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**FREEWAY SURVEILLANCE STUDY -
MARK TWAIN EXPRESSWAY,
ST. LOUIS, MISSOURI.**

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1967 FREEWAY SURVEILLANCE STUDIES
MARK TWAIN EXPRESSWAY-SAINT LOUIS, MISSOURI

Prepared by
MISSOURI STATE HIGHWAY DEPARTMENT
Division of Highway Planning

November, 1968

in cooperation with
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
Bureau of Public Roads

The opinions, findings, and conclusions
expressed in this publication are not necessarily
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Introduction

Since the movement of traffic is the purpose of freeways, maintenance of satisfactory operating conditions is as important as maintenance of the physical structure.

This report is based on the freeway congestion studies conducted in the summer of 1967 which were part of a continuing surveillance of freeway operations in Missouri. This is the second report on studies of this type on the Mark Twain Expressway. The first study was conducted during the summer of 1964 and the report published in October 1964. Should the need develop, these studies should provide much of the information necessary for the planning of control systems or measures designed to improve traffic flow by pointing out areas where operations have reached a critical level.

The primary purpose of this report is to provide an inventory of present operating conditions on the Mark Twain Expressway in St. Louis rather than a detailed analysis of operations at any location.

Study Area

The name Mark Twain Expressway applies to the portion of Interstate Route 70 in the St. Louis Area. The area under study begins at Carson Road and runs to Shreve Avenue, a distance of 5.29 miles. This is the same area covered in the study made in 1964.

The geometrics of the study section are shown in Figure 1. The sketch at the top of the page has been distorted slightly so

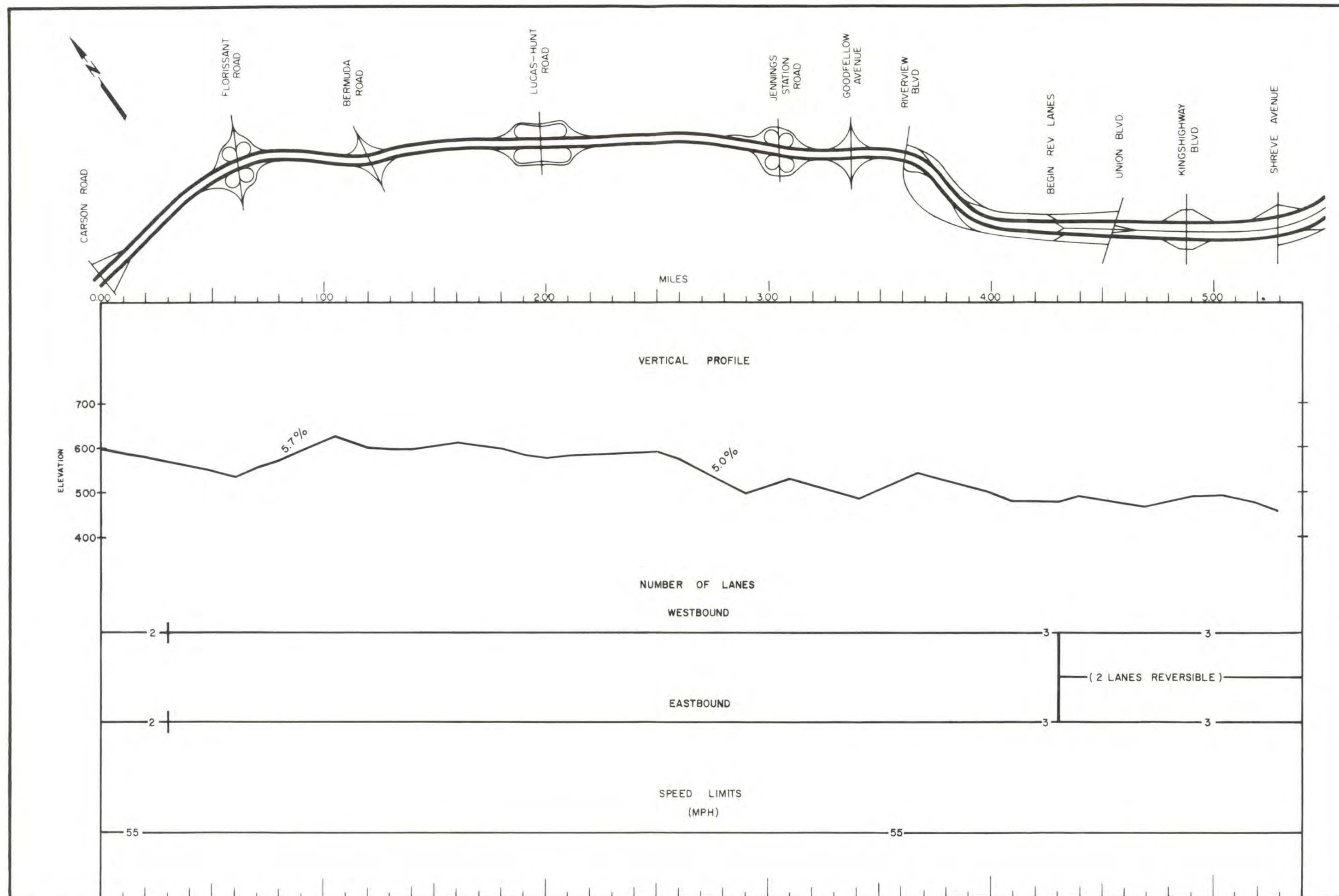


FIGURE 1. MARK TWAIN EXPRESSWAY (I-70) ST. LOUIS MISSOURI

that each interchange corresponds with its correct milepost on the line diagrams. This is the same base sketch used on the density charts in this study. The number of through lanes varies from two to five lanes (including the two reversible lanes) as indicated in Figure 1. Grades over 3 percent are indicated on the profile sketch. Speed limits are shown as they existed January 1, 1968.

Traffic Volumes

The traffic counts used in this study were made during September 1967. For this study a complete inventory of ramp traffic was not taken. Counts made on selected ramps were used to update existing count data.

Counts from the permanent traffic counter located east of Lucas-Hunt Road indicate that the September average traffic should be within 3 percent of the annual average traffic; therefore, no attempt was made to factor this traffic into an annual average. All traffic figures, both daily and peak hour, are average weekday traffic.

Through lane volumes were obtained by taking the volume from the permanent counter and adding or subtracting ramp volumes. This produces through lane volumes which should be within the same accuracy range that counting between each interchange would provide and has the advantage of providing balanced volumes.

Average September weekday volumes are shown in Figure 2. As expected, the lowest volumes occur on the west end with increases along the way to a maximum volume just east of Lucas-Hunt Road

AVERAGE SEPT. WEEKDAY VOLUME 1967

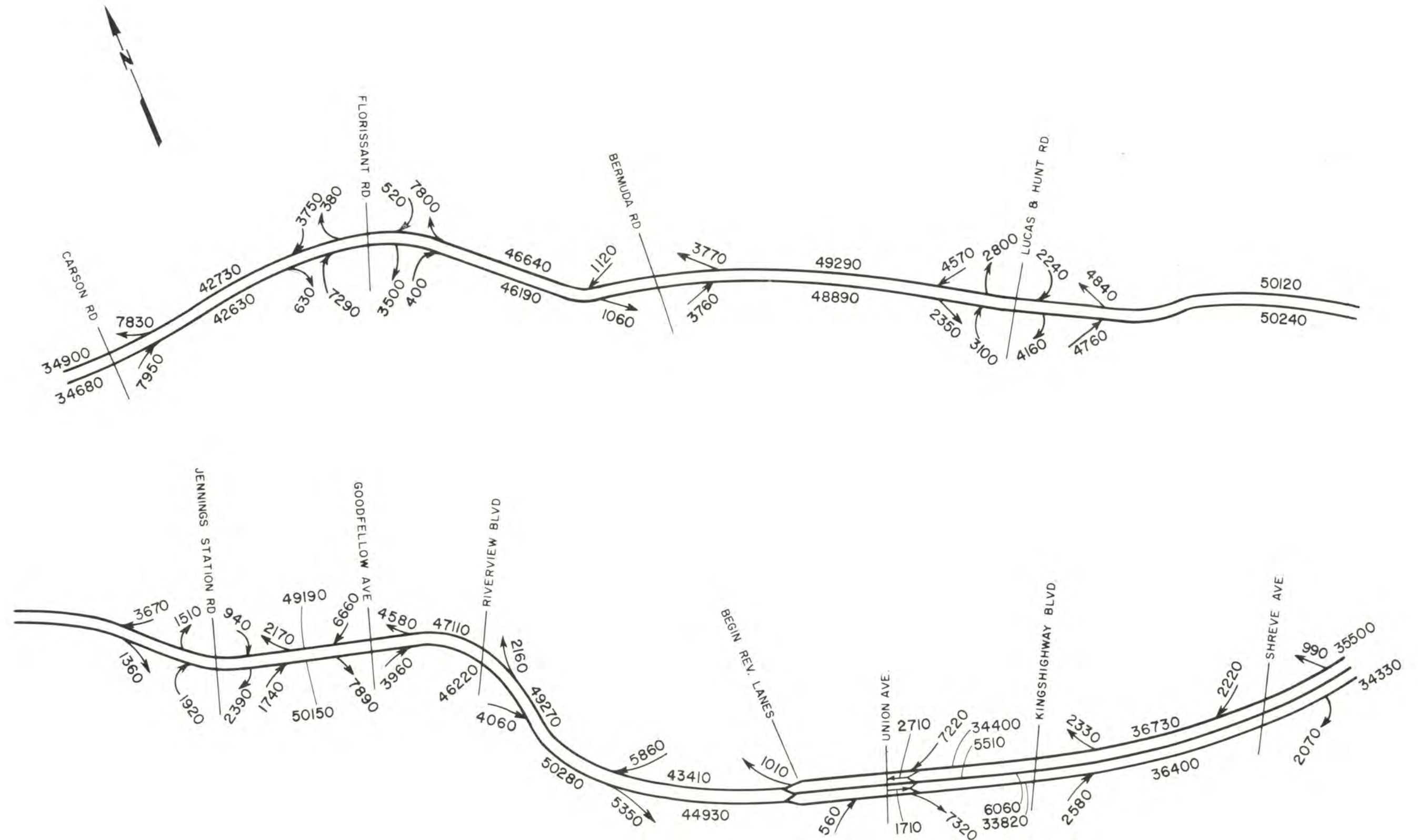


FIGURE 2. AVERAGE SEPTEMBER WEEKDAY TRAFFIC VOLUME.

Interchange. At this location the two-way weekday volume appears to exceed 100,000 vehicles. This is a sizable increase over the counts taken in 1964. A direct comparison cannot be made, however, since the 1964 counts were daily rather than weekday.

The volumes shown in Figure 3 are for the time period during which the peak hour most often occurred on the ramps. This provides approximate peak hour volumes with a balanced flow. The actual peak volume at any specific location may be slightly higher than shown.

The maximum volume during the A.M. peak hour (E.B. lanes) occurs just east of Riverview Boulevard. The volume in either direction generally decreases with movement westward along the freeway.

The maximum P.M. peak hour volume (W.B. lanes) occurs just west of Goodfellow Avenue. At this location the freeway is three lanes, with an additional lane serving as an acceleration-deceleration ramp.

During the P.M. peak hour, the west end of the reversible lanes, operating in the westbound direction, has a relatively low volume (less than one-half the A.M. eastbound peak hour). This is apparently due to the difficulty in merging with traffic in the through lanes.

Densities

The use of traffic density, expressed in terms of vehicles per lane per mile, has been established as a means of measuring over-all operating conditions on freeways. Density, for this study, was determined by counting the number of vehicles on each

AVERAGE PEAK HOUR VOLUME

SEPT., 1967

EB AM 6:45-7:45

WB PM 4:15-5:15

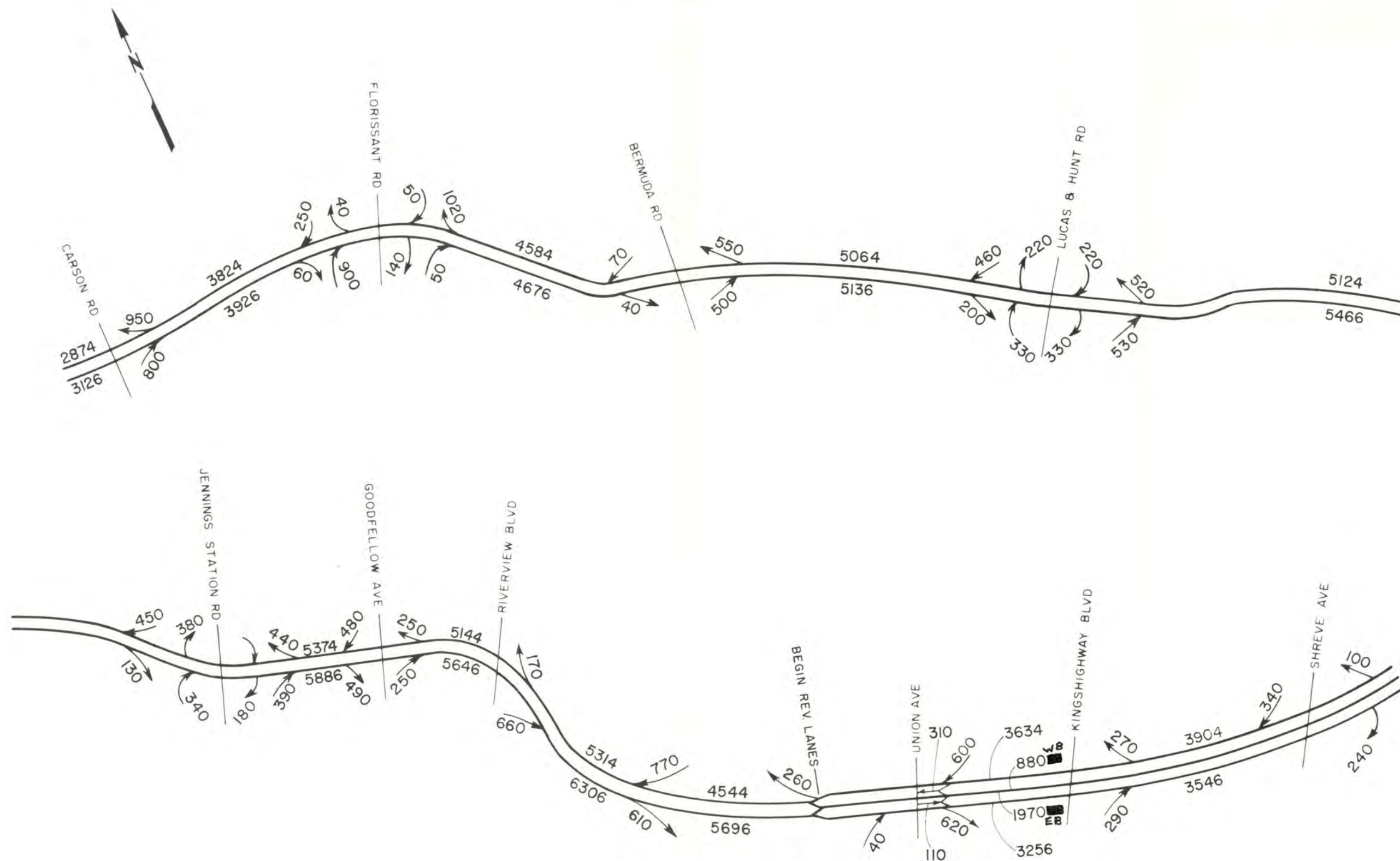


FIGURE 3. AVERAGE SEPTEMBER PEAK HOUR TRAFFIC VOLUME.

section of road as they appeared on aerial photographs. In order to use density as a measure of operation, it is necessary to relate it to some recognizable quantity, such as speed, which was used in this case.

Speed and volume measurements were made at various locations on the three freeways being studied. These measurements were then used to compute spot density at these locations. Density vs. speed charts were plotted, and a least squares fit was made for each location as shown in Figure 4. Data gathered from all the locations were used to develop an equation to relate speed and density (line No. 7 on Figure 4). This equation has a standard error of 4.4 m.p.h. Densities were calculated which correspond to the speeds associated with Levels of Service, as defined by the 1965 Highway Capacity Manual.

At each location where data were collected, the speed limit was 55 m.p.h. Therefore, it was unlikely that many speeds above 55 m.p.h. would have been recorded, regardless of the density. Because of this, the speed-density relationships above 55 m.p.h. are considered unreliable and the Levels of Service above Level C (50-55 m.p.h.) cannot be distinguished.

Figure 5 was prepared to give the reader an idea of how the various densities look from the air. The observer will note that the cars do not appear as closely spaced as one would think. This is due to the fact that most people are used to observing traffic at ground level where the gap between cars tends to disappear.

In Figures 6 and 7 the densities are presented as contours

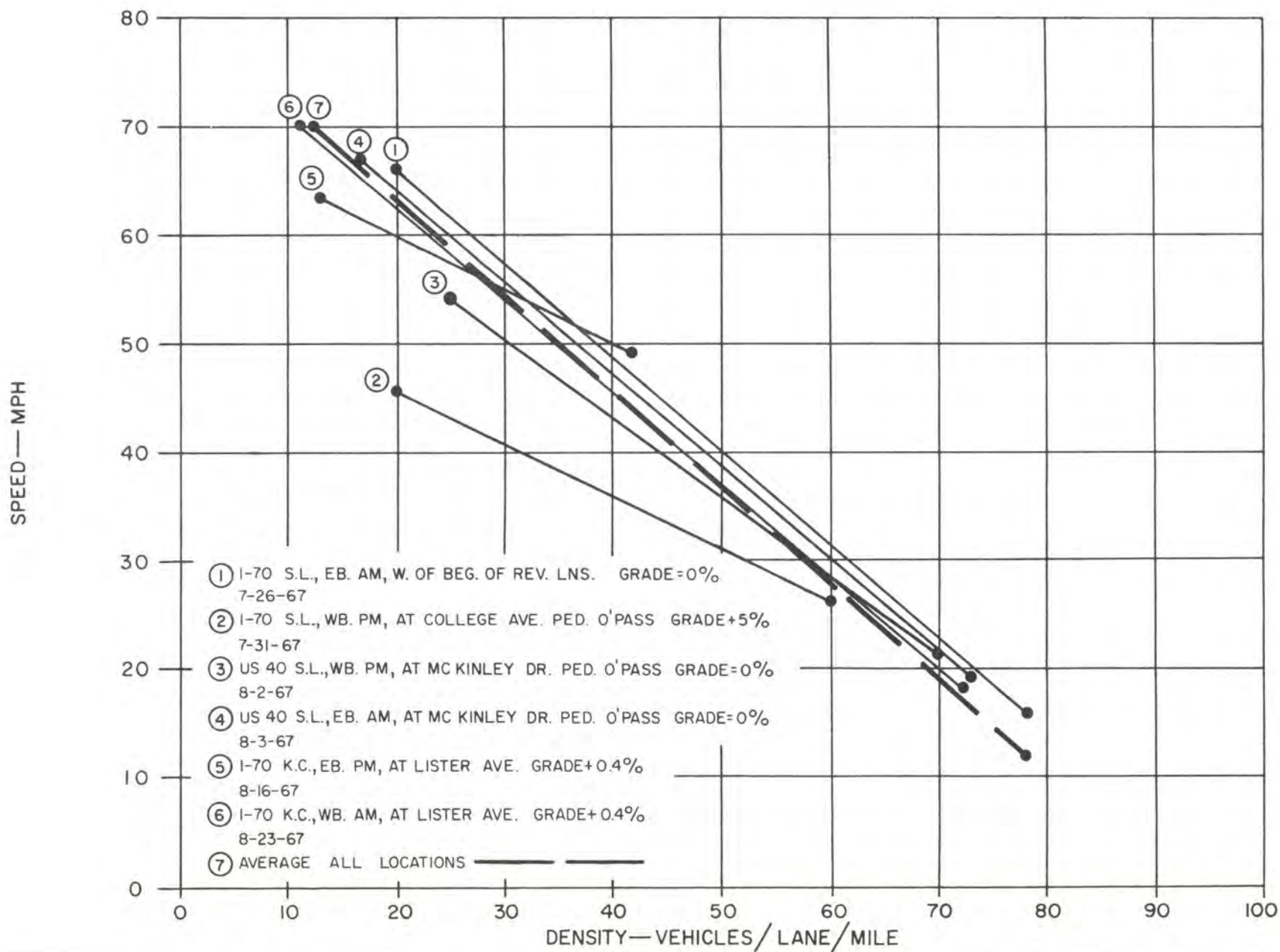


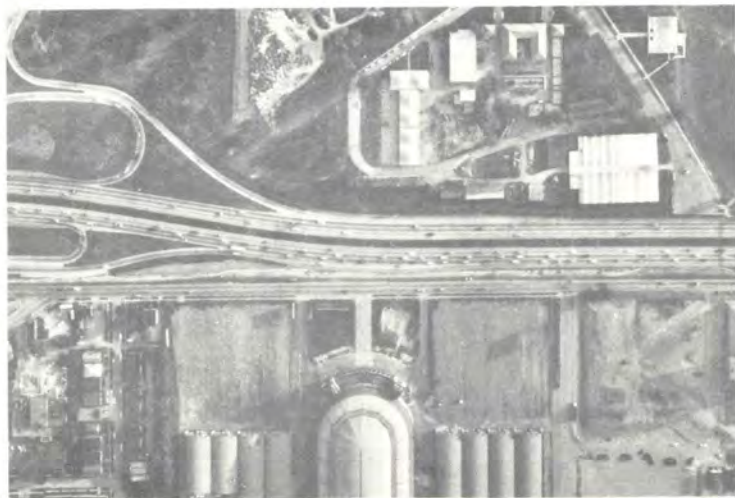
FIGURE 4 SPEED VS DENSITY SELECTED LOCATIONS



33 VEH./LN./MI., (LEVEL C)



47 VEH./LN./MI., (LEVEL D)



59 VEH./LN./MI., (LEVEL E)



75 VEH./LN./MI., (LEVEL F)

FIGURE 5. TYPICAL URBAN FREEWAY OPERATING UNDER VARIOUS TRAFFIC DENSITY LEVELS.

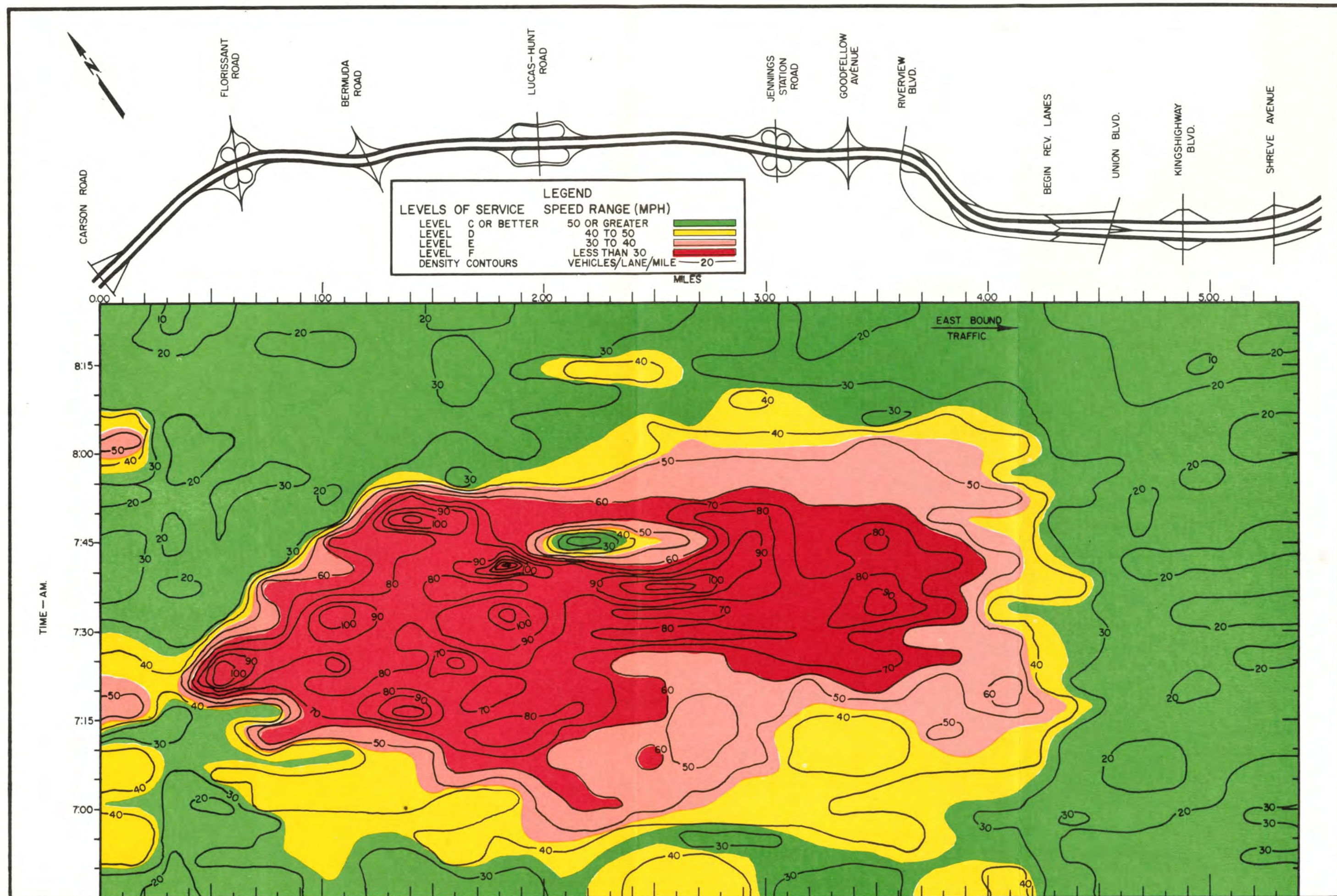


FIGURE 6. TRAFFIC DENSITY CONTOURS AND LEVELS OF SERVICE DURING THE MORNING PEAK PERIOD ON THE EASTBOUND LANES.

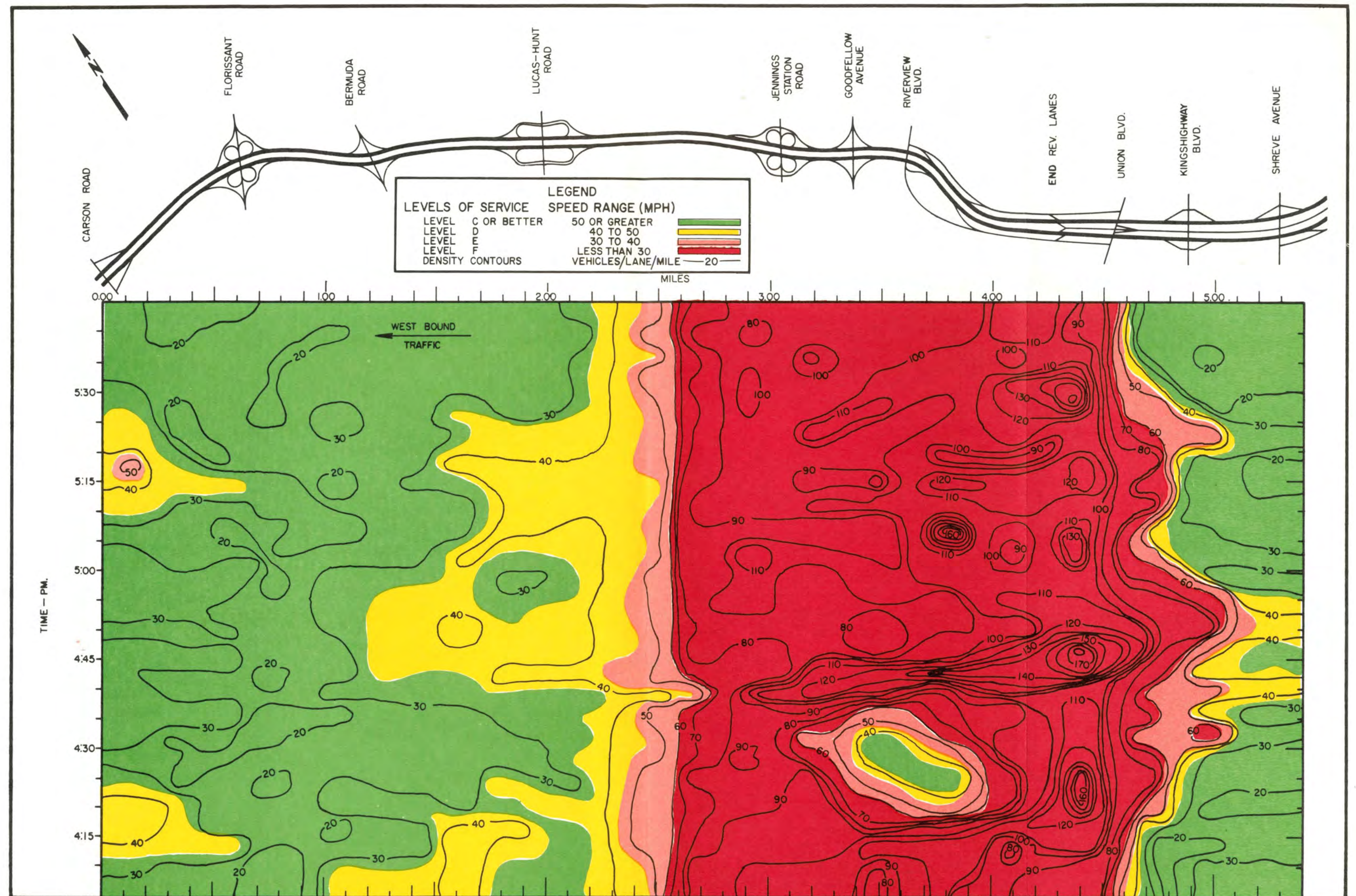


FIGURE 7. TRAFFIC DENSITY CONTOURS AND LEVELS OF SERVICE DURING THE AFTERNOON PEAK PERIOD ON THE WESTBOUND LANES.

on a time-distance chart. To reflect the equivalent level of service, the density contours have been color coded. With the use of color, the density charts are virtually self-explanatory. Red indicates the lowest level of service (level F), while green indicates the best level that could be determined (level C or better).

It should be remembered that these charts represent operation on only one day, and while no unusual incidents were detected on that day, daily variations in operating conditions do occur.

The eastbound lanes (Figure 6) carry the heavy traffic and are the lanes of interest during the morning peak period. Congestion, or impending congestion (levels E and F), is prevalent throughout most of the study area ^{west}~~east~~ of the reversible lanes. These conditions appear to prevail during the 7 to 8 A.M. peak hour. This is the same general area where these conditions were observed during the 1964 study, except in 1964 conditions were much less severe.

It is difficult to pinpoint critical locations where congestion first appears. The congestion appears at nearly the same time in the entire area between Florissant Road and the reversible lanes. The highest densities were found between Bermuda Road and Lucas-Hunt Road. The congestion found west of this section could be a result of back-up from this section.

Operating conditions in the westbound lanes on the day represented in Figure 7 were rather extreme and difficult to analyze. The extent of congestion is readily apparent. The area was congested throughout the entire study period. This makes it impossible

to determine the location or time when congestion first occurs. This area extends from the western terminus of the reversible lanes to the crest of a 5 percent grade midway between Jennings Station Road and Lucas-Hunt Road. At times the congestion backs up into the reversible lanes section as far as Kingshighway Boulevard.

The congestion extends over the same area as found in the 1964 study, although in 1964 it was much less severe.

It is not apparent whether the congestion found on the 5 percent grade west of Jennings Station Road originates there, or if it begins at the curve at Jennings Station Road and the grade merely prevents the traffic from regaining normal operating speeds.

The western terminus of the reversible lanes, where five lanes merge into three, is the location of considerable congestion. Vehicles in the reversible lanes form a single lane and merge with the three through lanes. This is the apparent reason for the high densities that occur periodically in the area. For a brief period, this congestion in the merging area tied up traffic to the extent that it was "metering" traffic and downstream traffic began to operate under free flow conditions (indicated by the pool of green in the middle of the red).

Operating conditions on the day the westbound lanes were filmed were somewhat poorer than anticipated. The early appearance of such heavy congestion may be an indication that some incident, which caused a slowdown in traffic movement, may have occurred earlier in the day.

Summary

Traffic volumes are continuing to increase on the Mark Twain Expressway. October daily traffic now exceeds 100,000 vehicles.

Heavy densities and low levels of service are found throughout most of the A.M. peak hour on the eastbound lanes between Florissant Road and the beginning of the reversible lanes.

During the P.M. peak period, the westbound lanes are heavily congested between the reversible lanes and a point midway between Jennings Station Road and Lucas-Hunt Road. While not covering as long an area, the P.M. congestion is much more severe than that found during the morning period. Any detailed study of critical areas would include most of this area.

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