded. The arithmetic average, variance, and standard deviation were computed to two decimal places for each two and one-half minute and five minute interval within a test period. Statistical formulae are included in Annexes A and B.

If the standard deviation was greater than five MPH, the data points and computations were checked for accuracy.

Density. Data reduction consisted of enlarging the aerial film strip by a 35mm projector and counting the number of vehicles on the test roadway by lane for each photograph.

Inconspicuous marker strips which designated the beginning and the end of the test roadway were placed by the side of the test roadway prior to the surveys. Only those vehicles which fell within the designated area were counted. Incomplete and undecipherable pictures were not reduced.

It must be noted that the roadway length for the aerial photographs does not correspond exactly to that for radar speed measurement.

Since the photography equipment did not have an automatic timing device, it was necessary to determine approximate time of day for each photo. Those photos which recorded special or unusual events were identified and matched with a timed log of events compiled from other data sources. The exact times were assigned to these photos and times were estimated for the intervening pictures.

Traffic counts. Lane changes, number of vehicles entering or leaving a roadway and traffic volumes were in number count form and required no further reduction.

Special or unusual occurrences. This information was orally taped and later transcribed. No further reduction was required.

Methods of Analysis

Analytical methods varied by type of data collected and site of collection. Some of the data required special mathematical adjustment prior to statistical treatment. It was necessary to combine some of the speed data into 15-minute time intervals and recalculate averages and variances. The analyses are specifically discussed by site location for a specified volume category.

Hourly traffic volumes. These data are vehicles per hour (VPH) and are defined as the number of vehicles that pass over a given section of roadway during a time period of one hour or less.

Vehicles were counted for either two and one-half or five minute intervals for each lane and expanded to hourly rates. The hourly figures for the lanes were combined and plotted on graphs for a direction of traffic by time of day.

Normally, there is a negative correlation between speed and volume. As volume increases, speed tends to decrease. This relationship holds only if volume is sufficiently large.

Speeds were plotted for volumes at all collection sites and coefficients of correlation were computed for Elvas Avenue.

The coefficients of correlation at Elvas Avenue ($r \geq .90$) indicated a strong negative relationship between speeds and volumes. For this reason, volumes are considered in the Elvas site speed analysis. The plots for El Centro Road, Foothill Farms, and Mace Site resulted in an uncorrelated scatter of data points. Volumes apparently were insufficient to affect speeds so speeds are analyzed independent of volumes for these sites.

Other traffic counts. Counts of vehicles entering, exiting, or changing lanes on the test roadway represented a very small proportion of total traffic volumes. The activities of these vehicles had minor, if any, effect on traffic. There are no analyses of these data.

Radar Speeds. Pretest site and test site speeds are analyzed by two methods, (1) graphical presentation and (2) statistical comparisons. Speeds are discussed by radar site location.

Pretest speeds are those measured by radar at a point some distance prior to the test vehicle site. The test vehicle was not visible to drivers at the pretest radar site. Test site speeds are those recorded as vehicles passed the test vehicles.

1. Graphical presentation. Average pretest and test site radar speeds are plotted for five-minute intervals by hour of day for El Centro Road, Foothill Farms and Mace Boulevard. The difference between speeds is observable.

The pretest and test site speeds for Elvas Avenue are plotted on separate graphs for eastbound traffic. The speeds are for two and one-half minute increments by volumes. A parabolic curve is fitted to the data points by least squares. The methodology is discussed in Annex B.

2. Statistical Analysis of Speeds. Radar speeds for El Centro, Foothill Farms, and Mace Boulevard are analyzed by average speeds for 15-minute test intervals. The Elvas speeds analyses are for the complete testing cycle. Analyses are for pretest and test site speeds only as postsite data were not always available.

Average speeds were compared and statistically tested to determine if there were significant differences resulting from the test situation. The differences of primary interest are those which result from the lighting, the presence of a vehicle and/or type of vehicle.

Changes in speeds are analyzed in terms of the test situation and its components. Definitions and methods of measurements are described by type of effect.

Test Situation Effect. Behavioral changes attributed to the test situation result from the type of test vehicle, type of light, or a combination of both factors. The Elvas data were difficult to standardize and the analysis is for the differences between light-off, light-on speeds. The relationship of these variables may be additive, multiplicative, or both.

The effect of the test situation, i.e., vehicle with or without an operating light, is determined by comparing the pretest and test site speeds for differences. The vehicles and lighting are held constant, and the speeds for the data collection sites are variables.

Vehicle Effect. The effect of the vehicle results from the presence of any vehicle plus that of its specific characteristics. Test site speeds for the vehicles are compared by type of lighting. The type of lighting is held constant

and type of vehicle as a variable. The pretest speed comparisons are also compared to detect differences in approaching speeds.

Lighting Effect. The effect of specific lighting types is in addition to that of the vehicle. The effect may or may not be affected by the type of vehicle.

Test site speeds for different types of lighting are compared for each vehicle type. The type of vehicle is held constant, and the type of lighting is variable. Pretest speeds are also compared to determine whether test site differences could result from differences in approaching traffic flow speeds.

Other Unmeasured or Unknown Effects. These factors are those which cause statistical error in observations and measurements of data. If the difference can be identified and measured, the data may be adjusted. There are probably other factors which also effect and/or result from the test situation. It is assumed that these factors are reasonably constant for the tests, and that vehicle-light-speed differences may be detected.

Data adjustments and methodology are included in Annex D.

Average speeds were compared by the Student t test and variances by the F test. The statistical methodology is discussed in Annex A.

The results of the statistical Student t tests are provided in tables and significant differences (speed increases or decreases) are discussed.

Density. The number of vehicles recorded in each photograph of the test roadway is expanded to represent vehicle density per mile. The expanded figures are plotted for each photograph by time of day for each survey.

Average speeds are plotted by density for Elvas Avenue only. Since there is no significant speed-density correlation at the other survey sites, there is no value in plotting the data.

Data Analyses by Site

Light Volume - El Centro Road. El Centro Road is the only site which is classified into the light volume grouping. Two types of data are available, hourly traffic volumes and radar speed data.

Traffic volumes were very light for both northbound and southbound traffic. The average volumes for southbound traffic were 160 vehicles per hour. Northbound traffic averaged about 240 vehicles per hour. Volumes are shown in Figures 3 and 4, Annex F.

Radar speeds were plotted and statistically tested independent of volumes. Plots of the average pretest and test site speeds are shown in Figures 5, Annex F. Pretest speeds were not available for the first two afternoon test intervals and there is no test site data for southbound traffic during the evening testing.

Test site speeds were noticeably reduced for these test conditions:

Black and white vehicle for afternoon testing

Black and white vehicle with deck or revolving light on during night test

Orange pickup with light on or off during night test

Only those speed comparisons which result in significant speed differences are discussed. Differences attributable to the combined effect of vehicle and light are discussed first; effect of lighting, second; and effect of vehicle last.

The results of the statistical testing are shown in Tables I through III.

1. Afternoon cycle, black and white vehicle, reaction to vehicle and lighting.

Black and white vehicle, effect of vehicle and light. The pretest speed is 6.41 MPH greater than the test site speed for the revolving light test. Data for the no-light and deck light test for this vehicle were not collected due to radar failure and comparisons by type of lighting are not possible.

Black and white vehicle vs orange pickup, effect of vehicle. The black and white vehicle test site speed is 8.22 MPH less than the pickup speed for the revolving light test. Pretest speeds for the comparative vehicles are equal and there is no statistical difference between the light-off, light-on speeds for the pickup. It

appears that a greater portion of the difference between black and white pretest and test site speeds is due to the type of vehicle.

2. Night cycle, black and white vehicle and orange pickup, reaction to vehicle and lighting.

Black and white vehicle, effect of vehicle and lighting. The pretest speed is 7.97 MPH greater than the test site speed for the deck light test and 10.40 MPH greater for the revolving light test.

Black and white vehicle, effect of lighting. The light-off test speed is 6.03 MPH greater than the deck light and 6.59 MPH greater than the revolving light test site speeds. The deck and revolving light speeds are statistically equal, but pretest traffic speeds may have prevented an actual significant difference.

The flow of traffic speed appeared to increase progressively throughout the night time testing and probably causes an understatement of the comparative speed differences.

Orange Pickup, effect of vehicle and lighting. The pretest speed is 3.29 MPH greater than the test site speed for the

light-off test. This result is contrary to that found for the black and white test and will be discussed later in detail.

The pretest speed is 10.24 MPH greater than the test site speed for the revolving light test. This difference is statistically comparable to that for the black and white vehicle.

Orange pickup, effect of lighting. The light-off test site speed is 3.93 MPH greater than the test site speed for the revolving light. The pretest speed is 3.02 MPH greater for the light-on test. This very likely understates that portion of the speed reduction which is caused by the light.

Black and white vehicle vs orange pickup, effect of vehicle. The 3.29 MPH difference between pretest and test site speeds for light-off tests suggests that the difference is due to the vehicle type. The pickup would seem to be more visible than the black and white vehicle on the unlighted roadway. The bright orange color and height of the pickup reflect light better and should be more easily seen by approaching drivers.

The comparison between the vehicles, however, indicates that the type of vehicle does not significantly effect speed. The following may explain the lack of significance.

The pretest and test site speeds for both vehicle types are statistically equal, but the pickup pretest speed is about 1.26 MPH greater and the test site speed is about 1.20 MPH less than for the black and white vehicle. The comparative differences create a range in the pickup speeds which might be sufficient for a statistical difference by vehicle type.

3. Summary of significant results.

The black and white vehicle with the revolving light appears to significantly reduce average speeds (about six and one-fourth MPH) during the afternoon test. The orange pickup does not.

The pickup test site speed is about three and one-fourth MPH less than the pretest speed, during the night time, light-off test. Difference may be attributable to reflectiveness of the bright orange color, height of vehicle, or by chance. Drivers apparently did not see

the black and white vehicle at night when the light was off.

The operation of both the deck light and the revolving light at night appears to significantly reduce test site speeds (eight to ten MPH). This occurs for both test vehicles and a greater portion of the difference appears due to the lighting.

There is no significant difference between speeds for the deck light-revolving light tests.

TABLE I

EL CENTRO ROAD

Mean Difference Between Pretest Site and Test Site Speeds, Southbound Traffic

Time of Day	Type of Light	Type of Vehicle Black & White	Type of Vehicle Orange Pickup
Afternoon	None	No Data	n = 64 D = -2.48 MPH Not Significant
	Deck	No Data	Not Tested
	Revolving	n = 88 D = 6.41 MPH Significant	n = 71 D = -1.52 MPH Not Significant
Evening		No Data	No Data
Night	None	n = 96 D = 0.83 MPH Not Significant	n = 95 D = 3.29 MPH Significant
	Deck	n = 77 D = 7.97 MPH Significant	Not Tested
	Revolving	n = 75 D = 10.40 MPH Significant	n = 62 D = 10.24 MPH Significant

n = Sample Size
D = Difference between average speeds for 15-minute intervals i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE II

EL CENTRO ROAD

Mean Difference Between Average Speeds for Vehicles by Comparative Types of Lighting Test Site Speeds - Southbound

Time of Day	Comparative Types of Light	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	No Light/Deck	Not Available	Not Tested
	No Light/Revolving	Not Available	n = 65 D = 1.01 MPH Not Significant
	Deck/Revolving	Not Available	Not Tested
Night	No Light/Deck	n = 103 D = 6.03 MPH Significant	Not Tested
	No Light/Revolving	n = 103 D = 6.59 MPH Significant	n = 97 D = 3.93 MPH Significant
	Deck/Revolving	n = 97 D = 0.56 MPH Not Significant	Not Tested

Mean Difference Between Average Speeds for Comparative Vehicles by Type of Lighting, Test Site Speeds - Southbound

Time of Day	Comparative Vehicles	Type of Lighting	
Afternoon	Black and White/ Orange Pickup	Light Off	n = 69 D = -3.42 MPH Significant
		Revolving Light	n = 64 D = -8.22 MPH Significant
Night	Black and White/ Orange Pickup	Light Off	n = 108 D = 1.20 MPH Not Significant
		Revolving Light	n = 92 D = -1.46 Not Significant

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $\bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE III

EL CENTRO ROAD

Mean Difference Between Average Speeds for Vehicles by Comparative Types of Lighting Pretest Site Speeds - Southbound

Time of Day	Comparative Types of Lighting	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	No Light/Deck	Not Available	Not Tested
	No Light/Revolving	Not Available	n = 80 D = 0.05 MPH Not Significant
Night	No Light/Deck	n = 98 D = -1.11 MPH Not Significant	Not Tested
	No Light/Revolving	n = 103 D = -2.98 MPH Significant	n = 97 D = 3.02 MPH Significant
	Deck/Revolving	n = 97 D = 1.87 MPH Not Significant	Not Tested

Mean Difference Between Average Speeds for Comparative Vehicles by Type of Lighting Southbound

Time of Day	Comparative Vehicles	Type of Lighting	
Afternoon	Black and White/ Orange Pickup	Light Off	Not Available
		Revolving Light	n = 90 D = -0.29 MPH Not Significant
Night	Black and White/ Orange Pickup	Light Off	n = 108 D = -1.26 MPH Not Significant
		Revolving Light	n = 92 D = -1.30 MPH Not Significant

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $\bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

Medium Volume - Foothill Farms (Spruce Avenue). Both Foothill Farms (Spruce) and Mace test sites are classified in the medium volume grouping. Occasionally traffic volumes did reach the classification of "heavy" during the Foothill Farms data collection, but most of the volumes were in the "medium" category. Several types of data were collected for these sites; radar speed data, traffic volumes, on ramp-off ramp counts, lane change counts, and aerial photographs of density patterns. Vehicles per hour, average radar speeds, and density are discussed in this section.

Volume counts in vehicles per hour are plotted by five-minute intervals for both lanes. The counts are for eastbound and westbound traffic and are shown in Figures 6 and 7, Annex F.

The westbound traffic volumes ranged from about 2,000 to 2,660 vehicles per hour during the day and afternoon testing. Volumes continuously decreased during the night testing and were less than 1,000 vehicles per hour by the end of the data collection. Traffic flowed very well during the data collection.

Radar speeds are plotted in Figure 8 by time of day for westbound traffic only. The average pretest site and test

site radar speeds are plotted on the same graph by five-minute intervals and differences are observable. There is a roadway characteristic difference of about 1.49 MPH between the westbound pretest site and test vehicle site. Drivers apparently reduce speed slightly at the pretest site possibly because of the Spruce Avenue on and off ramps. An adjustment for this difference has not been included in the graphs.

Radar speeds are statistically analyzed by the previously described methodology. Since volumes and speeds were not correlated at this test location, the speeds were compared independent of volumes. The results of these comparisons are shown in Tables IV through VII.

Pretest speeds for the statistical comparisons include an adjustment of +1.49 MPH for roadway characteristics. A discussion of the determination of the adjustment factor and resultant methodology is included in Annex D. The analysis of speeds is summarized by type of reaction.

1. Afternoon cycle, black and white vehicle vs orange pickup, reaction to vehicles and lighting.

Black and white vehicle, effect of vehicle and lighting. The pretest speed is 5.2 MPH greater than the test site

speed for the revolving light test. Data for the no-light and deck light test for this vehicle was not collected due to radar failure.

Orange pickup, effect of vehicle and lighting. The pretest speed is about 1.89 MPH greater than the test site speed.

Black and white vehicle vs orange pickup, effect of vehicle, revolving light. The black and white test site speed is 2.69 MPH less than the pickup speed and pretest speeds are comparatively equal for the two vehicles. It appears that the black and white vehicle has a greater effect on traffic than the pickup and a greater portion of the pretest-test site speed difference is due to the type of vehicle.

2. Evening cycle, black and white vehicle, reaction of vehicle and lighting.

Black and white vehicle, effect of vehicle and lighting. The deck light pretest speed is 1.16 MPH greater than the test site speed and the difference is significant. The test vehicle was on the opposite roadway (eastbound traffic) and the light would not be visible to westbound

drivers. The difference may be caused by the speed adjustment factor (See Annex D). Since the sample size (530) is very large for this time increment, even a small speed adjustment error would be sufficient to result in a statistically significant difference.

Black and white vehicle vs orange pickup, effect of vehicle. The black and white test site speed is 0.77 MPH significantly less than the pickup speed when the vehicle was on the eastbound test roadway. The difference is very small and the sample size very large. The pretest speed for the black and white vehicle is 0.47 MPH less and this may be sufficient to negate the significance between the two speeds.

3. Night cycle, black and white vehicle vs orange pickup, reaction to vehicle and lighting.

Black and white vehicle, effect of vehicle and lighting. The deck light pretest speed is 1.84 MPH greater than the test site speed. There was very little difference between the speeds for the light-off or revolving light tests. The roadway lighting would reduce the effectiveness of the emergency light and this may explain the small amount of speed differences for the other tests.

Black and white vehicle, effect of lighting. The light-off test speed is 1.68 MPH greater than the deck light speed, and the pretest speed difference between the two light tests is very small. The difference between the pretest and test site speeds appears due to the lighting.

The deck light test site speed is 2.46 MPH less than that for the revolving light. The pretest speed is significantly slower for the deck light by about 1.44 MPH. This may or may not negate the significance of the difference between the test site speeds. Nevertheless, it appears that drivers did not see the revolving light or the test vehicle.

Orange pickup, effect of vehicle and lighting. The pretest speed is 1.69 MPH less than the test site speed for the no-light test. It appears that the unlighted vehicle was not visible and had no effect on traffic. There was a +1.54 MPH difference for the revolving light test, however, the difference is not significant. The pickup may have been a little more visible during the light-on test because of its bright orange color.

Orange pickup, effect of lighting. The light-off test site speed is 2.67 MPH greater than the revolving light speed and the pretest speeds are comparatively equal. Since there was no significant difference between revolving light pretest and test site speeds, it is doubtful that this difference is due to the lighting.

Black and white vehicle vs orange pickup, effect of vehicle. The test site speed for the black and white vehicle light-off test is 1.85 MPH less than that for the pickup and the pretest site speeds are statistically equal. Neither vehicle appeared visible to approaching traffic. The black and white vehicle probably was less visible than the pickup due to its color.

The black and white vehicle, revolving light, test site speed is 1.60 MPH greater than the pickup speed. Although the difference is significant, the pretest speed for the black and white vehicle is 0.88 MPH greater. If the difference between the test site speeds is not due to the pretest speed, it appears that the black and white vehicle was also less visible than the pickup during the revolving light testing.

4. Summary of significant speed comparisons

The black and white vehicle appears to cause a greater speed reduction during the afternoon than the pickup. The difference for the black and white vehicle is about five MPH and just less than two MPH for the pickup.

The deck light during the night time black and white vehicle testing appears to reduce speeds about 1.8 MPH. The drivers do not seem to see either the light or the vehicle for the other night tests. The pickup appears somewhat more visible than the black and white vehicle for the light-on test (speed decrease of about one and one-half MPH) but significantly less visible when the light is off.

Densities for the combined lanes are shown in Figure 9, Annex F. Densities in vehicles per mile are plotted by hour of day for eastbound and westbound traffic. Speeds were not plotted by densities at this site because of lack of correlation between speeds and volumes.

TABLE IV

FOOTHILL FARMS OVERCROSSING (SPRUCE AVENUE)
Mean Difference Between Average Speeds for
Comparative Vehicles by Type of Lighting
Pretest Site Speeds - Westbound

Time of Day	Comparative Vehicles	Type of Lighting	
Afternoon	Black & White/ Orange Pickup	Light Off	Not Available
		Revolving Light	n = 117 D = -0.65 MPH Not Significant
Evening		Light Off	n = 178 D = 0.47 MPH Not Significant
		Revolving Light	n = 179 D = -0.43 MPH Not Significant
Night		Light Off	n = 120 D = 0.35 MPH Not Significant
		Revolving Light	n = 155 D = 0.88 MPH Not Significant

Test Site Speeds - Westbound

Time of Day	Comparative Vehicles	Type of Lighting	
Afternoon	Black & White/ Orange Pickup	Light Off	Not Available
		Revolving Light	n = 241 D = -2.69 MPH Significant
Evening		Light Off	n = 1039 D = -0.77 MPH Significant
		Revolving Light	n = 839 D = -0.05 MPH Not Significant
Night		Light Off	n = 332 D = -1.85 MPH Significant
		Revolving Light	n = 306 D = 1.60 MPH Significant

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE V

FOOTHILL FARMS OVERCROSSING (SPRUCE AVENUE)
Mean Difference Between Average Pretest Site Speeds
and Test Site Speeds - Westbound

Time of Day	Type of Light	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	No Light	Not Available	n = 248 D = 1.75 MPH Significant
	Deck Light	Not Available	Not Tested
	Revolving	n = 210 D = 5.23 MPH Significant	n = 248 D = 1.89 MPH Significant
Evening	No Light	n = 668 D = 0.81 MPH Not Significant	n = 549 D = -0.43 MPH Not Significant
	Deck Light	n = 530 D = 1.16 MPH Significant	Not Tested
	Revolving	n = 459 D = 0.05 MPH Not Significant	n = 559 D = 0.53 MPH Not Significant
Night	No Light	n = 259 D = 0.51 MPH Not Significant	n = 236 D = -1.69 MPH Significant
	Deck	n = 247 D = 1.84 MPH Significant	Not Tested
	Revolving	n = 247 D = 0.82 MPH Not Significant	n = 247 D = 1.54 MPH Not Significant

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE VI

FOOTHILL FARMS OVERCROSSING (SPRUCE AVENUE)
Mean Difference Between Average Speeds for Vehicle
by Type of Lighting, Pretest Site Speeds - Westbound

Time of Day	Type of Comparative Lighting	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	Light Off/Deck	Not Available	Not Tested
	Light Off/ Revolving	Not Available	n = 153 D = -0.69 MPH Not Significant
	Deck/Revolving	Not Available	
Evening	Light Off/Deck	n = 171 D = -0.38 MPH Not Significant	
	Light Off/ Revolving	n = 171 D = 0.56 MPH Not Significant	n = 179 D = -0.34 MPH Not Significant
	Deck/Revolving	n = 165 D = 0.94 Not Significant	
Night	Light Off/Deck	n = 124 D = 0.35 Not Significant	
	Light Off/ Revolving	n = 118 D = -1.09 MPH Not Significant	n = 139 D = -0.56 MPH Not Significant
	Deck/Revolving	n = 166 D = -1.44 MPH Significant	

n = Sample Size
D = Difference between average speed for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE VII

FOOTHILL FARMS OVERCROSSING (SPRUCE AVENUE)
Mean Difference Between Average Speeds for Vehicles
by Type of Light, Test Site Speeds - Westbound

Time of Day	Type of Comparative Lighting	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	Light Off/ Deck	n = 330 D = 0.66 MPH Not Significant	Not Tested
	Light Off/ Revolving	n = 327 D = 1.83 MPH Significant	n = 343 D = -0.55 MPH Not Significant
	Deck/ Revolving	n = 357 D = 1.17 MPH Significant	Not Tested
Evening	Light Off/ Deck	n = 1027 D = -0.03 MPH Not Significant	Not Tested
	Light Off/ Revolving	n = 949 D = -0.20 MPH Not Significant	n = 929 D = 0.52 MPH Not Significant
	Deck/ Revolving	n = 818 D = -0.17 MPH Not Significant	Not Tested
Night	Light Off/ Deck	n = 332 D = 1.68 MPH Significant	Not Tested
	Light Off/ Revolving	n = 338 D = -0.78 MPH Not Significant	n = 328 D = 2.67 MPH Significant
	Deck/ Revolving	n = 306 D = -2.46 MPH Significant	Not Tested

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

Medium volume - Mace Boulevard Overcrossing. The types of data collected at Foothill Farms were also collected at Mace Boulevard.

Hourly volume counts (vehicles per hour) are by five-minute intervals for both eastbound and westbound traffic. The volumes are plotted by hour of day and are shown in Figures 10 and 11, Annex F.

Volumes were light and traffic flowed well throughout the testing. Eastbound volumes averaged about 1,440 vehicles per hour with a maximum of about 2,340 vehicles at 9:15 p.m. Westbound volumes were slightly greater. The average was about 2,100 vehicles per hour with a maximum of about 2,580 vehicles at 3:16 p.m.

A plot of the speeds by volumes indicated that volumes had negligible effect on speeds. Volumes were not considered in the analysis of radar speed data.

Radar speeds are plotted and statistically tested for westbound traffic only. Test site speeds appear reduced about 2.97 MPH because of roadway characteristics. There is an off-ramp about 1,500 feet west of the pretest site and an

on-ramp about 500 feet prior to the test site which could effect speeds. The methodology for determining the characteristic difference and procedure of adjustment is included in Annex D.

The average unadjusted pretest and test site speeds are plotted for five-minute periods by hour of day and are shown in Figure 12, Annex F.

Radar speeds are analyzed statistically for westbound pretest and test site speeds. The test site speeds were adjusted by a constant +2.97 MPH prior to testing. The statistical test results are contained in Tables VIII through XI.

High average speeds were maintained during the data collection and variances were small. The standard deviation was usually less than five MPH. Since sample sizes are large, a small difference between comparative speeds can result in a significant difference.

The speeds are analyzed by type of driver reaction.

1. Afternoon cycle, black and white vehicle vs orange pickup, reaction to vehicle and lighting.

Black and white vehicle, effect of vehicle and lighting. The pretest speed is 2.57 MPH greater than the test site speed for the revolving light test. Data were not collected for the black and white light-off, deck light tests because of radar failure.

Orange pickup, effect of vehicle and lighting. The difference for the pickup test, light-off is 1.45 MPH. There is no difference for the pickup revolving light test.

Black and white vehicle vs orange pickup, effect of vehicle. The revolving light test site speed for the black and white vehicle is 1.15 MPH less than for the pickup. Since the pretest speed for the black and white is 1.34 MPH greater, the difference between the speeds for the two vehicles is probably understated. A major portion of the difference between pretest and test site for the black and white vehicle is probably due to the type of vehicle.

2. Evening cycle, black and white vehicle vs orange pickup, reaction to vehicle and lighting.

Black and white vehicle, effect of vehicle and lighting. The pretest speed is 3.09 MPH greater than the test site speed during the light-off test. The difference is 1.47 MPH for the deck light test. The differences for the revolving light phase and the pickup tests are less than one-fourth miles per hour.

These results are questionable since the test vehicle was on the eastbound roadway and appeared visible to westbound drivers during the first two test intervals only.

Black and white vehicle, effect of lighting. The light-off test speed is 1.69 MPH less than for the revolving light. The light-off pretest speed is 1.77 MPH greater than for the revolving light.

The deck light speed is 1.50 MPH less than for the revolving light and comparative pretest speeds are statistically equal. These results are also questionable.

Black and white vehicle vs orange pickup, effect of vehicle. The light-off test site speed for the black and white vehicle is 2.36 MPH greater than that of the pickup. Pretest speeds are comparatively equal. The result of this comparison infers that westbound vehicle drivers see the black and white vehicle and reduce speeds. It is not known whether drivers saw the pickup.

These statistical findings for the evening cycle are somewhat questionable for these reasons:

The black and white vehicle is on the eastbound portion of the divided highway.

The light-off test appears to have a greater reduction on speed than the revolving light.

If the black and white vehicle, light-off causes a noticeable speed reduction, then it is logical that the nonvisible flashing deck light would also reduce speeds.

There are several possible reasons for the inconsistent findings.

The speed for the general flow of traffic fluctuates considerably and may be responsible for what appears to be statistically significant differences. Changes in traffic flow speeds make comparisons by type of lighting difficult and the results are questionable. Comparative speeds and differences are shown below.

Time of Day	Test Vehicle	Average Pretest Speed (MPH)	Adjusted Average Test Site Speed (MPH)	Speed Difference (MPH)
5:02 PM:5:17 PM	B & W*	64.27	61.18	3.09
5:18 PM:5:37 PM	B & W*	62.84	61.37	1.47
5:38 PM:5:53 PM	B & W*	62.50	62.84	-0.34
6:13 PM:6:28 PM	O**	63.77	63.54	0.23
6:29 PM:6:44 PM	O**	62.62	62.87	-0.25

*B & W = Black and White enforcement vehicle
**O = Orange Pickup

It is also possible that the time of day (evening) may have limited the visibility of the vehicles. The light-off comparisons were for fifteen-minute periods beginning at 5:00 p.m. and 6:13 p.m. The light-on period comparison was for periods beginning at 5:38 p.m. and 6:29 p.m. The difference between pretest site and test site speeds was greater for the earlier time comparisons and declined with the changing daylight.

The westbound traffic was facing the setting sun. Trees along the roadway created shadows across the roadway and may have partially concealed the test vehicles. A combination of these factors would reduce vehicle visibility and could considerably limit the effect of the revolving light.

The test site speed adjustment of +2.97 MPH was applied as a constant amount for all speeds. The adjustment could be inadequate for some of the test intervals.

The significant speed differences may result from the presence of the vehicle (there were no differences for the pickup), but the effect of lighting is questionable for any or a combination of the suggested explanations.

3. Night cycle, black and white vehicle vs orange pickup, reaction to vehicle and lighting.

Black and white vehicle, effect of vehicle and lighting. The pretest speed is 2.37 MPH greater than the test site speed during the light-off test, and 1.89 MPH and 2.59 MPH greater for the deck and revolving light tests.

Black and white vehicle, effect of lighting. The test site speed for the light-off test is 1.51 MPH greater than for the deck light test. However, the difference between the two pretest speeds is 1.29 MPH. The difference in the general traffic flow would be sufficient to negate the test site speed differences.

The deck light test site speed is 1.36 MPH greater than for the revolving light. The difference of 0.61 MPH between the comparative pretest speed is not significant. An adjustment of test site speeds for approaching traffic flow differences would probably negate the significant difference.

Orange pickup, effect of vehicle and lighting. The pretest speed is 2.37 MPH greater for the light-off test. Comparative data are not available for the revolving light test due to power failures.

4. Summary of significant speed comparisons.

Significant speed reductions from about one and one-half to two and one-half MPH occurred during the presence of either test vehicle. The differences are generally comparable for day and night tests.

There does not appear to be differences in reaction between the deck and revolving lights for the black and white vehicle.

The vehicle appears to be a major contributor to the speed reduction and operation of the lighting is minor. Since this test roadway is lighted, there is increased visibility of the vehicle and decreased visibility of lighting.

Density graphs for eastbound and westbound traffic were not plotted. There were numerous incomplete photograph recordings at this site which were not reduced.

TABLE VIII

MACE BOULEVARD OVERCROSSING
Mean Difference Between Average Pretest Site and Test Site Speeds - Westbound

Time of Day	Type of Light Operating	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	None	No Data	n = 264 D = 1.41 MPH Significant
	Deck	No Data	Not Tested
	Revolving	n = 24 D = 2.57 MPH Significant	n = 263 D = 0.08 MPH Not Significant
Evening	None	n = 173 D = 3.09 MPH Significant	n = 178 D = 0.23 MPH Not Significant
	Deck	n = 189 D = 1.47 MPH Significant	Not Tested
	Revolving	n = 173 D = -0.37 MPH Not Significant	n = 179 D = -0.25 MPH Not Significant
Night	None	n = 259 D = 2.37 MPH Significant	n = 133 D = 2.31 MPH Significant
	Deck	n = 238 D = 1.89 MPH Significant	Not Tested
	Revolving	n = 258 D = 2.59 MPH Significant	No Data

n = Sample Size
D = Difference between average speed for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE IX

MACE BOULEVARD OVERCROSSING
Mean Difference Between Average Speeds for Vehicle by Type of Lighting, Test Site Speeds - Westbound

Time of Day	Comparative Types of Light	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	No Light/Deck Light	No Data	Not Tested
	No Light/ Revolving	No Data	n = 247 D = 0.38 MPH Not Significant
	Deck/Revolving	Not Available	
Evening	No Light/ Deck Light	n = 176 D = 0.19 MPH Not Significant	Not Tested
	No Light/ Revolving	n = 174 D = -1.69 MPH Significant	n = 179 D = 0.67 MPH Not Significant
	Deck/Revolving	n = 176 D = -1.50 MPH Significant	Not Tested
Night	No Light/ Deck Light	n = 319 D = 0.15 MPH Not Significant	Not Tested
	No Light/ Revolving	n = 338 D = 1.51 MPH Significant	Not Available
	Deck/Revolving	n = 317 D = 1.36 MPH Significant	Not Tested

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE X

MACE BOULEVARD OVERCROSSING
Mean Difference Between Average Speeds for Vehicle
by Type of Lighting, Pretest Site Speeds - Westbound

Time of Day	Comparative Types of Light	Type of Vehicle Black and White	Type of Vehicle Orange Pickup
Afternoon	No Light/Deck	No Data	Not Tested
	No Light/ Revolving	No Data	n = 170 D = 1.70 MPH Significant
	Deck/Revolving	No Data	Not Tested
Evening	No Light/Deck	n = 176 D = 1.43 MPH Significant	Not Tested
	No Light/ Revolving	n = 172 D = 1.77 MPH Significant	n = 178 D = 1.15 MPH Significant
	Deck/ Revolving	n = 176 D = 0.34 MPH Not Significant	Not Tested
Night	No Light/Deck	n = 178 D = 0.62 MPH Not Significant	Not Tested
	No Light/ Revolving	n = 179 D = 1.29 MPH Significant	Not Available
	Deck/ Revolving	n = 179 D = 0.61 MPH Not Significant	Not Tested

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

TABLE XI

MACE BOULEVARD OVERCROSSING
Mean Difference Between Average Speeds for Comparative Vehicles
by Type of Lighting - Westbound

Pretest Site Speeds

Time of Day	Comparative Vehicles	Type of Lighting	
Afternoon	Black & White/ Orange Pickup	Light Off	No Data
		Revolving Light	n = 156 D = 1.34 MPH Significant
Evening	Black & White/ Orange Pickup	Light Off	n = 174 D = 0.50 MPH Not Significant
		Revolving Light	n = 176 D -0.12 MPH Not Significant
Night	Black & White/ Orange Pickup	Light Off	n = 174 D = 0.80 MPH Not Significant

Test Site Speeds

Time of Day	Comparative Vehicles	Type of Lighting	
Afternoon	Black & White/ Orange Pickup	Light Off	No Data
		Revolving Light	n = 347 D = -1.15 MPH Significant
Evening	Black & White/ Orange Pickup	Light Off	n = 177 D = 2.36 MPH Significant
		Revolving Light	n = 176 D = 0.00 MPH Not Significant
Night	Black & White/ Orange Pickup	Light Off	n = 218 D = 0.73 MPH Not Significant

n = Sample Size
D = Difference between average speeds for 15-minute intervals, i.e., $D = \bar{X}_1 - \bar{X}_2$
MPH = Miles Per Hour

Heavy Volume - Elvas Avenue Underpass. The presentation of the analysis of the data collected from the four study days on the Elvas Freeway is slightly different from the presentations for the other three study sites. Because of the traffic volumes and special problems present on the Elvas, additional information was sought and analyzed for the Division of Highways. This additional analysis dealt with the speed density relationships of the traffic movement under heavy traffic conditions. Volume counts, lane changes, and radar speed data were collected for all four surveys. Aerial photographs were taken during the first three surveys when a test vehicle was present. There was no test vehicle on July 31, 1969, the fourth survey. Traffic volumes, radar speeds, and densities are analyzed in this section.

Volume counts in vehicles per hour are plotted by time of day for the "A" Street and Southern Pacific Overcrossing locations. These counts are shown in Figures 13 through 20, Annex F.

Volumes were very heavy and frequently reached or exceeded design capacity of 6,000 vehicles per hour between the peak period of 4:45 p.m. to 5:00 p.m.*

*Design capacity figure estimated from guidelines appearing in the previously cited Highway Capacity Manual-1965.

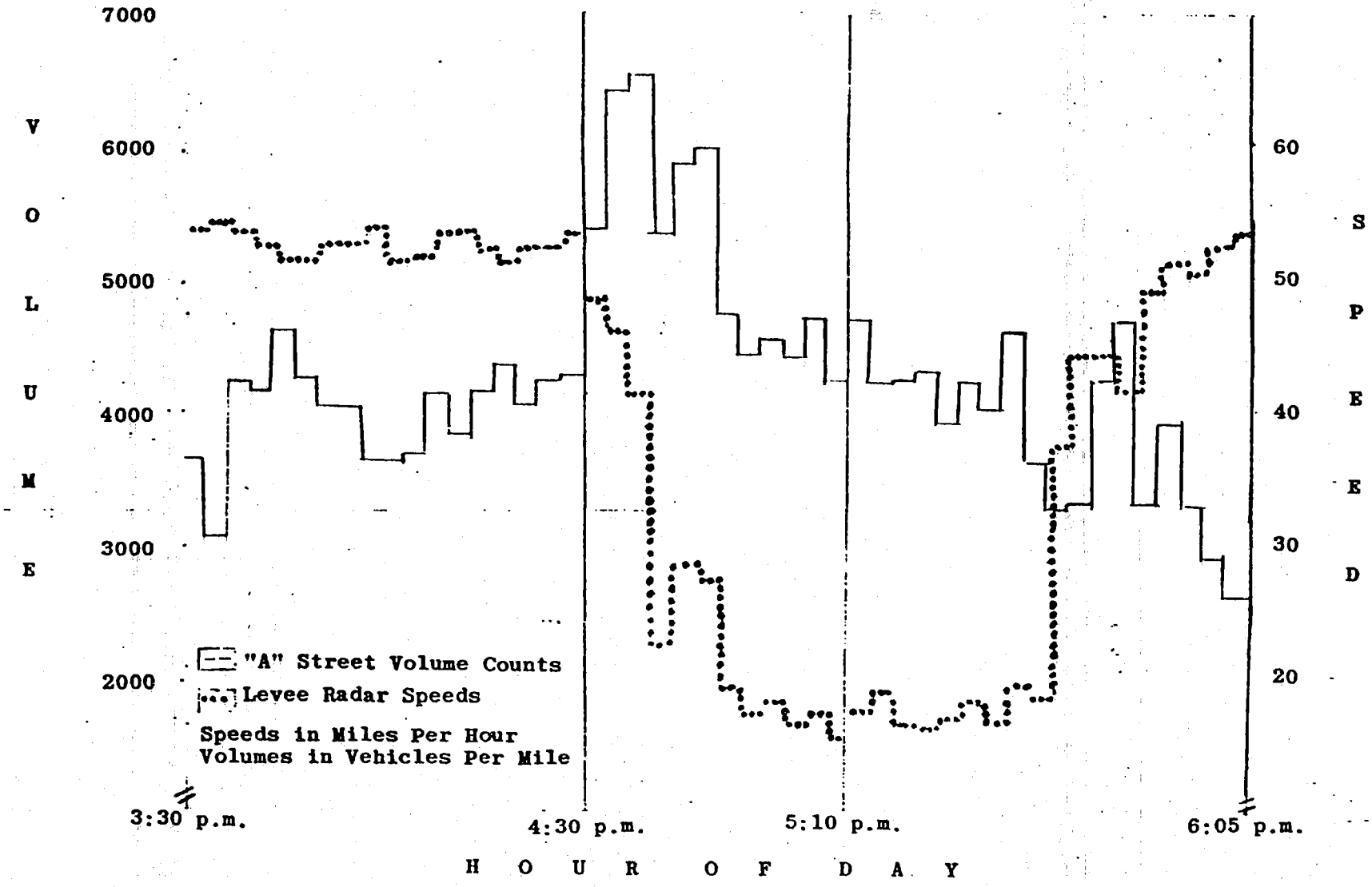
Total estimated volume counts for 3:30 p.m. to 6:05 p.m. include estimated volumes for nondata collection periods. The observed volumes were expanded to include noncollection periods. The estimation is subject to some error as volumes change rapidly at the Elvas site during peak hour traffic.

The radar speed data analysis considers the effect of volume on speeds at this site. There is a highly correlated speed-volume relationship which is demonstrated by Figure 21. As volumes increase, speeds tend to decrease. It was necessary to remove the effect of volumes before speeds could be analyzed.

Average speeds for each two and one-half minutes were plotted by corresponding volumes. There is a speed-volume plot for each survey for all radar collection sites. Since there is a curvelinear relationship between speed-volume, a parabolic curve is fitted to the data points. The purpose of the parabola is to remove the effect of volumes and permit analysis of speeds. The theoretical curve is calculated from speeds and volumes data by least squares regression.

FIGURE 21

ELVAS AVENUE - SPEEDS AND VOLUMES
BLACK AND WHITE VEHICLE - 7-17-69



The speed volume plots are shown in Figures 22 through 33, Annex F. Statistical methodology is discussed in Annex B.

For analysis purposes, the plotted speed data points were compared to the theoretical point on the curve to determine the amount of variation from the curve. The sum of the variations (differences) was then used to compute the average difference and variance for Student t test comparisons. The methodology is described in Annex B.

It is not possible to compare radar speeds for effect by vehicle type. The differences in the speed-volume traffic distributions for each of the surveys are so great that data cannot be effectively standardized. When examining the speed volume plots, Figures 22-33 of Annex F, we find that no two parabolic curves are comparable. For this reason, statistical tests of significance are for <u>effect of lighting</u> only.

The average differences in speeds between the light-off and light-on tests were compared by the Student t test. The results are shown in Table XII on page T-73 for each survey date by individual radar sites. None of the differences is large enough for a statistical difference at $\alpha = .05$. These results indicate that the lighting had no effect on

speed at this survey site. The results appear to be logical when other factors are considered, i.e., bright sun, heavy volumes and unknown and/or unmeasurable variables. The lighting is less visible during bright daylight hours.

When traffic volumes near, reach, or exceed capacity, mathematical calculations are less stable and tend to degenerate. Since capacity was reached or exceeded frequently at Elvas, it is difficult to treat the collected data statistically.

Density is analysed by hour of day and speed, specifically for the Division of Highways. Density figures are for all three eastbound lanes and are expressed as the number of vehicles per mile.*

1. Density by Hour of Day. The density recorded in each aerial photograph is plotted by hour of day. Figures 34, 35, and 36, Annex F, show density for the survey dates, July 17, 23, and 29.

*Density is usually expressed as number of vehicles per lane mile. Since there are three lanes at this site, the number per lane may be determined by division of total density by three (lanes).

Density begins increasing about 4:30 p.m. with the onset of afternoon commuter traffic and peaks within 15-20 minutes. The highest measure of density occurred on July 17 when the black and white enforcement vehicle was tested.

2. Speed vs Density. Figures 37, 38, 39, and 40, Annex F, are graphs of speed vs density. Average pretest and test site speeds are plotted on the Y (vertical) axis and density is on the X (horizontal) axis. Densities for July 17, 23, and 29, are expanded from aerial photographs. Density for July 31 is calculated from speeds and volumes recorded at the Southern Pacific Overcrossing. A straight line is fitted to the data points by least squares regression. The calculations are explained in Annex C.

The purpose of the graph is to determine the difference in density for a given radar speed. An example of the difference is shown in Figure 37, Annex F, for the July 17 survey. Holding speed constant at 50 MPH, density is about 130 vehicles (for all three lanes) at the pretest site and 92 at the test site.

Although it is technically possible to calculate volumes per hour from the data points on the graph, it is not

feasible to do so. Error results from using total roadway density with Southern Pacific Overcrossing speeds. Total density tends to average the amount of space between vehicles and may understate or overstate density at a specific location for a given time. This is particularly true for the speed-density on July 17 when there was considerable variability between Levee and Southern Pacific Overcrossing speeds. There was less variation for subsequent surveys.

Part of the difference between densities may be due to roadway characteristics. It is possible that such a difference occurs at greater speeds and diminishes as speeds decrease. Also, as congestion increases it may be impossible to measure a difference which actually exists. Density for the vehicle test on July 31 is estimated in an attempt to identify roadway characteristic differences.

Figures 37 through 39, Annex F, indicate that initially the pretest site speeds are greater than test site speeds for a given density. The amount of difference diminishes as density increases and speeds decrease. The speed regression lines on all graphs cross near the point of maximum density. When maximum density is reached on this roadway, vehicles

are usually in a queueing state. This may prevent detection of differences in speeds, density, or volumes which result from an incident, test situation or roadway characteristics.

Speed vs density is shown by type of test vehicle only. A trial plot of the data points indicated no measured difference between those for the light-off, light-on tests. The figures are explained by type of vehicle.

Black and white enforcement vehicle, 7/17/69. Figure 37, Annex F. If a given speed is held constant, there is a noticeable difference between densities for the pretest and test site speeds during light traffic flow. The amount of difference diminishes as speeds decrease and density increases. The densities at the pretest site are greater than those at the test site until the regression lines meet at a density of approximately 220 vehicles per mile, all lanes. At this point, traffic becomes so congested that it is no longer possible to detect differences.

Yellow tow service truck, 7/23/69, Figure 38, Annex F. Test site density is less than pretest density until a

density of about 230 vehicles per mile (all lanes) is reached. The difference between densities for a given speed is less than for the black and white vehicle.

Division of Highways orange maintenance pickup, 7/29/69, Figure 39, Annex F. The difference between reduced densities is less than that for the previous surveys. The comparative speeds are the same when density reaches approximately 150 vehicles per mile, all lanes. Average speeds were greater than those measured for the prior surveys.

The regression line of test site speeds on density for this survey was computed without the traffic transition data points. The traffic transition from high speed-low volumes to low speeds-high volumes occurs within a few minutes and it is difficult to treat these points statistically.

No test vehicle, 7/31/69, Figure 40, Annex F. Density is estimated from speed and volume data since aerial photographs were not taken for this survey. Care should be exercised in comparing densities from aerial photographs and those estimated from other data.

Recorded density for aerial photographs is for a portion of the test road and by one to one and one-half minute intervals. The figures are expanded to express vehicles per mile. Estimated density per mile is calculated from Southern Pacific Overcrossing volumes and pretest, test site speeds are by two and one-half minute intervals. This results in a greater averaging of the data and reduces variation between speeds-volumes.

Density is slightly greater at the pretest site until the regression lines meet at a density of about 140 vehicles per mile. This reduction in density may result from roadway characteristics or another unidentified variable which diminishes with increased density. The difference between the regression lines appears comparable to that of the 7/29/69 pickup test survey. It is possible that density differences for 7/29/69 are attributable to roadway characteristics rather than to the presence of the vehicle. A portion of the differences for the other two surveys may also be affected by roadway characteristics.

TABLE XII

ELVAS AVENUE UNDERPASS

Average Difference Between Observed and Expected Speeds for Light Off vs Light On Tests for Each Survey by Position of Radar

Date	Test Site	Southern Pacific Overcrossing Pretest	Levee Pretest
7-17-69	$\bar{D}$ = -0.1022	$\bar{D}$ = 0.09	$\bar{D}$ = -1.65
	t = -0.1105	t = +0.115	t = -1.00
	DF = 20	DF = 17	DF = 20
	Not Significant	Not Significant	Not Significant
7-23-69	$\bar{D}$ = 0.07	$\bar{D}$ = -0.75	$\bar{D}$ = 0.44
	t = +0.12	t = -0.76	t = +0.37
	DF = 18	DF = 22	DF = 21
	Not Significant	Not Significant	Not Significant
7-29-69	$\bar{D}$ = -0.23	$\bar{D}$ = 0.83	$\bar{D}$ = 0.98
	t = -0.2049	t = 1.70	t = +0.88
	DF = 22	DF = 22	DF = 18
	Not Significant	Not Significant	Not Significant
7-21-69	$\bar{D}$ = -0.126	$\bar{D}$ = 1.41	$\bar{D}$ = -0.90
	t = -0,12	t = 1.46	t = -0.7784
	DF = 17	DF = 25	DF = 22
	Not Significant	Not Significant	Not Significant

$\bar{D}$ = Average observed - expected light off speeds minus observed - expected light on speeds
t = Calculated value by Student t test
DF = Degrees of freedom

BIAS

Design of Study. The study design resulted in certain limitations:

1. Selection of roadways in or near Sacramento, California.
2. Three types of paved roads; two-lane undivided, four-lane divided, and six-lane divided.
3. Hot and humid summer weather conditions.
4. Afternoon, evening, and night traffic.
5. Sunday surveys at three locations, peak hour commuter traffic weekdays at one location.

These delimitations do not necessarily result in biases, however, they must be considered for predictive purposes. Traffic conditions on a six-lane, divided roadway in Sacramento may be quite different from a ten-lane, divided road in Los Angeles. (It was felt that the hot summer weather would effect traffic less than the wet winter weather). Surveys were conducted on Sundays so that traffic volumes would be maximized.

Data Collection. Data were collected according to a centrally coordinated predetermined schedule.

Personnel. Survey personnel consisted of professional traffic count teams and research analysts. Personnel were oriented prior to the surveys and furnished printed time schedules. Crew members were provided breaks throughout the surveys and fatigue did not appear to be a factor.

Equipment

Radars and Graphic Recorders. Radar speed measuring devices and graphic recorders were calibrated prior to each data collection period and cross-checked at the calibration speed. In addition, the traffic observer drove by the radar site and the speedometer reading was compared to radar and recorder readings. This was done to check the angle of the radar head and ensure that calibrated speeds were true speeds.

A complete set of speed data are not available due to equipment failure. Radar speeds for the black and white vehicle, no-light and deck light test were not secured for the light and medium volume surveys.

When failures occurred at the main pretest or test sites, data collection was suspended on the opposite side of the road and equipment transferred.

Aerial photography. Since the photographs were not automatically timed, it was necessary to estimate actual times. This was done by detecting unusual events in the photographs and assigning the actual time recorded from other sources. There is some error caused by estimating the times for the intervening photographs. However, the aircraft tended to pass over the test site by constant time increments and the timing error would probably be less than a minute. Average speeds for speed vs density comparisons were by two and one-half minute increments and data matching is probably fairly accurate.

Illegible and incomplete photos were not reduced. Generally these were less than 2% except for the Mace Boulevard site.

Data Reduction

Radar speeds. Since there were tremendous volumes of data, several individuals were needed to reduce the raw data. Figure 41 on page T-80 is a reproduction of actual speed recordings which were used.

Each point on the graph represented the recorded speed for a vehicle. The columns on the graphs were readings for either five or ten second intervals. The data points were averaged to the nearest whole mile per hour for each column.

The average speeds and variances for each two and one-half and five minute interval was then computed. Calculations were to three decimal places and rounded to two places.

There were periodic checks of the reduced data to determine consistency of results by various personnel. The results were very comparable and averages probably varied less than one-tenth mile per hour.

Aerial Photographs. All photographs were reduced by the same personnel. A recheck of selected frames indicated that the counts were accurate about 99% of the time.

Data Analysis.

Standard statistical formulae were used.[6] Calculations for average speeds and variances were rounded to two decimal places. Student t, F tests, correlation coefficient and regression equations were calculated to six decimal places and rounded to two places.

Quality Control.

Data from the various sources were cross-checked to determine reliability. For example, density was estimated from

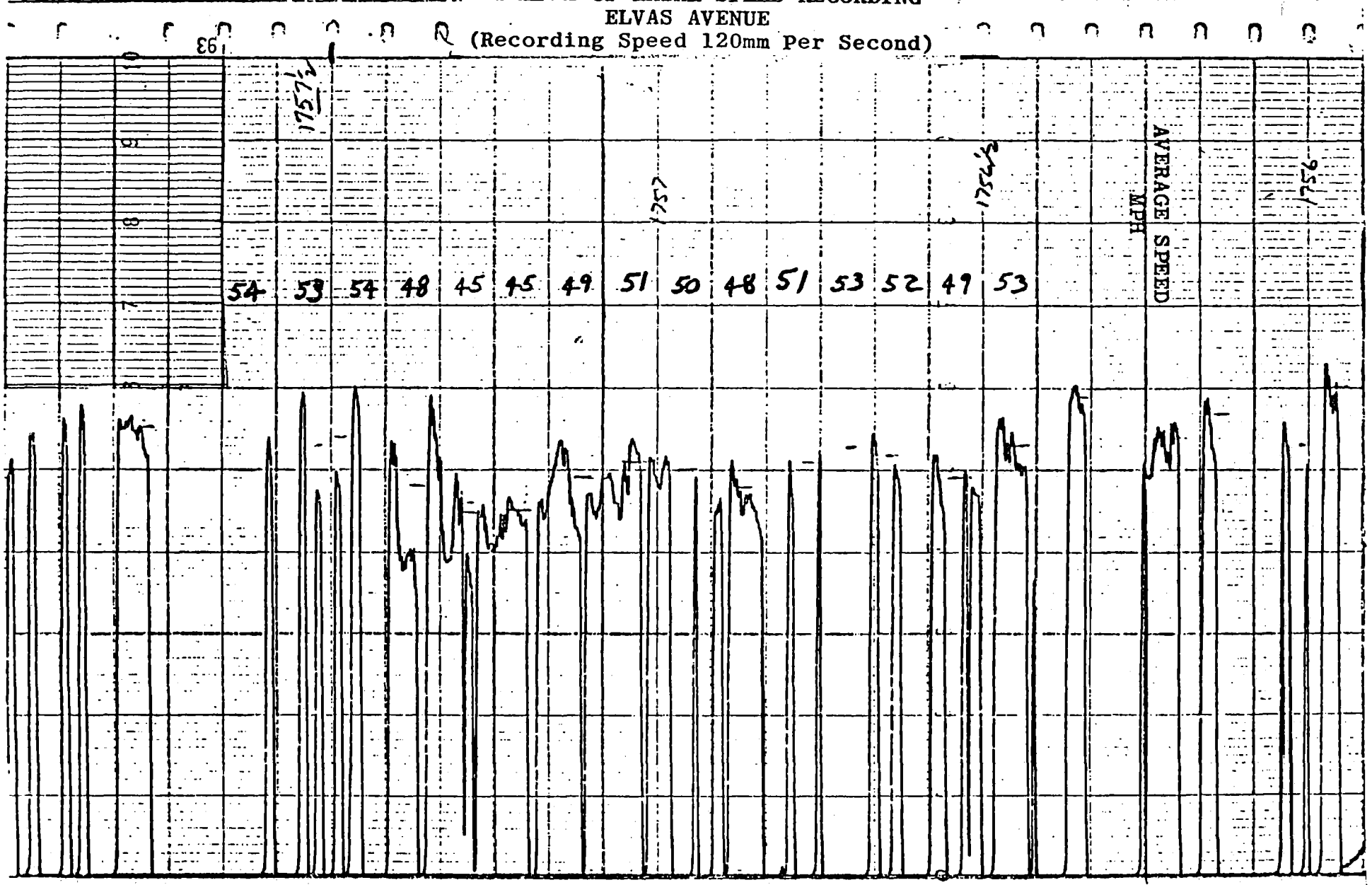
[6]Source of formulae, Edward C. Bryant, Statistical Analysis, (New York: McGraw Hill Book Company, 1966, pp 321.)

radar speeds and volume counts and then compared to actual density.

There was a systematic variance at two sites which appeared to result from roadway characteristics. These variances and subsequent adjustments are described in Annex D.

FIGURE 41

SAMPLE OF RADAR SPEED RECORDING
ELVAS AVENUE
(Recording Speed 120mm Per Second)



ANNEX A

STATISTICAL METHODOLOGY
EL CENTRO, FOOTHILL FARMS, MACE

Average Speeds and Variances. Speeds were averaged from the raw data for each fifteen-minute test interval and variances were computed.

These formulae were used:

Average speed = $\bar{X}$

and $\bar{X} = \frac{1}{N} \sum X_i \quad i = 1 \text{ through } N$

where X = vehicle speeds

N = number of intervals or frequencies

Variance = S^2

$$S^2 = \frac{N \sum X^2 - (\sum X)^2}{N\ (N-1)}$$

Hypothesis of Testing for Significance. A null hypothesis was used to test that the comparative speeds are not different. The alternative hypothesis (H_a) was that the comparative speeds are different. This may be expressed mathematically:

$$H_o : \bar{X}_1 = \bar{X}_2$$

$$H_a : \bar{X}_1 \neq \bar{X}_2$$

Where H_o = Null Hypothesis

H_a = Alternate Hypothesis

$\bar{X}_1$ = Average Speed for one test interval

$\bar{X}_2$ = Average Speed for second comparative test

S_1^2 = Variance of speeds for $\bar{X}_1$

S_2^2 = Variance of speeds for $\bar{X}_2$

The speed for each fifteen-minute interval was compared to determine whether the test situation (type of vehicle and lighting) effected driver behavior. Speeds were tested by the Student t test for significant differences. Variances were tested by the F test. All statistical tests were at an $\alpha = .05$ level of significance, two tail tests.

Comparison of Variances by F Test. The variances were compared by the F test. If the resulting ratio fell within acceptable statistical limits, the variances were considered to be of the same population. The average speeds for these variances were tested by Student t formula.

F test formula:

$$F = S_L^2 / S_s^2 \text{ with } (n_L - 1) \text{ and } (n_s - 1) df$$

Where S_L^2 = the larger of the two variances,

and S_S = the smaller of the two variances.

n_L = Sample size of largest variance

n_s = Sample size of smallest variance

The degrees of freedom (df) corresponding to the variance are used in determining the value for rejection of equality.

Comparison of Average Speeds by Student t Test. Each fifteen-minute test interval represented one unique test situation. The speed for each test situation was tested by the Student t test. This test was used consistently, although some of the samples are of sufficient size to use the Z test for standard scores.

Formula, Student t test, variances of the same population:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{Sp\left[(1/n_1 + 1/n_2)\right]^{\frac{1}{2}}}$$

$$\text{Where } Sp = \left[\frac{S_1^2 (n_1 - 1) + S_2^2 (n_2 - 1)}{(n_1 + n_2) - 2}\right]^{\frac{1}{2}}$$

and subscript 1 denotes sample 1 and subscript 2, sample 2.

The rejection criterion is for a two tail test.

Calculated t equals or exceeds $\pm t_{\alpha/2\ (n_1 + n_2 - 2df)}$

Modified Student t, variances not from the same population:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\left[S^2_{\bar{X}_1} + S^2_{\bar{X}_2}\right]^{\frac{1}{2}}}$$

Where $S^2_{\bar{X}_1} = \frac{S^2}{N_1}$ and $S^2_{\bar{X}_2} = \frac{S^2}{N_2}$

and calculating for degrees of freedom

$$\left[\frac{\left(S^2_{\bar{X}_1} + S^2_{\bar{X}_2}\right)^2}{\left[(S^2_{\bar{X}_1})^2 / (n_1 + 1)\right] + \left[(S^2_{\bar{X}_2})^2 / (n_2 + 1)\right]}\right] \text{ -2 degrees of freedom}$$

The rejection criterion is for a two tail test, calculated t equals or exceeds $\pm t_{\alpha/2}$ (calculated degrees of freedom).

ANNEX B

STATISTICAL METHODOLOGY
ELVAS AVENUE

Radar Speeds

Average speeds and variances. Speeds and variances were computed for two and one-half and five-minute intervals by standard formulae described previously.

Standardization of data. The average speed for each two and one-half minute interval was plotted by corresponding volume of vehicles per hour (VPH). A parabolic curve was fitted to the data points by least squares regression. The theoretical curve provides a measure of expected speed if the effect of volume is removed.

Formula

$$V^* = A + BS + CS^2$$

Where V^* = estimated volume

S = recorded average speeds

The maximum V^* was set at road design capacity of 6,000 VPH and the constants were obtained by least squares. Theoretical speeds were then substituted for S to determine estimated volume (V^*) for that speed.

The theoretical speed-volume data points were plotted and the parabolic curve drawn.

Speed volumes were averaged by five-minute increments to partially remove the effect of extreme values. However, some of the data points which occurred during the high speed-low volume to low speed-high volume transition were so extreme that they could not be explained or treated statistically. It was necessary to remove some of these data prior to statistical testing. The transition period occurred within about five minutes and only one or two data points were actually removed.

The averaging by five-minute increments resulted in twelve degrees of freedom possible for each lighting condition, 24 for both light-on, light-off tests. (Four test intervals x 15 minutes each ÷ five-minute intervals = 12 degrees of freedom.)

Testing for significant differences. The average differences between actual and theoretical speeds for light-off and light-on tests were compared by the Student t test.

Formula:

$$t = \frac{\bar{D}_1 - \bar{D}_2}{\left[\frac{s_1^2 (n_1 - 1) + s_2^2 (n_2 - 1)}{n_1 + n_2 - 2}\right]^{\frac{1}{2}} \left[\frac{1}{n_1} + \frac{1}{n_2}\right]^{\frac{1}{2}}}$$

Where $\bar{D}_1$ = average difference between observed and expected speeds, light-on test

$\bar{D}_2$ = average difference for light-off test

s_1^2 = variance for $\bar{D}_1$

s_2^2 = variance for $\bar{D}_2$

n_1 = degrees of freedom for $\bar{D}_1$

n_2 = degrees of freedom for $\bar{D}_2$

α = .05, two tail test

and $$\bar{D} = \frac{\sum (X_1 - X_2)}{n}$$

Where X_1 = observed speeds

X_2 = expected speeds

n = degrees of freedom

Variances s_1^2 and s_2^2 were computed as follows:

$$\frac{\sum (X_1 - X_2)^2}{n - 1}$$

Testing procedure. The variances were compared by the F test prior to the Student t test comparison. If the ratio was rejected at $\alpha = .05$, the previously described modified Student t test formula was used.

The following procedure was used for each parabola:

Speeds-volumes averaged for each five-minute interval.

Observed average speeds compared with theoretical speeds and differences taken.

Differences summed, grand means and variances computed.

Variances for light-on, light-off tests compared,

$\alpha = .05$

$H_o: s_1 = s_2$

$H_a: s_1 \neq s_2$

The grand means of average differences for light-on, light-off tests compared by the Student $\underline{t}$ test, $\alpha = .05$.

$H_o: \bar{D}_1 = \bar{D}_2$

$H_a: \bar{D}_1 \neq \bar{D}_2$

Calculated t values were compared to Fisher's Statistical Table of $\underline{t}$ values. Area of rejection for

$H_o: t \leq -t_{\alpha 2/.05}$ or $\geq t_{\alpha 2/.05}$

ANNEX C

DENSITY

Vehicles Per Mile. The number of vehicles counted in each photograph were expanded to express the number of vehicles per mile.

$$\text{Vehicles Per Mile} = \frac{\text{Number of vehicles on test road}}{\text{Length of test road in ft./5280}}$$

Linear Regression of Speed on Density. Speeds were plotted on the Y axis by densities on the X axis.

The regression line of Y on X was computed by the least squares method.

$$Y_i = A + BX_i$$

Where i = 1 through N

The constants A and B are secured by simultaneously solving normal equations. The constants are then used in the formula to estimate speeds for various values of X, i.e., densities.

Estimation of Density From Other Data, 7/31/69 Survey. The following relationships exist:

Volume (vehicles per hour) = Average speed x density (vehicles per mile)

Since volume and average speeds are known, density may be calculated

$$\text{Density} = \frac{\text{volume}}{\text{speed}}$$

The Southern Pacific Overcrossing volume counts, pretest site, and test site speeds were used to estimate pretest and test site densities. The speeds were then plotted by the estimated densities. The base data were by two and one-half minute increments which partially eliminates the effect of extreme values.

Densities from the photographs are by one to one and one-half minute increments and corresponding speeds are by two and one-half minute increments. The estimated measures are mathematically correct, but the rounding effect causes difficulty in comparing recorded with estimated density.

Density was estimated for the 7/23/69 survey and regression lines calculated. Although considerable rounding of data occurred, the relationship of the pretest and test site regression lines indicated a greater difference in densities than for the 7/31/69 estimates.

ANNEX D

RADAR SPEED ADJUSTMENT FOR ROADWAY CHARACTERISTICS

Both Mace Boulevard and Foothill Farms westbound radar speeds appeared affected by a roadway characteristic or some other unidentified factor. The term roadway characteristic is defined for this study as a variable, condition, or some other factor which affects traffic patterns. The factor may be an element(s) of roadway design, construction, environment or unknown. There are on and off ramps adjacent to the test roadway at both locations. These ramps may have caused or contributed to a speed reduction.

Mace Boulevard test site speeds appear reduced from expected speeds by about 2.97 MPH and Foothill Farms pretest site speeds by about 1.49 MPH. These amounts were considered as constants and added to or subtracted from average speeds prior to statistical analysis.

The characteristic difference was determined by computing the average speed and variance for two 15-minute test intervals. These intervals were from 6:13 p.m.-6:28 p.m. and 6:29 a.m.-6:44 p.m. when there was no test vehicle on the westbound side. The pickup test vehicle was located on the eastbound side of the road during this period. It was felt that the pickup on the opposite side of the road during

daylight hours would effect traffic least and the average difference in pretest, test site speeds could be attributed to roadway characteristics.

The speeds for the two intervals were tested by the Student t test at $\alpha = .05$ to determine whether the pickup light had an effect on westbound traffic.

There was no statistical difference between the light-on, light-off pretest and test site speeds at Foothill Farms. The pretest traffic was approaching at a statistically greater speed during the light-off period at Mace Boulevard yet there is no difference at the test site. This infers that the pickup light had no effect on traffic speeds at either location.

Three methods were considered to determine and remove the effects of roadway characteristcs. The third method was used to adjust the speeds.

1. (Speed, test site) = A + B·(Speed, pretest site)
   The values of A and B were secured by simultaneous equations. This formula yields a very small B value and large A value. Application of this adjustment

to the speed distribution causes considerable rounding and tends to distort less than average values.

2. (Speed, test site) = A + B·(Speed, pretest site) and assuming that A = 0.
A was set to zero and B computed as a ratio. This method is fairly satisfactory but tends to affect extreme values more than is desirable.

3. (Speed, test site) = A + B·(Speed, pretest site) and assuming that B = 1, $\bar{X}_1$ = Pretest Speed and $\bar{X}_2$ = Test Site Speed. Solving for A, the difference in speed is merely $\bar{X}_1 - \bar{X}_2$. This amount is either subtracted from $\bar{X}_2$ or added to $\bar{X}_1$.
This method is simple to compute, has a lesser effect on extreme values and yields average results comparable to method #2.

The adjustment factors were calculated as follows:

1. Foothill Farms

$S_T = A + B \cdot S_P$

Where S_T = Average speed at test site for 30-minute period

A = Constant increment to be determined

$B = 1$

S_p = Average speed at pretest site for 30-minute period.

and substituting with actual values

$$62.13 = A + 1 \cdot 60.64$$

$$62.13 = A + 60.64$$

$$-A = 60.64 - 62.13$$

$$A = 1.49$$

Since the pretest site speed is 1.49 MPH less than the test site speed when speeds should be approximately equal, this constant amount is added to the pretest speeds.

2. Mace Boulevard (Using same formula)

$$S_T = A + B \cdot S_P$$

$$60.23 = A + 1 \cdot 63.20$$

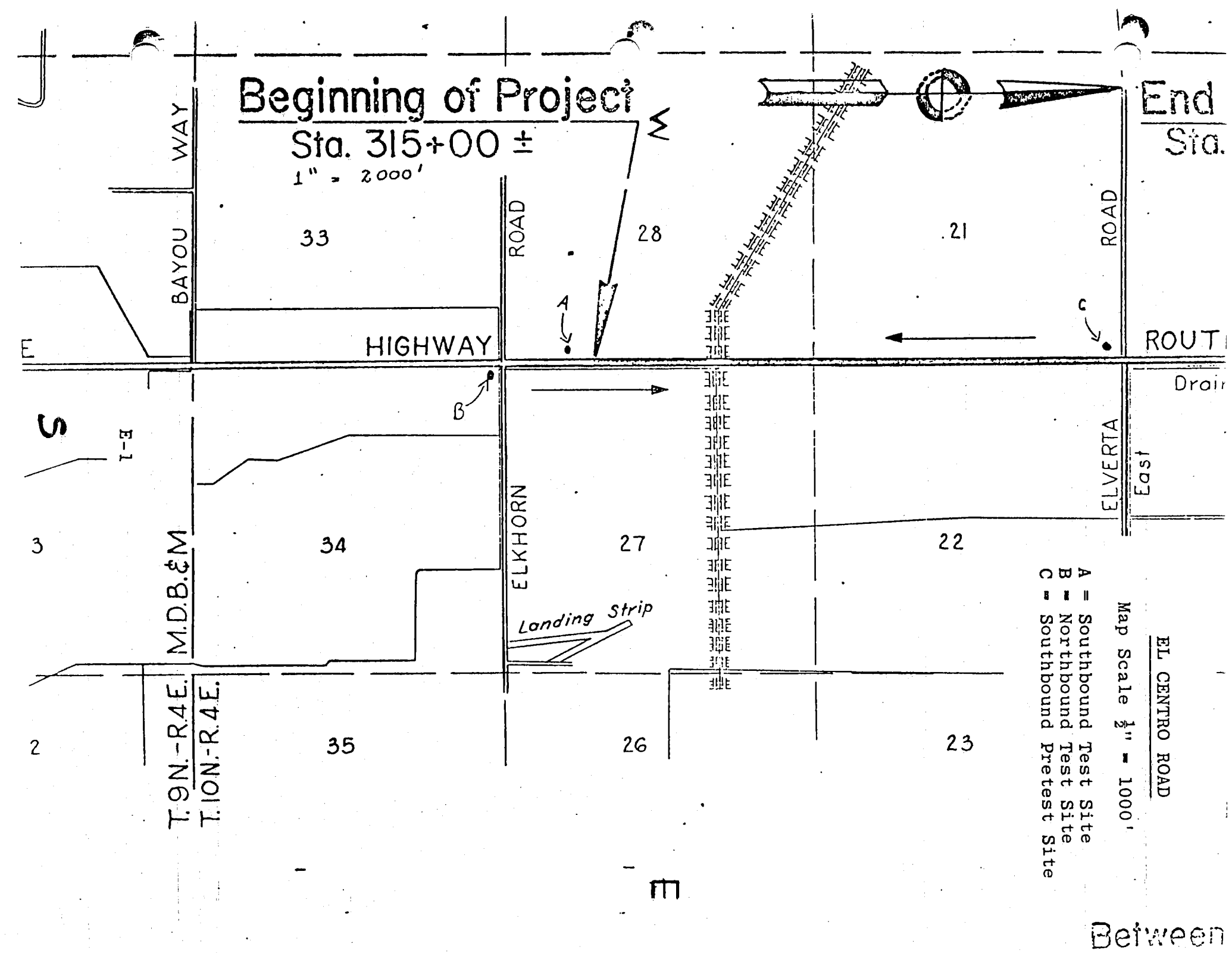
$$60.23 = A + 63.20$$

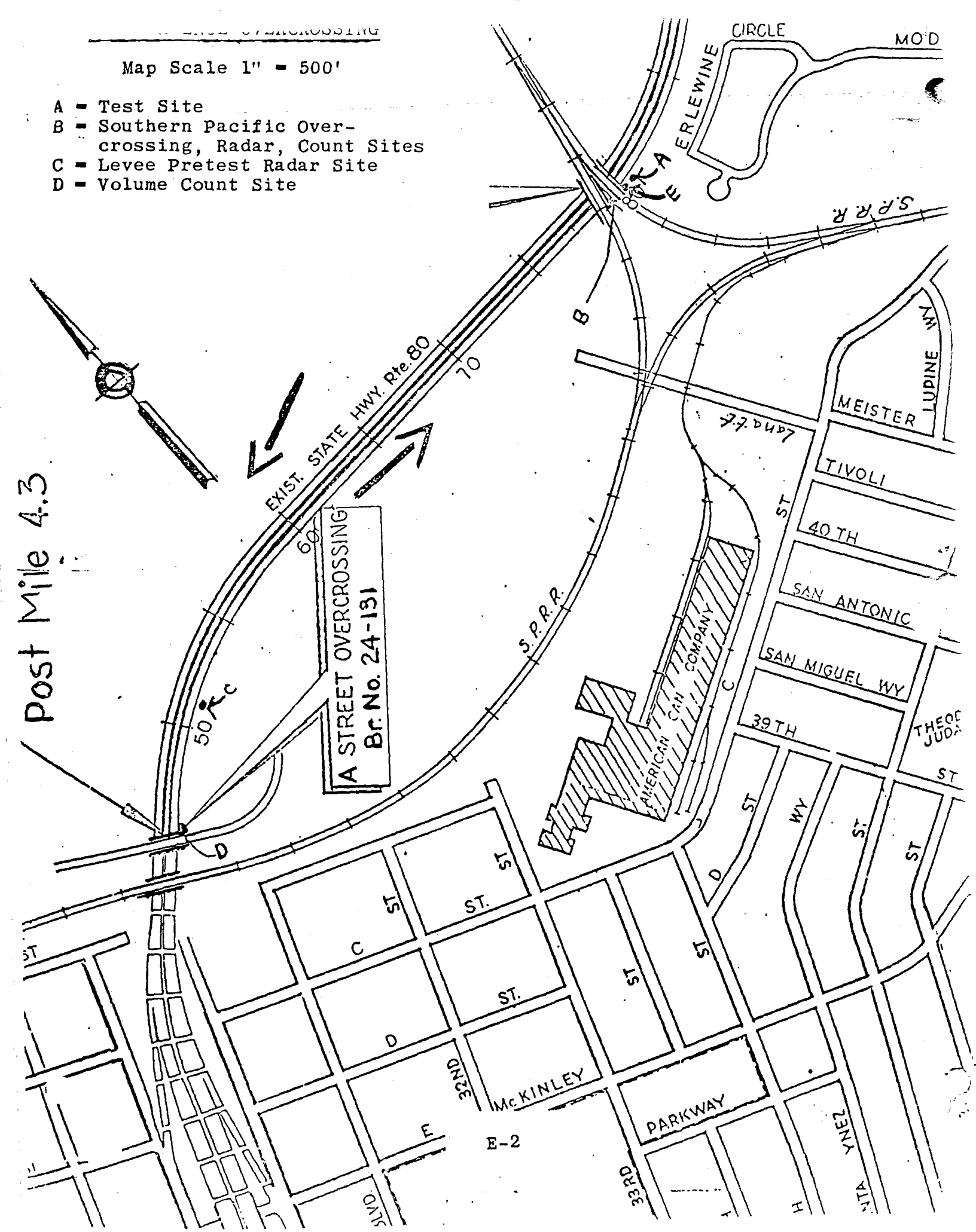
$$-A = 63.20 - 60.23$$

$$A = -2.97$$

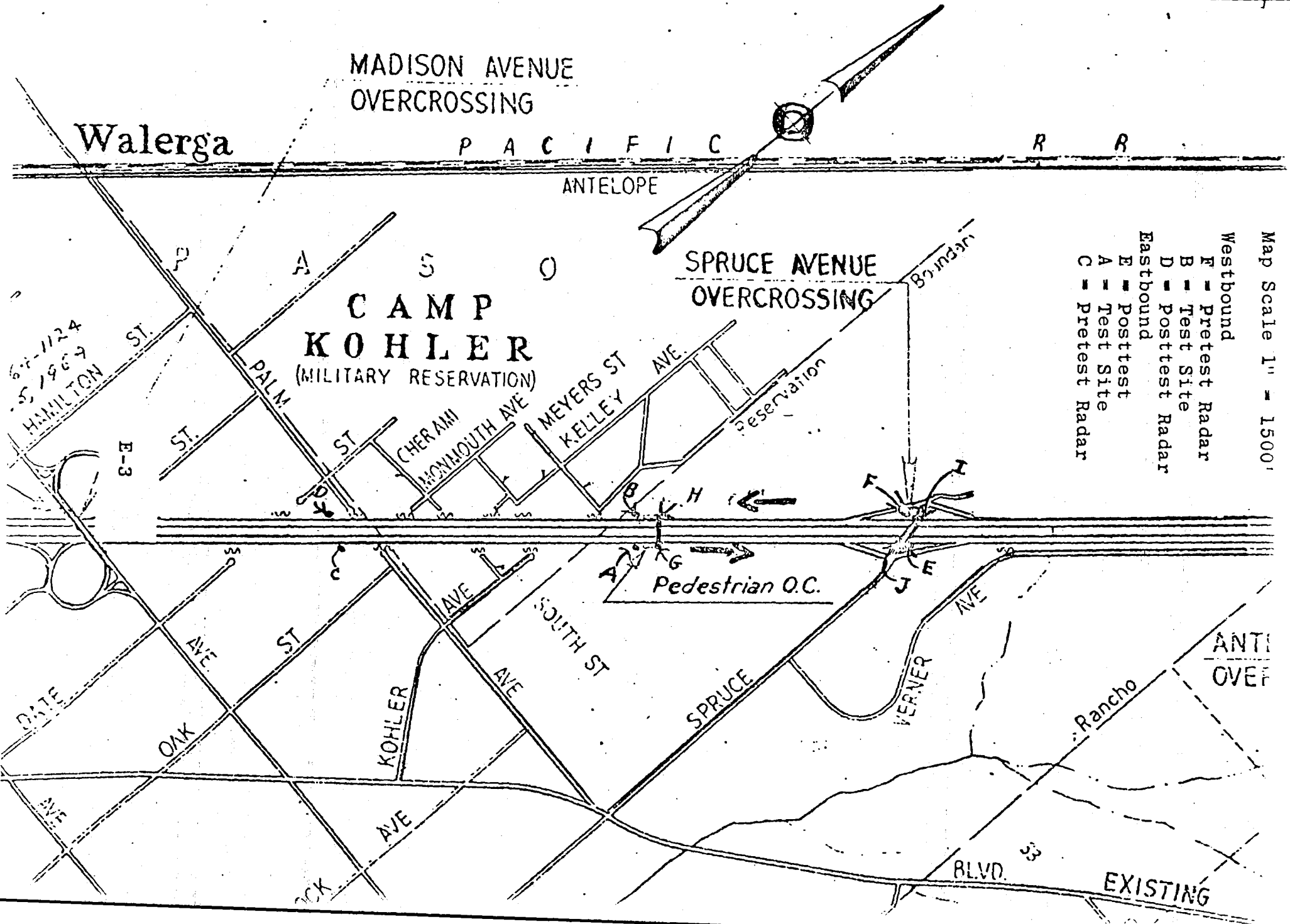
Since test site speeds appear continuously depressed, this constant is added to average test site speeds.

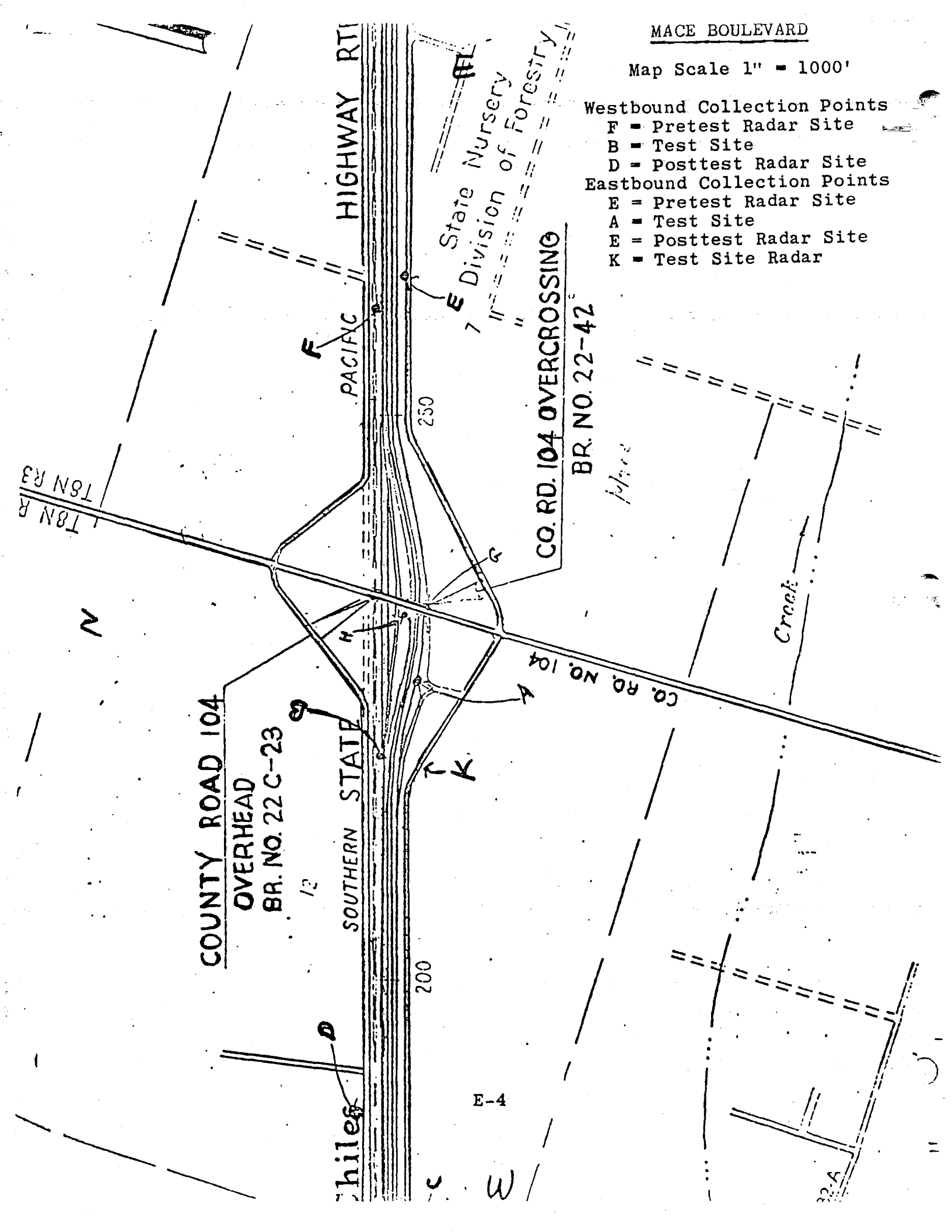
ANNEX E


Beginning of Project
Sta. 315+00 ±
1" = 2000'
End
Sta.
WAY
BAYOU
ROAD
ROAD
HIGHWAY
ROUT
Drai
A
B
C
E-1
ELVERTA
East
ELKHORN
Landing Strip
M.D.B.&M
T.9N.-R.4E.
T.10N.-R.4E.
33
28
21
34
27
22
35
26
23
3
2
A = Southbound Test Site
B = Northbound Test Site
C = Southbound Pretest Site
Map Scale ½" = 1000'
EL CENTRO ROAD
Between


Map Scale 1" = 500'
A = Test Site
B = Southern Pacific Over-crossing, Radar, Count Sites
C = Levee Pretest Radar Site
D = Volume Count Site
Post Mile 4.3
EXIST. STATE HWY. Rte. 80
70
60
50
A STREET OVERCROSSING
Br. No. 24-131
S.P.R.R.
AMERICAN CAN COMPANY
CIRCLE
MEISTER
LUPINE WY
TIVOLI
40TH
SAN ANTONIO
SAN MIGUEL WY
39TH
ST
WY
McKINLEY
PARKWAY
32ND
33RD
BLVD
A
B
C
D

FREEWAY AGREEMENT




MACE BOULEVARD
Map Scale 1" = 1000'
Westbound Collection Points
F = Pretest Radar Site
B = Test Site
D = Posttest Radar Site
Eastbound Collection Points
E = Pretest Radar Site
A = Test Site
E = Posttest Radar Site
K = Test Site Radar
HIGHWAY RT
State Nursery
Division of Forestry
PACIFIC
CO. RD. 104 OVERCROSSING
BR. NO. 22-42
250
T8N R3
T8N R
CO. RD. NO. 104
Creek
COUNTY ROAD 104
OVERHEAD
BR. NO. 22 C-23
SOUTHERN STATE
200
N
E-4

ANNEX F

EL CENTRO ROAD

HOURLY TRAFFIC VOLUMES BY TIME OF DAY

JULY 20, 1969

FIGURE 3

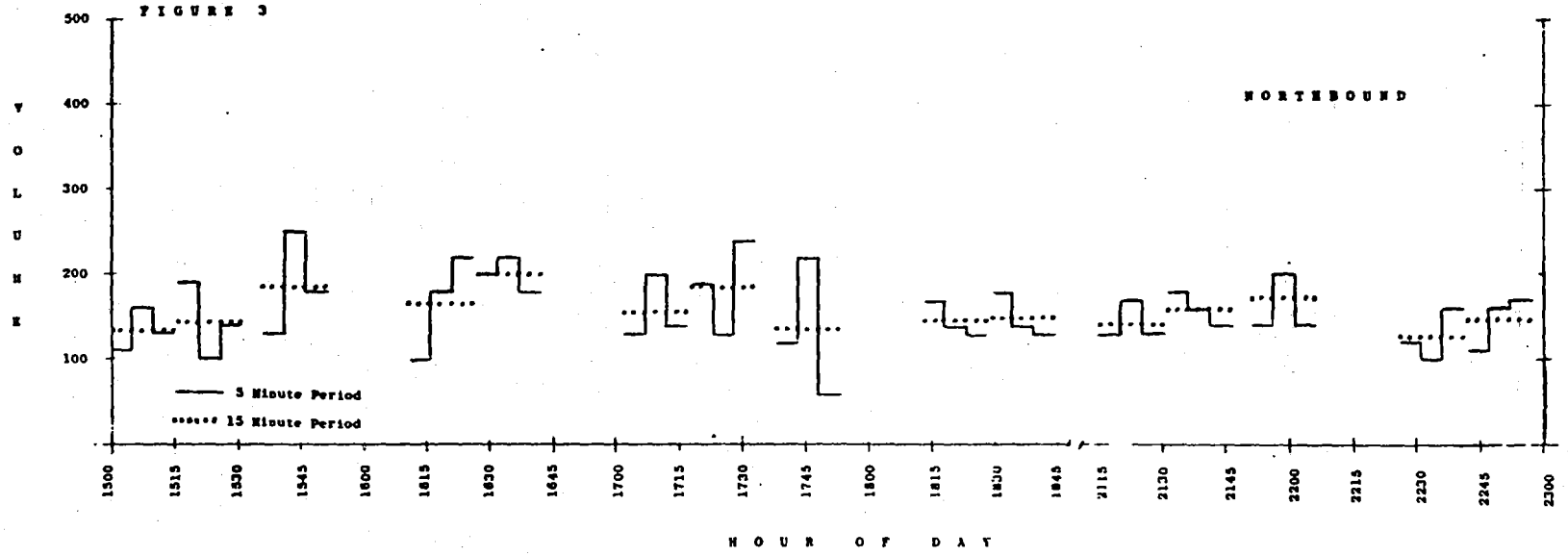


FIGURE 4

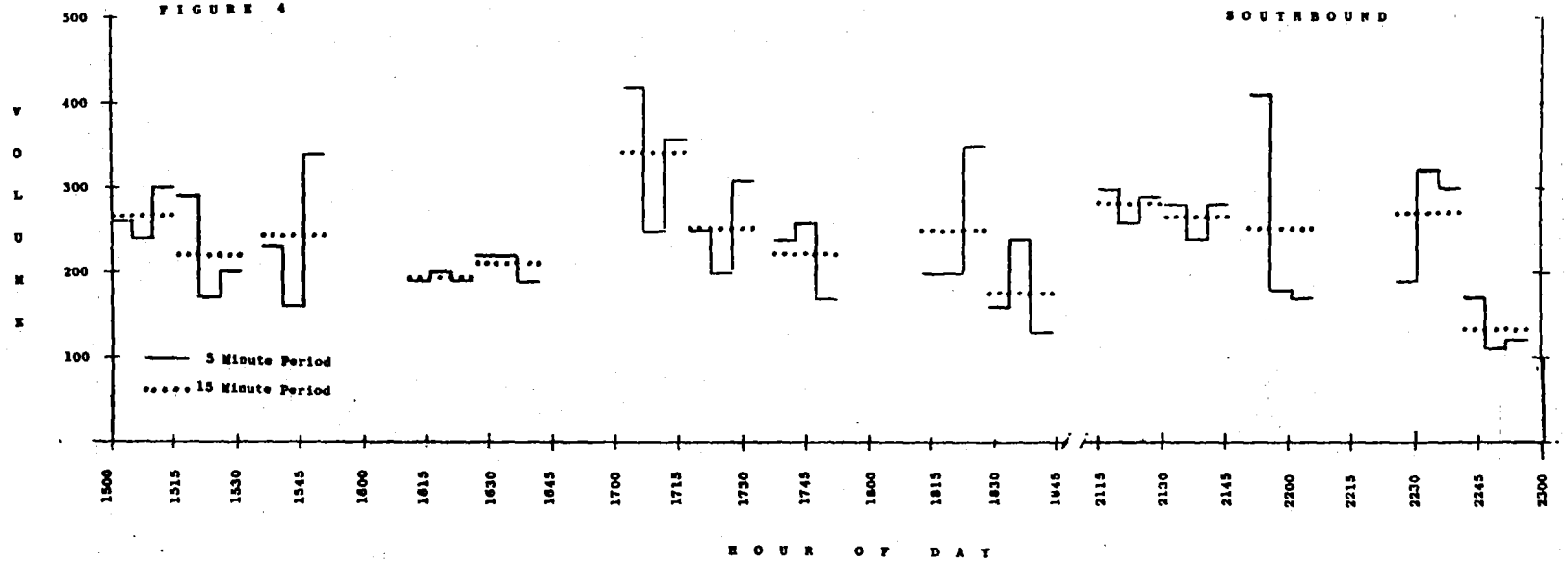
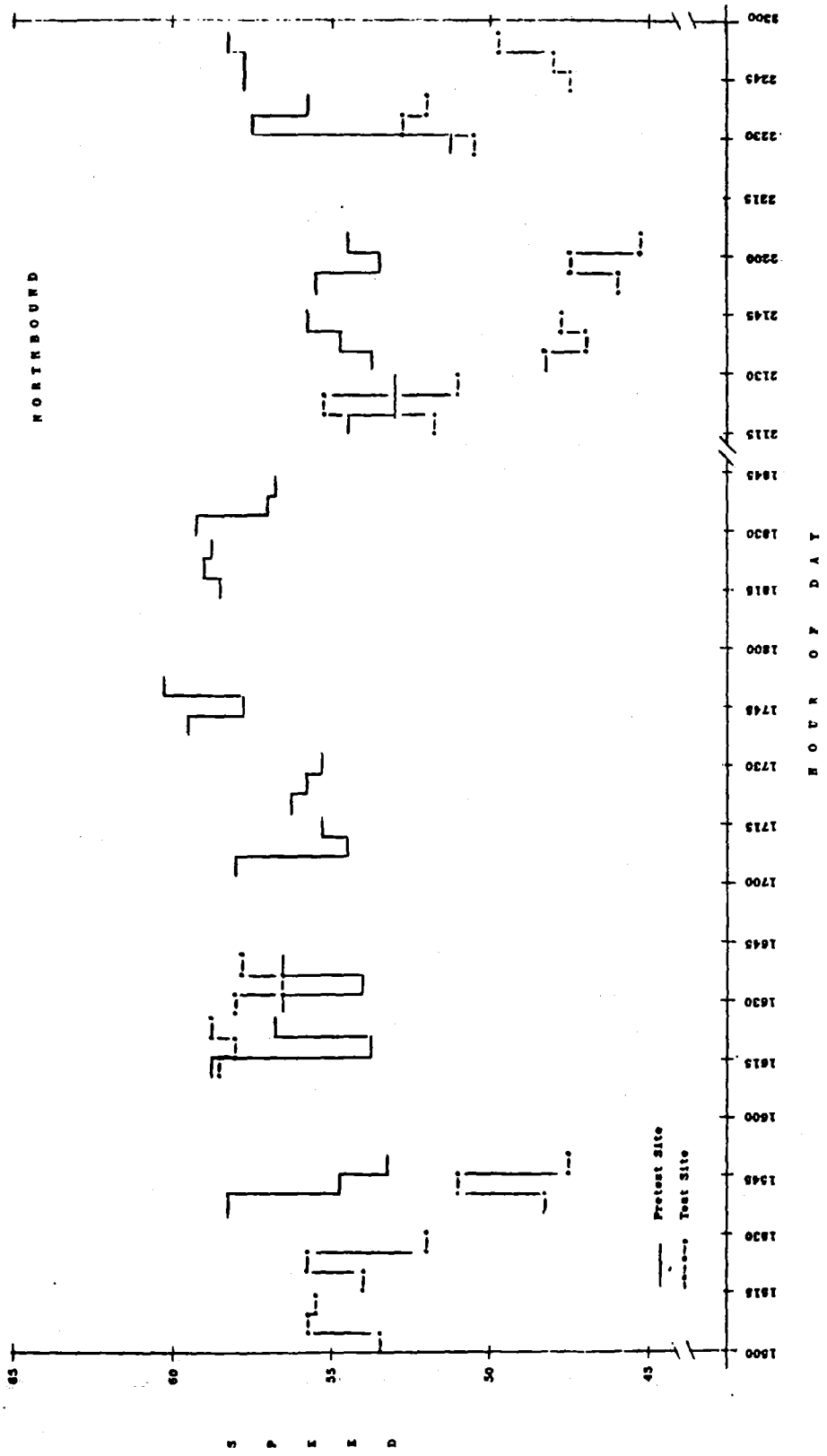


FIGURE 3

COMPARATIVE AVERAGE TRAFFIC SPEEDS FOR EACH 5 MINUTES OF TEST PERIODS

BY HOUR OF DAY

EL CENTRO ROAD RADAR SPEEDS JULY 20, 1969 3:00 PM - 11:00 PM



FOOTHILL FARMS PEDESTRIAN OVERCROSSING (SPRUCE AVENUE)
HOURLY TRAFFIC VOLUMES BY TIME OF DAY
JULY 27, 1969

FIGURE 6

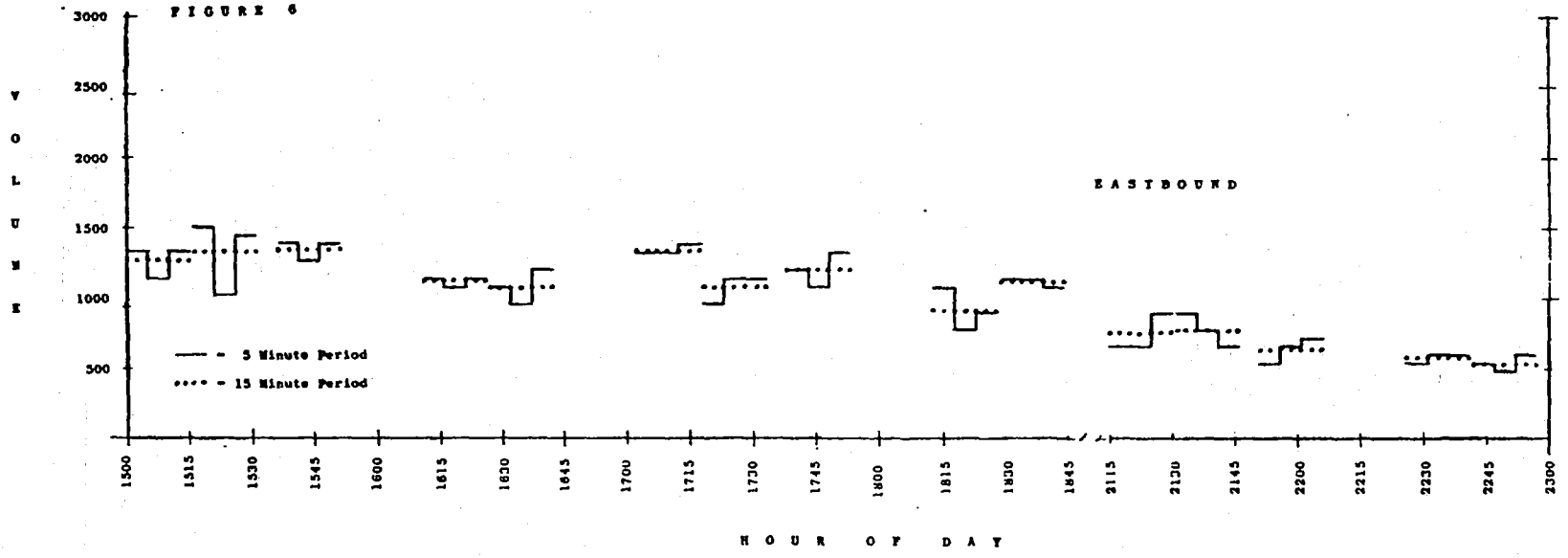


FIGURE 7

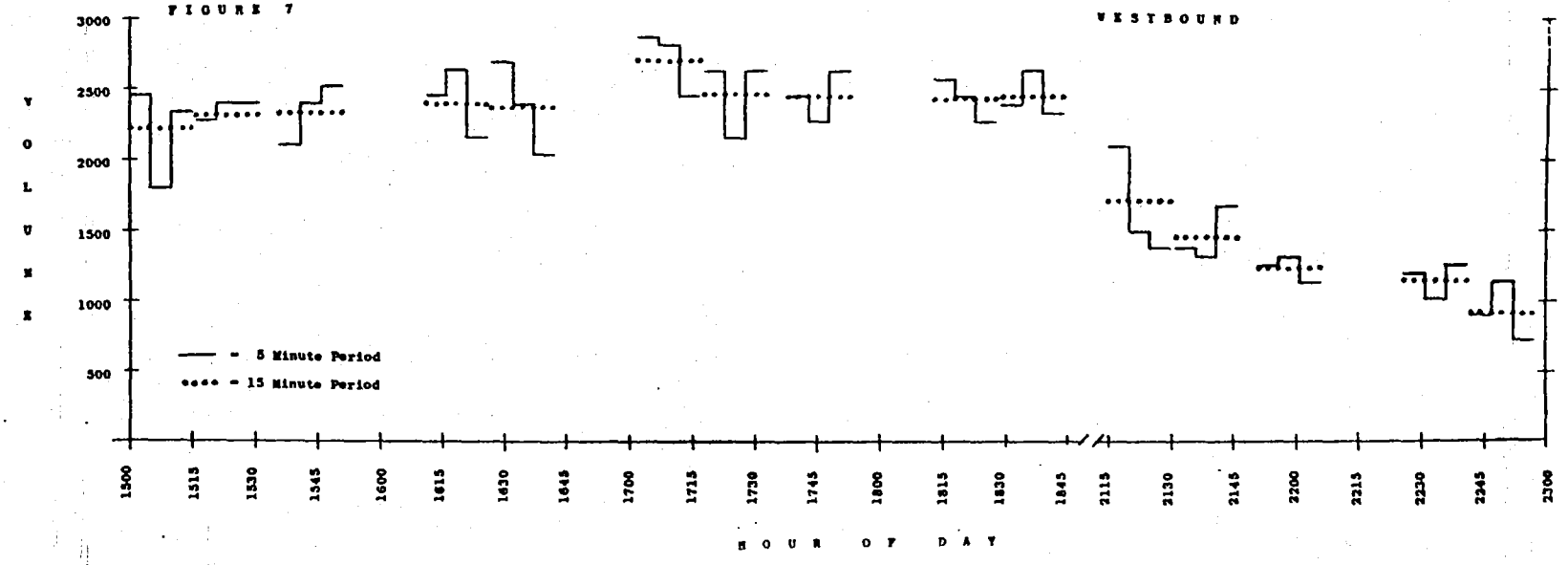
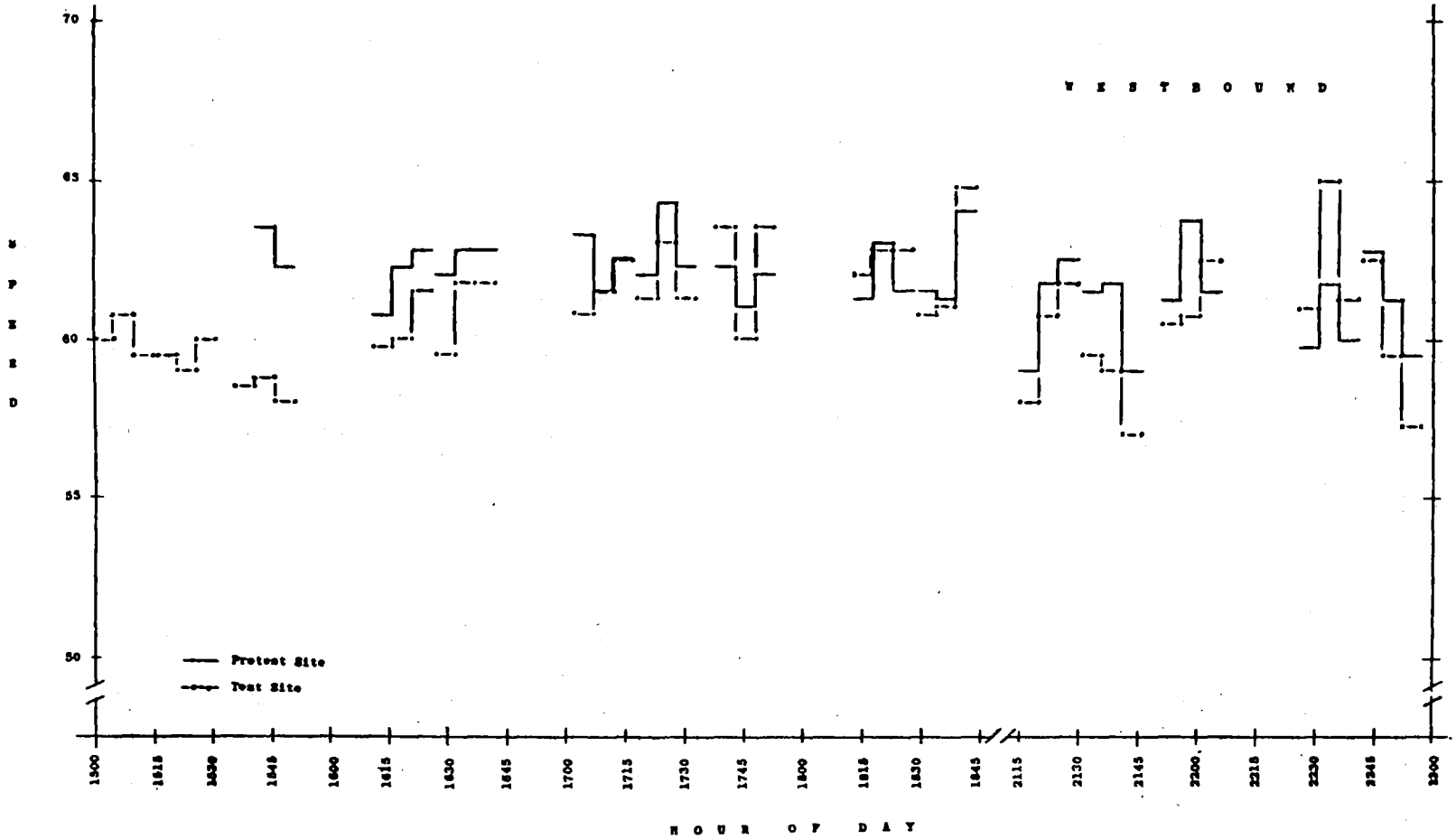


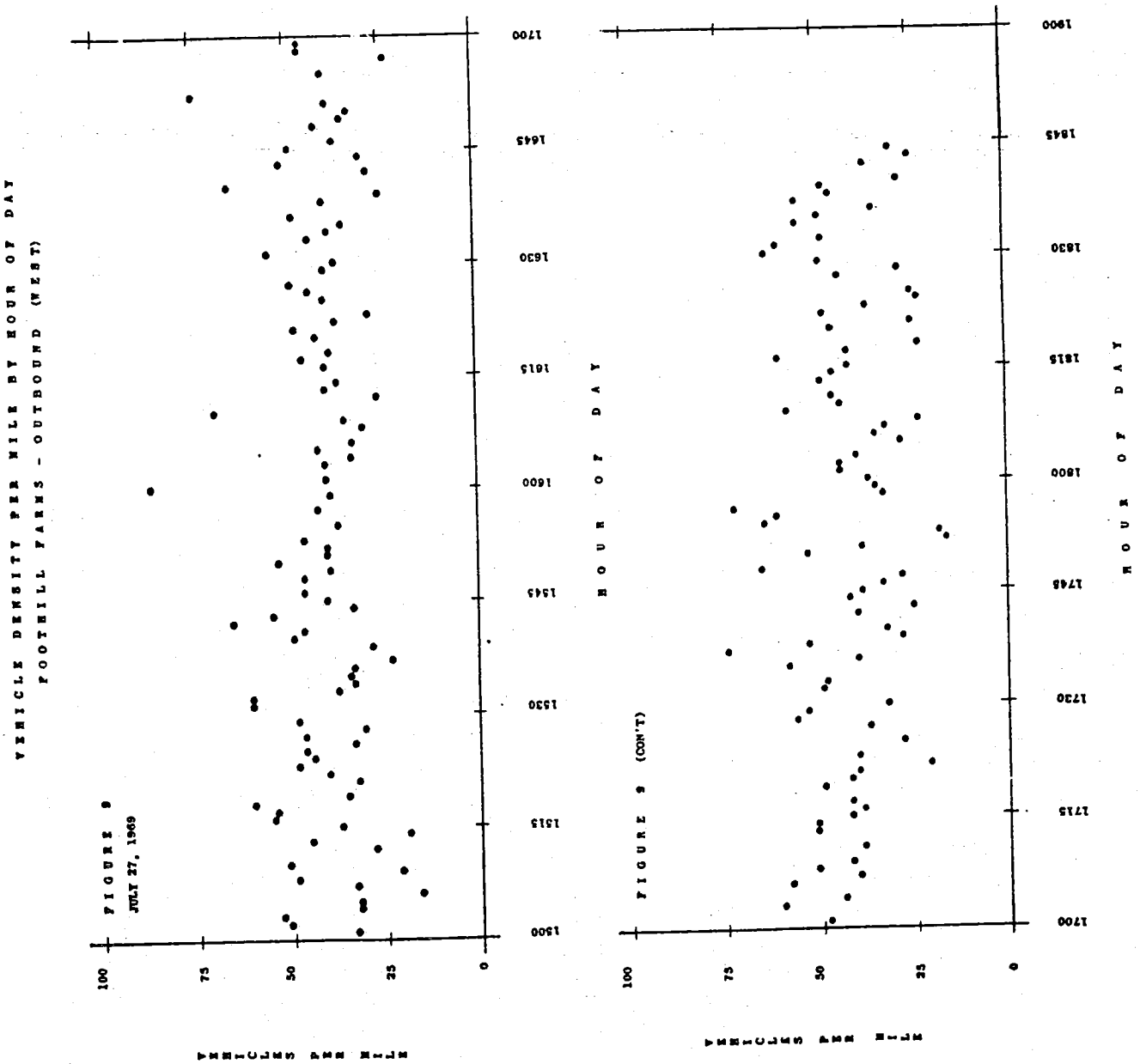
FIGURE 8

COMPARATIVE AVERAGE TRAFFIC SPEEDS FOR EACH 5 MINUTES OF TEST PERIODS

BY HOUR OF DAY

FOOTHILL FARMS (SPRUCE) RADAR SPEEDS - JULY 27, 1969 - 3:00 PM - 11:00 PM




VEHICLE DENSITY PER MILE BY HOUR OF DAY
FOOTHILL FARMS - OUTBOUND (WEST)
FIGURE 9
JULY 27, 1969
VEHICLES PER MILE
HOUR OF DAY
1500
1515
1530
1545
1600
1615
1630
1645
1700
0
25
50
75
100
FIGURE 9 (CON'T)
1700
1715
1730
1745
1800
1815
1830
1845
1900

MACE BOULEVARD OVERCROSSING

HOURLY TRAFFIC VOLUME BY TIME OF DAY

AUGUST 3, 1969

FIGURE 10

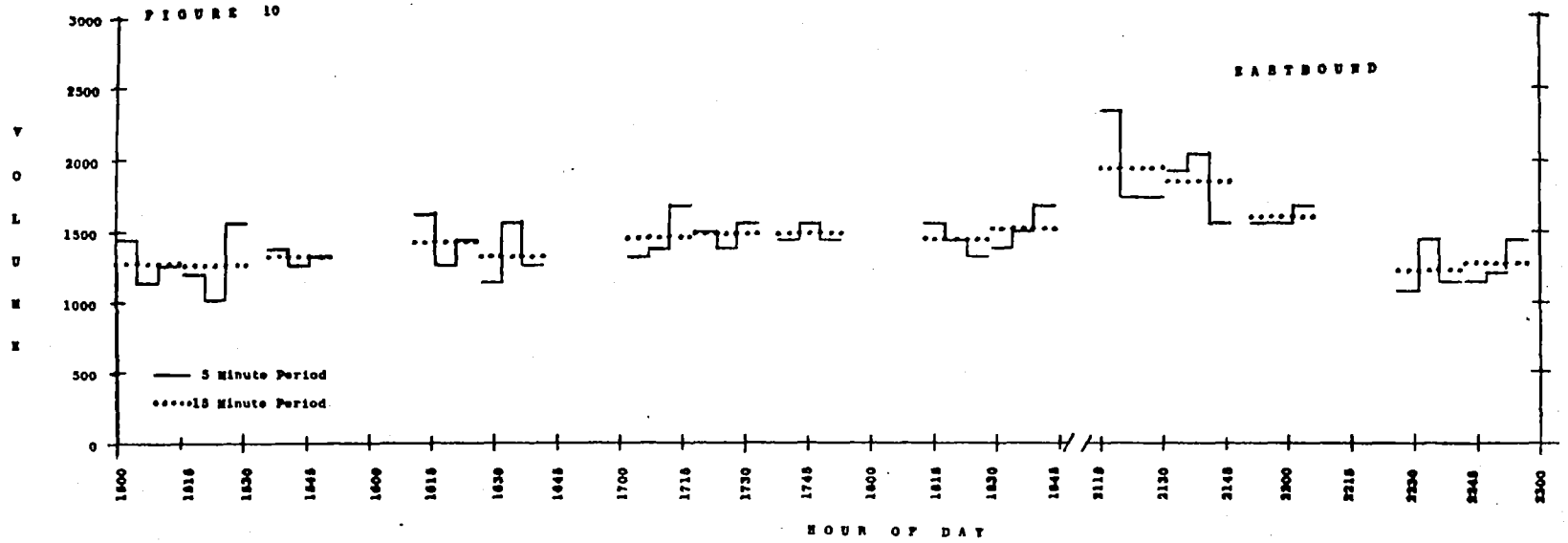
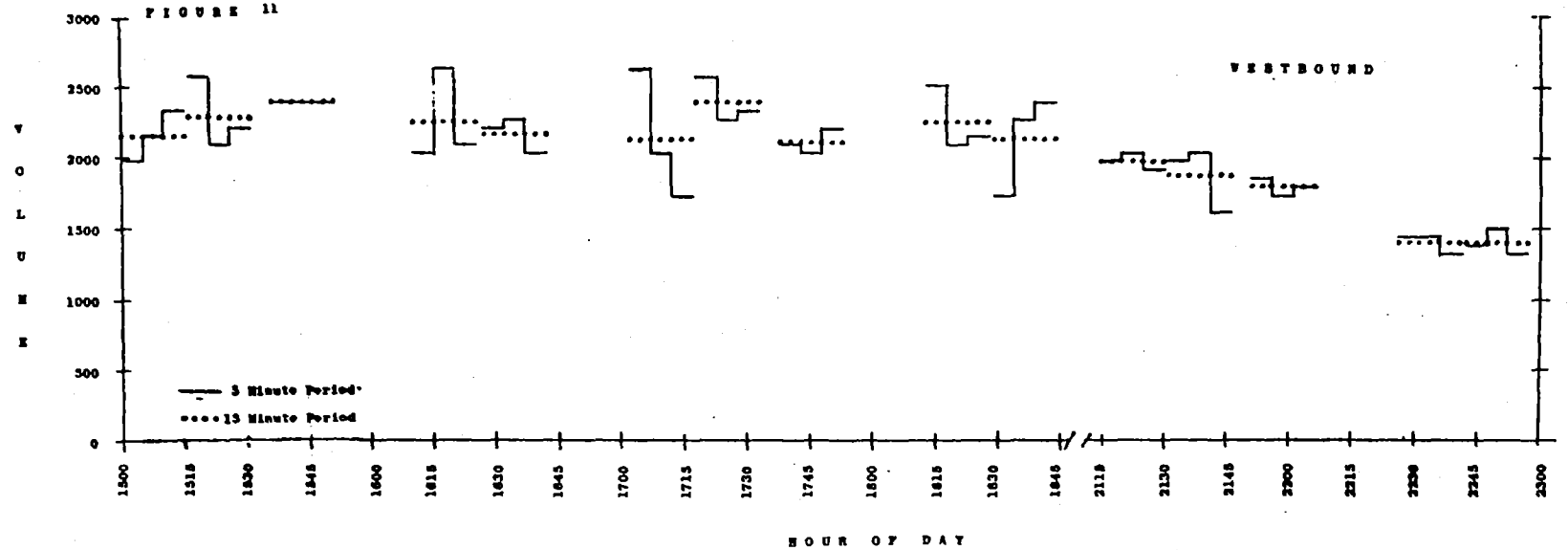


FIGURE 11

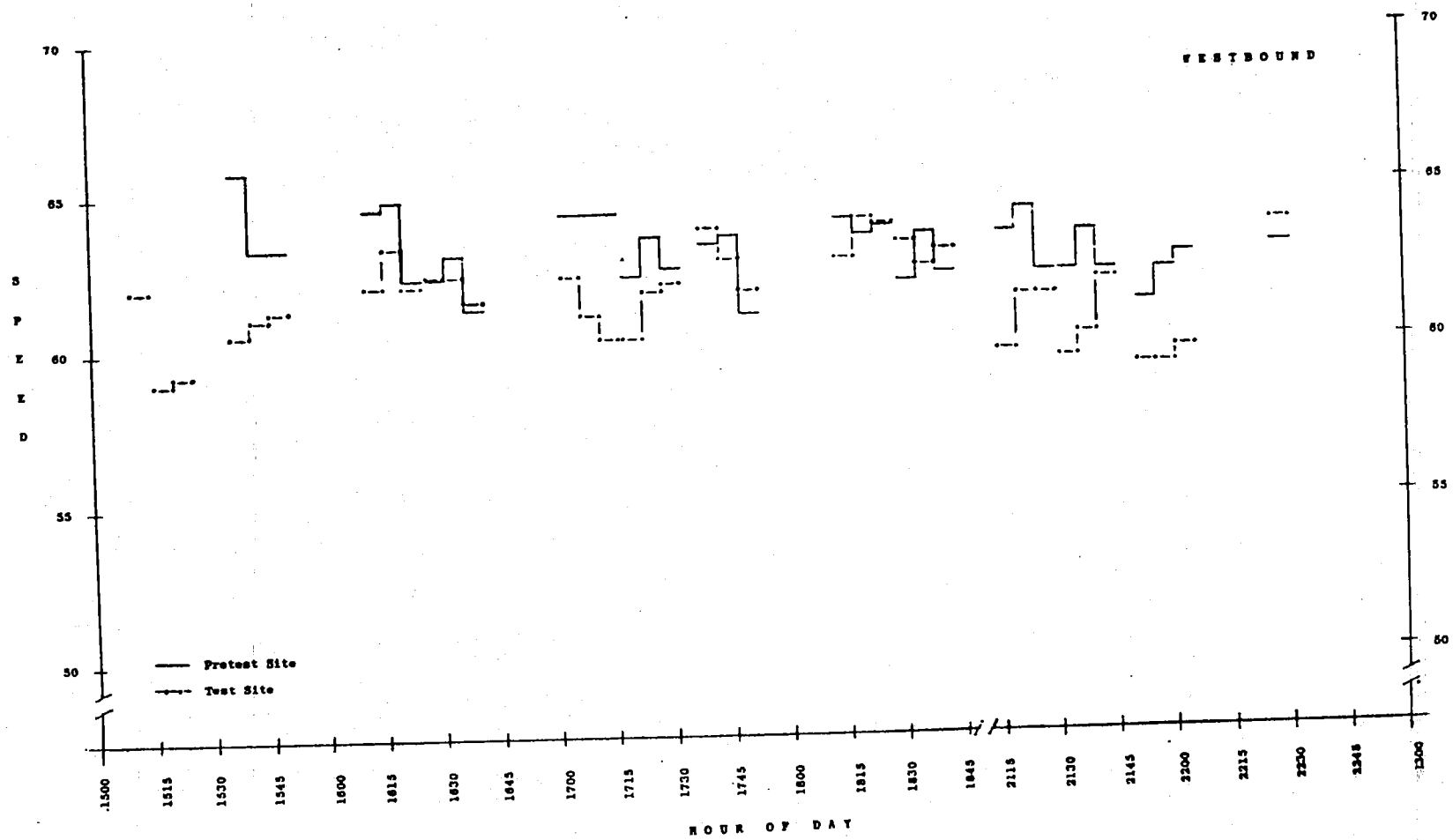


F I G U R E 12

COMPARATIVE AVERAGE TRAFFIC SPEEDS FOR EACH 5 MINUTES OF TEST PERIODS

BY HOUR OF DAY

MACK BOULEVARD RADAR SPEEDS - AUGUST 3, 1969 - 3:00 PM - 11:00 PM



ELVAS FREEWAY - OUTBOUND (EAST)

HOURLY TRAFFIC VOLUMES BY TIME OF DAY

BLACK AND WHITE VEHICLE - JULY 17, 1969

TOW TRUCK VEHICLE - JULY 23, 1969

FIGURE 13

"A" STREET OVERCROSSING

PRE TEST SITE

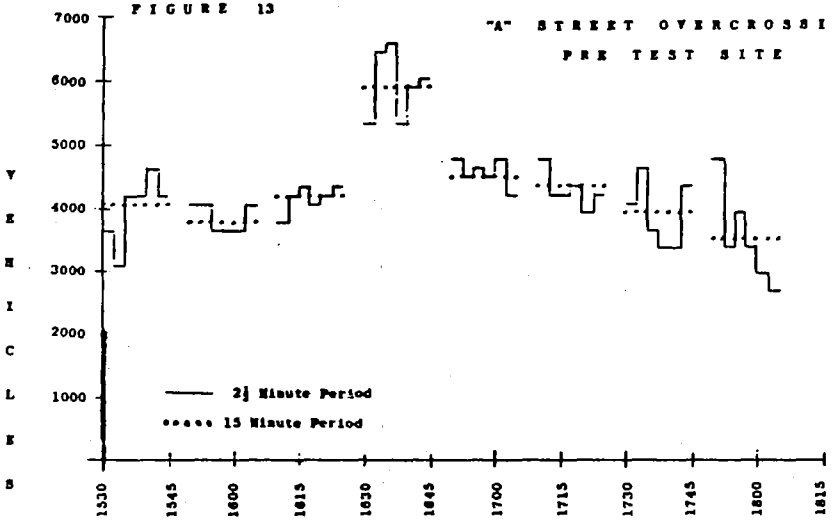


FIGURE 15

"A" STREET OVERCROSSING

PRE TEST SITE

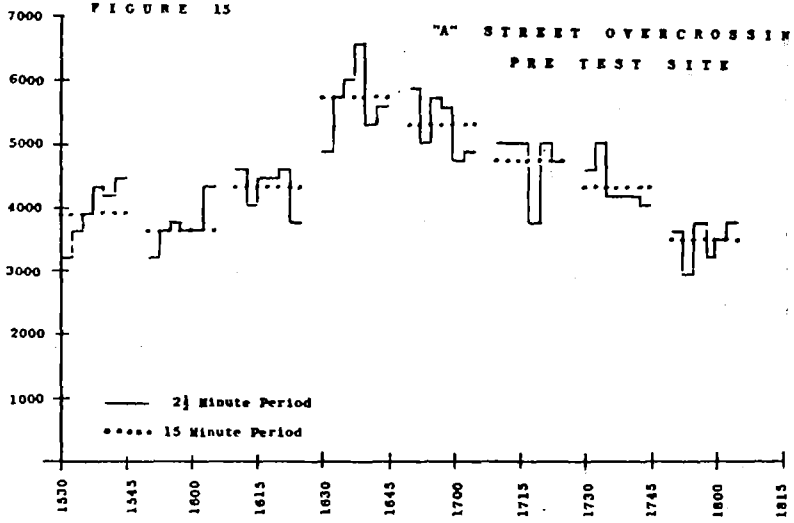


FIGURE 14

S. P. OVERCROSSING

TEST SITE

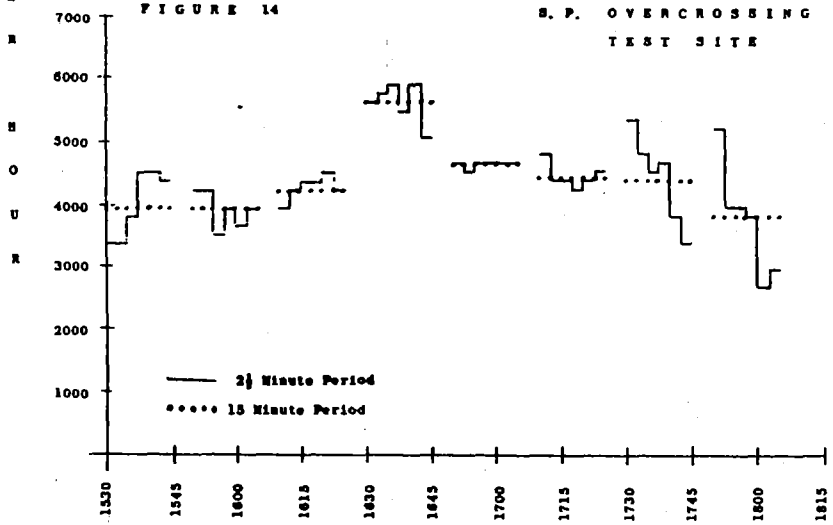
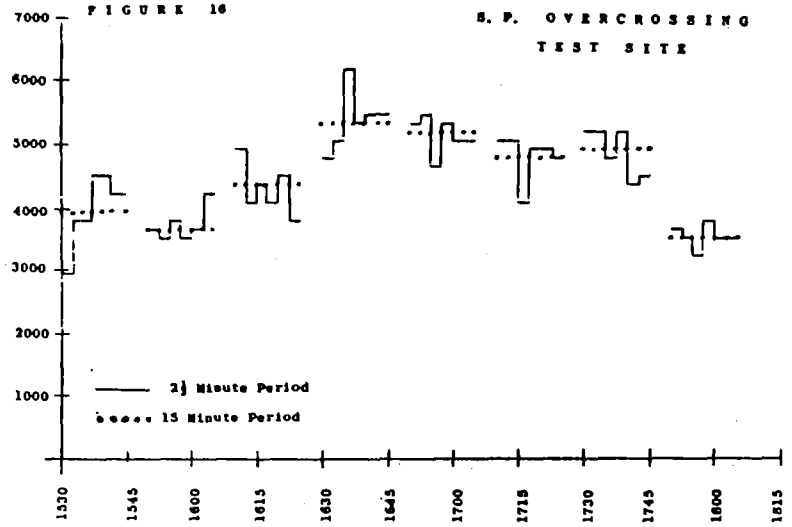


FIGURE 16

S. P. OVERCROSSING

TEST SITE



VEHICLES PER HOUR

HOUR OF DAY

ELVAS FREEWAY - OUTBOUND (EAST)

HOURLY TRAFFIC VOLUMES BY TIME OF DAY

DIVISION OF HIGHWAYS PICKUP - JULY 29, 1969

FIGURE 17

"A" STREET OVERCROSSING
PRE TEST SITE

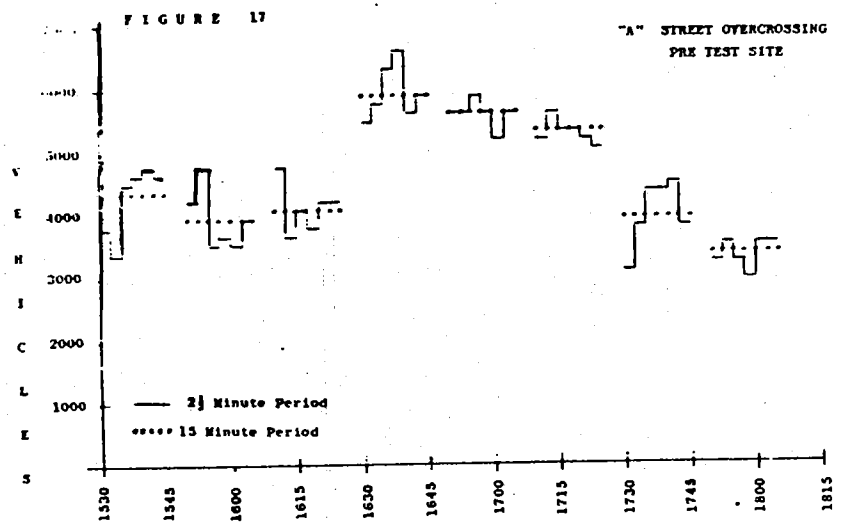
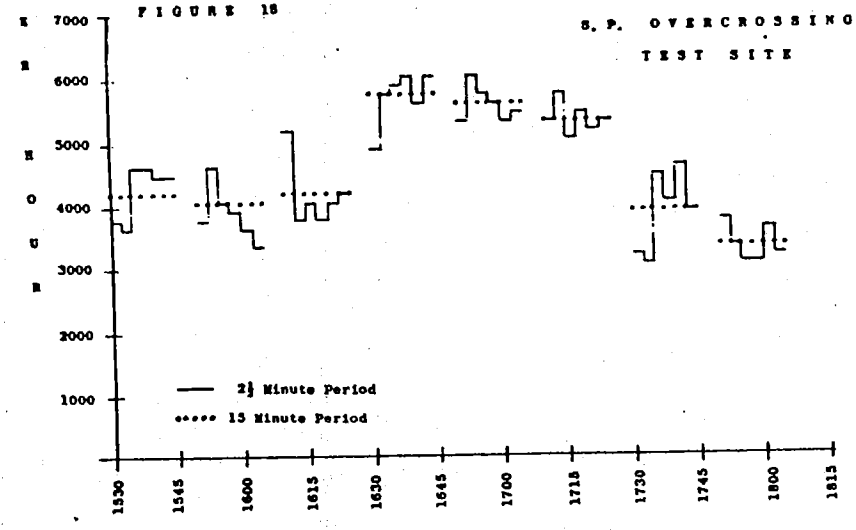


FIGURE 18

S. P. OVERCROSSING
TEST SITE



NO TEST VEHICLE - JULY 31, 1969

FIGURE 19

"A" STREET OVERCROSSING
PRE TEST SITE

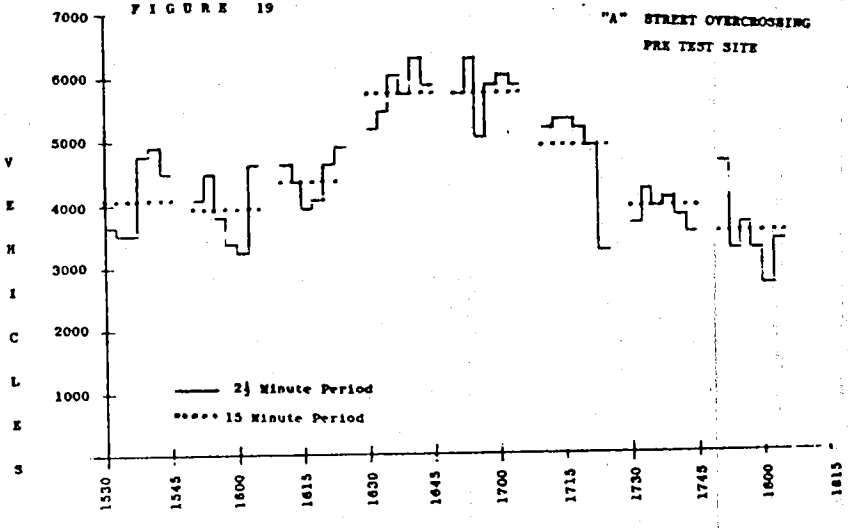
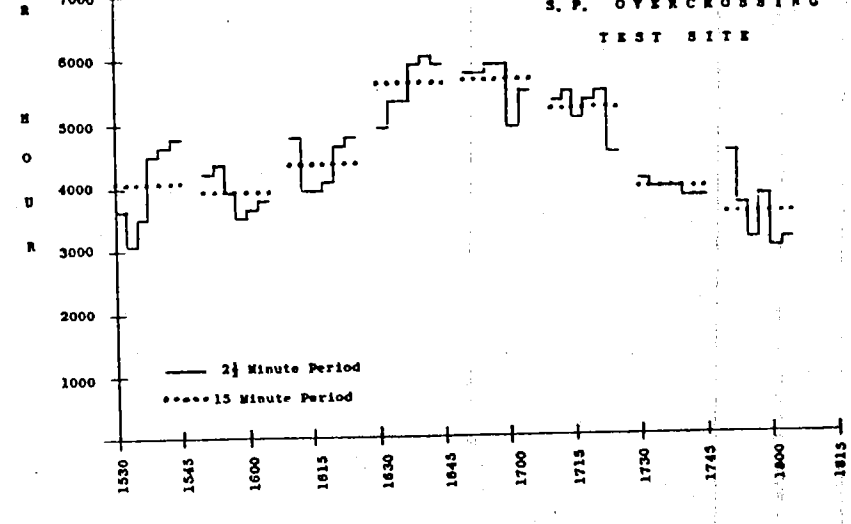


FIGURE 20

S. P. OVERCROSSING
TEST SITE



HOUR OF DAY

FIGURE 22

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS

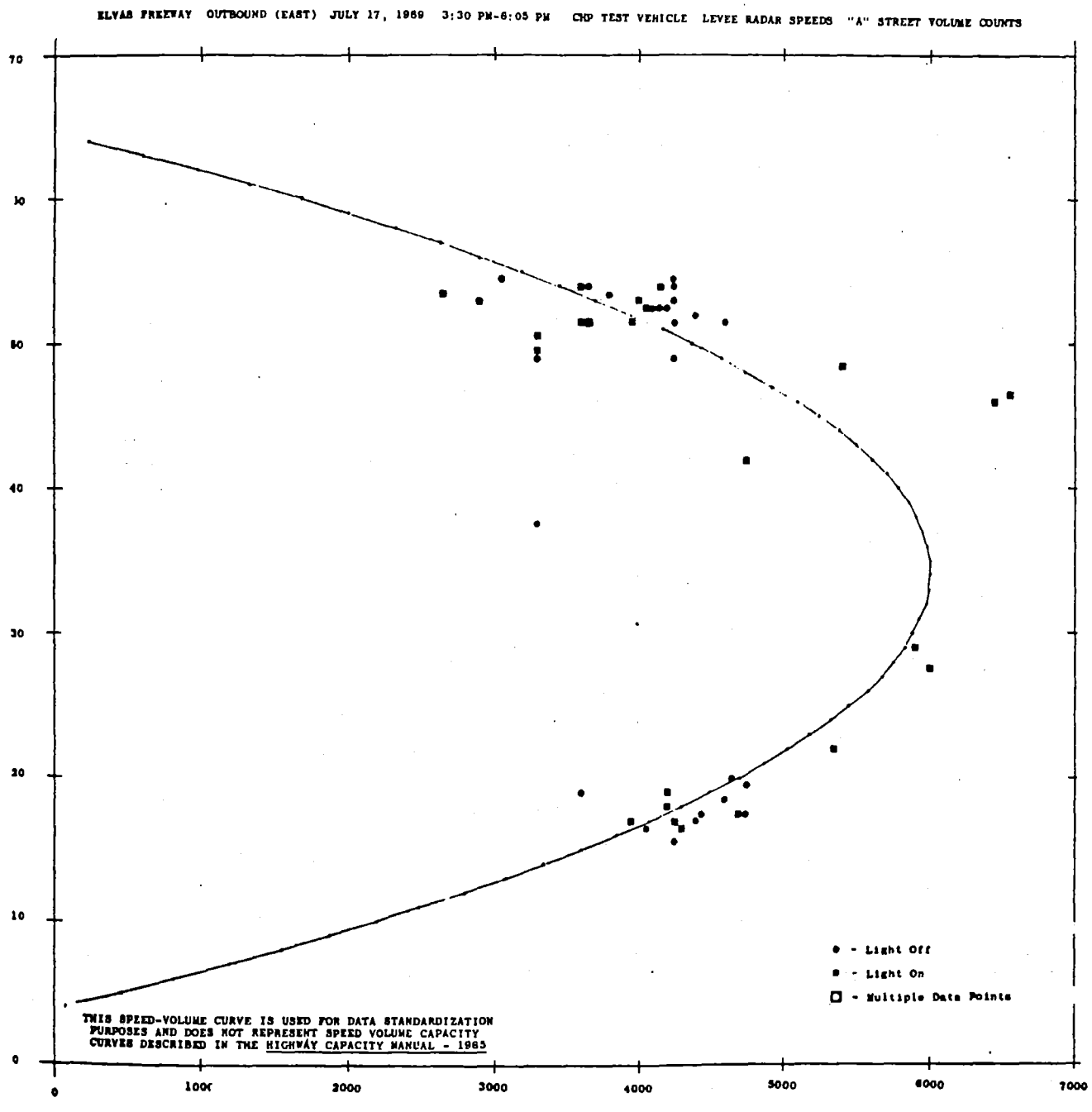


FIGURE 23

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS

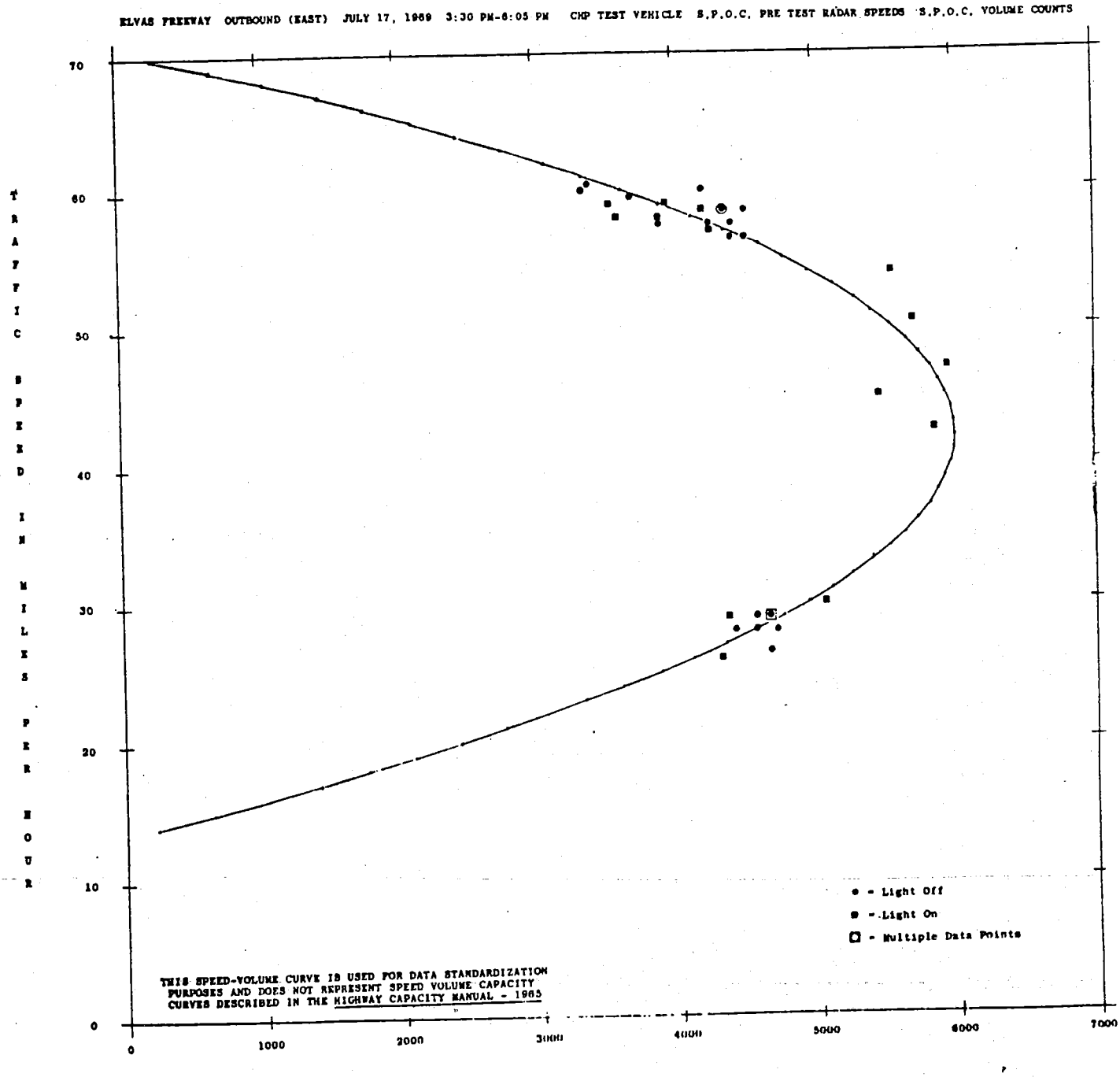


FIGURE 24

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS

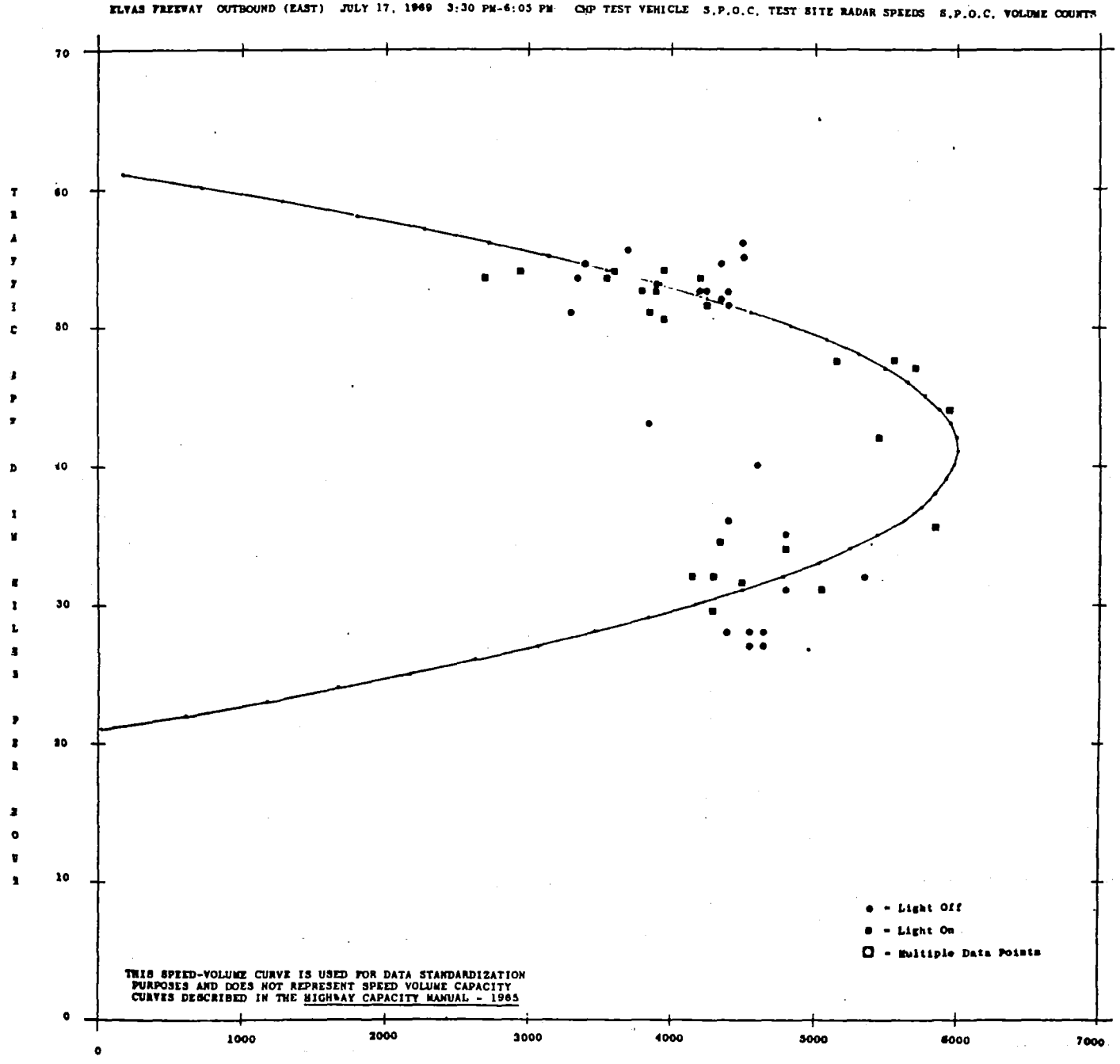
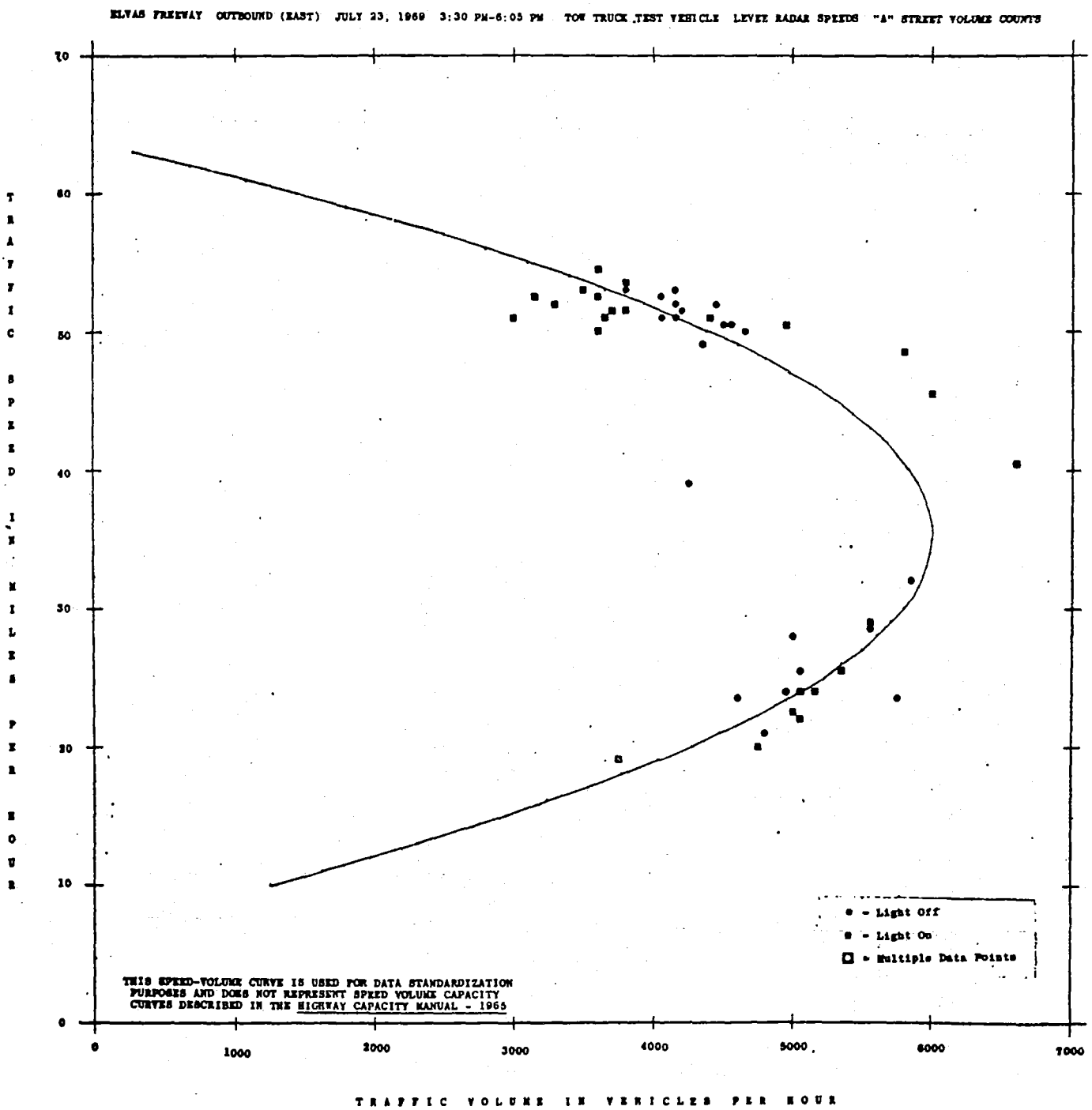


FIGURE 25

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS



F I G U R E 26

A V E R A G E T R A F F I C S P E E D B Y A V E R A G E T R A F F I C V O L U M E
F O R E A C H 2½ M I N U T E S O F T E S T P E R I O D S

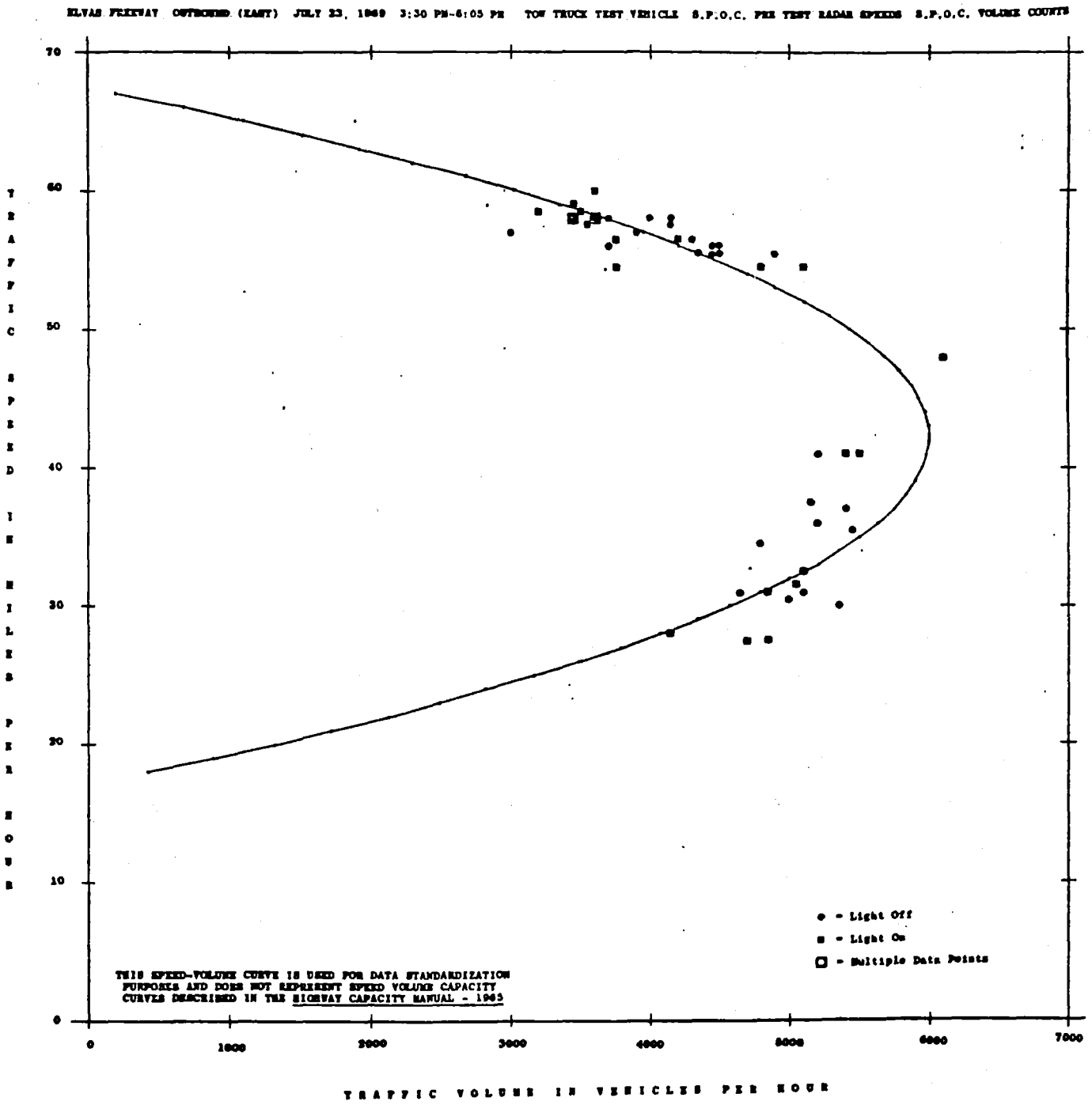


FIGURE 27

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS

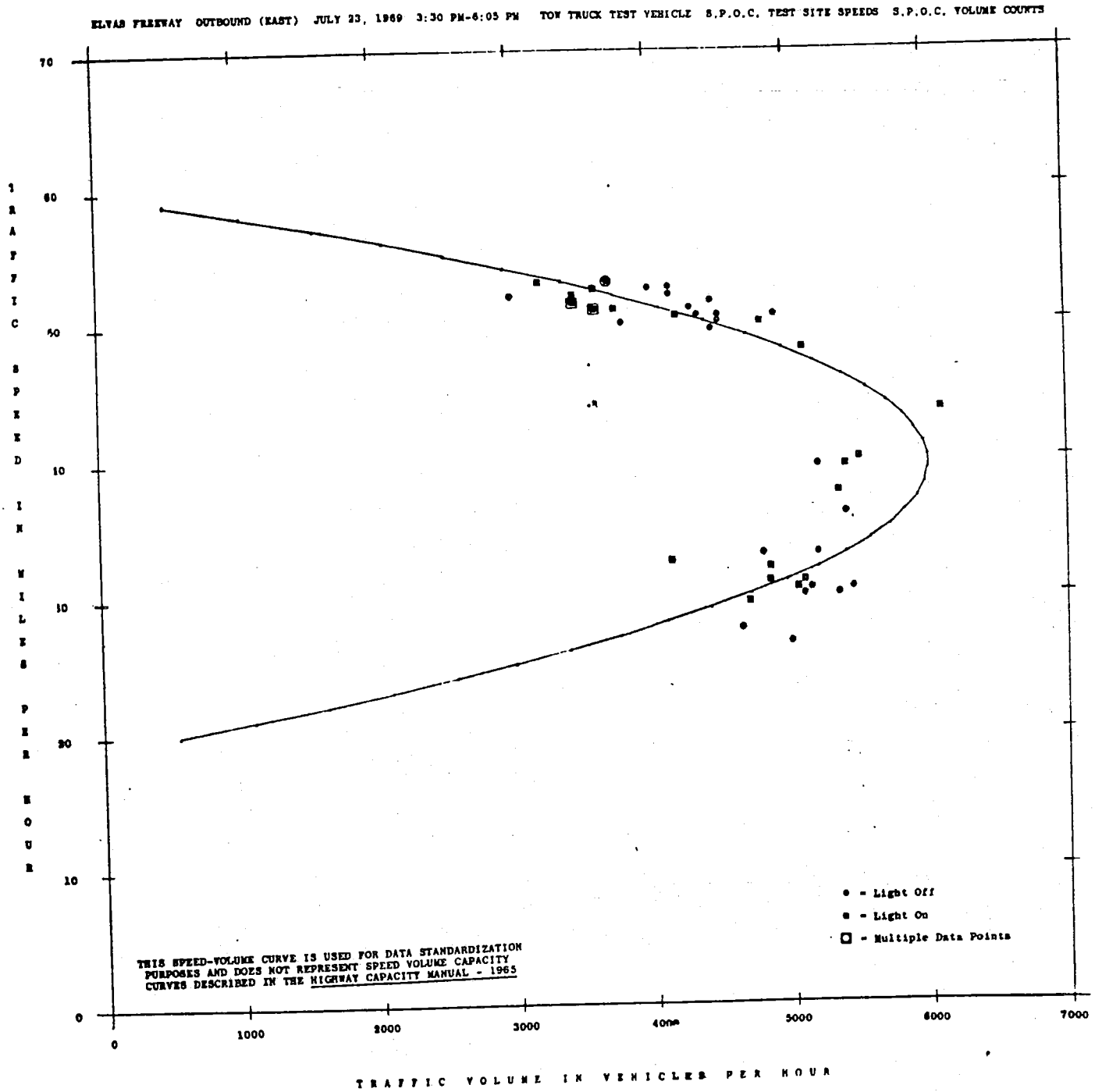


FIGURE 28

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS

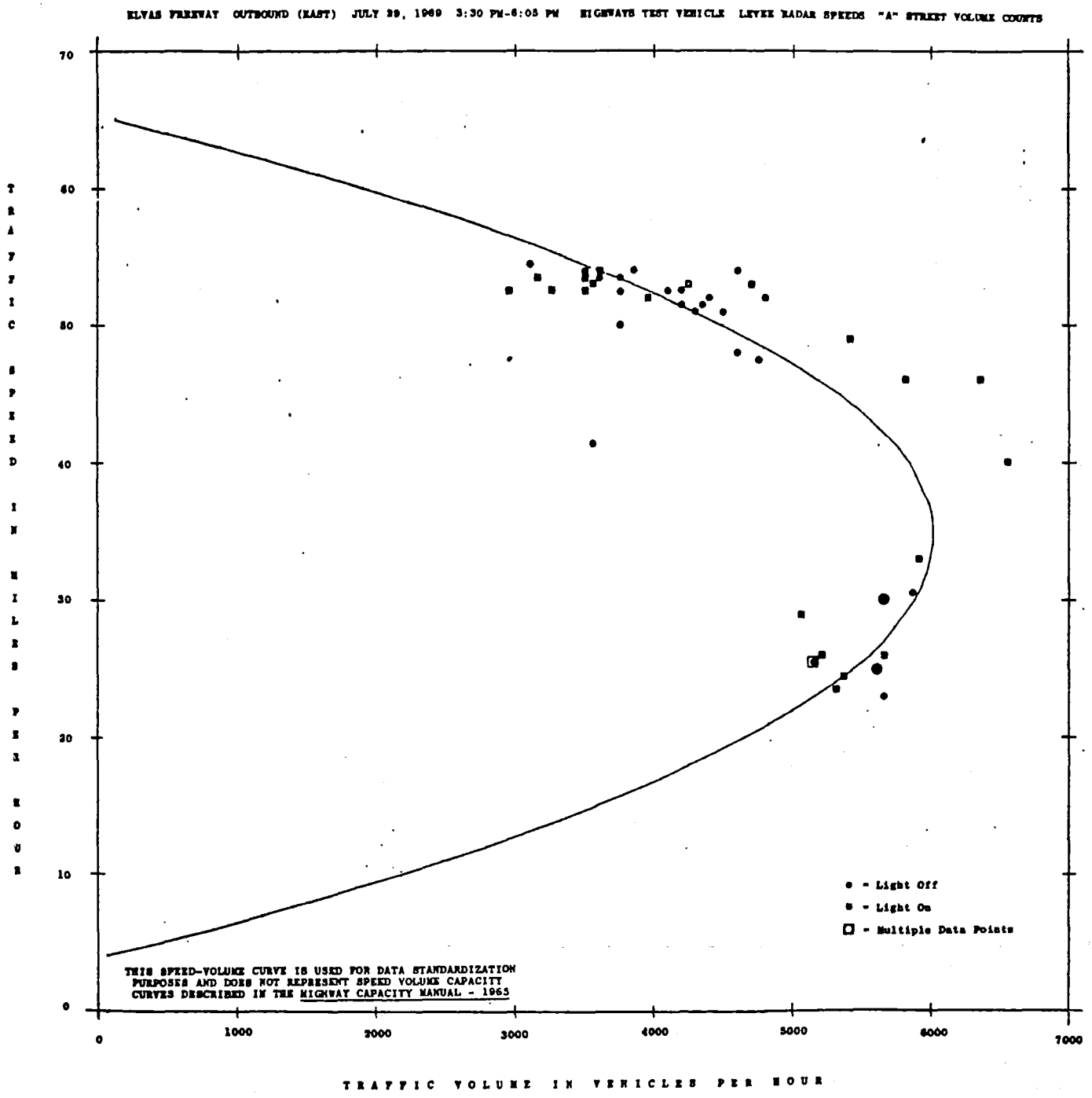
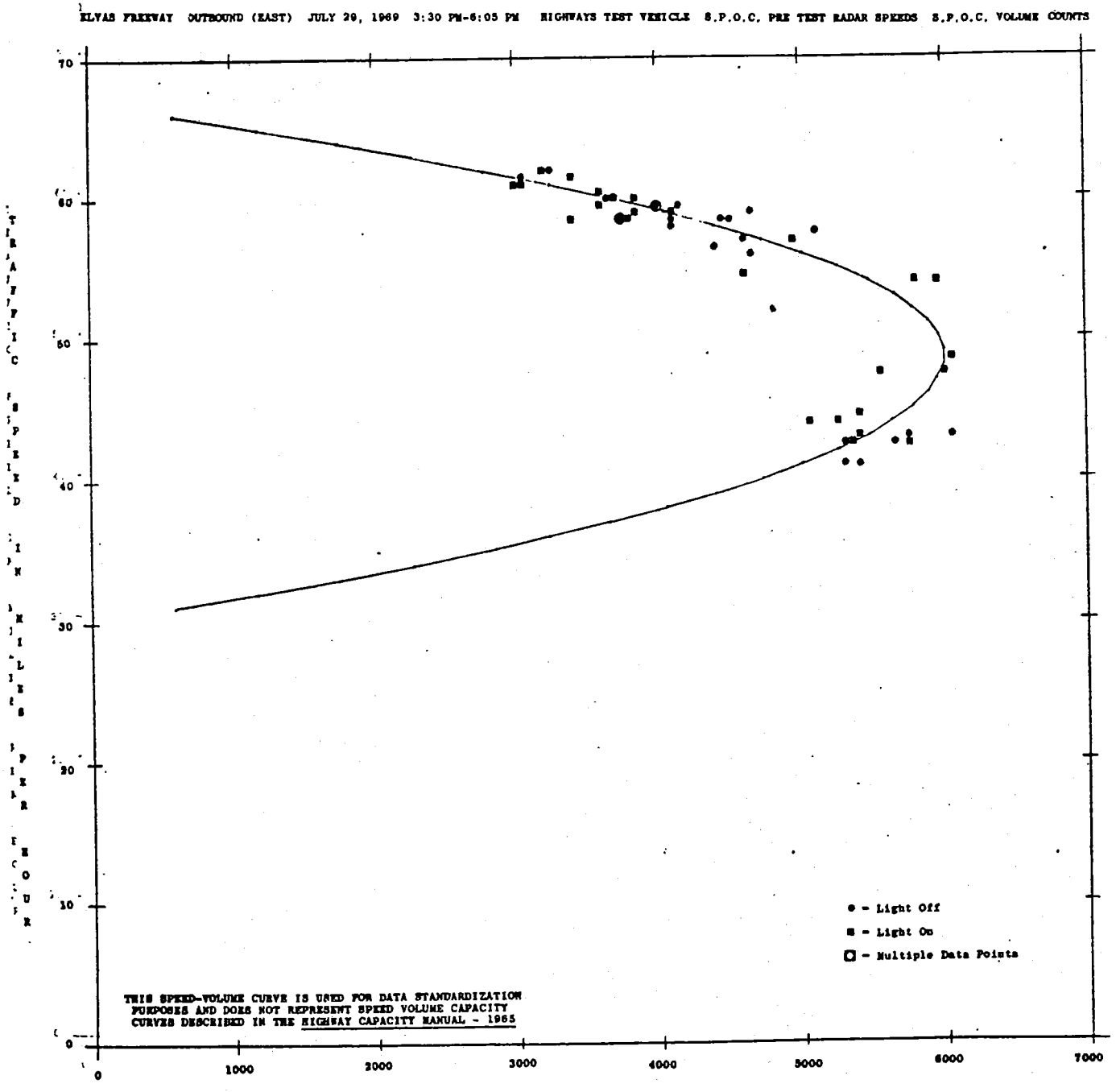


FIGURE 29

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS



F I G U R E 30

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS

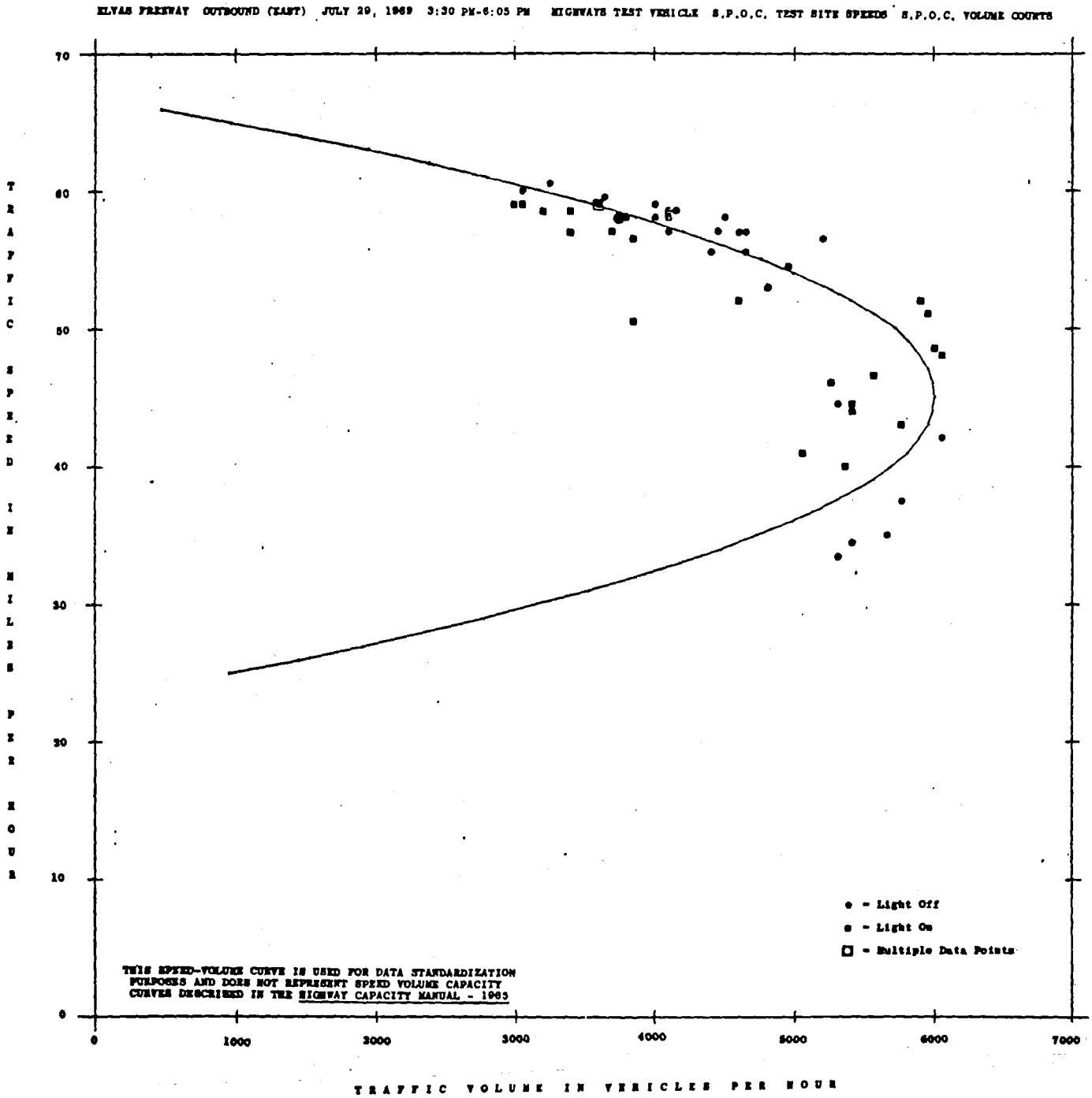
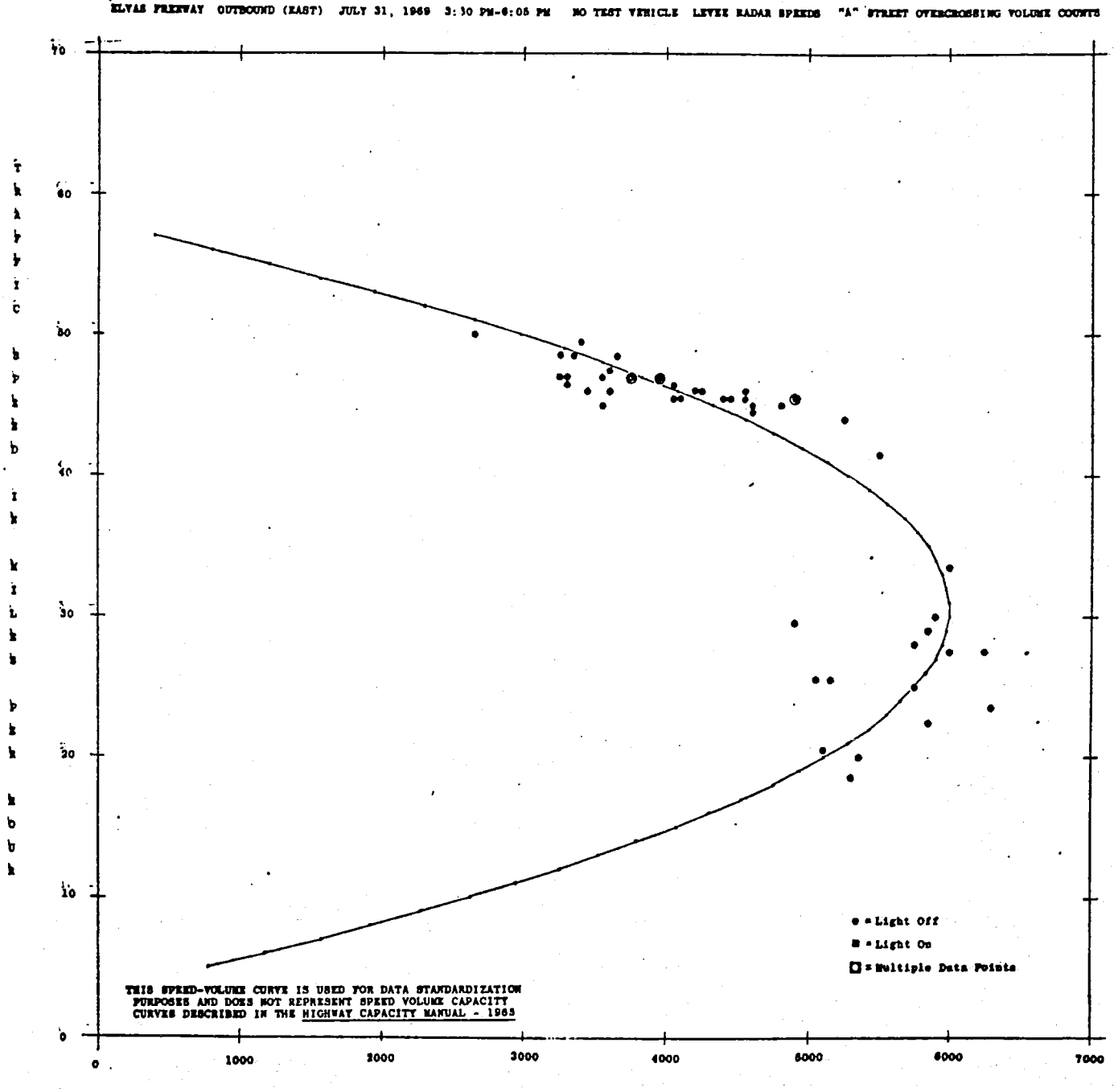


FIGURE 31

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME

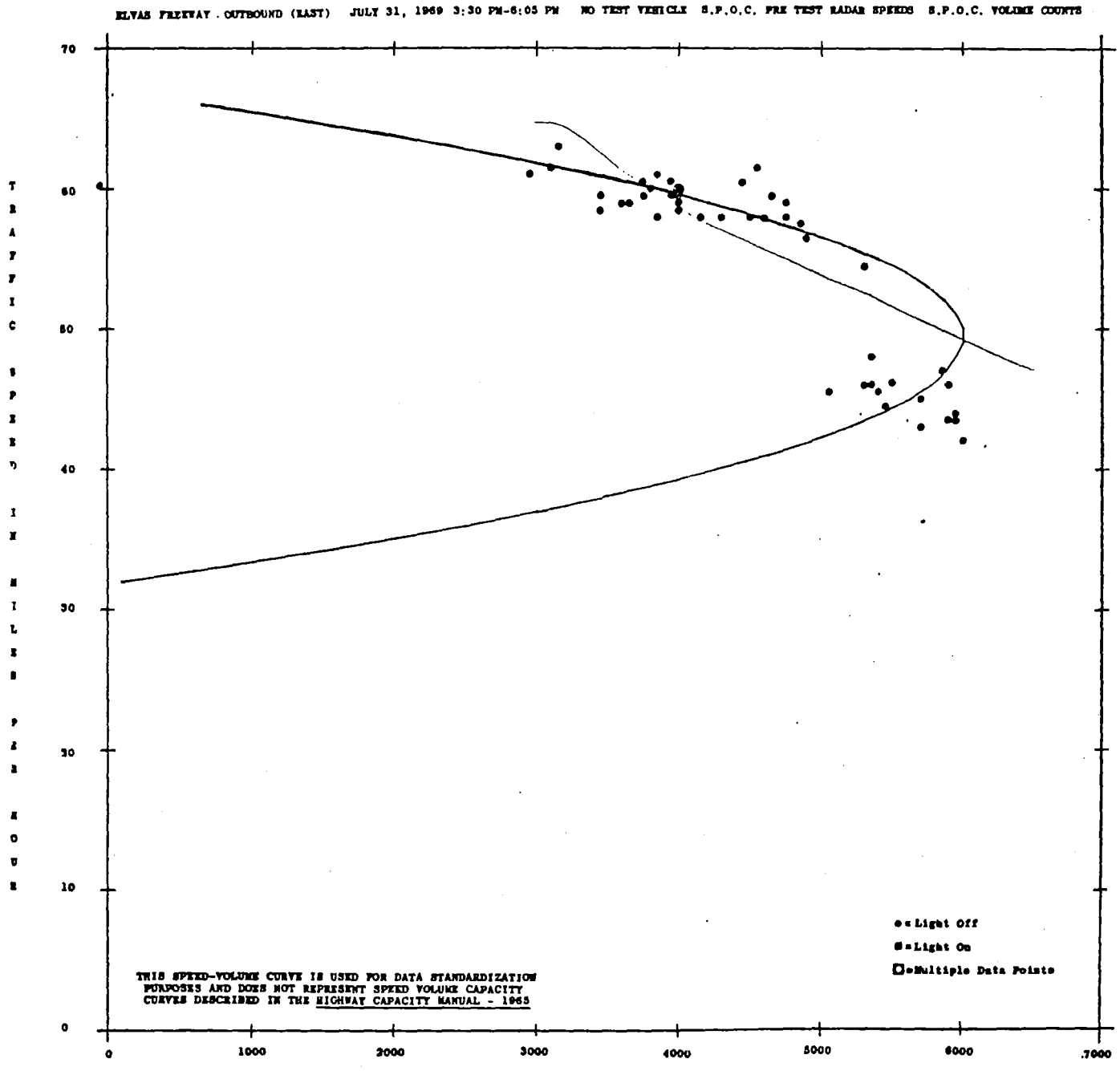
FOR EACH 2½ MINUTES OF TEST PERIODS



TRAFFIC VOLUME IN VEHICLES PER HOUR

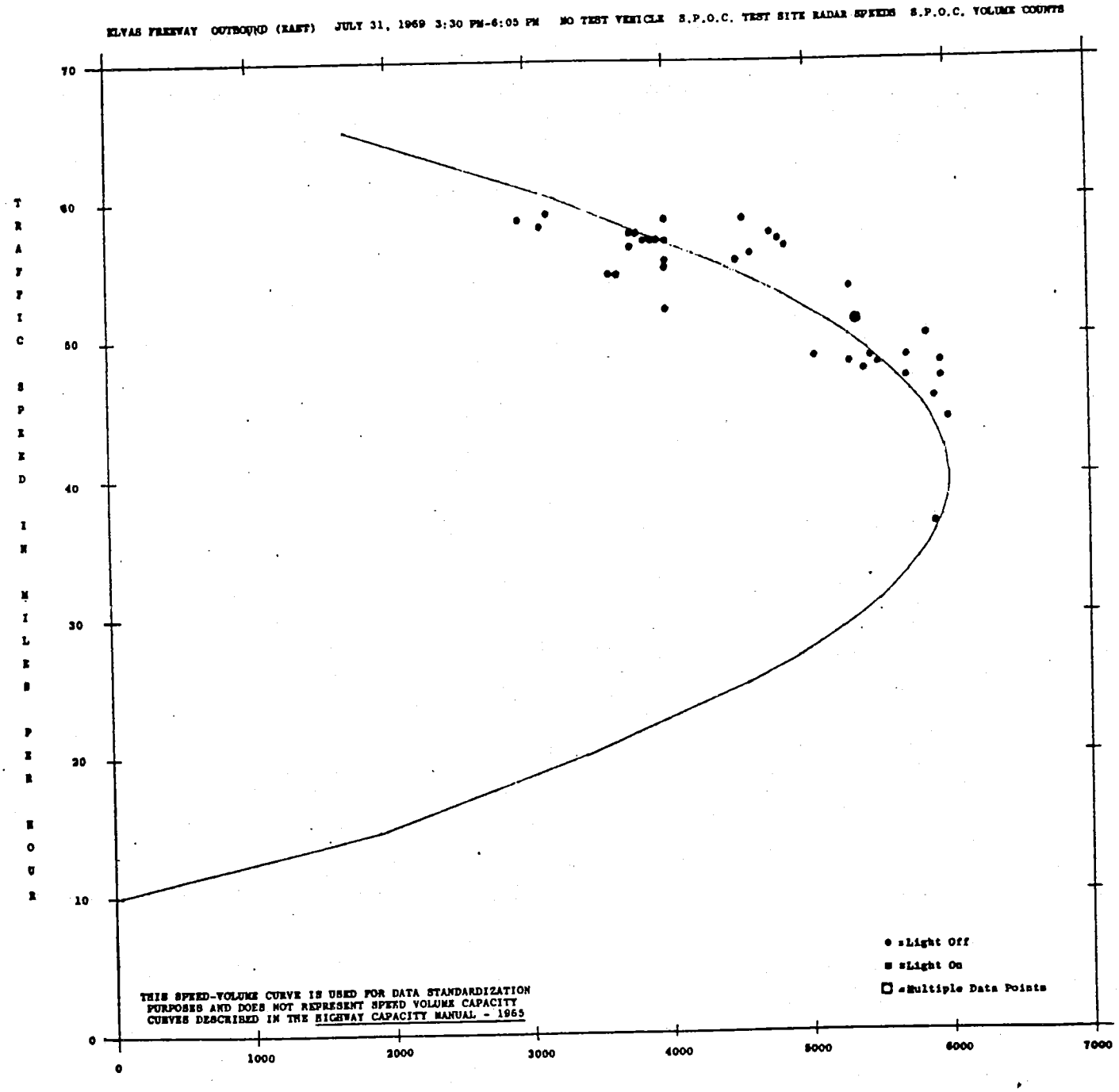
FIGURE 33

AVERAGE TRAFFIC SPEED BY AVERAGE TRAFFIC VOLUME
FOR EACH 2½ MINUTES OF TEST PERIODS



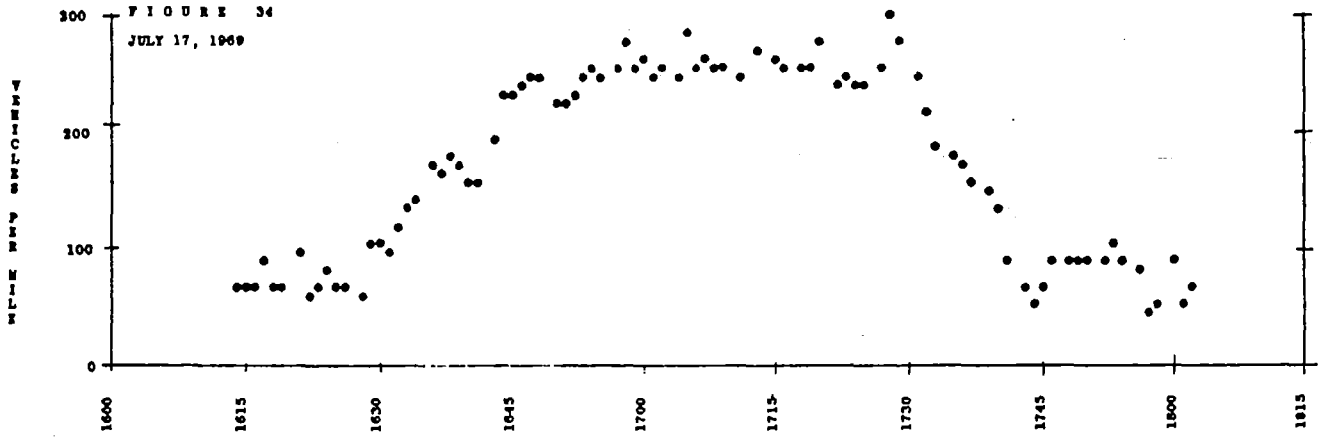
F I G U R E 33

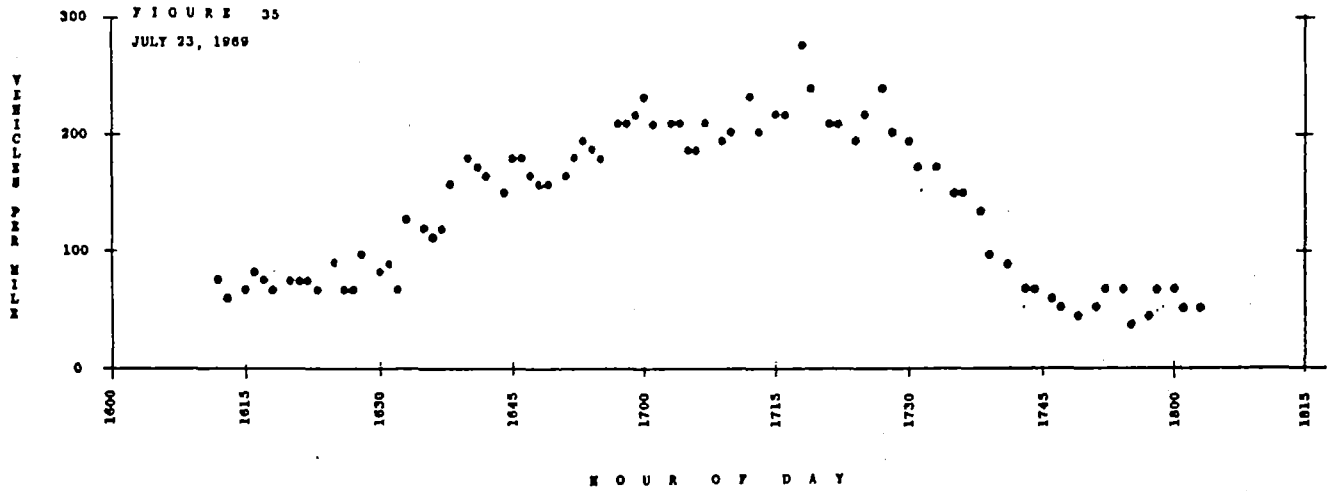
A V E R A G E T R A F F I C S P E E D B Y A V E R A G E T R A F F I C V O L U M E
F O R E A C H 2½ M I N U T E S O F T E S T P E R I O D S



VEHICLE DENSITY PER MILE BY HOUR OF DAY

ELVAS FREEWAY - OUTBOUND (EAST)





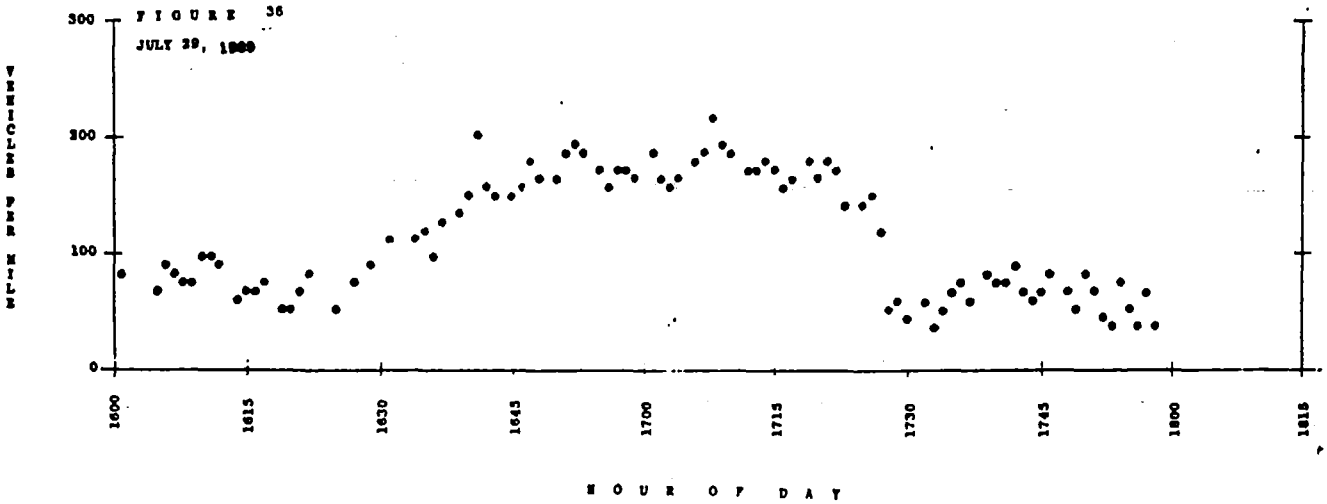


FIGURE 37

AVERAGE SPEED BY DENSITY

FOR BLACK AND WHITE ENFORCEMENT VEHICLE

ELVAS FREEWAY OUTBOUND (EAST) JULY 17 1969 4:00 PM - 6:05 PM

SOUTHERN PACIFIC OVERCROSSING RADAR SPEEDS

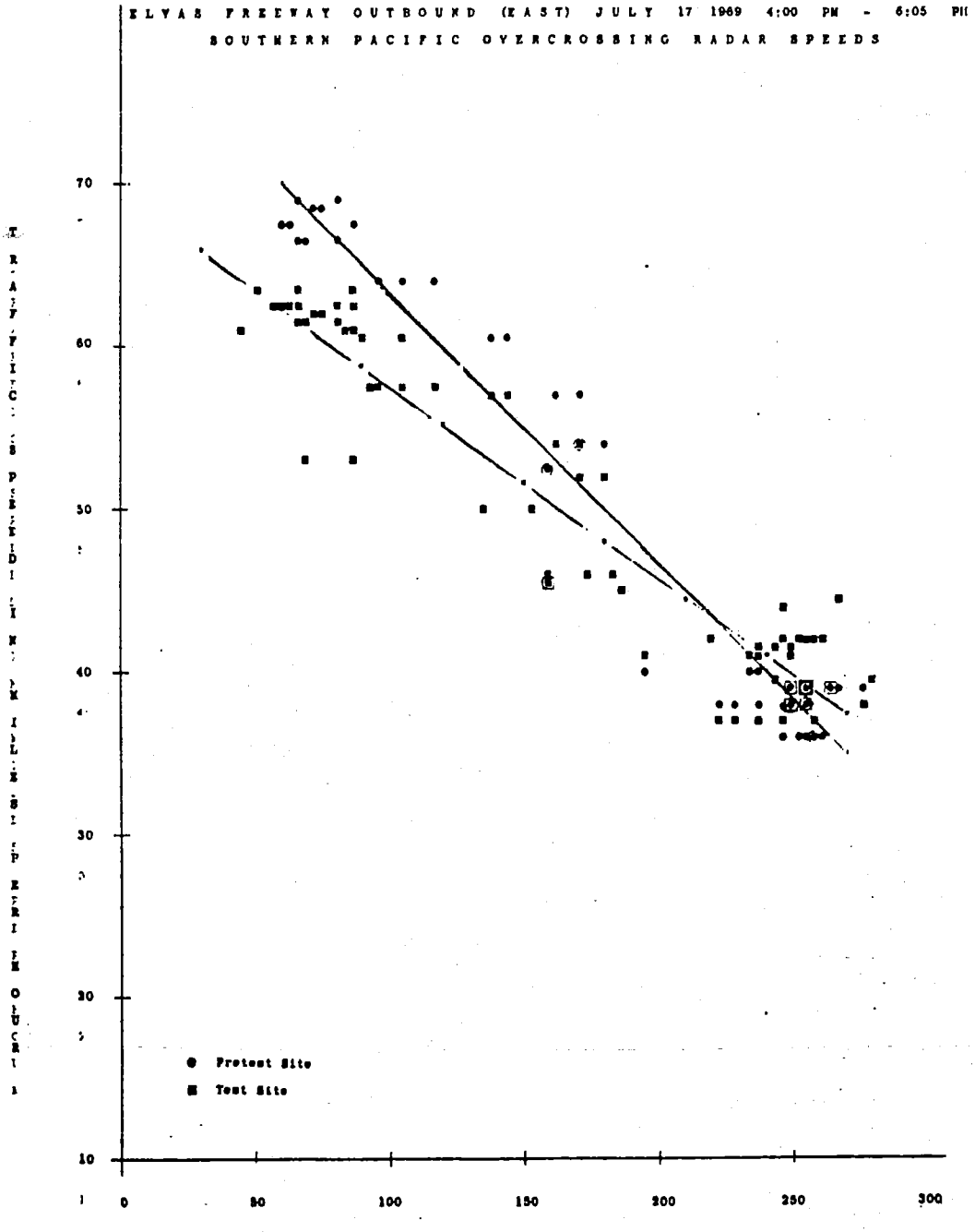


FIGURE 38

AVERAGE SPEED BY DENSITY FOR
TOW SERVICE TRUCK VEHICLE
ELVAS FREEWAY OUTBOUND (EAST) JULY 23, 1969 4:00 PM - 6:05 PM
SOUTHERN PACIFIC OVERCROSSING RADAR SPEEDS

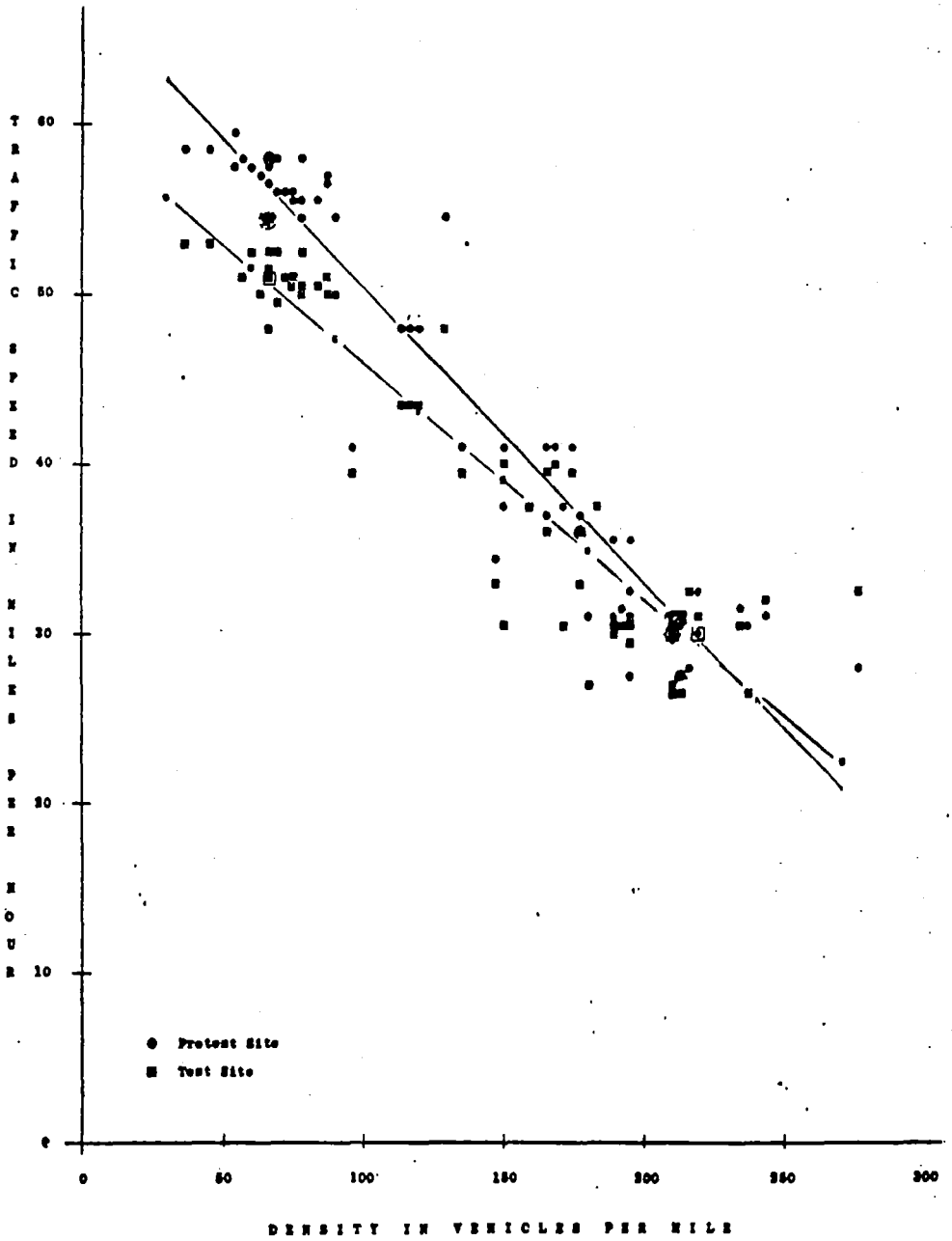


FIGURE 39

AVERAGE SPEED BY DENSITY FOR
DIVISION OF HIGHWAYS MAINTENANCE PICKUP
ELVAS FREEWAY OUTBOUND (EAST) JULY 29, 1969 4:00 PM - 6:05 PM
SOUTHERN PACIFIC OVERCROSSING RADAR SPEEDS

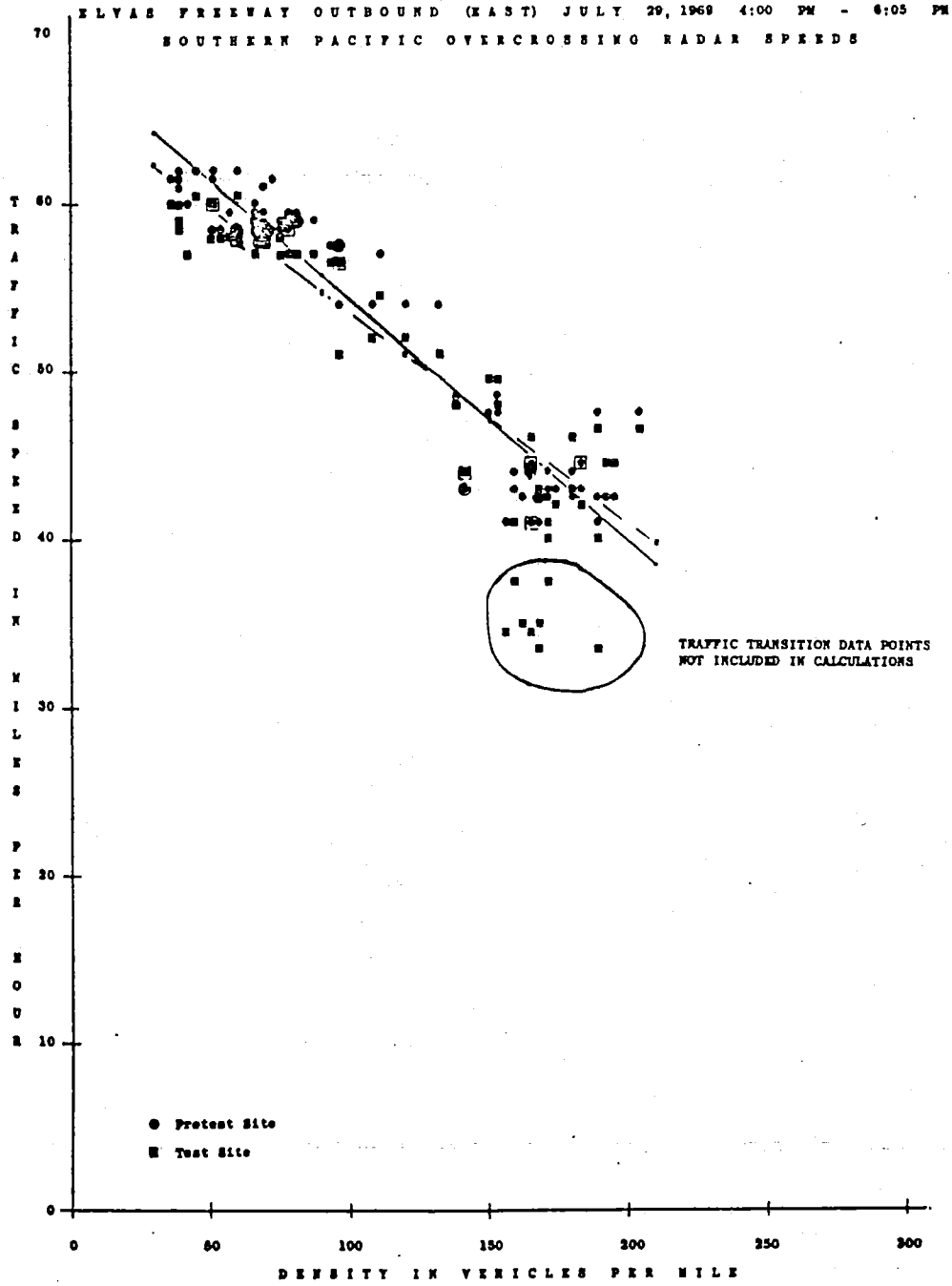
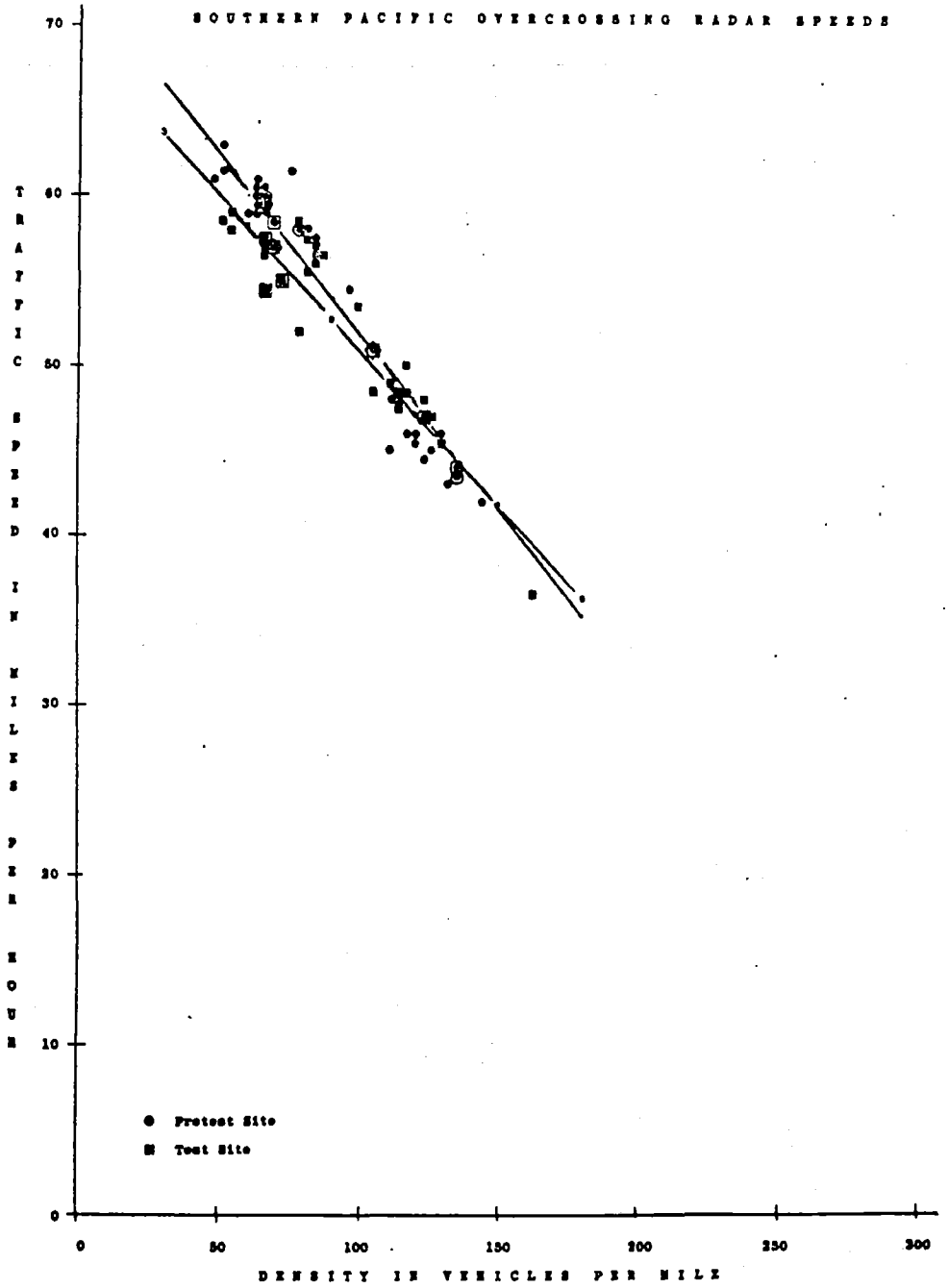


FIGURE 40

AVERAGE SPEED BY DENSITY FOR
NO TEST VEHICLE
ELVAS FREEWAY OUTBOUND (EAST) JULY 31, 1969 4:00 PM - 6:05 PM
SOUTHERN PACIFIC OVERCROSSING RADAR SPEEDS



ANNEX G

A. The headings for the Tables XIV through XXII are defined as follows:

$\bar{X}$ = mean speed

S - standard deviation

N = number of speed intervals

I = speed interval time in seconds

B. Within the table:

NA = data not available

C. Site indication on the tables refer to locations as shown on the maps of Annex E.

TABLE XIV

TRAFFIC SPEED DATA (By Radar)

El Centro Road
July 20, 1969 3:00 pm Thru 10:57 pm

Time Period	Site A - At Site Southbound				Site B - At Site Northbound				Site C - Presite Southbound			
	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I
1500 -1502½	53.00	2.94	3	10	NA				NA			
1502½-1505	53.57	2.47	7	10	NA				NA			
1505 -1507½	53.50	3.04	6	10	NA				NA			
1507½-1510	59.00	5.24	4	10	NA				NA			
1510 -1512½	56.14	3.91	7	10	NA				NA			
1512½-1515	55.11	5.19	9	10	NA				NA			
1516 -1518½	54.20	4.96	5	10	NA				NA			
1518½-1521	53.75	5.49	8	10	NA				NA			
1521 -1523½	56.00	2.00	2	10	NA				NA			
1523½-1526	55.71	5.38	7	10	NA				NA			
1526 -1528½	50.60	6.86	5	10	NA				NA			
1528½-1531	53.40	2.80	5	10	NA				NA			
1536 -1538½	47.00	3.00	2	10	NA				58.54	5.33	13	10
1538½-1541	48.50	4.89	6	10	NA				57.50	5.82	6	10
1541 -1543½	51.71	5.46	7	10	NA				54.00	4.65	10	10
1543½-1546	50.56	3.02	9	10	NA				55.75	1.09	8	10
1546 -1548½	47.29	2.94	7	10	NA				56.37	4.77	8	10
1548½-1551	47.83	3.93	6	10	NA				48.83	3.76	6	10
1611 -1613½	57.50	8.98	6	10	NA				60.00	3.03	5	10
1613½-1616	59.29	4.53	7	10	NA				57.25	3.96	4	10
1616 -1618½	59.00	4.90	5	10	NA				56.12	4.41	8	10
1618½-1621	57.00	5.10	5	10	NA				51.29	3.30	7	10
1621 -1623½	59.50	3.84	4	10	NA				60.50	0.50	2	10
1623½-1626	58.33	4.31	6	10	NA				55.20	3.37	5	10
1627 -1629½	58.00	4.88	9	10					55.33	5.61	9	10
1629½-1632	58.00	1.00	2	10	NA				58.33	3.41	6	10
1632 -1634½	56.50	7.35	8	10	NA				54.83	6.47	6	10
1634½-1637	56.67	3.03	3	10	NA				52.75	2.59	4	10
1637 -1639½	57.67	4.60	3	10	NA				57.67	3.03	3	10
1639½-1642	57.71	4.02	7	10	NA				56.27	5.87	11	10
1702 -1704½	NA				49.50	4.86	6	10	57.40	6.93	15	10
1704½-1707	NA				47.20	4.96	10	10	59.11	7.02	9	10
1707 -1709½	NA				50.83	2.19	6	10	55.00	6.37	10	10
1709½-1712	NA				50.33	5.22	6	10	54.25	3.67	8	10
1712 -1714½	NA				48.80	2.14	5	10	55.67	9.67	12	10
1714½-1717	NA				45.67	3.99	6	10	54.60	6.15	10	10
1718 -1720½	NA				49.82	2.29	11	10	56.50	4.57	10	10
1720½-1723	NA				46.75	3.90	4	10	55.89	4.76	9	10
1723 -1725½	NA				52.67	4.19	6	10	57.00	4.69	10	10
1725½-1728	NA				52.70	6.02	10	10	54.70	6.13	10	10
1728 -1730½	NA				49.50	2.63	6	10	55.09	7.31	11	10
1730½-1733	NA				52.00	7.30	8	10	55.50	4.72	10	10
1738 -1740½	NA				51.43	3.18	7	10	60.00	6.70	9	10
1740½-1743	NA				49.00	7.01	5	10	59.13	4.56	8	10
1743 -1745½	NA				49.55	5.46	11	10	54.50	6.58	8	10
1745½-1748	NA				50.00	4.74	4	10	60.78	6.46	9	10
1748 -1750	NA				54.63	5.43	8	10	60.83	3.86	6	10
1750½-1753	NA				54.00	6.19	7	10	59.57	7.16	7	10

TABLE XIV Cont.

El Centro Road cont.
July 20, 1969 3:00 pm Thru 10:57 pm

Time Period	Site A - At Site Southbound				Site B - At Site Northbound				Site C - Presite Southbound			
	X	S	N	I	X	S	N	I	X	S	N	I
1813 -1815½	NA				52.30	4.10	10	10	60.00	2.35	8	10
1815½-1818	NA				59.86	6.10	7	10	57.40	5.85	10	10
1818 -1820½	NA				53.38	3.87	8	10	62.20	2.14	5	10
1820½-1823	NA				57.50	2.36	6	10	57.67	4.81	12	10
1823 -1825½	NA				56.09	4.77	11	10	57.00	5.77	11	10
1825½-1828	NA				56.46	3.50	13	10	61.67	5.55	6	10
1829 -1831½	NA				56.63	4.17	8	10	55.63	7.43	8	10
1831½-1834	NA				51.33	5.50	6	10	62.63	5.71	8	10
1834 -1836½	NA				52.67	4.01	9	10	57.13	4.85	8	10
1836½-1839	NA				51.40	2.65	5	10	57.00	7.70	6	10
1839 -1841½	NA				54.33	5.69	9	10	55.56	7.11	9	10
1841½-1844	NA				54.30	3.32	10	10	59.00	2.10	5	10
2115 -2117½	50.75	4.68	8	10	NA				53.80	3.89	10	10
2117½-2120	54.33	10.63	3	10	NA				56.22	6.66	9	10
2120 -2122½	53.67	4.86	9	10	NA				53.43	9.04	7	10
2122½-2125	57.13	6.43	8	10	NA				52.44	4.06	9	10
2125 -2127½	52.00	5.33	9	10	NA				52.50	5.14	12	10
2127½-2130	49.71	3.6,	7	10	NA				54.20	4.40	5	10
2131 -2133½	50.29	8.44	7	10	NA				53.67	2.13	9	10
2133½-2136	45.67	2.43	6	10	NA				54.00	0.82	3	10
2136 -2138½	46.67	5.28	3	10	NA				55.00	3.46	12	10
2138½-2141	47.00	3.51	6	10	NA				54.38	6.72	8	10
2141 -2143½	43.50	1.71	6	10	NA				53.30	3.47	10	10
2143½-2146	47.33	4.75	3	10	NA				61.75	5.26	4	10
2151 -2153½	43.50	3.35	4	10	NA				56.00	5.89	8	10
2153½-2156	47.29	3.22	7	10	NA				55.27	5.22	11	10
2156 -2158½	52.50	3.57	4	10	NA				53.60	4.36	10	10
2158½-2201	42.25	2.28	4	10	NA				53.57	4.97	7	10
2201 -2203½	52.00	.00	1	10	NA				55.42	6.45	12	10
2203½-2206	43.50	2.18	4	10	NA				51.67	8.24	3	10
2226 -2228½	51.00	2.28	5	10	NA				49.40	4.76	5	10
2228½-2231	50.20	5.95	10	10	NA				52.08	6.95	12	10
2231 -2233½	53.75	3.15	8	10	NA				56.10	5.22	10	10
2233½-2236	51.00	1.90	5	10	NA				59.00	3.24	8	10
2236 -2238½	51.40	1.62	5	10	NA				53.42	7.24	12	10
2238½-2241	52.50	5.02	6	10	NA				58.89	2.05	9	10
2242 -2244½	47.00	2.12	4	10	NA				60.67	7.22	6	10
2244½-2247	50.00	.00	1	10	NA				54.20	5.31	5	10
2247 -2249½	47.50	4.03	4	10	NA				53.86	8.25	7	10
2249½-2252	45.00	5.55	5	10	NA				61.13	5.94	8	10
2252 -2254½	51.67	2.81	3	10	NA				64.50	7.41	6	10
2254½-2257	48.50	4.39	4	10	NA				54.22	6.18	9	10

TABLE XV

TRAFFIC SPEED DATA (By Radar)

Elvas Freeway - Outbound (East)
July 17, 1969 3:30 pm Thru 6:05 pm

Time Period	Levee Radar Presite				S.P.O.C. Radar Presite				S.P.O.C. Radar At Site			
	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I
1530 -1532½	53.80	2.93	10	5	59.87	3.06	30	5	53.37	5.09	30	5
1532½-1535	54.43	4.40	30	5	60.30	3.03	30	5	54.31	4.87	29	5
1535 -1537½	53.22	3.21	27	5	59.61	3.53	18	5	55.63	2.43	30	5
1537½-1540	52.58	4.03	26	5	56.43	2.97	30	5	55.12	3.64	25	5
1540 -1542½	51.73	2.89	30	5	58.31	2.39	29	5	56.13	2.68	30	5
1542½-1545	51.33	3.35	30	5	58.71	1.93	17	5	54.47	2.16	30	5
1550 -1552½	52.60	3.16	30	5	56.83	2.45	12	5	51.40	2.43	30	5
1552½-1555	52.77	2.55	30	5	58.60	1.80	30	5	53.37	2.08	30	5
1555 -1557½	54.03	4.91	30	5	58.92	2.22	25	5	53.30	2.60	30	5
1557½-1600	51.30	4.32	30	5	57.88	2.59	24	5	52.39	2.32	28	5
1600 -1602½	51.38	3.72	29	5	57.77	2.26	22	5	54.20	3.46	30	5
1602½-1605	53.87	3.97	30	5	58.77	2.87	30	5	54.33	2.89	30	5
1610 -1612½	53.57	3.43	30	5	57.71	1.84	21	5	53.17	2.33	30	5
1612½-1615	52.30	3.15	30	5	57.37	3.09	30	5	52.50	3.28	30	5
1615 -1617½	51.87	2.59	30	5	56.40	1.85	30	5	51.37	2.50	30	5
1617½-1620	52.33	3.41	30	5	58.32	2.11	28	5	51.97	2.00	30	5
1620 -1622½	52.43	3.73	30	5	57.43	2.89	28	5	52.53	3.42	30	5
1622½-1625	53.80	3.57	30	5	59.03	2.14	30	5	52.57	3.19	30	5
1630 -1632½	48.47	2.73	30	5	54.09	2.45	23	5	47.37	3.45	30	5
1632½-1635	46.10	5.08	30	5	50.63	2.98	30	5	47.21	3.79	28	5
1635 -1637½	41.37	4.04	30	5	46.97	2.22	30	5	44.00	1.61	30	5
1637½-1640	22.07	2.77	30	5	44.96	2.17	28	5	42.13	1.80	30	5
1640 -1642½	28.80	3.10	30	5	42.40	3.30	30	5	35.43	3.33	30	5
1642½-1645	27.43	3.00	30	5	30.17	5.23	30	5	31.00	2.79	30	5
1650 -1652½	19.30	2.15	30	5	28.10	3.19	30	5	26.87	2.04	30	5
1652½-1655	17.27	4.12	30	5	27.93	3.00	30	5	27.87	2.39	30	5
1655 -1657½	18.43	1.72	30	5	26.42	4.32	26	5	27.03	2.36	30	5
1657½-1700	16.90	2.40	30	5	29.23	2.25	26	5	27.93	2.23	30	5
1700 -1702½	17.70	3.00	30	5	28.79	4.06	28	5	28.03	2.83	30	5
1702½-1705	15.63	3.87	30	5	28.07	3.93	30	5	31.10	4.33	30	5
1710 -1712½	17.43	1.82	30	5	28.19	4.19	26	5	33.90	4.48	30	5
1712½-1715	19.03	4.21	30	5	29.21	2.33	14	5	34.70	4.08	30	5
1715 -1717½	16.83	2.08	30	5	25.80	1.60	5	5	31.93	4.64	30	5
1717½-1720	16.30	2.88	30	5	NA				31.90	3.92	30	5
1720 -1722½	17.00	3.05	30	5	NA				29.50	5.11	30	5
1722½-1725	18.23	4.61	30	5	NA				31.67	2.20	12	5
1730 -1732½	16.67	3.83	30	5	NA				32.03	4.42	30	5
1732½-1735	19.93	2.38	30	5	NA				35.13	4.25	30	5
1735 -1737½	18.93	2.26	30	5	NA				35.77	2.51	30	5
1737½-1740	37.30	14.23*	30	5	NA				39.80	4.59	30	5
1740 -1742½	49.17	3.07	30	5	NA				42.83	2.28	18	5
1742½-1745	49.20	3.06	30	5	NA				51.17	2.19	12	5
1750 -1752½	41.93	3.15	30	5	NA				47.47	1.89	30	5
1752½-1755	49.43	5.38	30	5	NA				50.30	5.33	30	5
1755 -1757½	51.60	4.30	30	5	NA				50.80	3.12	30	5
1757½-1800	50.53	3.12	30	5	NA				52.70	2.55	30	5
1800 -1802½	52.97	4.48	30	5	NA				53.57	3.30	30	5
1802½-1805	53.50	4.55	30	5	NA				54.07	3.64	30	5

*Traffic Flow Transition

TABLE XVI

TRAFFIC SPEED DATA (By Radar)

Elvas Freeway - Outbound (East)
July 23, 1969 3:30 pm Thru 6:05 pm

Time Period	Levee Radar Presite				S.P.O.C. Radar Presite				S.P.O.C. Radar At Site			
	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I
1530 -1532½	NA				57.13	2.73	15	10	52.10	2.57	30	5
1532½-1535	NA				56.00	2.48	15	10	52.86	2.55	29	5
1535 -1537½	NA				58.00	2.63	15	10	52.97	2.21	29	5
1537½-1540	48.90	5.21	30	5	55.27	3.14	15	10	50.50	3.90	30	5
1540 -1542½	51.97	3.51	30	5	55.87	2.13	15	10	51.47	2.89	30	5
1542½-1545	51.93	4.36	30	5	57.80	2.95	15	10	52.17	2.95	24	5
1550 -1552½	52.66	3.47	29	5	60.00	2.50	15	10	52.30	3.27	30	5
1552½-1555	54.27	3.77	30	5	58.00	2.37	15	10	51.67	3.90	12	5
1555 -1557½	51.60	3.15	30	5	56.47	1.90	15	10	50.81	2.51	26	5
1557½-1600	51.00	3.52	30	5	58.93	2.84	15	10	51.87	2.43	30	5
1600 -1602½	50.00	3.11	30	5	57.87	2.63	15	10	51.03	2.24	29	5
1602½-1605	50.90	3.30	30	5	56.53	2.27	15	10	50.45	2.89	20	5
1610 -1612½	50.27	3.04	30	5	55.67	2.47	15	10	50.27	3.60	30	5
1612½-1615	51.07	4.40	30	5	57.47	1.59	15	10	52.60	2.14	30	5
1615 -1617½	50.47	3.03	30	5	55.67	3.42	15	10	50.67	3.88	30	5
1617½-1620	52.90	2.34	30	5	57.87	1.93	15	10	52.60	1.91	30	5
1620 -1622½	50.20	3.00	30	5	56.20	2.32	15	10	51.07	3.02	30	5
1622½-1625	52.80	2.94	30	5	56.80	2.93	15	10	50.10	2.07	30	5
1630 -1632½	50.40	3.94	30	5	54.40	3.52	30	5	50.10	3.32	30	5
1632½-1635	48.33	2.99	30	5	54.27	2.52	30	5	48.13	3.05	30	5
1635 -1637½	45.57	2.52	30	5	47.81	2.00	26	5	43.67	2.59	30	5
1637½-1640	40.63	4.66	30	5	NA				37.30	2.25	30	5
1640 -1642½	25.60	2.40	30	5	40.81	2.18	16	5	39.63	2.30	30	5
1642½-1645	29.21	3.51	29	5	40.97	3.02	29	5	40.03	2.23	30	5
1650 -1652½	32.14	2.30	28	5	37.20	2.18	30	5	36.17	5.28	30	5
1652½-1655	25.63	1.86	30	5	35.27	1.92	30	5	30.70	2.69	30	5
1655 -1657½	23.52	3.17	29	5	31.10	1.90	30	5	27.27	1.66	30	5
1657½-1700	28.70	3.10	30	5	29.80	3.88	30	5	30.17	3.75	30	5
1700 -1702½	20.85	3.69	27	5	30.73	2.62	30	5	26.27	2.02	30	5
1702½-1705	24.04	3.86	27	5	30.93	3.61	30	5	30.20	3.01	30	5
1710 -1712½	23.80	3.63	30	5	31.33	3.99	30	5	30.63	3.18	30	5
1712½-1715	24.17	4.74	30	5	32.42	1.88	12	5	31.03	4.57	30	5
1715 -1717½	22.34	3.87	29	5	27.91	4.60	22	5	32.27	4.14	30	5
1717½-1720	19.24	1.81	29	5	30.83	4.54	30	5	32.20	3.91	30	5
1720 -1722½	21.96	2.47	26	5	27.43	4.57	30	5	30.80	5.29	30	5
1722½-1725	20.07	2.52	28	5	27.37	3.60	30	5	29.40	3.44	30	5
1730 -1732½	23.50	2.11	30	5	36.20	1.78	30	5	33.17	3.57	30	5
1732½-1735	27.86	3.17	30	5	37.50	1.84	30	5	30.57	5.24	30	5
1735 -1737½	38.93	7.87*	30	5	34.40	3.16	30	5	33.07	2.63	30	5
1737½-1740	50.93	4.24	30	5	41.00	4.63	30	5	39.53	4.64	30	5
1740-1742½	51.33	2.73	30	5	56.53	2.36	30	5	51.03	3.40	29	5
1742½-1745	52.33	2.93	30	5	55.70	2.18	30	5	49.33	2.03	9	5
1750 -1752½	52.33	5.38	30	5	57.93	3.37	30	5	50.86	4.39	29	5
1752½-1755	51.23	3.74	30	5	58.10	3.35	30	5	51.53	3.35	30	5
1755 -1757½	51.59	5.06	29	5	58.60	3.71	30	5	53.21	2.28	14	5
1757½-1800	51.80	3.61	30	5	54.70	2.79	30	5	NA			
1800 -1802½	52.97	4.71	30	5	58.73	2.69	30	5	NA			
1802½-1805	53.67	3.54	27	5	57.73	2.64	30	5	NA			

*Traffic Flow Transition

TABLE XVII

TRAFFIC SPEED DATA (By Radar)

Elvas Freeway -- Outbound (East)
July 29, 1969 3:30 pm Thru 6:05 pm

Time Period	Levee Radar Presite				S.P.O.C. Radar Presite				S.P.O.C. Radar At Site			
	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I
1530 -1532½	49.73	4.10	30	5	58.25	2.46	28	5	57.77	3.10	30	5
1532½-1535	51.34	4.89	29	5	59.93	2.00	30	5	59.37	2.47	30	5
1535 -1537½	50.63	3.84	30	5	57.10	2.95	30	5	57.23	3.85	30	5
1537½-1540	47.96	5.63	29	5	55.77	3.46	30	5	55.63	3.53	30	5
1540 -1542½	47.36	7.56	30	5	56.70	3.67	30	5	55.40	4.89	30	5
1542½-1545	53.80	3.73	26	5	58.33	2.10	30	5	56.90	2.34	30	5
1550 -1552½	52.90	4.35	30	5	60.17	2.81	30	5	58.40	4.36	30	5
1552½-1555	53.00	3.88	28	5	54.27	6.81	30	5	52.17	6.61	30	5
1555 -1557½	52.40	4.36	30	5	58.80	3.18	30	5	57.83	3.53	30	5
1557½-1600	53.62	3.85	29	5	58.85	3.01	27	5	56.73	4.22	30	5
1600 -1602½	53.06	3.40	29	5	59.64	2.10	14	5	59.00	2.83	13	5
1602½-1605	51.86	3.20	29	5	58.40	3.86	30	5	58.57	4.12	30	5
1610 -1612½	52.06	4.44	30	5	57.58	3.61	24	5	56.40	1.82	30	5
1612½-1615	53.30	3.62	30	5	58.63	2.95	30	5	58.13	3.18	30	5
1615 -1617½	52.31	3.17	29	5	58.50	2.17	30	5	58.53	2.96	30	5
1617½-1620	52.35	4.28	28	5	58.41	3.35	29	5	58.10	3.24	30	5
1620 -1622½	52.43	2.94	30	5	59.50	2.50	2	5	59.00	1.00	2	5
1622½-1625	51.53	4.18	30	5	59.42	2.51	26	5	58.36	3.10	25	5
1630 -1632½	49.10	2.81	30	5	57.00	2.17	30	5	54.67	2.51	30	5
1632½-1635	45.93	2.69	30	5	53.93	2.05	27	5	51.80	2.23	30	5
1635 -1637½	45.76	3.24	30	5	53.87	1.08	30	5	51.23	2.84	30	5
1637½-1640	39.80	3.10	30	5	48.26	3.70	27	5	47.77	3.68	30	5
1640 -1642½	25.06	5.62	30	5	47.30	2.33	30	5	46.67	1.87	30	5
1642½-1645	33.13	2.72	30	5	47.53	3.15	30	5	48.57	1.55	30	5
1650 -1652½	23.00	1.84	30	5	42.27	3.97	30	5	44.60	2.30	30	5
1652½-1655	24.83	1.82	30	5	42.97	2.53	30	5	42.23	2.28	30	5
1655 -1657½	30.36	1.96	30	5	43.13	1.77	30	5	37.37	1.34	30	5
1657½-1700	29.66	1.77	30	5	42.40	3.44	30	5	34.87	3.27	30	5
1700 -1702½	25.33	3.32	30	5	41.03	4.91	30	5	33.43	3.06	30	5
1702½-1705	30.06	2.71	30	5	41.20	2.06	30	5	34.30	3.70	30	5
1710 -1712½	25.60	2.73	30	5	42.40	3.92	30	5	40.00	4.45	30	5
1712½-1715	25.96	1.94	30	5	42.53	3.41	30	5	42.93	2.33	30	5
1715 -1717½	24.26	1.36	30	5	43.97	2.41	30	5	41.17	3.60	30	5
1717½-1720	23.53	1.39	30	5	44.30	1.55	30	5	44.50	4.44	30	5
1720 -1722½	25.40	2.66	30	5	44.23	2.67	30	5	46.07	1.83	30	5
1722½-1725	28.70	2.37	30	5	43.10	5.46	30	5	44.10	3.77	30	5
1730 -1732½	54.50	2.66	30	5	62.20	3.00	30	5	60.40	2.76	30	5
1732½-1735	53.50	3.43	30	5	61.73	3.37	30	5	60.00	3.10	30	5
1735 -1737½	51.60	2.87	30	5	58.53	2.35	30	5	57.83	3.05	30	5
1737½-1740	51.17	2.41	29	5	58.17	2.85	30	5	56.87	2.43	30	5
1740 -1742½	52.10	2.97	30	5	59.17	4.09	12	5	56.97	2.49	30	5
1742½-1745	54.13	3.67	30	5	59.60	2.58	20	5	58.03	2.61	30	5
1750 -1752½	53.48	2.53	29	5	59.80	2.68	25	5	56.86	2.66	22	5
1752½-1755	54.14	3.63	28	5	61.50	3.28	16	5	58.60	2.80	15	5
1755 -1757½	52.30	2.18	30	5	60.77	2.37	30	5	58.97	3.02	30	5
1757½-1800	52.25	4.01	27	5	61.23	3.79	30	5	58.90	3.84	29	5
1800 -1802½	53.50	3.22	30	5	60.53	2.91	30	5	59.00	3.08	29	5
1802½-1805	NA				61.83	2.41	30	5	58.57	3.14	28	5

TABLE XVIII

TRAFFIC SPEED DATA (By Radar)

Elvas Freeway - Outbound (East)
July 31, 1969 3:30 p.m. Thru 6:05 p.m.

Time Period	Levee Radar Presite				S.P.O.C. Radar Presite				S.P.O.C. Radar At Site			
	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I
1530 -1532½	45.83	3.31	30	5	NA				NA			
1532½-1535	45.90	3.94	30	5	NA				NA			
1535 -1537½	45.63	3.07	30	5	58.50	1.80	6	5	NA			
1537½-1540	45.00	2.52	30	5	60.43	2.93	30	5	NA			
1540 -1542½	45.30	2.42	30	5	59.27	1.88	30	5	NA			
1542½-1545	45.57	3.79	30	5	59.13	2.30	30	5	NA			
1550 -1552½	45.40	2.75	30	5	57.77	1.96	30	5	NA			
1552½-1555	45.57	2.89	30	5	58.17	2.30	30	5	NA			
1555 -1557½	47.00	2.25	30	5	58.10	3.09	30	5	NA			
1557½-1600	48.33	2.87	30	5	59.62	3.60	29	5	NA			
1600 -1602½	47.03	2.84	30	5	59.20	2.65	30	5	54.44	5.17	27	5
1602½-1605	44.93	4.10	30	5	60.77	2.60	30	5	57.17	3.65	30	5
1610 -1612½	44.37	2.85	30	5	56.46	1.75	24	5	56.83	2.26	24	5
1612½-1615	46.07	2.39	30	5	60.18	3.01	11	5	52.00	5.01	9	5
1615 -1617½	46.97	3.10	30	5	59.10	2.66	30	5	55.67	3.20	30	5
1617½-1620	45.47	2.47	30	5	58.40	2.93	30	5	56.97	2.45	30	5
1620 -1622½	45.97	3.05	30	5	58.10	2.94	30	5	55.83	3.10	30	5
1622½-1625	45.50	2.92	30	5	58.00	2.85	30	5	57.60	3.47	30	5
1630 -1632½	44.07	2.54	30	5	57.27	2.52	11	5	56.50	2.20	10	5
1632½-1635	41.67	2.05	30	5	54.71	2.92	28	5	53.53	2.84	30	5
1635 -1637½	33.43	5.44	30	5	48.03	1.85	30	5	51.03	2.18	30	5
1637½-1640	27.80	2.27	30	5	47.17	3.25	30	5	50.07	2.34	30	5
1640 -1642½	27.37	1.69	30	5	42.07	3.50	30	5	44.23	4.02	30	5
1642½-1645	30.07	1.91	30	5	43.73	3.06	30	5	36.70	3.87	30	5
1650 -1652½	24.93	3.19	30	5	45.03	2.76	30	5	48.43	2.35	30	5
1652½-1655	23.57	3.60	30	5	42.97	1.72	30	5	46.83	2.38	30	5
1655 -1657½	25.27	4.00	30	5	44.00	2.45	30	5	46.90	2.33	30	5
1657½-1700	29.20	2.12	30	5	46.13	3.19	23	5	45.47	4.35	30	5
1700 -1702½	27.37	2.03	30	5	43.71	2.51	14	5	47.82	1.59	11	5
1702½-1705	22.27	5.42	30	5	44.37	2.07	30	5	48.27	2.49	30	5
1710 -1712½	25.27	2.71	30	5	50.75	1.92	20	5	51.22	2.24	23	5
1712½-1715	19.90	1.85	30	5	45.82	1.56	22	5	48.05	2.35	21	5
1715 -1717½	18.70	1.73	30	5	45.37	2.69	30	5	48.60	2.36	30	5
1717½-1720	20.33	1.19	30	5	45.77	2.42	30	5	48.17	2.25	30	5
1720 -1722½	29.50	9.87*	30	5	45.25	2.49	24	5	47.56	1.98	25	5
1722½-1725	46.50	3.63	30	5	61.29	3.46	7	5	58.57	4.26	7	5
1730 -1732½	48.30	2.60	30	5	60.70	2.40	30	5	58.73	2.07	30	5
1732½-1735	45.80	2.75	30	5	59.30	3.45	30	5	54.79	5.47	29	5
1735 -1737½	47.20	3.27	30	5	60.27	2.73	30	5	56.86	5.24	29	5
1737½-1740	46.33	3.17	30	5	59.60	2.46	30	5	56.87	3.35	30	5
1740 -1742½	46.90	3.08	30	5	59.73	3.20	30	5	57.67	4.44	30	5
1742½-1745	47.93	1.91	30	5	60.10	3.60	29	5	57.37	4.12	30	5
1750 -1752½	45.63	2.31	30	5	58.10	3.74	30	5	55.47	2.90	30	5
1752½-1755	47.20	3.20	30	5	58.97	3.07	30	5	54.33	5.43	30	5
1755 -1757½	47.50	3.04	30	5	61.41	2.95	29	5	57.89	4.58	28	5
1757½-1800	48.70	2.48	30	5	60.74	2.39	27	5	56.70	3.31	30	5
1800 -1802½	48.90	2.69	30	5	60.87	3.19	30	5	58.25	3.79	28	5
1802½-1805	49.45	2.94	29	5	62.97	2.25	30	5	59.21	3.94	28	5

*Traffic Flow Transition

TABLE XIX

TRAFFIC SPEED DATA (By Radar)

Foothill Farms (Spruce) - Outbound (East)
July 27, 1969 3:00 pm Thru 10:57 pm

Time Period	Site A At Site X̄	S	N	I	Site C Presite X̄	S	N	I	Site E Post Site X̄	S	N	I
1500 -1502½	NA				57.60	2.42	15	10	**			
1502½-1505	NA				58.40	4.80	15	10	62.05	4.87	99	5
1505 -1507½	NA				58.79	4.53	14	10	**			
1507½-1510	NA				57.20	4.72	15	10	60.00	6.12	71	5
1510 -1512½	NA				58.31	3.63	13	10	**			
1512½-1515	NA				59.73	4.34	15	10	62.76	5.53	76	5
1516 -1518½	NA				57.93	4.25	15	10	**			
1518½-1521	NA				60.28	3.21	14	10	61.51	5.24	96	5
1521 -1523½	NA				59.42	3.46	12	10	**			
1523½-1526	NA				58.00	3.27	14	10	62.04	5.15	65	5
1526 -1528½	NA				57.60	3.54	15	10	**			
1528½-1531	NA				59.79	4.50	14	10	62.50	5.26	103	5
1536 -1538½	NA				57.53	2.94	15	10	**			
1538½-1541	NA				59.33	3.68	15	10	62.01	6.00	102	5
1541 -1543½	NA				58.36	3.93	14	10	**			
1543½-1546	NA				57.07	2.05	15	10	62.84	6.00	89	5
1546 -1548½	NA				56.53	3.44	15	10	**			
1548½-1551	NA				59.41	5.35	14	10	62.24	5.32	96	5
1611 -1613½	**				58.73	4.02	15	10	**			
1613½-1616	62.84	6.35	293	5	59.67	2.72	15	10	63.23	5.03	82	5
1616 -1618½	NA				59.07	3.40	15	10	**			
1618½-1621	NA				60.57	4.77	14	10	63.88	5.24	80	5
1621 -1623½	NA				59.40	4.38	15	10	**			
1623½-1626	NA				59.43	4.74	14	10	62.15	5.17	86	5
1627 -1629½	**				58.86	2.35	14	10	**			
1629½-1632	63.07	7.19	141	5	57.53	3.07	15	10	61.72	4.75	72	5
1632 -1634½	NA				61.73	4.22	15	10	**			
1634½-1637	NA				61.69	4.42	13	10	62.88	5.80	80	5
1637 -1639½	NA				58.43	3.20	14	10	**			
1639½-1642	NA				59.93	4.40	15	10	62.75	6.03	79	5
1702 -1704½	59.07	6.82	28	5	58.29	6.16	14	10	**			
1704½-1707	58.58	5.23	26	5	58.14	4.14	14	10	59.91	5.94	110	5
1707 -1709½	61.35	3.84	26	5	60.25	3.77	12	10	**			
1709½-1712	61.67	5.87	27	5	NA				61.11	6.32	83	5
1712 -1714½	59.50	7.07	28	5	55.50	6.72	14	10	**			
1714½-1717	59.93	4.59	28	5	60.36	4.33	14	10	60.70	5.23	89	5
1718 -1720½	62.40	2.15	20	5	60.53	4.41	15	10	**			
1720½-1723	61.46	4.41	26	5	58.71	3.00	14	10	63.53	5.80	63	5
1723 -1725½	59.93	4.61	27	5	55.23	3.03	13	10	**			
1725½-1728	61.94	4.71	18	5	58.00	2.16	3	10	62.33	4.73	86	5
1728 -1730½	61.79	3.87	24	5	NA				**			
1730½-1733	62.30	3.95	27	5	NA				63.22	5.95	83	5
1738 -1740½	61.32	3.78	28	5	NA				**			
1740½-1743	60.25	4.37	24	5	NA				62.44	5.65	86	5
1743 -1745½	61.26	4.59	23	5	NA				**			
1745½-1748	57.33	7.95	24	5	NA				60.69	6.90	83	5
1748 -1750½	57.22	5.55	27	5	NA				**			
1750½-1753	60.46	4.38	28	5	NA				62.44	5.08	86	5

** N = Number of vehicles
I = Speed interval in minutes

Foothill Farms (Spruce) - Outbound (East) cont.
July 27, 1969 3:00 pm Thru 10:57 pm

Time Period	Site A At Site X	S	N	I	Site C Presite X	S	N	I	Site E Post Site X	S	N	I
1813 -1815½	60.64	5.78	28	5	NA				**			
1815½-1818	63.00	4.31	23	5	NA				62.18	6.22	79	5
1818 -1820½	62.84	5.10	25	5	NA				**			
1820½-1823	60.12	7.86	25	5	NA				62.23	5.73	56	5
1823 -1825½	63.14	4.18	21	5	NA				**			
1825½-1828	61.32	5.79	22	5	NA				63.35	6.01	65	5
1829 -1831½	63.00	4.24	4	5	NA				**			
1831½-1834	61.00	5.59	26	5	NA				62.03	6.04	75	5
1834 -1836½	61.70	4.58	27	5	NA				**			
1836½-1839	63.71	4.41	24	5	NA				64.77	4.86	88	5
1839 -1841½	61.28	5.91	25	5	NA				**			
1841½-1844	64.11	5.73	27	5	NA				63.40	5.37	83	5
2115 -2117½	**				NA				**			
2117½-2120	61.88	5.64	97	5	NA				60.34	4.46	44	5
2120 -2122½	**				NA				**			
2122½-2125	62.71	6.19	24	2½	NA				61.69	4.88	43	5
2125 -2127½	**				NA				**			
2127½-2130	63.87	5.98	62	5	NA				59.12	4.15	65	5
2131 -2133½	**				NA				**			
2133½-2136	62.77	5.87	74	5	NA				57.00	3.84	60	5
2136 -2138½	**				NA				**			
2138½-2141	65.09	5.62	58	5	NA				58.85	5.43	52	5
2141 -2143½	**				NA				**			
2143½-2146	61.25	5.32	44	5	55.17	4.77	6	5	56.60	4.66	50	5
2151 -2153½	**				52.17	4.70	12	10	**			
2153½-2156	61.32	6.19	51	5	55.38	5.38	13	10	57.11	4.44	38	5
2156 -2158½	**				56.62	3.85	13	10	**			
2158½-2201	61.61	5.89	62	5	54.77	3.73	13	10	58.30	6.27	50	5
2201 -2203½	**				48.60	3.53	10	10	**			
2203½-2206	61.31	8.51	42	5	57.80	4.26	10	10	54.17	5.93	45	5
2226 -2228½	*				55.58	4.93	12	10	**			
2228½-2231	63.54	5.03	53	5	54.85	4.71	13	10	62.26	6.68	41	5
2231 -2233½	**				55.50	3.52	12	10	**			
2233½-2236	65.37	5.06	47	5	53.64	2.99	11	10	61.47	4.88	39	5
2236 -2238½	*				55.46	4.24	13	10	**			
2238½-2241	65.64	5.78	35	5	56.08	3.55	12	10	61.75	4.94	40	5
2242 -2244½	**				56.45	4.50	11	10	**			
2244½-2247	63.60	6.58	50	5	54.54	2.68	11	10	60.92	5.28	38	5
2247 -2249½	**				54.27	3.38	11	10	**			
2249½-2252	63.59	6.74	32	5	54.56	5.39	9	10	59.44	5.73	36	5
2252 -2254½	**				54.15	3.20	13	10	**			
2254½-2257	62.88	6.61	52	5	52.18	4.49	11	10	60.39	5.01	38	5

**N = Number of Vehicles
**I = Speed Interval Time in Minutes

TABLE XX

TRAFFIC SPEED DATA (By Radar)

Foothill Farms (Spruce) - Inbound (West)
July 27, 1969 3:00 pm Thru 10:57 pm

Time Period	Site B At Site X	S	N	I	Site D Post Site X	S	N	I	Site F Presite X	S	N	I
1500 -1502½	58.80	4.62	30	5	60.87	4.22	15	10	NA			
1502½-1505	61.37	5.05	30	5	61.67	3.46	15	10	NA			
1505 -1507½	61.96	2.82	25	5	61.20	4.04	15	10	NA			
1507½-1510	59.38	5.11	26	5	61.00	2.88	14	10	NA			
1510 -1512½	60.00	4.79	22	5	58.29	4.28	14	10	NA			
1512½-1515	59.09	5.18	22	5	61.00	4.87	15	10	NA			
1516 -1518½	60.97	3.37	29	5	61.07	3.15	15	10	NA			
1518½-1521	58.13	4.69	30	5	60.73	4.58	15	10	NA			
1521 -1523½	59.61	2.79	28	5	62.40	2.22	15	10	NA			
1523½-1526	58.60	3.26	30	5	60.33	3.05	15	10	NA			
1526 -1528½	59.30	2.61	30	5	60.67	3.24	15	10	NA			
1528½-1531	60.50	4.26	28	5	62.53	2.85	15	10	NA			
1536 -1538½	56.74	3.51	27	5	62.40	2.94	15	10	NA			
1538½-1541	60.17	3.78	29	5	60.53	3.77	15	10	NA			
1541 -1543½	57.55	4.32	29	5	59.87	2.58	15	10	59.80	4.44	15	10
1543½-1546	60.11	4.08	28	5	58.93	5.14	15	10	64.07	2.54	15	10
1546 -1548½	59.07	3.34	30	5	62.47	1.70	15	10	60.88	2.24	8	10
1548½-1551	56.72	4.00	29	5	56.80	4.26	15	10	NA			
1611 -1613½	59.72	5.13	29	5	60.93	3.55	15	10	59.33	4.45	15	10
1613½-1616	59.93	4.01	29	5	58.60	4.10	15	10	59.43	3.58	14	10
1616 -1618½	59.59	4.88	29	5	58.33	5.47	15	10	60.07	3.61	15	10
1618½-1621	60.43	6.34	30	5	59.73	6.28	15	10	61.67	3.09	15	10
1621 -1623½	62.00	4.12	28	5	62.60	3.09	15	10	61.33	3.32	15	10
1623½-1626	60.86	3.66	29	5	NA				NA			
1627 -1629½	57.93	4.90	29	5	NA				60.13	3.70	15	10
1629½-1632	61.00	4.61	29	5	NA				60.80	3.73	15	10
1632 -1634½	62.83	4.17	29	5	NA				62.20	4.15	15	10
1634½-1637	60.53	3.65	30	5	NA				59.67	2.61	6	10
1637 -1639½	61.07	4.77	30	5	NA				62.64	1.97	14	10
1639½-1642	62.59	3.32	22	5	NA				60.14	4.44	14	10
1702 -1704½	**				58.00	4.33	15	10	59.57	2.90	14	10
1704½-1707	60.85	5.14	227	5	58.16	2.78	15	10	64.00	5.42	15	10
1707 -1709½	**				58.66	3.43	15	10	58.53	4.13	15	10
1709½-1712	61.66	5.66	191	5	58.00	4.56	15	10	61.67	3.00	15	10
1712 -1714½	**				59.59	4.15	15	10	62.13	3.56	15	10
1714½-1717	62.66	5.27	161	5	61.09	3.09	15	10	59.67	3.48	15	10
1718 -1720½	**				59.59	2.71	9	10	62.00	4.06	12	10
1720½-1723	61.15	5.60	152	5	56.25	3.54	15	10	59.27	5.01	15	10
1723 -1725½	**				59.71	4.05	15	10	62.00	2.79	10	10
1725½-1728	62.99	7.06	102	5	60.54	3.49	14	10	63.47	3.07	15	10
1728 -1730½	**				58.75	4.21	15	10	59.53	2.42	15	10
1730½-1733	61.34	5.19	194	5	59.34	4.65	15	10	62.00	3.12	15	10
1738 -1740½	**				50.89	5.24	7	10	61.13	3.30	15	10
1740½-1743	63.56	4.83	123	5	61.16	3.70	15	10	60.87	2.71	15	10
1743 -1745½	**				59.84	3.98	15	10	60.64	2.95	14	10
1745½-1748	60.00	5.07	180	5	59.41	4.10	15	10	58.60	2.06	15	10
1748 -1750½	**				58.59	3.56	15	10	57.60	2.75	15	10
1750½-1753	63.54	5.75	67	3	60.00	3.93	15	10	63.47	2.70	15	10

** N = Number of vehicles
I = Speed interval in minutes

TABLE XX Cont.

Foothill Farms (Spruce) - Inbound (West) cont.
July 27, 1969 3:00 pm Thru 10:57 pm

Time Period	Site B At Site				Site D Post Site				Site F Presite			
	X	S	N	I	X	S	N	I	X	S	N	I
1813 -1815½	**				61.25	4.45	15	10	58.80	3.64	15	10
1815½-1818	61.94	5.98	171	5	59.66	5.14	15	10	60.73	3.34	15	10
1818 -1820½	**				60.75	3.70	15	10	61.87	3.00	15	10
1820½-1823	62.66	5.65	289	10	62.59	2.71	15	10	61.07	4.03	15	10
1823 -1825½					62.75	2.68	15	10	60.40	3.52	15	10
1825½-1828					58.66	4.58	15	10	59.93	3.03	14	10
1829 -1831½	**				63.50	3.93	15	10	62.13	5.47	15	10
1831½-1834	60.78	4.86	186	5	60.91	4.00	15	10	58.20	3.41	15	10
1834 -1836½	**				60.16	3.88	15	10	60.80	3.51	15	10
1836½-1839	61.02	5.28	162	5	59.34	3.19	15	10	58.60	2.73	15	10
1839 -1841½	**				60.91	3.34	15	10	61.93	2.84	15	10
1841½-1841	64.69	4.36	121	5	62.09	3.28	15	10	63.20	2.88	15	10
2115 -2117½	57.68	4.63	30	5	56.75	7.30	15	10	57.80	2.81	15	10
2117½-2120	58.51	4.52	30	5	58.75	3.98	15	10	57.07	4.44	15	10
2120 -2122½	60.96	4.12	29	5	59.75	5.00	15	10	60.71	3.42	14	10
2122½-2125	60.56	3.31	27	5	59.41	3.09	15	10	59.79	3.52	14	10
2125 -2127½	61.82	3.88	29	5	59.75	4.34	15	10	60.80	3.75	15	10
2127½-2130	61.88	3.62	26	5	62.50	2.93	15	10	61.07	3.94	15	10
2131 -2133½	59.58	3.53	23	5	62.08	3.81	15	10	59.23	3.50	13	10
2133½-2136	60.16	3.36	25	5	62.31	3.64	14	10	60.57	3.96	14	10
2136 -2138½	60.16	3.46	25	5	61.91	3.59	15	10	58.53	3.53	14	10
2138½-2141	57.95	4.37	29	5	63.08	2.63	15	10	61.47	3.42	15	10
2141 -2143½	57.54	4.80	30	5	62.00	2.28	15	10	57.60	3.65	15	10
2143½-2146	56.47	4.73	29	5	61.08	4.33	15	10	57.33	5.91	15	10
2151 -2153½	60.00	4.53	27	5	60.41	4.49	15	10	59.67	3.26	12	10
2153½-2156	61.18	4.37	28	5	61.51	3.54	14	10	59.93	3.49	15	10
2156 -2158½	60.59	7.27	29	5	62.59	2.83	14	10	62.83	6.38	12	10
2158½-2201	61.10	3.47	29	5	62.25	3.88	15	10	61.54	3.95	13	10
2201 -2203½	63.26	3.91	27	5	62.08	4.79	15	10	60.08	2.48	13	10
2203½-2206	61.63	4.33	27	5	64.46	3.34	14	10	59.93	5.37	15	10
2226 -2228½	58.88	5.89	24	5	60.16	6.83	15	10	57.00	4.52	14	10
2228½-2231	62.84	4.94	25	5	61.78	5.14	14	10	60.00	5.24	12	10
2231 -2233½	66.17	3.84	23	5	64.83	3.34	15	10	61.43	3.49	14	10
2233½-2236	64.08	4.49	25	5	63.84	2.66	14	10	59.40	2.85	15	10
2236 -2238½	60.28	4.85	29	5	59.78	3.64	15	10	58.47	3.42	15	10
2238½-2241	62.36	4.98	28	5	57.01	3.79	13	10	58.83	5.12	12	10
2242 -2244½	62.59	3.45	22	5	57.91	4.76	15	10	62.86	3.43	14	10
2244½-2247	62.20	4.83	20	5	62.05	3.75	14	10	59.31	6.52	13	10
2247 -2249½	59.35	4.69	26	5	63.50	3.93	15	10	58.62	5.10	13	10
2249½-2252	59.79	4.02	24	5	59.23	4.36	13	10	60.85	5.20	13	10
2252 -2254½	60.75	4.67	20	5	59.51	4.90	13	10	59.08	7.21	13	10
2254½-2257	54.85	5.44	27	5	56.25	5.64	13	10	56.44	4.93	9	10

**N = Number of Vehicles
**I = Speed Interval Time in Minutes

TRAFFIC SPEED DATA (By Radar)

Mace Boulevard - Inbound (East)
August 3, 1969 3:00 pm Thru 11:10 pm

Time Period	Site A At Site X̄	S	N	I	Site C Presite X̄	S	N	I	Site K At Site X̄	S	N	I
1500 -1502½	[1]Not Scheduled				63.14	3.31	14	10	57.87	3.46	15	10
1502½-1505					63.38	3.75	13	10	55.73	2.91	15	10
1505 -1507½					62.13	3.78	15	10	54.65	4.03	13	10
1507½-1510					62.57	3.52	14	10	54.67	3.09	14	10
1510 -1512½					61.86	7.08	14	10	[3]No Data			
1512½-1515					63.33	2.50	12	10				
1516 -1518½					62.62	4.13	13	10				
1518½-1521					62.36	5.25	11	10				
1521 -1523½					63.58	3.40	12	10				
1523½-1526					63.07	4.55	15	10				
1526 -1528½					62.25	2.38	12	10				
1528½-1531					63.54	3.20	13	10				
1536 -1538½					66.21	3.15	14	10				
1538½-1541					66.20	3.63	15	10				
1541 -1543½					62.27	5.89	15	10				
1543½-1546					62.53	5.07	15	10				
1546 -1548½					63.38	3.56	13	10				
1548½-1551					62.62	4.67	13	10				
1611 -1613½					[3]No Data							
1613½-1616												
1616 -1618½												
1618½-1621												
1621 -1623½					61.36	3.05	11	10				
1623½-1626												
1627 -1629½					58.73	3.04	15	10				
1629½-1632					60.36	4.39	14	10				
1632 -1634½					60.23	2.08	13	10				
1634½-1637					61.46	2.44	13	10				
1637 -1639½					57.43	4.92	14	10				
1639½-1642					58.42	3.57	12	10				
1702 -1704½	59.58	5.72	19	5	61.14	5.90	14	10	[2]Not Scheduled			
1704½-1707	59.33	5.24	24	5	63.27	3.51	15	10				
1707 -1709½	54.54	5.12	26	5	62.13	4.75	15	10				
1709½-1712	54.95	5.25	26	5	62.27	2.89	15	10				
1712 -1714½	56.75	3.47	27	5	62.73	3.57	15	10				
1714½-1717	57.31	4.10	28	5	64.62	3.00	13	10				
1718 -1720½	54.47	4.39	23	5	57.22	3.52	9	10				
1720½-1723	56.53	3.42	27	5	61.47	4.53	15	10				
1723 -1725½	57.45	4.77	26	5	60.08	4.91	13	10				
1725½-1728	56.84	4.71	23	5	60.20	3.90	15	10				
1728 -1730½	56.19	3.92	28	5	61.20	4.20	15	10				
1730½-1733	55.07	4.43	24	5	62.08	2.72	12	10				
1738 -1740½	56.62	5.10	27	5	56.92	3.81	13	10				
1740½-1743	57.78	3.74	26	5	57.50	4.27	6	10				
1743 -1745½	55.74	5.46	26	5	No Data							
1745½-1748	56.53	4.59	25	5								
1748 -1750½	57.35	3.68	27	5								
1750½-1753	55.37	5.27	26	5								

TABLE XXI Cont.

Mace Boulevard - Inbound (East) cont.
August 3, 1969 3:00 pm Thru 11:10 pm

Time Period	Site A At Site X	S	N	I	Site C Presite X	S	N	I	Site K At Site X	S	N	I
1813 -1815½	57.48	4.26	24	5	59.54	2.74	13	10	[2]Not Scheduled			
1815½-1818	59.68	4.38	26	5	60.71	4.35	14	10				
1818 -1820½	58.36	4.83	25	5	59.46	3.27	13	10				
1820½-1823	56.07	3.48	26	5	59.13	3.44	15	10				
1823 -1825½	58.87	3.85	22	5	59.67	2.29	12	10				
1825½-1828	58.98	2.99	25	5	59.71	2.67	14	10				
1829 -1831½	56.53	3.56	24	5	58.57	3.33	14	10				
1831½-1834	58.45	4.48	25	5	59.93	2.96	15	10				
1834 -1836½	58.56	3.61	26	5	60.07	1.71	14	10				
1836½-1839	57.31	3.76	23	5	61.27	5.89	15	10				
1839 -1841½	60.56	4.39	13	5	59.60	4.10	15	10				
1841½-1844	60.49	3.49	8	5	60.73	4.19	15	10				
2115 -2117½	[1]Not Scheduled				[3]No Data				61.27	3.06	15	10
2117½-2120									64.00	2.87	15	10
2120 -2122½									60.40	5.96	15	10
2122½-2125									59.87	3.48	15	10
2125 -2127½									63.07	3.10	15	10
2127½-2130									60.29	4.45	14	10
2131 -2133½									60.07	3.02	14	10
2133½-2136									62.47	3.50	15	10
2136 -2138½									61.93	2.60	15	10
2138½-2141									62.07	3.23	15	10
2141 -2143½									62.27	2.51	15	10
2143½-2146									60.50	3.89	14	10
2151 -2153½									59.93	3.26	15	10
2153½-2156									62.00	3.26	15	10
2156 -2158½									60.79	4.74	14	10
2158½-2201									61.46	3.46	13	10
2201 -2203½									61.27	4.25	15	10
2203½-2206									63.67	3.91	15	10
2226 -2228½									58.31	4.24	13	10
2228½-2231									61.13	3.16	15	10
2231 -2233½									62.21	2.51	14	10
2233½-2236									61.27	4.64	15	10
2236 -2238½									60.83	3.92	12	10
2238½-2241									61.13	3.61	15	10
2255 -2257½									60.64	2.14	14	10
2257½-2300									60.07	1.92	15	10
2300 -2302½									58.93	4.65	14	10
2302½-2305									60.20	4.87	15	10
2305 -2307½									57.93	4.51	14	10
2307½-2310									59.64	2.25	11	10

[1]Data collection scheduled for 1702-1844 only.
[2]Data collection not scheduled for 1702-1844.
[3]No data due to radar failure.
[4]Data collection period rescheduled due to equipment failure.

TRAFFIC SPEED DATA (By Radar)

Mace Boulevard - Outbound (West)
August 3, 1969 3:00 pm Thru 11:10 pm

Time Period	Site B At Site				Site D Post Site				Site F Presite			
	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I	$\bar{X}$	S	N	I
1500 -1502½	[1]No Data				53.47	4.04	15	10	[1]No Data			
1502½-1505					54.86	3.96	14	10				
1505 -1507½					53.53	4.03	15	10				
1507½-1510					55.62	2.39	13	10				
1510 -1512½	61.71	4.62	19	5	55.73	2.66	15	10				
1512½-1515	57.38	4.80	29	5	54.60	2.52	15	10				
1516 -1518½	56.66	3.94	30	5	54.67	3.01	15	10				
1518½-1521	55.23	4.92	27	5	52.53	3.89	15	10				
1521 -1523½	56.24	4.48	29	5	53.71	4.22	14	10				
1523½-1526	[1]No Data				54.33	3.45	15	10				
1526 -1528½					54.00	3.81	15	10				
1528½-1531					52.80	4.68	15	10				
1536 -1538½	57.06	4.88	30	5	54.60	3.44	15	10				
1538½-1541	58.14	3.57	27	5	54.47	3.83	15	10	65.83	3.10	6	10
1541 -1543½	58.14	4.34	27	5	55.30	3.63	13	10	63.60	3.14	15	10
1543½-1546	58.04	3.95	30	5	55.50	2.90	14	10	63.07	3.45	15	10
1546 -1548½	58.34	3.29	30	5	53.87	4.96	15	10	63.40	2.22	15	10
1548½-1551	58.04	2.97	30	5	54.00	2.34	15	10	63.00	3.18	15	10
1611 -1613½	60.31	3.61	28	5	56.79	2.38	14	10	64.20	2.76	15	10
1613½-1616	57.85	4.71	29	5	56.36	3.59	14	10	65.00	3.63	15	10
1616 -1618½	59.44	4.81	30	5	56.36	2.88	11	10	64.47	3.22	15	10
1618½-1621	60.99	5.62	30	5	57.00	2.83	15	10	64.93	5.16	15	10
1621 -1623½	59.62	3.05	29	5	56.54	3.52	13	10	63.13	2.88	15	10
1623½-1626	58.64	5.24	28	5	54.73	3.51	15	10	61.40	2.82	15	10
1627 -1629½	58.30	3.35	26	5	56.07	3.16	15	10	63.20	4.86	15	10
1629½-1632	60.30	3.52	29	5	58.07	2.35	15	10	61.40	3.81	15	10
1632 -1634½	58.95	3.72	29	5	55.00	4.16	15	10	62.53	3.81	15	10
1634½-1637	59.72	3.04	30	5	56.40	3.42	15	10	63.27	3.02	15	10
1637 -1639½	59.12	2.60	29	5	57.27	3.07	15	10	60.93	2.98	15	10
1639½-1642	58.17	4.65	30	5	57.40	3.38	15	10	61.60	4.48	15	10
1702 -1704½	59.93	4.85	15	10	55.40	3.18	15	10	63.40	4.24	15	10
1704½-1707	58.60	5.24	15	10	56.53	4.32	15	10	65.18	1.91	11	10
1707 -1709½	56.79	5.08	14	10	56.77	3.22	13	10	64.73	3.16	15	10
1709½-1712	59.20	3.43	15	10	55.93	3.71	15	10	63.87	3.81	15	10
1712 -1714½	55.93	4.32	14	10	56.46	2.24	13	10	64.27	3.55	15	10
1714½-1717	58.57	3.48	14	10	56.00	2.94	15	10	64.47	1.85	15	10
1718 -1720½	57.40	2.96	15	10	56.73	2.84	15	10	61.27	2.51	15	10
1720½-1723	56.93	4.77	14	10	55.80	2.61	15	10	63.13	3.05	15	10
1723 -1725½	57.67	4.77	15	10	55.71	2.99	14	10	63.33	3.24	15	10
1725½-1728	60.13	1.78	15	10	55.73	2.32	15	10	64.00	2.58	15	10
1728 -1730½	56.73	3.82	15	10	57.53	3.57	15	10	63.73	3.75	15	10
1730½-1733	61.47	3.07	15	10	56.92	3.09	12	10	61.60	3.98	15	10
1738 -1740½	60.93	4.89	15	10	55.73	2.59	15	10	64.07	3.51	15	10
1740½-1743	60.87	3.18	15	10	57.40	4.21	15	10	62.53	3.85	15	10
1743 -1745½	59.21	3.79	14	10	55.80	2.61	15	10	65.36	4.99	11	10
1745½-1748	60.57	3.95	14	10	56.33	2.62	15	10	61.93	2.79	15	10
1748 -1750½	60.00	3.27	14	10	54.93	2.18	14	10	61.53	3.42	15	10
1750½-1753	57.80	2.61	15	10	55.07	2.41	15	10	60.33	2.30	15	10

TABLE XXII Cont.

Mace Boulevard - Outbound (West) cont.
August 3, 1969 3:00 pm Thru 11:10 pm

Time Period	Site B At Site $\bar{X}$	S	N	I	Site D Post Site $\bar{X}$	S	N	I	Site F Presite $\bar{X}$	S	N	I
1813 -1815½	59.27	4.47	15	10	56.67	3.54	15	10	63.40	3.16	15	10
1815½-1818	60.40	2.96	15	10	54.40	3.74	15	10	64.80	2.99	15	10
1818 -1820½	61.73	2.67	15	10	56.80	2.86	15	10	63.67	3.57	15	10
1820½-1823	60.53	3.36	15	10	55.93	2.40	15	10	63.47	2.73	15	10
1823 -1825½	61.73	4.45	15	10	56.07	3.65	15	10	63.93	3.78	14	10
1825½-1828	59.73	4.01	15	10	54.07	3.60	14	10	63.36	2.98	14	10
1829 -1831½	60.53	3.54	15	10	56.00	3.16	15	10	59.80	3.26	15	10
1831½-1834	60.07	3.79	14	10	56.07	3.05	15	10	64.20	2.51	15	10
1834 -1836½	60.47	3.63	15	10	56.27	2.30	15	10	63.13	2.92	15	10
1836½-1839	58.40	5.29	15	10	56.36	2.76	14	10	63.87	2.52	15	10
1839 -1841½	60.53	2.71	15	10	54.92	3.10	13	10	63.13	3.33	15	10
1841½-1844	59.40	2.80	15	10	53.80	4.21	15	10	61.60	2.87	15	10
2115 -2117½	56.50	5.86	27	5	54.93	3.23	15	10	62.73	3.47	15	10
2117½-2120	57.00	4.93	29	5	53.71	2.69	14	10	64.13	2.37	15	10
2120 -2122½	59.12	3.74	28	5	54.40	2.96	15	10	63.87	2.36	15	10
2122½-2125	58.17	3.08	30	5	55.13	2.18	15	10	64.47	2.21	15	10
2125 -2127½	58.36	4.44	29	5	57.57	1.88	14	10	63.20	2.71	15	10
2127½-2130	58.63	3.83	27	5	55.33	3.02	15	10	61.36	4.02	14	10
2131 -2133½	55.52	3.40	15	5	53.47	2.59	15	10	61.21	4.27	14	10
2133½-2136	57.33	2.86	24	5	54.14	3.68	14	10	63.27	3.10	15	10
2136 -2138½	57.73	4.39	27	5	55.40	3.22	15	10	62.07	4.07	15	10
2138½-2141	57.00	4.60	27	5	53.20	5.29	15	10	65.00	3.14	15	10
2141 -2143½	60.71	3.50	28	5	58.14	2.42	14	10	61.87	3.74	15	10
2143½-2146	57.47	4.22	28	5	54.87	3.12	15	10	62.60	3.03	15	10
2151 -2153½	56.89	5.24	28	5	56.13	2.77	15	10	60.73	3.73	15	10
2153½-2156	55.57	5.11	29	5	55.40	2.52	15	10	61.67	3.49	15	10
2156 -2158½	56.03	4.96	26	5	53.00	3.14	13	10	61.93	2.96	15	10
2158½-2201	56.50	4.68	29	5	51.77	3.43	13	10	62.33	4.24	15	10
2201 -2203½	56.62	3.54	30	5	52.46	3.65	13	10	62.53	3.50	15	10
2203½-2206	57.21	3.61	26	5	50.57	4.20	14	10	62.93	2.96	15	10
2226 -2228½	58.56	6.06	24	5	53.58	2.37	12	10	63.93	5.07	14	10
2228½-2231	55.90	5.42	24	5	52.36	2.79	14	10	62.07	5.73	15	10
2231 -2233½	[1]No Data				52.83	2.00	12	10	61.57	3.36	14	10
2233½-2236					53.93	3.49	15	10	62.40	3.57	15	10
2236 -2238½					51.71	4.53	14	10	62.92	6.01	13	10
2238½-2241					52.08	2.64	13	10	62.21	2.70	14	10
2255 -2257½[2]	59.63	3.65	26	5	52.79	2.75	14	10	62.00	3.56	15	10
2257½-2300	61.98	4.86	26	5	54.20	2.64	15	10	66.38	3.75	13	10
2300 -2302½	61.88	5.53	24	5	58.29	2.59	14	10	62.87	2.84	15	10
2302½-2305	57.39	2.89	20	5	55.13	2.57	15	10	59.31	1.60	13	10
2305 -2307½	58.41	5.05	24	5	54.80	3.82	15	10	59.40	5.67	15	10
2307½-2310	59.16	4.02	21	5	56.00	4.01	13	10	58.53	5.12	15	10

[1]No Data due to radar failure.
[2]Data collection period rescheduled due to equipment failure.

TABLE XXIII

Traffic Count Data
El Centro Road
July 20, 1969 - 3:30 pm Thru 22:57 pm

Time Period	Direction of Travel		
	Northbound	Southbound	Total
1500 - 1505	9	22	31
1505 - 1510	13	20	33
1510 - 1515	11	25	36
Subtotal	33	67	100
1516 - 1521	16	24	40
1521 - 1526	8	14	22
1526 - 1531	12	17	29
Subtotal	36	55	91
1536 - 1541	11	19	30
1541 - 1546	21	13	34
1546 - 1551*	15	28	43
Subtotal	47	60	107
1611 - 1616	8	16	24
1616 - 1621	15	17	32
1621 - 1626	18	16	34
Subtotal	41	49	90
1627 - 1632	17	18	35
1632 - 1637	18	18	36
1637 - 1642	15	16	31
Subtotal	50	52	102
1702 - 1707	11	35	46
1707 - 1712	17	21	38
1712 - 1717	12	30	42
Subtotal	40	86	126
1718 - 1723	16	21	37
1723 - 1728	11	17	28
1728 - 1733	20	26	46
Subtotal	47	64	111

Time Period	Direction of Travel		
	Northbound	Southbound	Total
1738 - 1743	10	20	30
1743 - 1748	18	22	40
1748 - 1753	5	14	19
Subtotal	33	56	89
1813 - 1818	14	17	31
1818 - 1823	12	17	29
1823 - 1828	11	29	30
Subtotal	37	53	90
1829 - 1834	15	13	28
1834 - 1839	12	20	32
1839 - 1844	11	11	22
Subtotal	38	44	82
2115 - 2120	11	25	36
2120 - 2125	14	22	36
2125 - 2130	11	24	35
Subtotal	36	71	107
2131 - 2136	15	23	38
2136 - 2141	13	20	33
2141 - 2146	12	23	35
Subtotal	40	66	106
2151 - 2156	13	34	47
2156 - 2201	17	15	32
2201 - 2206	13	14	27
Subtotal	43	63	106
2226 - 2231	10	16	26
2231 - 2236	8	27	35
2236 - 2241	13	25	38
Subtotal	31	68	99
2242 - 2247	9	14	23
2247 - 2252	13	9	22
2252 - 2257	14	10	24
Subtotal	36	33	69

* A four minute count prorated to five minutes

TABLE XXIV

Traffic Count Data
Elvas Freeway - Outbound (East)
July 17, 1969 - 3:30 pm Thru 6:05 pm
(Distance between Count Stations = 0.658 Miles)

Time Period		A Street Overcrossing I 80 Sac PM. R4.25				S.P. Overcrossing I 80 Sac PM. 5.01			
		Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total	Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total
1530 - 1532½		57	52	44	153	42	55	42	139
1532½ - 1535		44	57	27	128	42	55	45	142
1535 - 1537½		53	66	58	177	45	52	58	155
1537½ - 1540		60	58	55	173	56	62	69	187
1540 - 1542½		65	65	62	192	52	68	67	187
1542½ - 1545		56	57	64	177	50	62	70	182
	Subtotal	335	355	310	1,000	287	354	351	992
1550 - 1552½		55	63	50	168	59	65	53	177
1552½ - 1555		62	54	51	167	49	60	65	174
1555 - 1557½		60	54	37	151	42	51	55	148
1557½ - 1600		59	54	38	151	52	55	55	162
1600 - 1602½		54	60	39	153	48	53	50	151
1602½ - 1605		54	67	51	172	47	60	58	165
	Subtotal	344	352	266	862	297	344	336	977
1610 - 1612½		55	57	47	159	43	61	58	162
1612½ - 1615		57	66	51	174	51	64	62	177
1615 - 1617½		63	68	52	183	56	66	61	183
1617½ - 1620		51	70	49	170	54	65	63	182
1620 - 1622½		54	64	59	177	49	69	66	184
1622½ - 1625		62	57	59	178	45	61	68	174
	Subtotal	342	382	317	1,041	298	386	378	1,062
1630 - 1632½		76	72	76	224	66	76	89	231
1632½ - 1635		78	94	96	268	69	83	86	238
1635 - 1637½		81	95	97	273	75	84	88	247
1637½ - 1640		74	73	76	223	71	75	82	228
1640 - 1642½		73	81	91	245	79	76	88	243
642½ - 1645		72	86	92	250	65	72	73	210
	Subtotal	454	501	528	1,483	425	466	506	1,397
1650 - 1652½		58	64	76	198	56	66	68	190
1652½ - 1655		55	63	68	186	54	62	68	184
1655 - 1657½		57	63	71	191	57	61	75	193
1657½ - 1700		53	60	71	184	55	66	73	194
1700 - 1702½		63	89	66	198	58	61	71	190
1702½ - 1705		53	62	62	177	54	64	77	195
	Subtotal	339	381	414	1,134	334	380	432	1,146
1710 - 1712½		63	65	68	196	52	66	78	196
1712½ - 1715		58	55	63	176	53	60	69	182
1715 - 1717½		55	59	63	177	50	60	69	179
1717½ - 1720		50	61	69	180	55	56	62	173
1720 - 1722½		47	61	56	164	56	58	65	179
1722½ - 1725		54	61	61	176	51	61	75	187
	Subtotal	327	362	380	1,069	317	361	418	1,096
1730 - 1732½		47	55	67	169	62	76	84	222
1732½ - 1735		56	67	70	193	58	63	80	201
1735 - 1737½		51	54	46	151	66	47	71	184
1737½ - 1740		54	49	35	138	61	67	64	192
1740 - 1742½		48	54	36	138	52	55	53	160
1742½ - 1745		61	54	63	178	38	47	53	138
	Subtotal	317	333	317	967	337	353	405	1,097
1750 - 1752½		62	70	65	197	67	68	79	214
1752½ - 1755		50	46	42	138	42	60	63	165
1755 - 1757½		66	59	40	165	57	56	48	161
1757½ - 1800		56	47	35	138	52	49	57	158
1800 - 1802½		47	48	25	120	37	44	32	113
1802½ - 1805		38	44	28	110	34	51	37	122
	Subtotal	319	314	235	868	289	328	316	933
Estimated Total Traffic (3:30 pm - 6:05 pm)		3,587	3,849	3,574	11,010	3,337	3,841	4,058	11,236
% of Estimated Total Traffic		32.57%	34.95%	32.46%	100.00%	29.69%	34.18%	36.11%	100.00%

TABLE XXV

Traffic Count Data
Elvas Freeway - Outbound (East)
July 23, 1969 - 3:30 pm Thru 6:05 pm
(Distance between Count Stations = 0.658 Miles)

Time Period		A Street Overcrossing I 80 Sac PM. R4.25				S.P. Overcrossing I 80 Sac PM. 5.01			
		Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total	Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total
1530 - 1532½		42	57	36	135	33	59	33	125
1532½ - 1535		46	65	43	154	47	53	55	155
1535 - 1537½		49	66	48	163	44	57	54	155
1537½ - 1540		59	65	58	182	50	69	68	187
1540 - 1542½		47	59	67	173	48	66	71	185
1542½ - 1545		53	68	64	185	45	60	68	173
	Subtotal	296	380	316	992	267	364	349	980
1550 - 1552½		46	47	39	132	53	57	39	149
1552½ - 1555		47	57	47	151	37	60	46	143
1555 - 1557½		50	57	48	155	44	53	60	157
1557½ - 1600		57	55	40	152	39	62	42	143
1600 - 1602½		61	47	43	151	42	56	53	151
1602½ - 1605		60	70	53	183	50	65	60	175
	Subtotal	321	333	270	924	265	353	300	918
1610 - 1612½		64	65	61	190	58	58	89	205
1612½ - 1615		52	61	56	169	49	63	60	172
1615 - 1617½		55	64	69	188	57	55	69	181
1617½ - 1620		54	59	60	173	47	57	63	167
1620 - 1622½		58	68	67	193	51	60	77	188
1622½ - 1625		48	59	51	158	46	57	56	159
	Subtotal	331	376	364	1071	308	350	414	1072
1630 - 1632½		66	71	70	207	55	75	71	201
1632½ - 1635		78	77	86	241	65	70	77	212
1635 - 1637½		76	82	92	250	76	73	105	254
1637½ - 1640		89	83	102	274	69	75	78	222
1640 - 1642½		70	78	74	222	68	74	84	226
1642½ - 1645		65	81	85	231	73	71	85	229
	Subtotal	444	472	509	1425	406	438	500	1344
1650 - 1652½		75	79	90	244	65	73	86	224
1652½ - 1655		66	76	69	211	72	73	83	228
1655 - 1657½		76	77	86	239	64	60	69	193
1657½ - 1700		70	77	84	231	67	74	81	222
1700 - 1702½		62	67	72	201	64	71	74	209
1702½ - 1705		61	60	85	206	70	65	77	212
	Subtotal	410	436	486	1332	402	416	470	1288
1710 - 1712½		70	70	74	214	64	73	74	211
1712½ - 1715		61	73	76	210	73	66	73	212
1715 - 1717½		64	68	76	208	57	72	43	172
1717½ - 1720		55	53	49	157	64	68	70	202
1720 - 1722½		61	75	75	211	67	65	71	203
1722½ - 1725		56	66	75	197	61	68	67	196
	Subtotal	367	405	425	1197	386	412	398	1196
1730 - 1732½		61	66	65	192	64	74	79	217
1732½ - 1735		62	74	73	209	72	68	74	214
1735 - 1737½		51	67	59	177	65	65	69	199
1737½ - 1740		58	60	55	173	63	75	79	217
1740 - 1742½		68	56	50	174	56	65	58	179
1742½ - 1745		53	58	58	169	47	68	70	185
	Subtotal	353	381	360	1094	367	415	429	1211
1750 - 1752½		52	54	44	150	40	62	49	151
1752½ - 1755		39	42	43	124	46	43	55	144
1755 - 1757½		53	54	52	159	33	46	55	134
1757½ - 1800		48	45	44	137	47	52	58	157
1800 - 1802½		49	49	47	145	40	55	50	145
1802½ - 1805		59	52	47	158	43	49	55	147
	Subtotal	300	296	277	873	249	307	322	878
Estimated Total Traffic (3:30 pm - 6:05 pm)		3,645	3,977	3,884	11,506	3,423	3,946	4,110	11,479
% of Estimated Total Traffic		31.68%	34.56%	33.76%	100.00%	29.82%	34.38%	35.80%	100.00%

TABLE XXVI

Traffic Count Data
Elvas Freeway - Outbound (East)
July 29, 1969 - 3:30 pm Thru 6:05 pm
(Distance between Count Stations = 0.658 Miles)

Time Period	A Street Overcrossing I 80 Sac PM. R4.25				S.P. Overcrossing I 80 Sac PM. 5.01			
	Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total	Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total
1530 - 1532½	55	65	36	156	46	56	55	157
1532½ - 1535	47	63	37	147	41	60	51	152
1535 - 1537½	71	63	54	188	52	71	69	192
1537½ - 1540	60	68	63	191	58	71	64	193
1540 - 1542½	73	70	54	197	52	67	65	184
1542½ - 1545	60	60	71	191	57	59	69	185
Subtotal	366	389	315	1070	306	384	373	1063
1550 - 1552½	57	61	59	177	39	62	59	160
1552½ - 1555	59	68	69	196	47	64	81	192
1555 - 1557½	52	52	42	146	46	61	63	170
1557½ - 1600	51	55	45	151	46	59	56	161
1600 - 1602½	51	54	43	148	49	53	49	151
1602½ - 1605	58	60	46	164	40	52	50	142
Subtotal	328	350	304	982	267	351	358	976
1610 - 1612½	63	66	70	199	62	76	79	217
1612½ - 1615	53	60	38	151	49	55	54	158
1615 - 1617½	57	64	50	171	43	66	61	170
1617½ - 1620	54	59	43	156	48	52	55	156
1620 - 1622½	54	70	52	176	46	62	59	167
1622½ - 1625	57	56	62	175	54	62	57	173
Subtotal	338	375	315	1028	303	373	365	1041
1630 - 1632½	76	76	74	226	63	71	73	207
1632½ - 1635	74	81	86	241	70	89	82	241
1635 - 1637½	75	96	94	265	75	82	90	247
1637½ - 1640	82	92	99	273	72	82	98	252
1640 - 1642½	69	79	86	234	76	74	82	232
1642½ - 1645	75	82	88	245	78	79	93	250
Subtotal	451	506	527	1484	434	477	518	1429
1650 - 1652½	76	70	89	235	78	68	75	221
1652½ - 1655	66	81	87	234	75	80	97	252
1655 - 1657½	71	83	90	244	70	75	95	240
1657½ - 1700	63	81	91	235	68	85	82	235
1700 - 1702½	65	71	78	214	64	78	78	220
1702½ - 1705	69	81	85	235	67	75	83	225
Subtotal	410	467	520	1397	422	461	510	1393
1710 - 1712½	66	71	80	217	69	70	83	222
1712½ - 1715	64	83	88	235	67	80	92	239
1715 - 1717½	69	70	83	222	60	71	80	211
1717½ - 1720	63	77	80	220	76	70	79	225
1720 - 1722½	59	75	80	214	62	75	81	218
1722½ - 1725	61	75	75	211	67	73	84	224
Subtotal	382	451	486	1319	401	439	499	1339
1730 - 1732½	49	44	36	129	34	51	50	135
1732½ - 1735	57	56	44	157	41	51	35	127
1735 - 1737½	63	58	60	181	47	70	70	187
1737½ - 1740	65	58	57	180	57	56	58	171
1740 - 1742½	56	64	64	184	53	66	75	194
1742½ - 1745	55	55	50	160	50	55	61	166
Subtotal	345	335	311	991	282	349	349	980
1750 - 1752½	46	51	35	132	44	55	56	155
1752½ - 1755	45	52	48	145	40	53	49	142
1755 - 1757½	53	46	37	136	37	48	43	128
1757½ - 1800	42	49	31	122	40	49	37	126
1800 - 1802½	49	60	36	145	41	58	51	150
1802½ - 1805	49	55	39	143	39	51	43	133
Subtotal	284	313	226	823	241	314	279	834
Estimated Total Traffic (3:30 pm - 6:05 pm)	3,751	4,115	3,880	11,746	3,430	4,066	4,199	11,695
% of Estimated Total Traffic	31.94%	35.03%	33.03%	100.00%	29.33%	34.77%	35.90%	100.00%

TABLE XXVII

Traffic Count Data
Elvas Freeway - Outbound (East)
July 31, 1969 - 3:30 pm Thru 6:05 pm
(Distance between Count Stations = 0.658 Miles)

Time Period		A Street Overcrossing I 80 Sac PM R4.25				S.P. Overcrossing I 80 Sac PM 5.01			
		Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total	Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total
1530 - 1532½		57	56	36	149	50	50	56	156
1532½ - 1535		57	47	40	144	41	50	40	131
1535 - 1537½		52	47	47	146	46	47	50	143
1537½ - 1540		61	77	63	201	49	63	74	186
1540 - 1542½		63	72	69	204	55	74	64	193
1542½ - 1545		64	66	54	184	56	65	77	198
	Subtotal	354	365	309	1028	297	349	361	1007
1550 - 1552½		59	65	45	169	47	69	57	173
1552½ - 1555		80	71	54	185	56	64	59	179
1555 - 1557½		56	46	54	156	46	58	57	161
1557½ - 1600		36	56	48	140	39	55	49	143
1600 - 1602½		47	51	38	136	44	56	51	151
1602½ - 1605		66	70	56	192	45	55	60	160
	Subtotal	324	359	295	978	277	357	333	967
1610 - 1612½		60	63	68	191	55	70	76	201
1612½ - 1615		63	59	56	178	42	65	59	166
1615 - 1617½		48	56	61	165	48	58	60	166
1617½ - 1620		62	58	50	170	45	57	65	167
1620 - 1622½		58	67	65	190	57	60	75	192
1622½ - 1625		63	68	73	204	48	71	78	197
	Subtotal	354	371	373	1098	295	381	413	1089
1630 - 1632½		63	73	82	218	57	66	80	203
1632½ - 1635		67	79	83	229	58	76	87	221
1635 - 1637½		77	80	94	251	72	74	76	222
1637½ - 1640		69	85	85	239	77	75	91	243
1640 - 1642½		81	85	95	261	75	81	95	251
1642½ - 1645		73	82	90	245	77	82	87	246
	Subtotal	430	484	529	1443	416	454	516	1386
1650 - 1652½		82	75	82	239	73	76	88	237
1652½ - 1655		78	88	96	262	74	77	86	237
1655 - 1657½		66	71	73	210	75	79	93	247
1657½ - 1700		75	84	85	244	79	78	88	245
1700 - 1702½		72	89	89	250	71	85	91	247
1702½ - 1705		70	85	89	244	62	83	83	228
	Subtotal	443	492	514	1449	434	478	529	1441
1710 - 1712½		66	73	75	214	66	81	75	222
1712½ - 1715		68	78	77	223	69	74	86	229
1715 - 1717½		67	74	80	221	64	70	77	211
1717½ - 1720		64	73	76	213	72	75	74	221
1720 - 1722½		63	67	74	204	69	75	82	226
1722½ - 1725		47	47	43	137	55	63	71	189
	Subtotal	375	412	425	1212	395	438	465	1298
1730 - 1732½		46	57	50	153	46	61	60	167
1732½ - 1735		54	57	63	174	50	58	58	166
1735 - 1737½		50	63	51	164	48	50	67	165
1737½ - 1740		61	56	52	169	48	59	56	163
1740 - 1742½		48	57	52	157	41	59	57	157
1742½ - 1745		57	51	40	148	47	63	48	158
	Subtotal	316	341	308	965	280	350	346	976
1750 - 1752½		66	60	64	190	50	65	72	187
1752½ - 1755		43	57	37	137	40	57	55	152
1755 - 1757½		48	57	46	149	36	49	45	130
1757½ - 1800		44	48	43	135	39	57	60	156
1800 - 1802½		43	43	24	110	38	50	34	122
1802½ - 1805		49	53	40	142	40	51	40	131
	Subtotal	291	318	254	863	243	329	306	878
Estimated Total Traffic (3:30 pm - 6:05 pm)		3,729	4,058	3,884	11,671	3,406	4,051	4,223	11,680
% of Estimated Total Traffic		31.95%	34.77%	33.28%	100.00%	29.16%	34.68%	36.16%	100.00%

TABLE XXVIII

Traffic Count Data
Foothill Farms Pedestrian Overcrossing - I 80 Sac PM 13.809
July 27, 1969 - 3:00 pm Thru 6:45 pm & 9:15 pm Thru 11:00 pm

Time Period		DIRECTION OF TRAVEL					
		Eastbound			Westbound		
		Lane 2 (Shoulder)	Land 1 (Median)	Total	Lane 2 (Shoulder)	Lane 1 (Median)	Total
1500 - 1505		57	54	111	82	127	209
1505 - 1510		50	47	97	65	83	148
1510 - 1515		52	58	110	77	117	194
	Subtotal	159	159	318	224	327	551
1516 - 1521		64	59	123	77	112	189
1521 - 1526		53	32	85	79	116	195
1526 - 1531		56	64	120	69	124	193
	Subtotal	173	155	328	225	352	577
1536 - 1541		58	58	116	73	100	173
1541 - 1546		55	51	106	82	118	200
1546 - 1551		67	50	117	73	135	208
	Subtotal	180	159	339	228	353	581
1611 - 1616		49	44	93	83	120	203
1616 - 1621		46	44	90	86	129	215
1621 - 1626		47	49	96	72	107	179
	Subtotal	142	137	279	241	356	597
1627 - 1632		51	41	92	82	141	223
1632 - 1637		46	36	82	75	126	201
1637 - 1642		52	49	101	69	103	172
	Subtotal	149	126	275	226	370	596
1702 - 1707		54	56	110	95	143	238
1707 - 1712		58	52	110	82	151	233
1712 - 1717		56	57	113	74	133	207
	Subtotal	168	165	333	251	427	678
1718 - 1723		37	41	78	77	144	221
1723 - 1728		47	45	92	63	118	181
1728 - 1733		47	45	92	77	142	219
	Subtotal	131	131	262	217	404	621
1738 - 1743		53	49	102	84	119	203
1743 - 1748		45	44	89	73	118	191
1748 - 1753		67	45	112	82	138	220
	Subtotal	165	138	303	239	375	614
1813 - 1818		51	40	91	76	137	213
1818 - 1823		40	25	65	77	126	203
1823 - 1828		39	35	74	79	109	188
	Subtotal	130	100	230	232	372	604
1829 - 1834		51	44	95	86	112	198
1834 - 1839		44	51	95	88	134	222
1839 - 1844		48	43	91	71	123	194
	Subtotal	143	138	281	245	369	614
2115 - 2120		33	23	56	72	102	174
2120 - 2125		33	20	53	57	70	127
2125 - 2130		39	36	75	46	71	117
	Subtotal	105	79	184	175	243	418
2131 - 2136		41	34	75	53	62	115
2136 - 2141		36	27	63	51	60	111
2141 - 2146		36	21	57	58	84	142
	Subtotal	113	82	195	162	206	368
2151 - 2156		33	13	46	46	60	106
2156 - 2201		37	20	57	42	66	108
2201 - 2206		41	17	58	48	49	97
	Subtotal	111	50	161	136	175	311
2226 - 2231		28	17	45	44	57	101
2231 - 2236		30	19	49	43	43	86
2236 - 2241		29	21	50	51	54	105
	Subtotal	87	57	144	138	154	292
2242 - 2247		29	17	46	30	43	73
2247 - 2252		31	11	42	43	51	94
2252 - 2257		32	18	50	23	38	61
	Subtotal	92	46	138	96	132	228

TABLE XXIX

Traffic Count Data
Mace Boulevard Overcrossing - I 80 Sac PM 2.680
August 3, 1969 - 3:00 pm Thru 6:45 pm & 9:15 pm Thru 11:00 pm

Time Period		DIRECTION OF TRAVEL							
		Eastbound				Westbound			
		Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total	Lane 3 (Shoulder)	Lane 2 (Center)	Lane 1 (Median)	Total
1500 - 1505		32	50	40	122	39	67	58	164
1505 - 1510		29	42	22	93	38	68	72	178
1510 - 1515		31	35	37	103	36	77	81	194
	Subtotal	92	127	99	318	113	212	211	536
1516 - 1521		34	41	24	99	47	79	90	216
1521 - 1526		20	36	29	85	36	67	72	175
1526 - 1531		45	54	29	128	39	69	77	185
	Subtotal	99	131	82	312	122	215	239	576
1536 - 1541		27	56	34	117	47	74	78	199
1541 - 1546		37	44	26	107	48	76	78	202
1546 - 1551		30	53	28	111	40	75	84	199
	Subtotal	94	153	88	335	135	225	240	600
1611 - 1616		37	53	44	134	30	71	69	170
1616 - 1621		27	48	30	105	43	79	96	218
1621 - 1626		33	42	42	117	38	72	66	176
	Subtotal	97	143	116	356	111	222	231	564
1627 - 1632		26	40	26	92	32	70	81	183
1632 - 1637		38	51	40	129	44	76	69	189
1637 - 1642		33	42	31	106	32	69	67	168
	Subtotal	97	133	97	327	108	215	217	540
1702 - 1707		33	44	32	109	43	84	95	222
1707 - 1712		43	44	30	117	31	66	71	168
1712 - 1717		40	50	48	138	38	56	51	145
	Subtotal	116	138	110	364	112	206	217	535
1718 - 1723		40	59	28	127	49	76	90	215
1723 - 1728		28	53	34	115	31	88	69	188
1728 - 1733		37	52	40	129	39	71	87	197
	Subtotal	105	164	102	371	119	235	246	600
1738 - 1743		37	43	38	118	39	71	63	173
1743 - 1748		40	56	34	130	39	71	62	172
1748 - 1753		33	55	33	121	35	86	67	188
	Subtotal	110	154	105	369	113	228	192	533
1813 - 1818		34	52	46	132	43	80	86	209
1818 - 1823		42	47	31	120	39	61	76	176
1823 - 1828		33	49	30	112	32	65	83	180
	Subtotal	109	148	107	364	114	206	245	565
1829 - 1834		36	52	29	117	30	55	60	145
1834 - 1839		32	53	42	127	37	73	80	190
1839 - 1844		39	50	50	139	42	73	85	200
	Subtotal	107	155	121	383	109	201	225	535
2115 - 2120		40	71	84	195	28	71	67	166
2120 - 2125		33	59	55	147	34	68	67	169
2125 - 2130		32	50	61	143	27	62	72	161
	Subtotal	105	180	200	485	89	201	206	496
2131 - 2136		43	55	64	162	30	67	67	164
2136 - 2141		43	64	64	171	36	65	66	167
2141 - 2146		35	56	41	132	24	54	58	136
	Subtotal	121	175	169	465	90	186	191	467
2151 - 2156		33	55	40	128	32	61	60	153
2156 - 2201		31	58	42	131	29	64	50	143
2201 - 2206		34	60	46	140	22	59	67	148
	Subtotal	98	173	128	399	83	184	177	444
2226 - 2231		17	40	32	89	20	53	47	120
2231 - 2236		26	51	45	122	19	67	35	121
2236 - 2241		30	31	36	97	17	51	42	110
	Subtotal	73	122	113	308	56	171	124	351
2242 - 2247		24	39	32	95	23	51	39	113
2247 - 2252		25	42	32	99	27	53	45	125
2252 - 2257		31	49	40	120	24	49	38	111
	Subtotal	80	130	104	314	74	153	122	349