OLYMPICS TRANSPORTATION SYSTEM MANAGEMENT PERFORMANCE ANALYSIS

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PRELIMINARY REPORT

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Abstract

This report is a preliminary evaluation of the CALTRANS transportation system management program implemented during the 1984 Los Angeles Summer Olympics. It discusses the objectives and strategies of the CALTRANS TSM program, describes highway system performance during the Olympics, and presents tentative conclusions regarding the overall success of the TSM program.

Results indicate that response to the Olympics was highly varied both in time and space. During the Olympics period, travel volumes were highly variable, starting out much below normal levels and gradually increasing. The most significant travel adjustments took place in the vicinity of the Los Angeles downtown/Coliseum area. In this area both traffic volumes and truck volumes remained low throughout the Olympics. The data also indicated a consistent drop in work trip travel of about 10 percent, a shift in truck traffic to evening hours, and a reduction in traffic incidents throughout Los Angeles County. It is concluded that the combination of these relatively minor changes, together with more intensive than normal traffic management, were responsible for the efficient flow of traffic during the Olympics.

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I. INTRODUCTION

CALTRANS District 7, in conjunction with several local transportation agencies and the LAOOC, invested two years of effort in the development of a viable and effective traffic management plan for the 1984 Summer Olympics. These agencies were faced with the formidable task of managing the circulation of an expected 1.2 million visitors, 6 million spectators, and nearly 25,000 atheletes, media, and Olympic family within a regional transportation system which has reached capacity in many areas. Owing to the lack of both funds and time, capital improvements to meet the anticipated increase were not feasible. Rather, Los Angeles transportation planners had no choice but to develop and implement the most ambitious transportation management program ever attempted.

From a traffic management perspective, the Los Angeles Summer Olympics were an unqualified success. With few exceptions, major traffic problems failed to materialize, and, particularly during the first week, traffic (and congestion) seemed to be lighter than usual. Moreover, for the first time in the recent history of the Olympics, not one group of spectators got stranded and missed an event. The Los Angeles Olympics provided a unique opportunity to test the effectiveness of transportation system management under extreme conditions. The apparent success of the experiment merits close analysis, both in order to identify what worked and what did not, and to determine whether lessons learned from the experience can provide guidelines for future transportation policy decisions.

The purpose of this report is to present the results of a performance evaluation of the CALTRANS transportation system management program. It consists of three parts: a discussion of the objectives and strategies of the CALTRANS TSM program, an analysis of highway system performance during the Olympics; and tentative conclusions regarding the overall success of the TSM program.

Results presented here are based on data available as of January, 1985. Final conclusions regarding the TSM program will be made after the second phase of this research has been completed.

CALTRANS played a major role in all aspects of the Olympics TSM program. District 7 management led the way in initiating interagency cooperation, developing specific programs, providing support for multi-agency efforts, and implementing programs during the Olympics. While the subject of this research is the specific TSM strategies implemented by CALTRANS, it should be noted that these do not represent CALTRANS' total effort.

II. THE CALTRANS TSM PROGRAM

The CALTRANS TSM program was part of a larger program developed and implemented through the cooperative efforts of CALTRANS, LADOT, SCRTD, LAOOC, Commuter Computer, CHP, LAPD, as well as several cities and counties in the greater Los Angeles area. The TSM program had a dual focus: to facilitate circulation at all 24 venues and to maintain the regional transportation system at an acceptable level of performance during the Olympics. In other words, the objective was to get everyone to and from Olympics events while at the same time allowing normal daily travel to proceed with as little extra congestion as possible.

The plan developed by CALTRANS and other agencies was multifaceted: it included a wide variety of TSM measures. In addition to specific circulation plans for each venue site and a more intensive use of traditional traffic management techniques (e.g. signal synchronization, ramp metering), several innovative strategies were implemented as well. These included the establishment of an interagency coordination center, a public relations program aimed at informing commuters, business, and visitors about expected travel conditions during the Olympics: a joint CHP/CALTRANS program to reduce truck traffic during peak hours; a massive system surveillance and monitoring program, and a stepped up public information program. Together, these measures formed the most comprehensive TSM program ever implemented.

II.A. Goals and Objectives of the CALTRANS Program

The primary goal of the CALTRANS TSM program can be expressed as that of system balancing: of matching system supply (capacity) and demand while achieving an acceptable level of system performance. Thus the task was one of managing supply and demand so as to minimize congestion and protect the safety of all highway users. Given that the regional freeway system operates at capacity in many areas under normal conditions, the management task was a challenging one. To make matters worse, Olympic Villages and major venue sites, the Coliseum complex and UCLA, were located in two of the most congested areas of the region. Thus the extent to which system balance would be achieved would be evident by the level of congestion experienced during the Olympics.

Implicit in the concept of system balancing is the management of both travel demand and capacity supply. Travel demand can be managed by shifting trips to less congested routes and/or time periods, by increasing vehicle occupancy, or by reducing the total number of trips. Capacity can be enhanced by increasing the efficiency of traffic flow, by providing extra capacity in bottleneck areas, and by eliminating delay-causing obstructions. Thus demand management refers to behavioral adjustments on the part of travelers, while capacity management refers to the physical characteristics of the transportation system. Elements of all of these methods, as well as many others, were utilized in the TSM program.

The CALTRANS program can be described in terms of two objectives: 1) Minimize traffic congestion and delay, and 2) Maximize system person through-put. The first objective refers to achieving system balance as discussed above. It means that system balance is to be achieved at the highest possible level of system performance; that is, with the least amount of congestion. The second objective combines demand and supply management by expressing capacity in terms of person-trips. To the extent that some trips are shifted away from peak periods, for example, person through-put (measured on a daily basis), will increase. In the same way, ramp metering and other traffic flow techniques will also increase the system's person-trip capacity. Each of these objectives is composed of several more specific sub-objectives, as presented in Table 1. The actual TSM methods or strategies developed by CALTRANS were aimed at achieving these objectives.

Table 1

CALTRANS TSM Program Objectives

1. Minimize traffic congestion and delay.
    a. Reduce venue related traffic congestion.
    b. Reduce congestion related to non-recurrent traffic events.
    c. Minimize impact of venue-related freeway closures.
    d. Reduce peak period (recurrent, work-trip related) traffic congestion.
2. Maximize system person through-put.
    a. Increase efficiency of traffic flow.
    b. Balance daily traffic volumes.
    c. Maximize roadway capacity.
    d. Increase vehicle occupancy.
    e. Promote transit use.

II.B. Strategies of the CALTRANS TSM Program

Both venue-related and non-venue traffic were of concern to CALTRANS. Circulation plans for each venue site had to be created, and methods for dealing with anticipated greater than usual traffic volume had to be developed. Venue sites with large spectator capacity, especially when located in normally congested areas, were of particular concern. Thus a series of strategies emerged, some of them specific to venue or non-venue situations; others of general application. The major strategies and their related objectives are summarized in Table 2.

It may be noted that CALTRANS' implementing responsibility was limited to the freeway system and a few segments of conventional highway. However, CALTRANS participated extensively in the planning and development of the complete TSM program. Some of the strategies described below were joint efforts; others were exclusively CALTRANS. Strategies are included here if 1) CALTRANS had a major role in the planning effort, and 2) they are relevant to performance of the freeway system.

II.B.1. Venue Site Traffic Management

Olympic events took place at 24 different venues located throughout the Los Angeles region. A total of 18 traffic management plans encompassing the 24 venues were developed. These plans were based on event requirements and local conditions. The traffic management plans included preferred spectator routes, bus priority streets and ramps, one-way streets, parking provisions, signing, traffic officer placement, signal timing, and other traffic management techniques as deemed

Table 2

CALTRANS TSM Program Strategies

Strategy	Description	Related Objectives
Venue Site Traffic Management	Venue site circulation and parking plans; bus access plans; ramp metering closures	Venue Site Traffic Congestion; Traffic Flow; Transit Use
Venue Site (Spectator) Public Information	Route signage; media programs; marketing of bus patronage and ridesharing	Venue site traffic congestion; Traffic Flow; Vehicle Occupancy; Transit Use
Freeway Closure Management	Provision of alternate routes, media information	Impact of Venue-Related Freeway Closures
Public Information for commuters, businesses, shippers	Marketing of ridesharing, transit, and alternative work hours; media information on daily events; traffic congestion reports; traffic information media service; freeway traffic condition maps	Peak Period Traffic Congestion; Non-recurrent Traffic Event Congestion; Balance Traffic Volumes; Vehicle Occupancy Transit Use
System Traffic Management	Ramp metering; removal of construction and maintenance activities; use of auxiliary lanes and shoulders for through traffic; truck diversion program; changeable message signs	Traffic Flow; Peak Period Congestion; Roadway Capacity
System monitoring and surveillance	Traffic Coordination Center, Traffic Operations Center, CCTV, aerial and field surveillance teams; MIMT; computerized electronic surveillance	Non-recurrent Event; Venue-related Traffic Congestion; Peak Period Traffic Congestion; Traffic Flow

necessary at each site. Because of their location in highly congested areas and because of the large number of spectators anticipated, the Coliseum and Westwood areas were singled out for particularly intensive traffic management plans.

The Coliseum area plan was based on a severe parking constraint. It was determined that 65% of the spectators would have to use bus service due to the lack of parking for private vehicles. Bus-only freeway ramps (off I-110 at Martin Luther King Blvd. and off I-10 at Vermont) and arterial traffic lanes were established. Spectator routes were devised to distribute spectator traffic along several alternate access/egress arterial routes. Ramp metering in the area was adjusted to coincide with anticipated spectator traffic.

II.B.2. Venue Site Public Information

An intensive public information program was employed before and during the Olympics to inform the public on how best to access event sites. The centerpiece of this program was the, "Summer Games Spectator Routes," a set of maps and guidelines generated by CALTRANS in cooperation with LADOT and the LAOOC. This information was distributed to the public, mailed to ticketholders by the LAOOC, and later published in local newspapers. The packet gave specific instructions on auto access and parking, transit services, and travel information sources. Special signs, Olympics Venue Guide Signs, were employed to mark spectator routes, guiding the spectator from the freeway to the designated parking areas.

Another important part of the public information program was the twice-daily media reports (press conferences) which provided route and daily traffic information. Event schedules and locations were also provided daily. In addition, an intensive marketing campaign to encourage transit use to the major event sites was employed. All of these efforts were directed at "getting the word out" so that the traffic management plans could be successfully implemented.

II.B.3. Freeway Closure Management

Freeways were closed on six separate occasions (all during weekends) for cycling and marathon practices and events. The most significant was the closure of 17 miles of Rte. 91. Diversion plans and signed detours, as well as public announcements in media and press, were employed to manage these closures.

II.B.4. Public Information for Commuters, Businesses, and Shippers

A particular concern for Los Angeles area transportation planners was the integration of the Olympics traffic with regular commuter traffic. Under normal conditions, freeways in the downtown, Westwood, and South Bay areas regularly experience several hours of congestion during peak periods. In some cases, Olympic events traffic was expected overlap with the peak period in these areas. Therefore, in addition to managing spectator traffic, planners wanted to mitigate the congestion caused by commuter traffic.

An intensive public information campaign was launched to inform the public of anticipated congestion problems and to promote shifts in mode choice, work hours, and work days. CALTRANS produced "The Olympic Traffic Picture," a set of maps depicting expected systemwide freeway traffic conditions for Coliseum event days, non-Coliseum events days, and weekends. Maps were produced for 8 AM, 11 AM, 3 PM, and 6 PM, indicating areas where congestion was expected to occur. These maps were based on the assumption that no changes in travel demand or travel patterns would occur.

The map packet, traffic management plans and other information was used by Commuter Computer to produce a packet of Olympic Commuter Traffic Information. This packet was distributed to businesses throughout the area, and was made available to local agencies, the media, and local press. It contained site-specific information on expected congestion, possible work hour alternatives, and suggested routes for commercial traffic. CALTRANS also distributed a similar packet.

Los Angeles planners also identified certain days, e.g., August 3, as being particularly problematic. Employers were encouraged to shift work hours, shift to a 4 day work week, give extra days off and observe Admission Day on August 6 in order to lessen commute traffic on these days. Businesses were encouraged to change operating hours and adjust delivery schedules. In addition, a lot of publicity on expected traffic problems was provided by the press.

Traffic information was provided throughout the Olympics period via twice daily press conferences and traffic reports issued by the TOC every 15 minutes throughout the day. These reports ware made available to the media. Several radio stations increased the frequency of traffic reporting and reported throughout the day. These efforts consistently provided commuters and other travelers with timely and accurate traffic information. In addition, telephone hotlines were available to the public.

II.B.5. System Traffic Management

In addition to persuading businesses and commuters to adjust travel behavior, Los Angeles planners employed several traffic management techniques to increase the carrying capacity of the road system. First, ramp metering was intensified on those freeways leading to and through the Westwood and Coliseum/downtown areas. Specifically, all-day ramp metering was employed on I-110, I-10, I-5 in the Coliseum/downtown area and on I-10 and I-405 in the Westwood area. Ramp metering was intensified on routes 101 and 170 as well. Second, all non-emergency construction and maintenance work was halted. In addition, peak hour only shoulder traffic lanes on I-5 were made available all day. The intent here was not only to make all roadway capacity available, but also to avoid delay caused by gawking.

A third effort was the truck diversion program, Operation Breezeway, developed and implemented by CHP and CALTRANS. Operation Breezeway was primarily a marketing campaign aimed at the trucking industry. It's purpose was to divert truck traffic from highly congested areas during peak hours. Truckers were asked to avoid peak hour travel on the freeways, and to shift deliveries to non-peak periods. The program depended on industry cooperation, as no enforcement authority was associated with the program.

A fourth component of the traffic management program was the use of changeable message signs (CMS) to inform motorists of problem locations, congestion, and alternate travel routes. CMS are routinely used in CALTRANS operations. The Olympics effort was a more comprehensive and responsive use of the equipment to provide timely information to motorists whenever necessary.

II.B.6. <u>Field Surveillance</u>

CALTRANS devoted significant effort to field surveillance capabilities during the Olympics in order to increase its ability to monitor the system and respond to non-recurrent events. The Traffic Operations Center (TOC) is the focus of system surveillance. Electronic sensors embedded in the freeway system roadway are connected to a computer in the TOC. Traffic flow information is transmitted on a continuous basis to the TOC enabling constant monitoring of approximately 200 miles of the freeway system. In areas where electronic surveillance was lacking, field observers with radios were stationed at strategic points. Additional monitoring capability was provided by closed circuit TV on I-10 from I-405 to I-110, at the four-level interchange, the East LA interchange, and the SR101 spur. Helicopters, as well as CALTRANS and CHP field teams were also employed. Taken together, these efforts provided continuous and timely information on the entire freeway system, with the highest level of information provided on the central area of the region. This enabled rapid detection, verification and response to traffic problems.

A second element of surveillance was the Traffic Coordination Center (TCC), a traffic monitoring center developed expressly for the Olympics to provide a mechanism for interagency communication and coordination. Located in the CALTRANS District 7 office, the TCC operated 24 hours per day, and was manned by representatives of several transportation and law enforcement agencies. Traffic information was transmitted from the TOC to the TCC. Information from CHP, LAPD, LADOT, SCRT, and LAOOC was also available. Closed circuit TV provided monitoring capability of the Coliseum area venues, as well as portions of the freeway system. The purpose of the TCC was to coordinate decision making and to be able to respond quickly to any emergency situation.

II.B.7. Major Incident Traffic Management Team

The Major Incident Traffic Management Team (MITMT)is a CALTRANS operational unit organized to respond to major incidents (defined as any unpredictable condition which severely reduces the capacity of the highway system). The MITMT is always avaliable, and is prepared to respond to major incidents. The MITMT made special preparations for the Olympics. Rehearsals of response to major incidents were conducted prior the Olympics, in order to be well prepared for possible emergency situations. Team members participated in venue traffic management and freeway closures.

III. HIGHWAY SYSTEM PERFORMANCE

This section describes performance of the highway system during the Olympics. It is based on data provided by CALTRANS District 7. The following issues are discussed: traffic volumes and congestion, truck traffic, vehicle occupancy, and traffic incidents.

III.A. Traffic Volumes and Congestion

One of the most notable aspects of the Olympics was the apparent lack of congestion on the freeway system. Commuters in the central Los Angeles and Westside areas found that the trip to and from work took less time than usual. No major traffic jams were reported around large venue sites until late in the second week, when traffic problems surfaced near the Rose Bowl area. National news services, poised to observe imminent "gridlock," issued surprised reports of free flowing traffic.

CALTRANS collected data on traffic volumes each day during the Olympics. The data came from two sources: the "42 mile loop," the loop of I-10, I-110, and I-405, and the new MODCOMP system, which gathered data from several points around the freeway system. CALTRANS used the 42 mile loop data to calculate ADT and daily delay. Using Summer 1983 42 mile loop data as a baseline, CALTRANS estimated that ADT varied from -25% to +10% of baseline during the Olympics, while freeway congestion ranged from -90% to -20%, and in no case reached normal levels.* In this

*Source - CALTRANS District 7 1984 Olympics "After Event" Report, 9/84.

research a series of freeway screenlines were examined. The results demonstrate an interesting variety of highway performance changes during the Olympics.

III.A.1. Issues related to analyzing Olympics traffic volumes and congestion.

Measuring the changes in traffic volumes and congestion during the Olympics is not a simple task for two reasons. First, traffic volumes are quite variable. Season, day of the week, weather conditions, and incident occurences all affect daily traffic volumes. Driver behavior can also affect traffic flow. In addition, volumes on apparently similar facilities are variable due to the particular geometrics, weaving patterns, and vehicle make-up which characterize the traffic flow. The fact that large portions of the Los Angeles area freeway system operate at or near capacity poses a second problem. Under these conditions traffic flow is highly variable: a very minor change either in road conditions or traffic pattern can generate a relatively large change in travel speed and congestion. Consequently, traffic congestion tends to have a large variance, even under identical conditions, e.g., same place, time, day of week. Previous CALTRANS research indicates that traffic congestion can vary by as much as 20% on a given screenline. As travel speeds decrease, volume also decreases once capacity is reached. Thus traffic volumes are also variable, though not to the same degree as congestion.

For both these reasons, the baseline to be used is critical. It is clear that one must consider all the sources of variation in volumes and congestion, and eliminate as many as possible. Thus one cannot compare across different seasons or days of the week, or across different screenlines, no matter how similar they appear to be. Ideally, we should use a set of observations on the same screenline, and generate an average and distribution by time of day. We would then be able to determine whether the conditions observed during the Olympics were significantly different from normal. Unfortunately, however, the data required to develop this type of baseline were not available. Available baseline data consisted of one week of observations from two weeks after the Olympics on the 42 mile loop, and one or two non-Olympics days for a variety of screenlines from the MODCOMP system data. We therefore elected to use data from the last week of August (with one exception) as our baseline.

III.2. Example of baseline conditions

In order to understand the characteristics of non-Olympics or baseline conditions it is useful to discuss one screenline example. The screenline chosen is SM18 eastbound, a screenline on I-10 at approximately La Brea Avenue. Table 3.1 gives AM, PM and total daily traffic volumes for August 27 through August 30 (Monday through Thursday), and June 30 (Friday), 1984. The June 30 data is used because it was the only non-Olympics Friday available. It should be noted that although AM and PM peak (3 hours each) volumes are given, there is no identifiable "peak" on this screenline. Rather, volumes build in the morning and remain high until well after 6:00 PM. Table 3.1 indicates that ADT ranges from 135,684 (Monday) to 145,985 (Friday), that the PM peak is more variable than the AM peak, and that the PM peak is generally heavier than the AM peak.

Table 3.1

Traffic Volumes for I-10 EB near La Brea

TIME	Monday 8/27	Tuesday 8/28	Wednesday 8/29	Thursday 8/30	Friday 6/30
0600-0900	23,349	23,358	23,257	23,983	22,419
1500-1800	26,778	23,874	27,054	23,450	25,494
24 hour total	135,684	136,726	142,601	142,838	145,985

The <u>Highway Capacity Manual</u> indicates that the maximum volume for 3 or more lane freeways is approximately 2000 vehicles/lane/hour (vph) with an associated speed of about 40 mph. This standard applies to facilities with a design speed of 70 mph. Unstable flow conditions set in at volumes of 1500-1800 vph, with associated speeds of 40 to 50 mph. For any given time interval, the actual volume depends upon the short-term fluctuations in demand. The greater the fluctuation, the less the volume will be. At peak demand, fluctuations in demand reduce the maximum volume. It therefore is unlikely that peak hour volumes of much more than 1800 vph would be observed, although the 2000 maximum might be reached for a very short time period, say one to five minutes (<u>Transportation and Traffic Engineering Handbook</u>, 2nd edition, 1982).

Table 3.2 gives some characteristics of the AM peak: three hour volume total, average hourly volume, and maximum 15 minute volume (expressed in vol/ln/hr). As expected, the 15 minute maximum is significantly higher than the average, and is in the expected range. Table 3.2 also gives the duration of time in which speed is less than

Table 3.2

Characteristics of AM Peak for I-10 EB near La Brea

	Monday 8/27	Tuesday 8/28	Wednesday 8/29	Thursday 8/30	Friday 6/30
Three hour volume	23,349	23,358	23,257	23,983	22,419
Average/ln/hr	1,557	1,558	1,550	1,599	1,495
Vol/ln/hr max (15 min)	1,851	1,810	1,830	1,900	1,942
Speed < 45 mph (hrs)	1.75	1.75	1.75	1.25	0

45 mph. Speed is estimated from occupancy, or the proportion of time the electronic sensor is occupied by a vehicle. At occupancy rates of approximately .20 or more, volume declines, indicating that capacity has been reached. The data indicate that the duration of less than 45 mph speed is not directly related to total volume. While the lowest volume day (Friday) also had the lowest duration of slower speed (none), the highest volume day had the second lowest duration. This is not surprising, given the variability of capacity due to demand patterns as discussed above.

Estimated speed is a surrogate indicator of congestion. Ideally, we would like to calculate delay, which is the difference betwen actual travel speed and mean free speed multiplied by the traffic volume over a given length of highway. However, since our data was not complete, it was not possible to do this. The screenline speed is a "second best" measure of congestion, since it does tell us that traffic is moving at less than free speed. It may be noted that speed is not an indicator of delay, however, because we are examining individual screenlines rather than lengths of highway.

III.A.3. Screenline Comparisons

Four screenlines on the I-10 and I-110 portions of the 42 mile loop were selected for analysis.* It was decided that only fully operational screenlines would be chosen in order to maximize data reliability. A total of seven screenlines on this portion of the loop had all lane counters operational: H08 (I-10 near El Segundo); SM06 (I-10 near Centinela), SM13 (near National), SM18 (near LaBrea), and SM27 (near Hoover). Of these, screenlines H08 (NB), H13 (NB), SM13 (WB), and SM18 (EB) were chosen.

CALTRANS District 7 provided screenline data for each day of the second week of the Olympics, as well as for Monday through Thursday, August 27-30, and Friday, June 30. the decision to use second Olympics week data was made prior to the Olympics. Because of the changes in travel which occurred daily during the Olympics, the second week data does not provide as appropiate a comparison as had been anticipated. Thus additional screenline data from the MODCOMP system was examined as well.

III.A.3.a. Harbor Freeway Screenlines

The screenlines at El Segundo and Century provide an interesting comparison. Figures 3.1 and 3.2 graphically present 24 hour volumes for Olympics and non-Olympics by day of week for the two screenlines. Table 3.3 provides the corresponding numbers. While ADT was higher every day during the Olympics at El Segundo, just the opposite occurred at

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*I-405 loop data were not available.

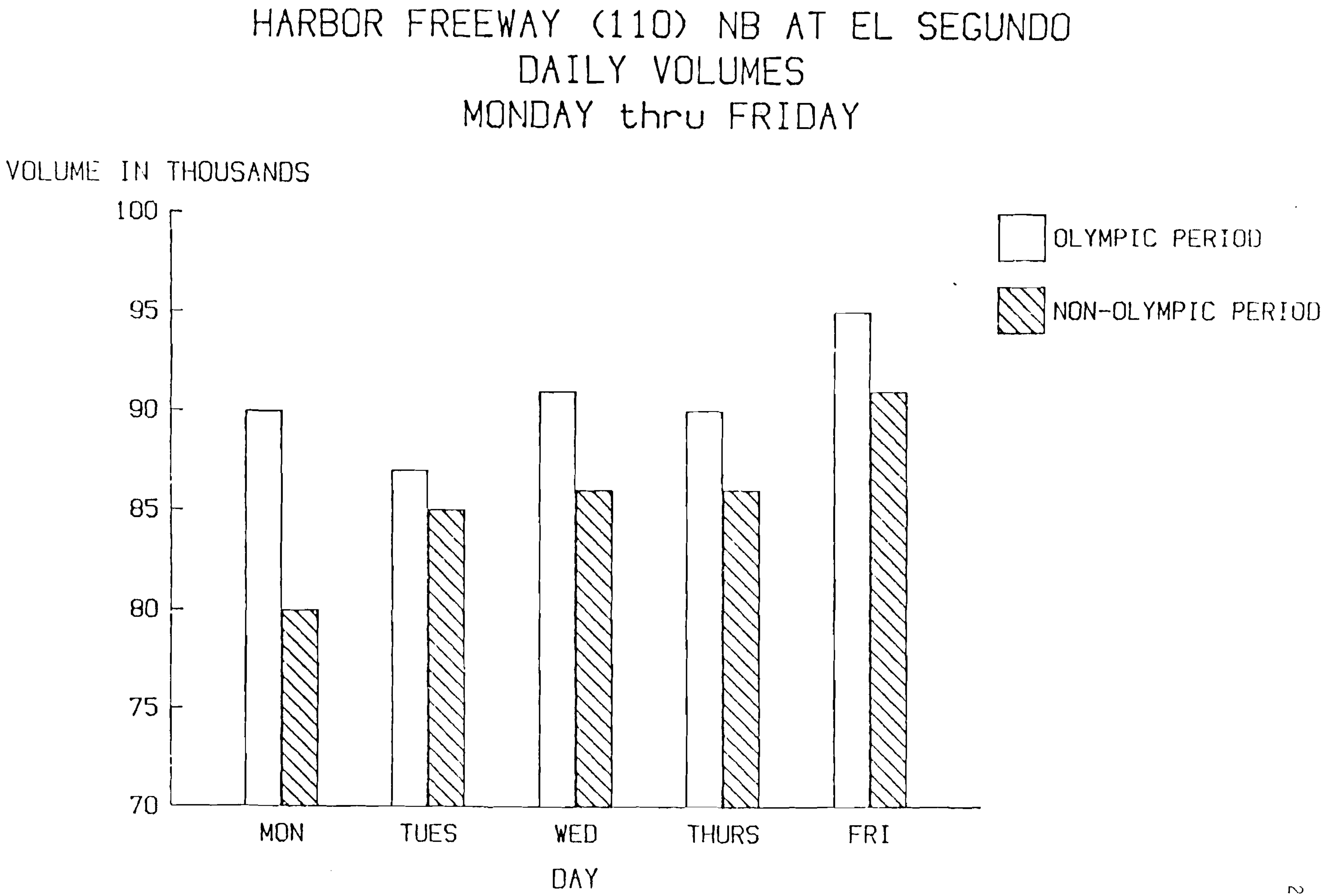


Figure 3.1

OLYMPIC PERIOD: AUGUST 6-10
NON-OLYMPIC PERIOD: AUGUST 27-30, JUNE 30

HARBOR FREEWAY (110) NB AT CENTURY
DAILY VOLUMES
MONDAY thru FRIDAY

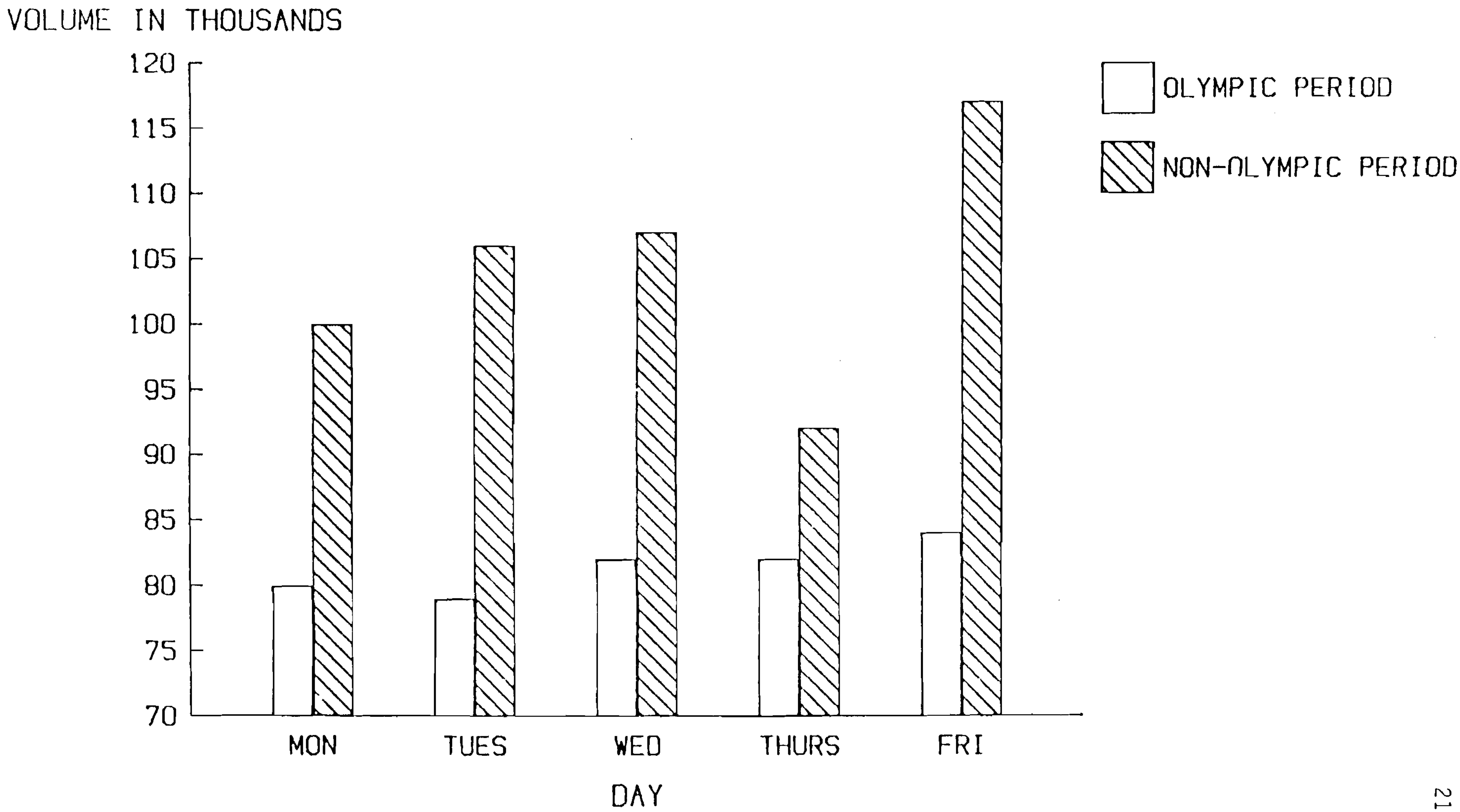


Figure 3.2

OLYMPIC PERIOD: AUGUST 6-10
NON-OLYMPIC PERIOD: AUGUST 27-30, JUNE 30

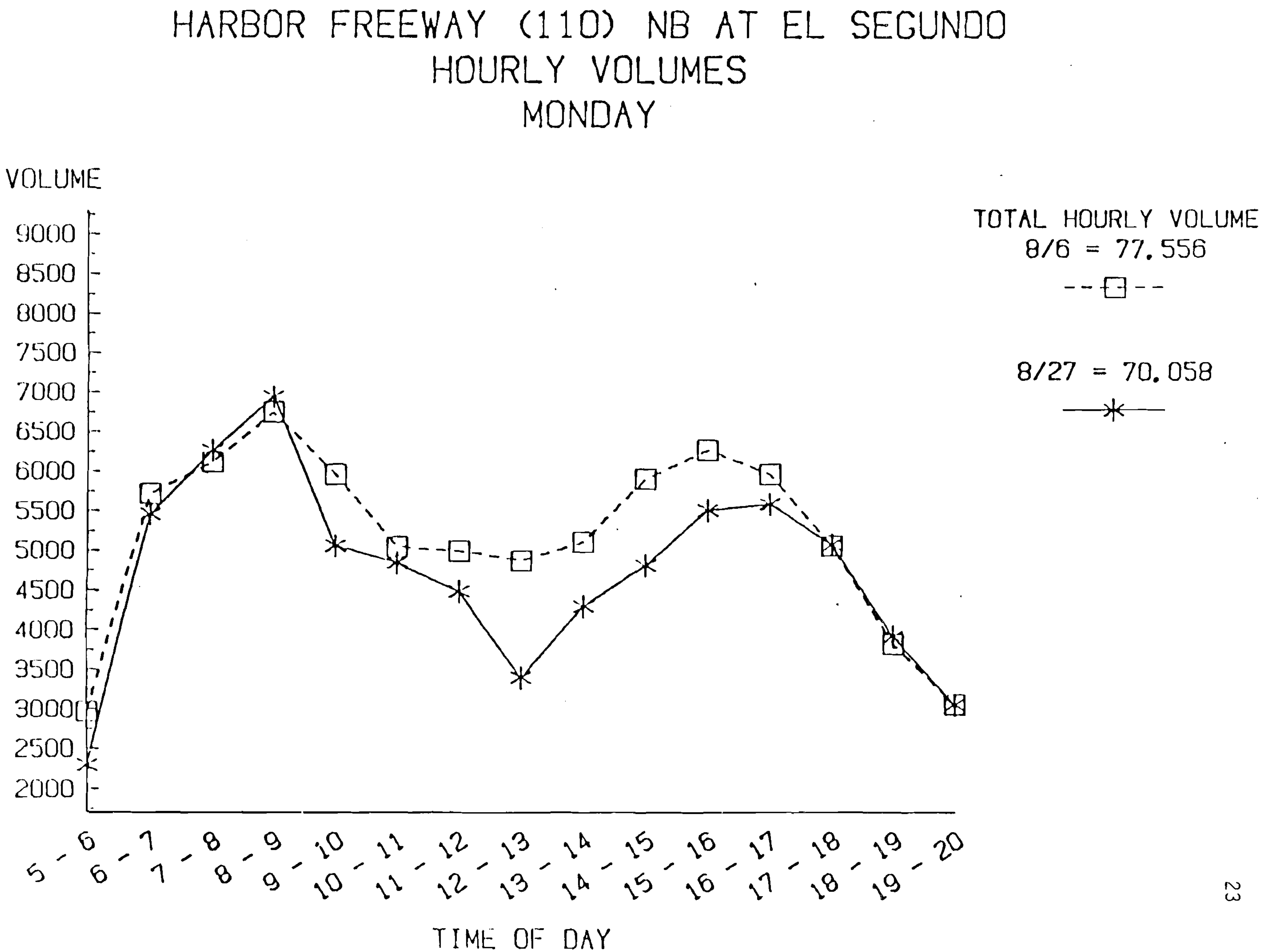
Table 3.3

Daily 24 Hour Volumes for El Segundo and Century Screenlines

El Segundo	Monday	Tuesday	Wednesday	Thursday	Friday
Olympics	90,040	87,389	91,383	90,296	94,688
Non-Olympics	79,501	84,608	85,694	86,438	90,978
Difference	+13.6%	+3.3%	+6.6%	+4.5%	+4.0%
Century					
Olympics	80,497	78,530	82,016	82,045	84,116
Non-Olympics	100,147	106,111	107,142	91,717	116,919
Difference	-19.6%	-26.0%	-23.4%	-10.5%	-28.0%

Century. Motorists apparently avoided the Harbor Freeway near the Coliseum area and switched to surface street routes (e.g. Figueroa and Flower). The lowest Olympics volume occurred on Tuesday, August 7 at both screenlines, the only non-Coliseum event day of this week. Not unexpectedly, the highest volume occurs on Friday for both Olympics and non Olympics.

Figures 3.3 through 3.5 graph hourly volumes for the El Segundo screenline, Olympics and non-Olympics, for Monday, Tuesday, and Thursday, from 5 AM to 8PM. The volume totals on these figures are for the corresponding time period. These graphs illustrate differences in the pattern of demand. On Monday, the Olympics AM peak begins somewhat earlier, daytime non-peak traffic is higher, and the PM peak is both earlier and higher. It would appear that this pattern was influenced by Coliseum activities which were scheduled 9:30 AM - 12:30 PM and 4:00 -


HARBOR FREEWAY (110) NB AT EL SEGUNDO
HOURLY VOLUMES
MONDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/6 = 77.556
8/27 = 70.058
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY
Figure 3.3

HARBOR FREEWAY (110) NB AT EL SEGUNDO
HOURLY VOLUMES
TUESDAY

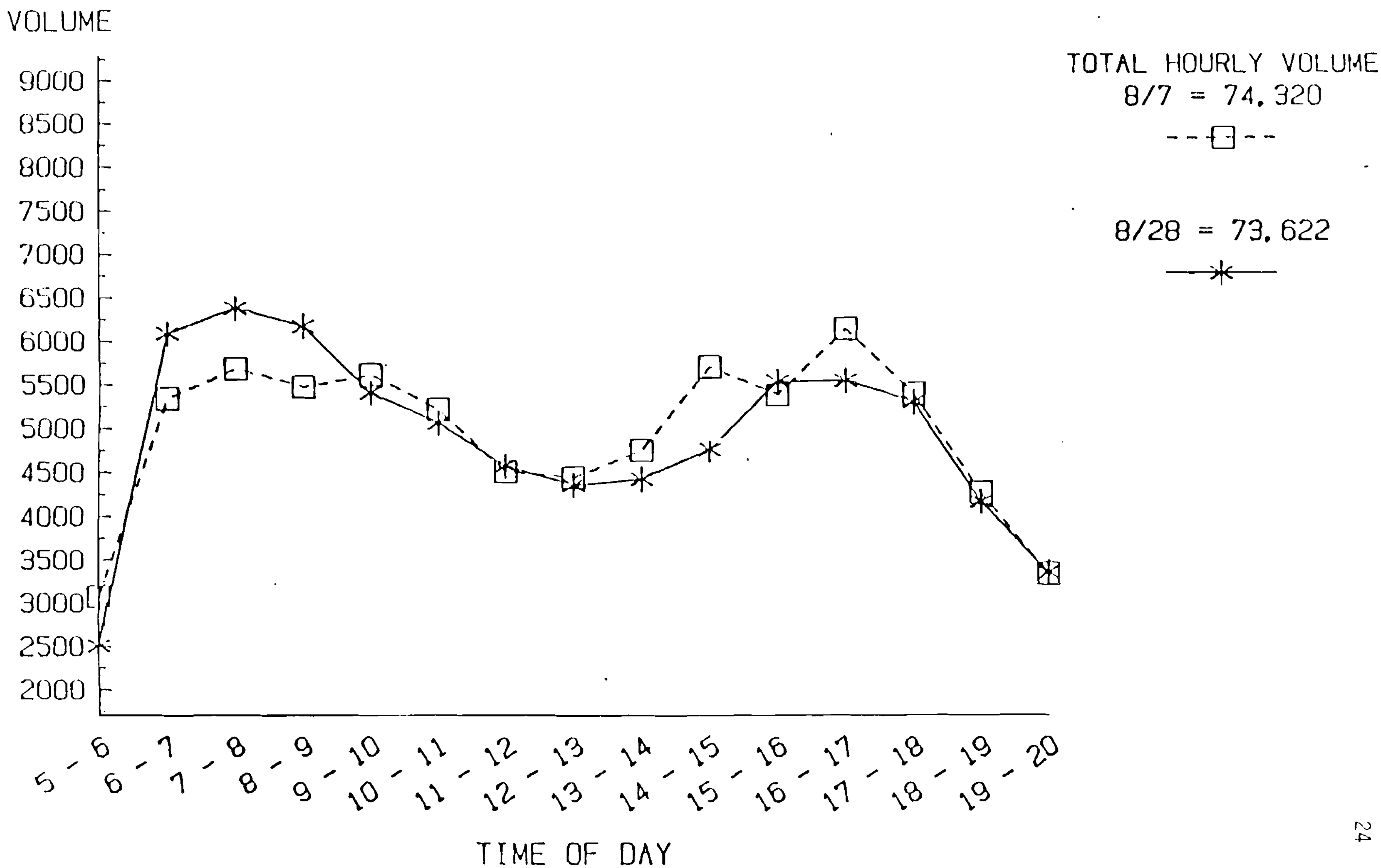


Figure 3.4

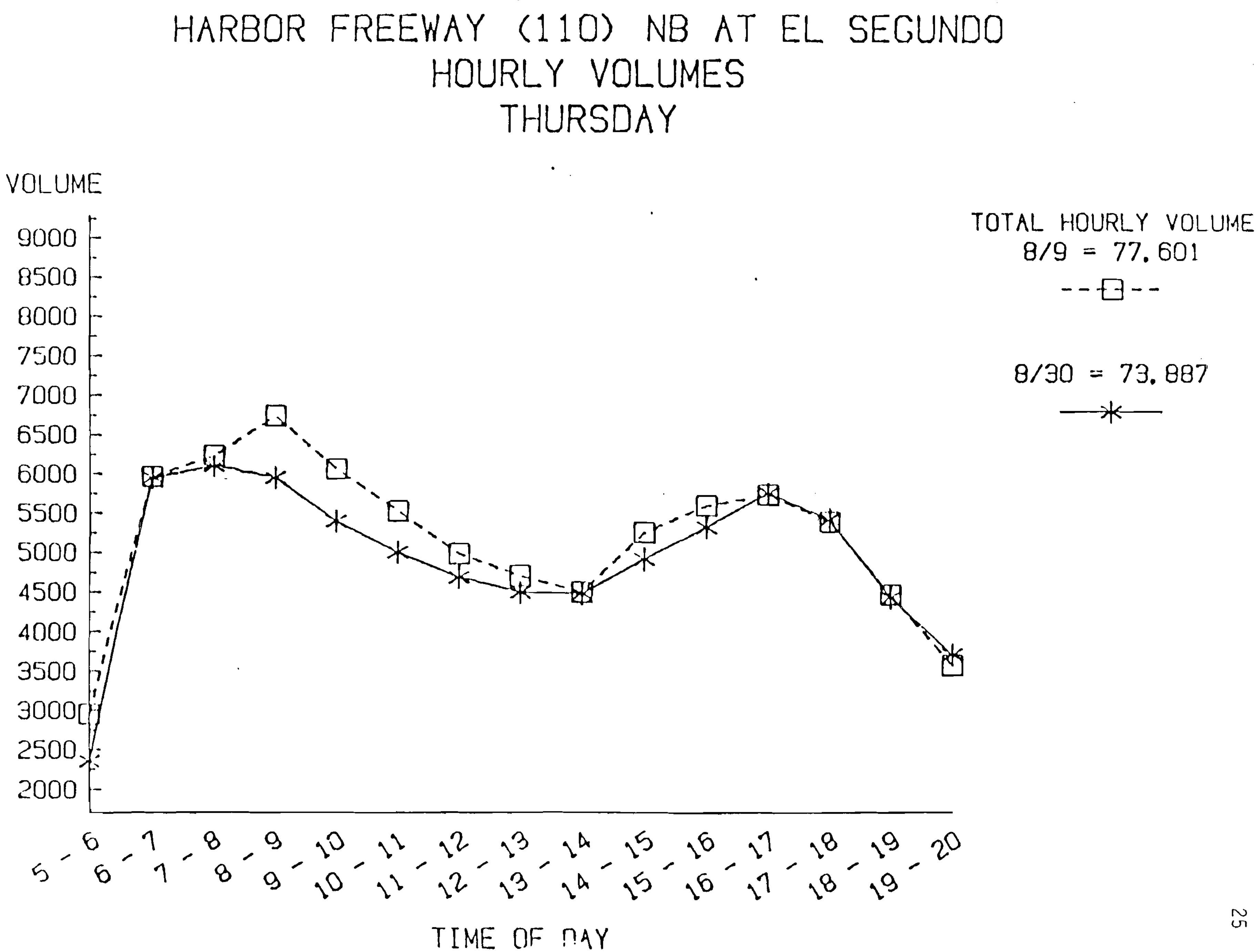
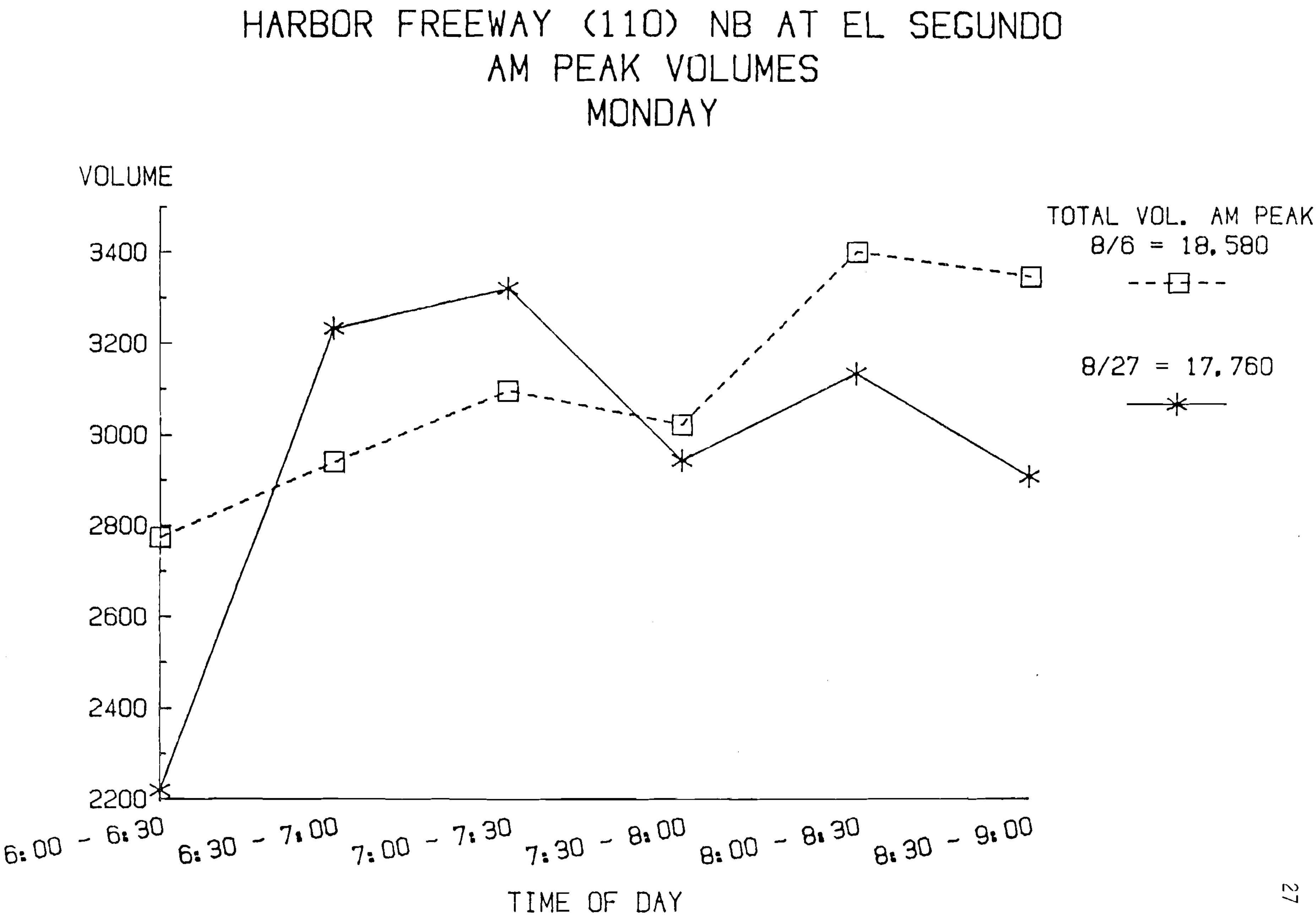

HARBOR FREEWAY (110) NB AT EL SEGUNDO
HOURLY VOLUMES
THURSDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/9 = 77,601
8/30 = 73,887
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY

Figure 3.5

8:15 PM (total Coliseum attendance on 8/6 was 137,773), and by commuters possibly shifting to an earlier work schedule. On Tuesday 8/7 AM peak traffic was lower, daytime off-peak traffic was unchanged, and PM peak traffic was both earlier and higher. The difference in AM peak suggests that work-related traffic was down about 10%, while afternoon traffic was again influenced by Olympics-related travel, although there were no Coliseum events. Thursday, 8/9, another Coliseum day, has a pattern similar to that of Monday, with the high traffic volumes between 7 and 10AM being a combination of work and Olympics (Coliseum) traffic.

On the northbound Harbor Freeway, AM is the dominant peak (towards downtown). In order to further examine changes in travel patterns during the Olympics, Figures 3.6 through 3.8 graph half-hourly volumes from 6 to 9 AM. Monday (Figure 3.6) clearly shows an earlier start of the peak and higher volumes in the last hour. Tuesday (Figure 3.7) shows lower volumes overall and a <u>later</u> start of the peak. The Thursday pattern (Figure 3.8) is almost identical to the non-Olympics until the last hour, when volumes are again higher.

These patterns present interesting daily shifts in travel behavior that might be interpreted as follows. Monday commuters, expecting the worst because this is just the second weekday that Coliseum events are scheduled, start off to work early to avoid spectator traffic. On Tuesday, commuters return to approximately their regular pattern since there are no Coliseum events. By Thursday, commuters have learned that the Coliseum specatator traffic does not seriously affect their commute, and they return to a normal pattern.


HARBOR FREEWAY (110) NB AT EL SEGUNDO
AM PEAK VOLUMES
MONDAY
VOLUME
3400
3200
3000
2800
2600
2400
2200
TOTAL VOL. AM PEAK
8/6 = 18,580
8/27 = 17,760
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY
Figure 3.6

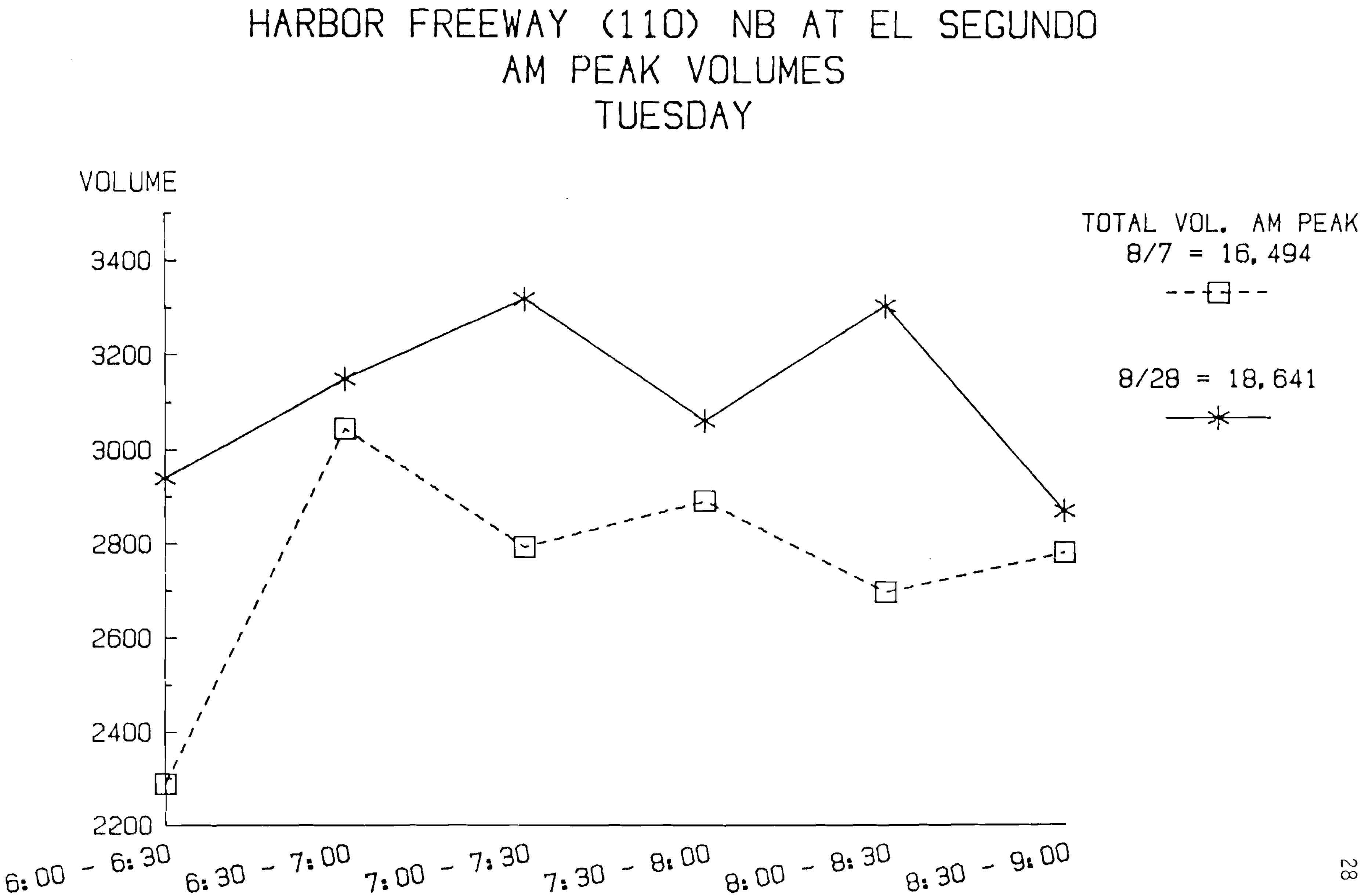

HARBOR FREEWAY (110) NB AT EL SEGUNDO
AM PEAK VOLUMES
TUESDAY
VOLUME
3400
3200
3000
2800
2600
2400
2200
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY
TOTAL VOL. AM PEAK
8/7 = 16,494
8/28 = 18,641

Figure 3.7

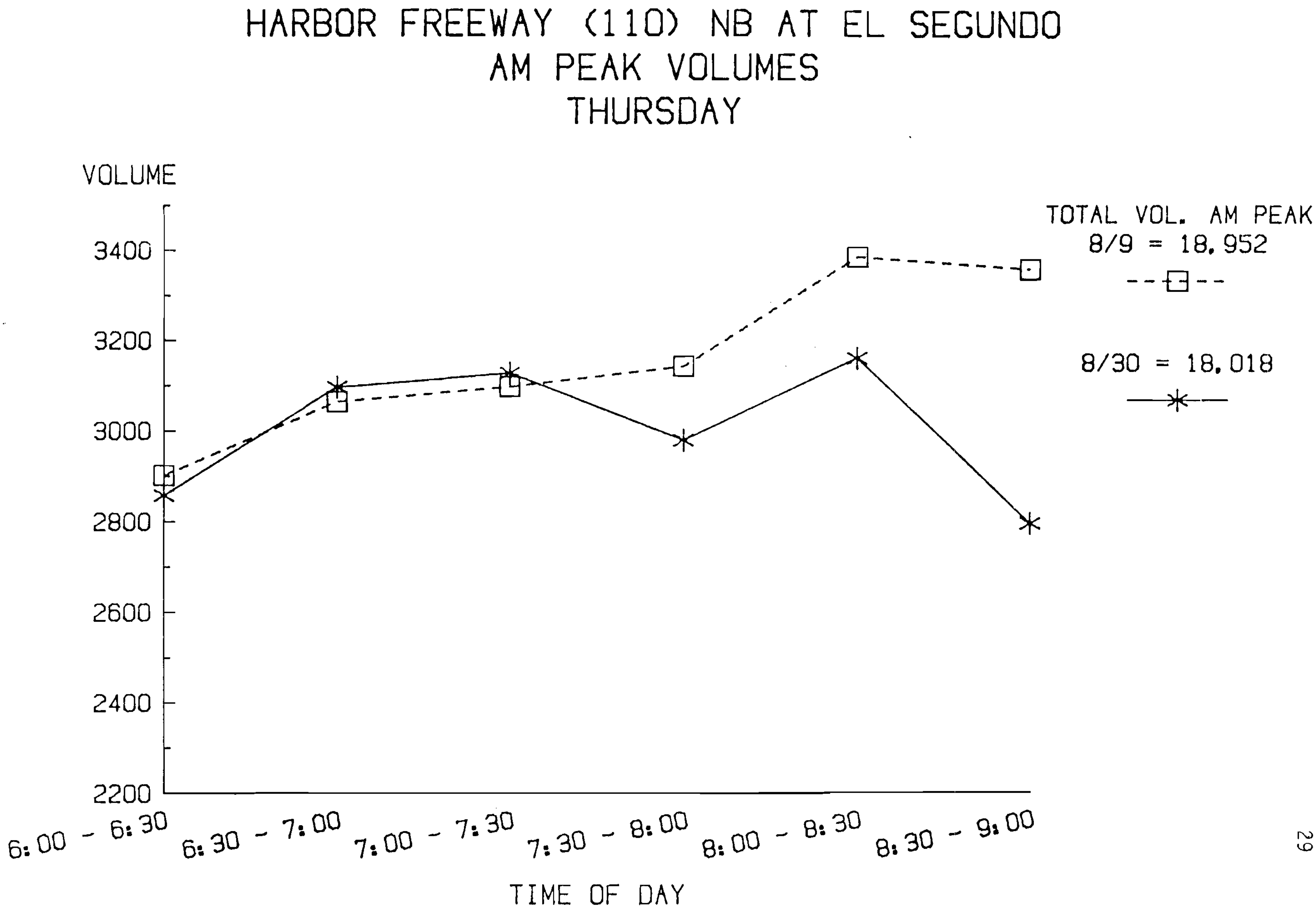

HARBOR FREEWAY (110) NB AT EL SEGUNDO
AM PEAK VOLUMES
THURSDAY
VOLUME
3400
3200
3000
2800
2600
2400
2200
TOTAL VOL. AM PEAK
8/9 = 18,952
8/30 = 18,018
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY

Figure 3.8

Daily traffic volume patterns for Monday, Tuesday, and Thursday, 5 AM to 8 PM, are graphed in Figures 3.9 through 3.11 for the Century screenline. The most evident characteristic here is the substantially lower volume during the Olympics. Comparing Monday and Tuesday (Figures 3.9 and 3.10) the influence of Coliseum traffic is apparent in the distance between the Olympics and non-Olympics lines. The dip at 4:00 PM, 8/7 was due to a traffic accident downstream at Slauson Ave. Figure 3.11, Thursday, provides an example of a bad baseline. The drastically lower traffic volumes between 3 and 6 PM on August 30 are an indication of a major traffic incident. (At this writing, incident information for this date was not available). Thus no conclusions can be drawn regarding Olympics vs. non-Olympics differences. Finally, the Century volume patterns indicate that there is no discernable peak; traffic volumes are fairly consistent throughout the day. Spectator traffic and a relatively smaller proportion of work trip traffic probably account for the slightly flatter profile of the Olympics pattern.

III.A.3.b. Santa Monica Freeway at La Brea

The Santa Monica Freeway is one of the most heavily traveled freeways in the region. It is also one of the highest capacity facilities, with four general traffic lanes and one or more auxiliary lanes in each direction over most of the I-405 to I-110 section. In the vicinity of La Brea Avenue, there are four regular general traffic lanes and one auxiliary lane in each direction. Review of the traffic volume data reveals that this portion of the freeway operates at or near capacity all day, and that there is no easily discernable peak period. Furthermore,

HARBOR FREEWAY (110) NB AT CENTURY
HOURLY VOLUMES
MONDAY

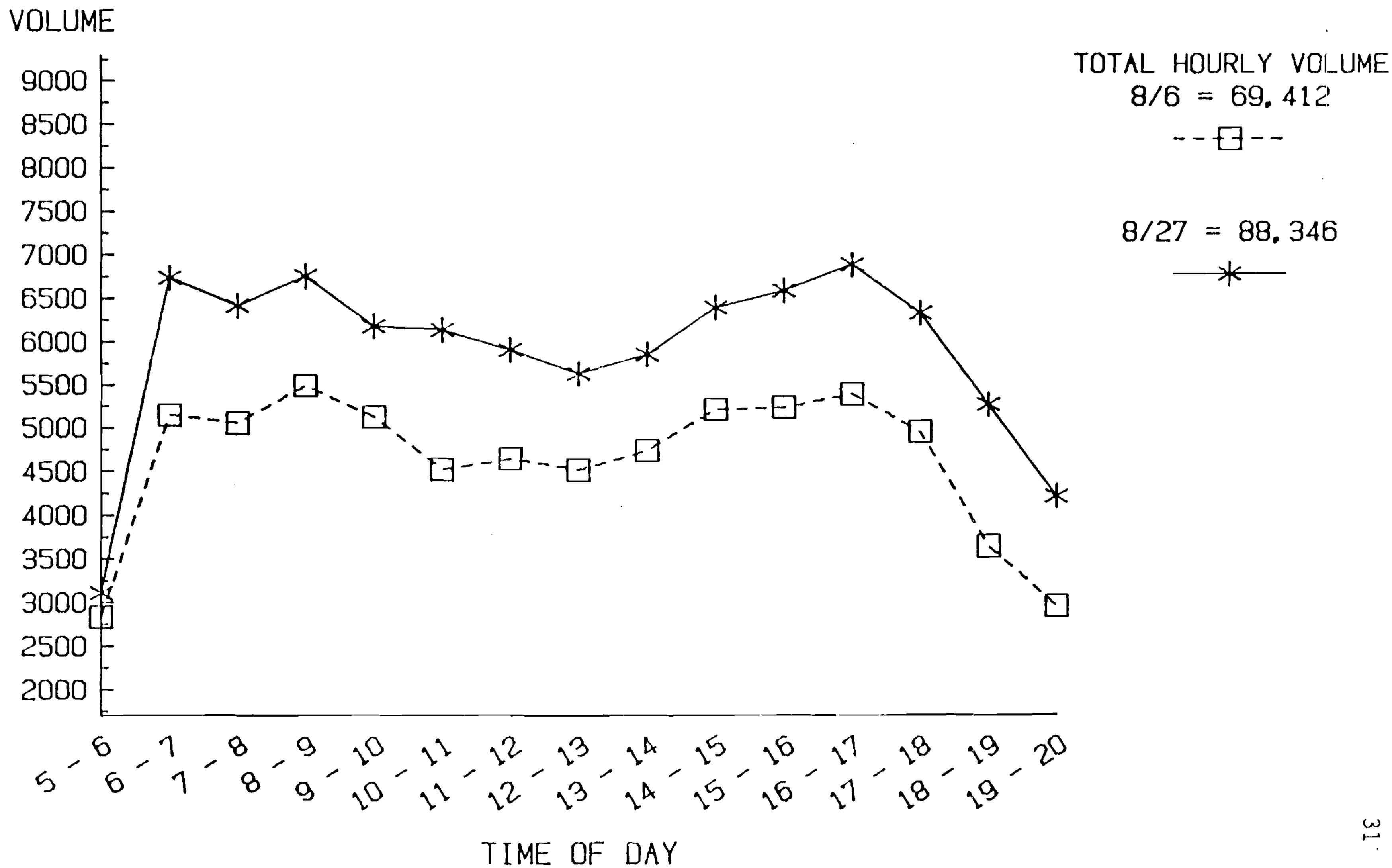


Figure 3.9

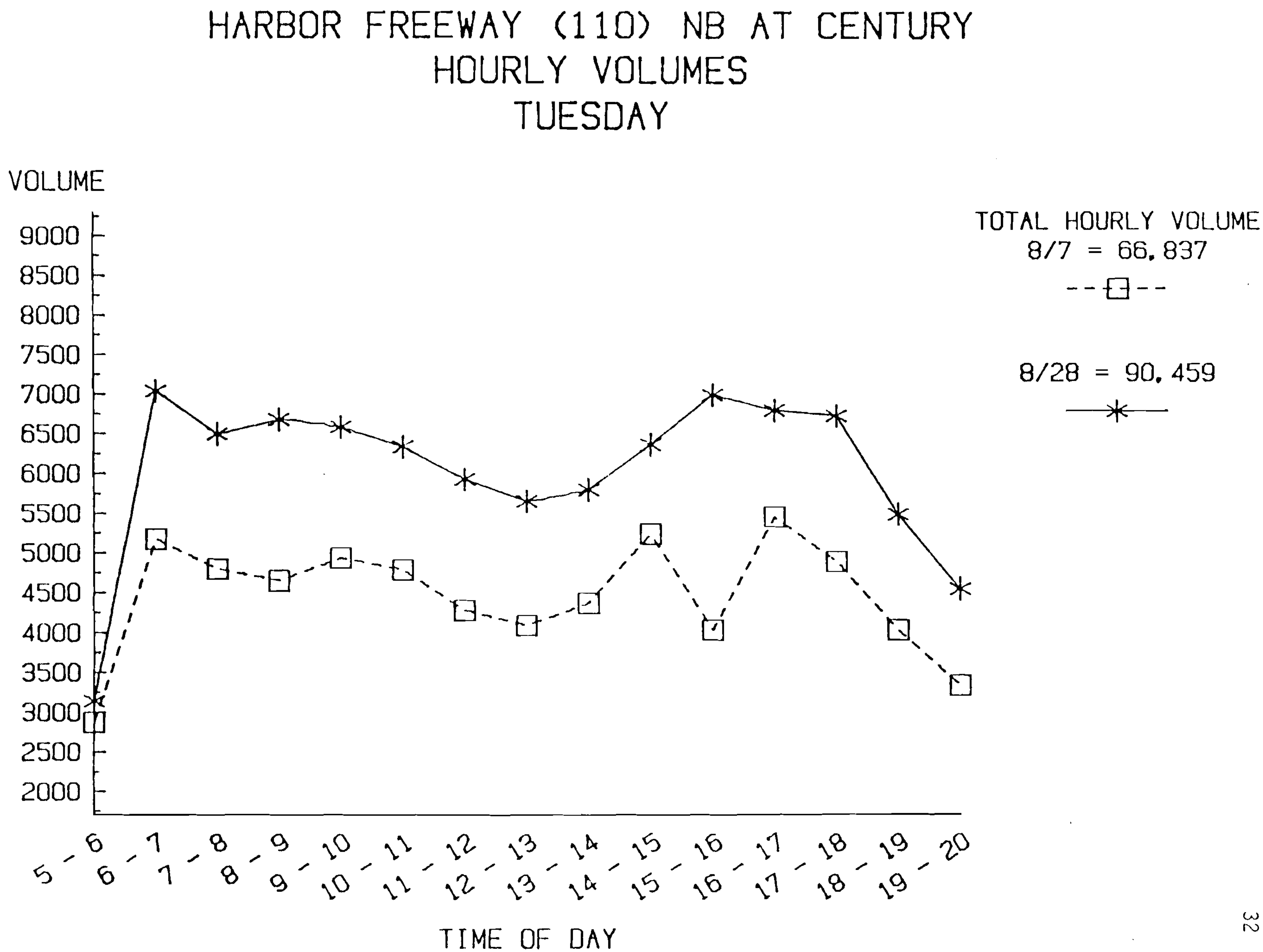
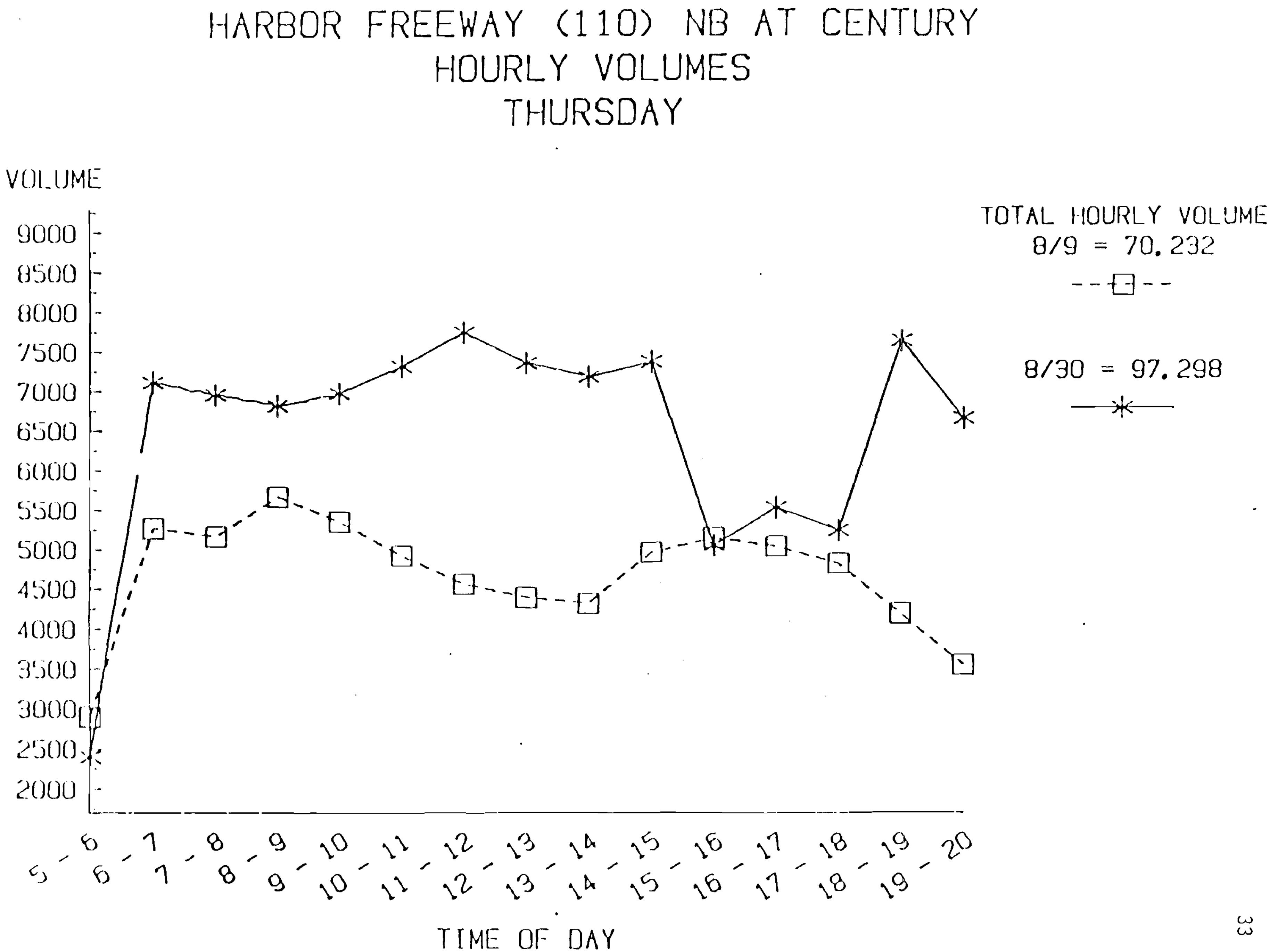

HARBOR FREEWAY (110) NB AT CENTURY
HOURLY VOLUMES
TUESDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/7 = 66,837
8/28 = 90,459
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY

Figure 3.10


HARBOR FREEWAY (110) NB AT CENTURY
HOURLY VOLUMES
THURSDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/9 = 70,232
8/30 = 97,298
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY
Figure 3.11

although the eastbound direction was selected for analysis, the PM peak tends to be slightly higher than the AM peak. That is, the heavier peak is towards downtown in the afternoon.

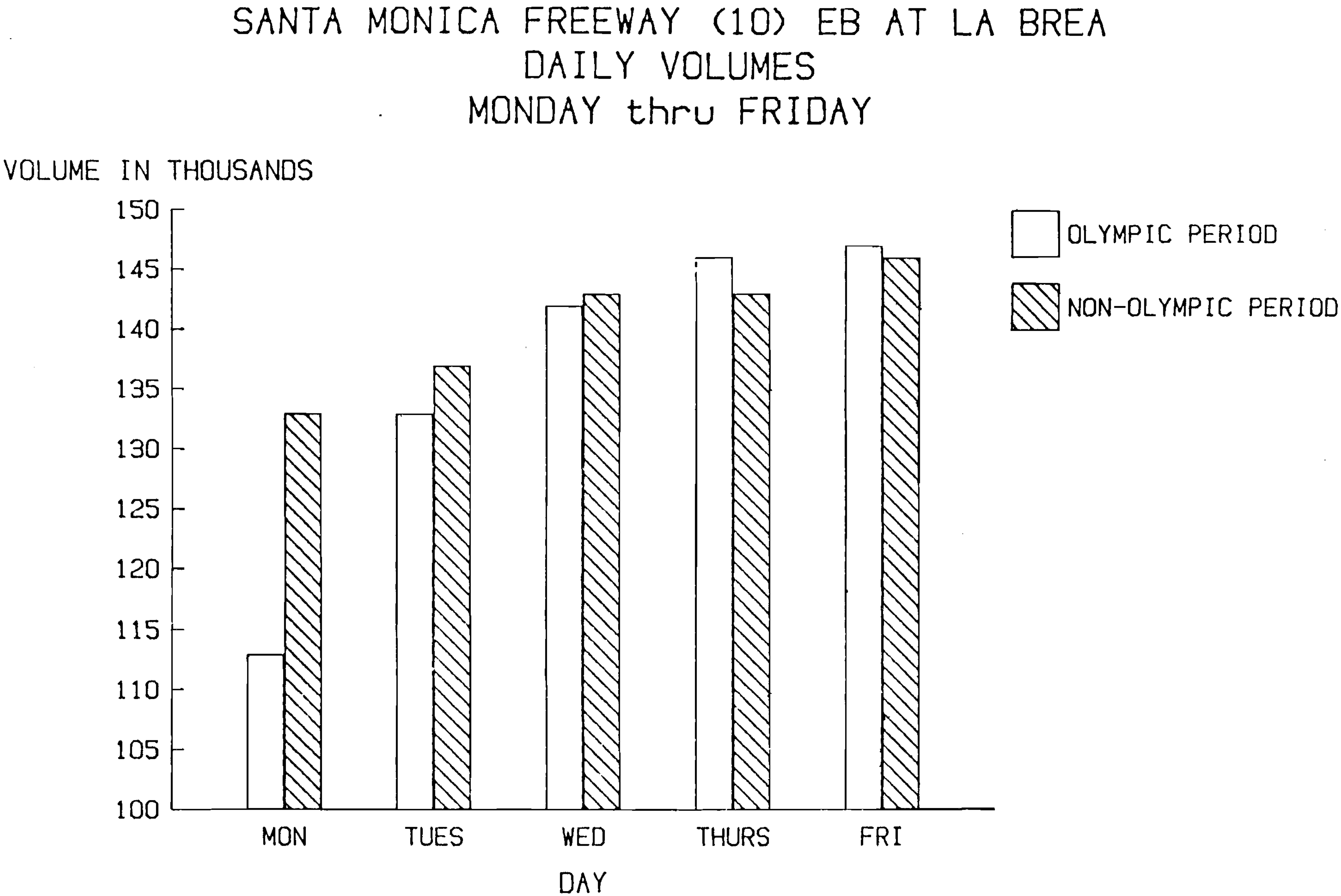
Figure 3.12 presents Olympics vs. non-Olympics weekday 24 hour volumes for the La Brea EB screenline, and the corresponding numbers are given in Table 3.4. Monday Olympics traffic was substantially lower, but by Wednesday volumes were at or above non-Olympics levels. For both periods, Friday traffic volumes were the highest.

Table 3.4

Daily 24 Hour Volumes for La Brea Screenline

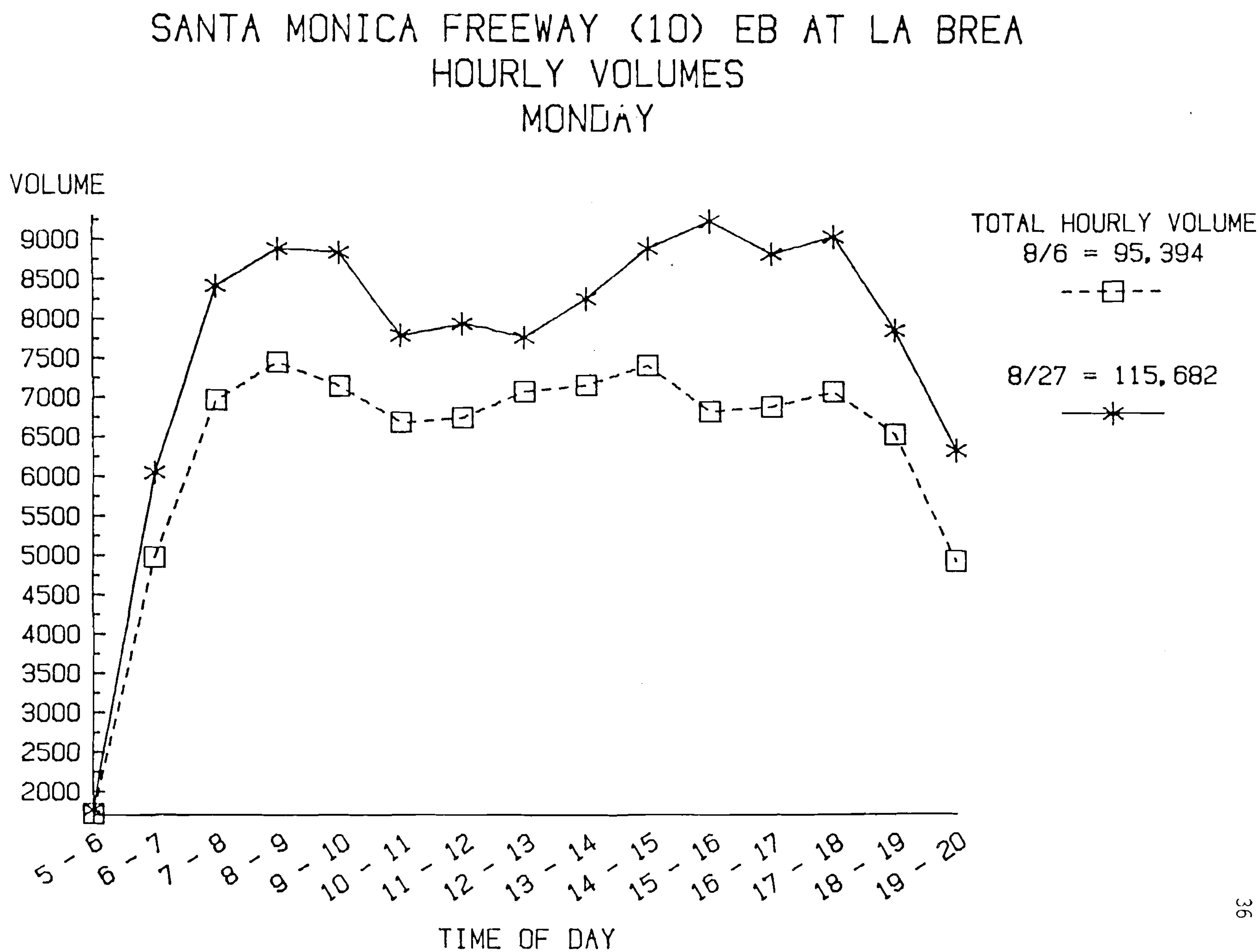
	Monday 8/27	Tuesday 8/28	Wednesday 8/29	Thursday 8/30	Friday 6/30
Olympics	113,462	133,141	142,198	145,943	147,345
Non-Olympics	135,684	136,726	142,601	142,838	145,985
Difference	-16.4%	-2.6%	insig	+2.1%	+.9%

Figures 3.13 through 3.15 graph hourly traffic volumes, Olympics and non-Olympics, for Monday, Tuesday, and Thursday for the La Brea screenline. The Monday graph (Figure 3.13) shows a flatter profile and consistently lower volumes for the Olympics, as observed on both of the Harbor Freeway screenlines. On Tuesday (Figure 3.14) Olympic AM peak volumes are lighter, while after noontime the pattern is almost identical to non-Olympics. On Thursday Olympic AM peak hourly volumes are slightly higher, with the remainder of the day almost identical to non-Olympics.



OLYMPIC PERIOD: AUGUST 6-10
NON-OLYMPIC PERIOD: AUGUST 27-30, JUNE 30

Figure 3.12


SANTA MONICA FREEWAY (10) EB AT LA BREA
HOURLY VOLUMES
MONDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY
TOTAL HOURLY VOLUME
8/6 = 95,394
8/27 = 115,682
Figure 3.13

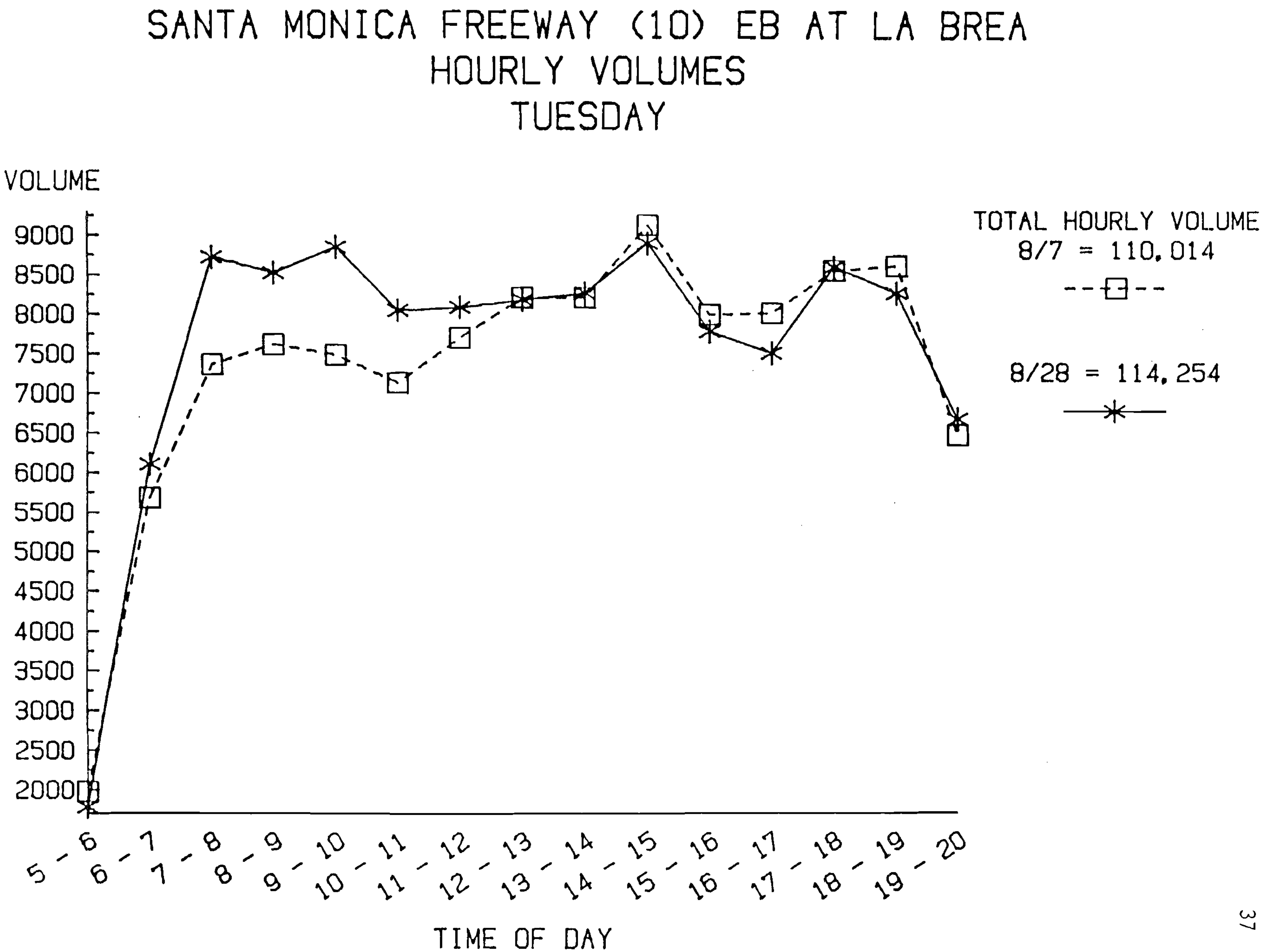

SANTA MONICA FREEWAY (10) EB AT LA BREA
HOURLY VOLUMES
TUESDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/7 = 110,014
8/28 = 114,254
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY

Figure 3.14

It may be noted that the jagged profile of the PM peak on Tuesday and Thursday is probably an indicator of congestion.

Because of its location between two major venue sites (Coliseum area and Westwood area), we would expect that spectator traffic made up a substantial portion of the traffic volumes on Olympic days. However, it is not possible to trace the influence of a specific venue (even the Coliseum), because of the number of events and different times they were scheduled.* With respect to commuter travel, it is probable that changes in the number of people taking time off from work had more of an influence on traffic volumes than changes in routes, because no significant traffic improvements were made on the east-west arteries, and many downtown employers observed the August 6 Admission Day holiday. In addition, the downtown employee survey data indicate that Monday and Friday of both Olympics weeks had the highest employee absence rates. It is also worth noting that the gradual buildup of traffic volumes through the second week of the Olympics is quite evident in the three graphs.

Figures 3.16 through 3.18 graph half-hourly volumes for the AM peak at La Brea. On Monday, (Fig. 3.16) the shape of the Olympics peak is quite similar to the baseline; however volumes are much lower. The relatively higher volumes at the end of the peak are again probably due to Olympic spectator traffic. On Tuesday, the Olympics peak gets off to a slower start than the baseline, while on Thursday the two patterns are virtually identical. These peak traffic patterns seem to indicate that there was no significant change in commuter behavior; changes in peak

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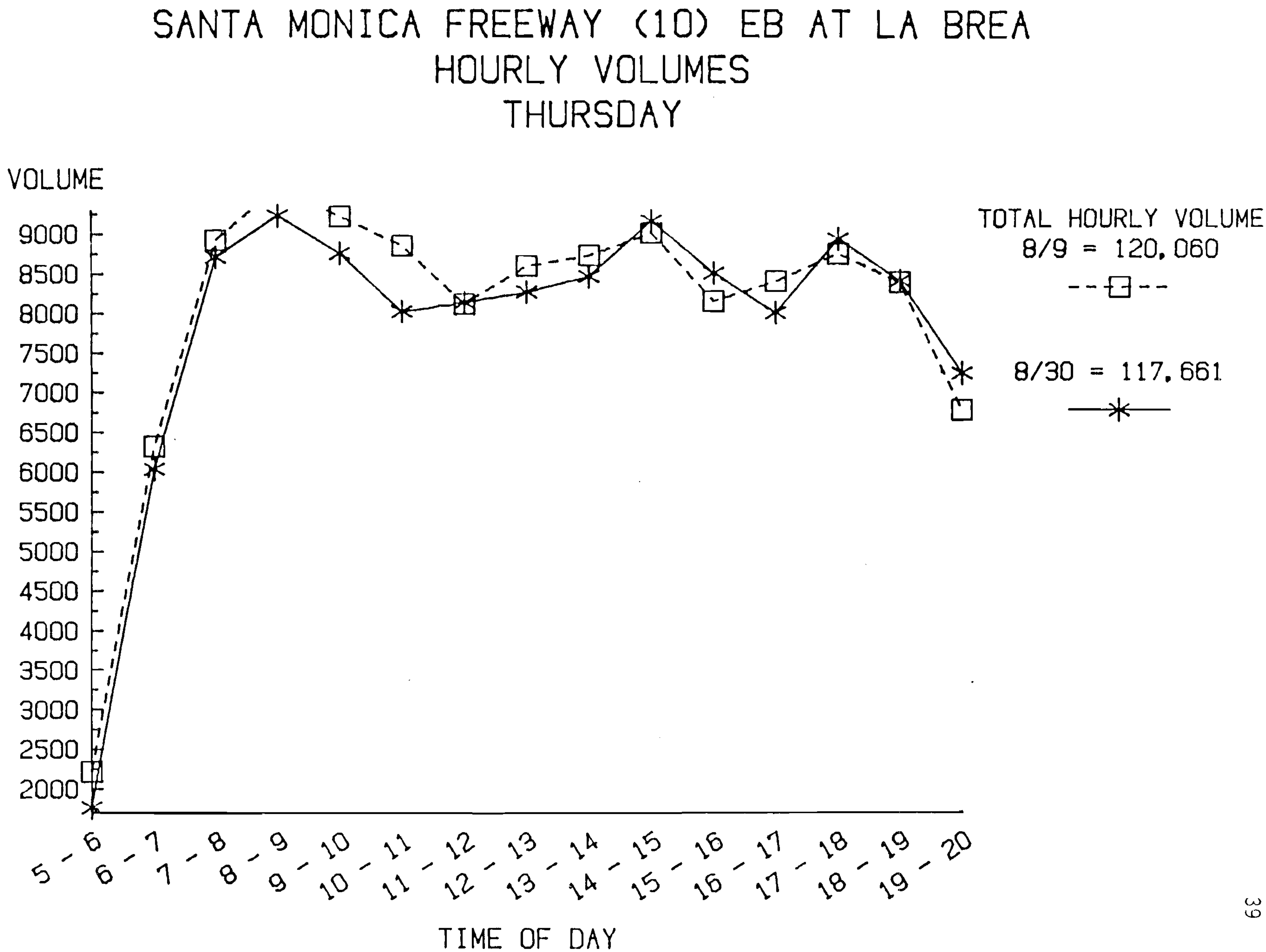
*Attendance at 9 westside and central Los Angeles area venues was 235,320 8/6, 93,730 8/7 and 196,480 8/9.


SANTA MONICA FREEWAY (10) EB AT LA BREA
HOURLY VOLUMES
THURSDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/9 = 120,060
8/30 = 117,661
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY
Figure 3.15

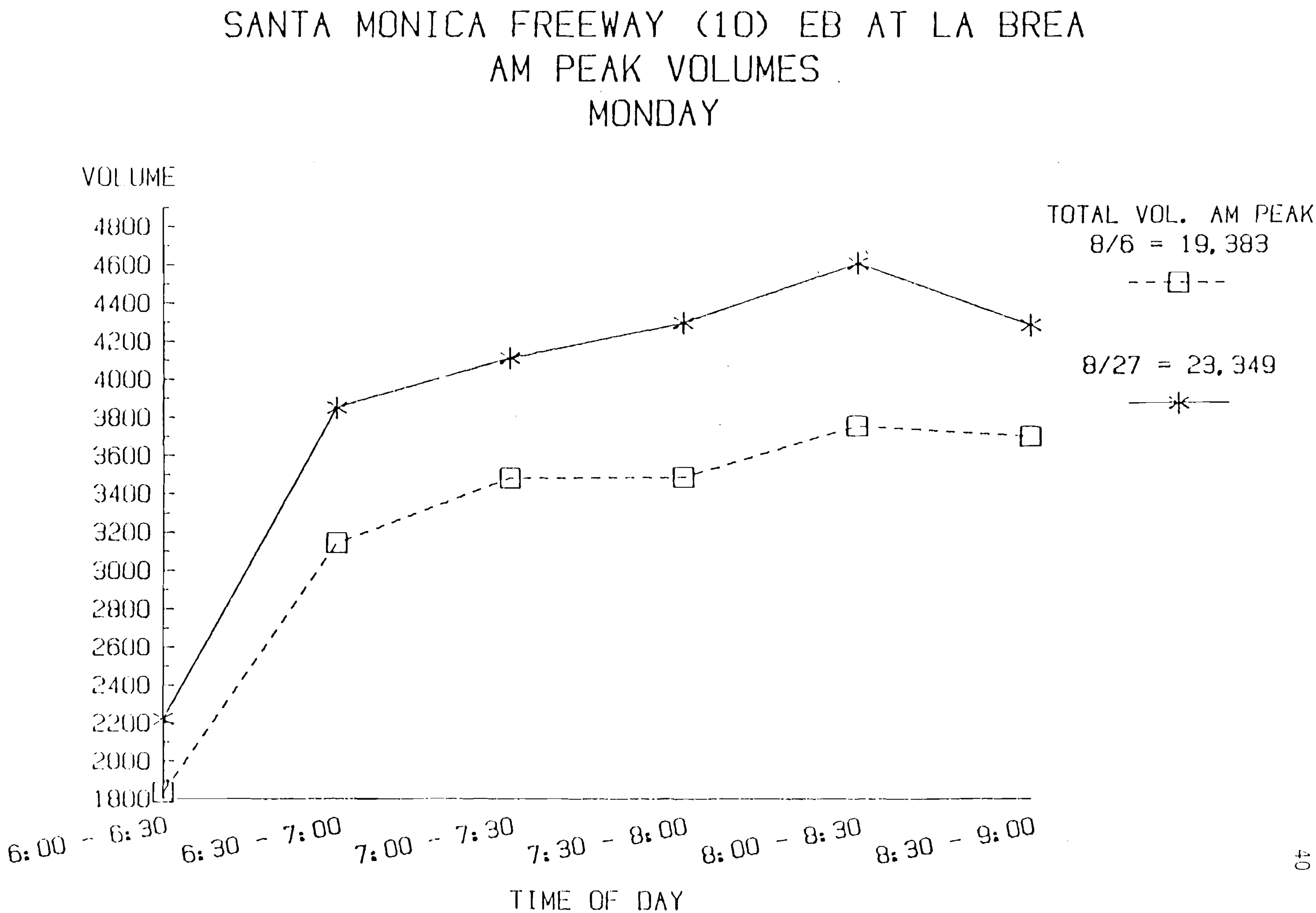

SANTA MONICA FREEWAY (10) EB AT LA BREA
AM PEAK VOLUMES
MONDAY
VOLUME
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
TOTAL VOL. AM PEAK
8/6 = 19,383
8/27 = 23,349
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY

Figure 3.16

SANTA MONICA FREEWAY (10) EB AT LA BREA
AM PEAK VOLUMES
TUESDAY

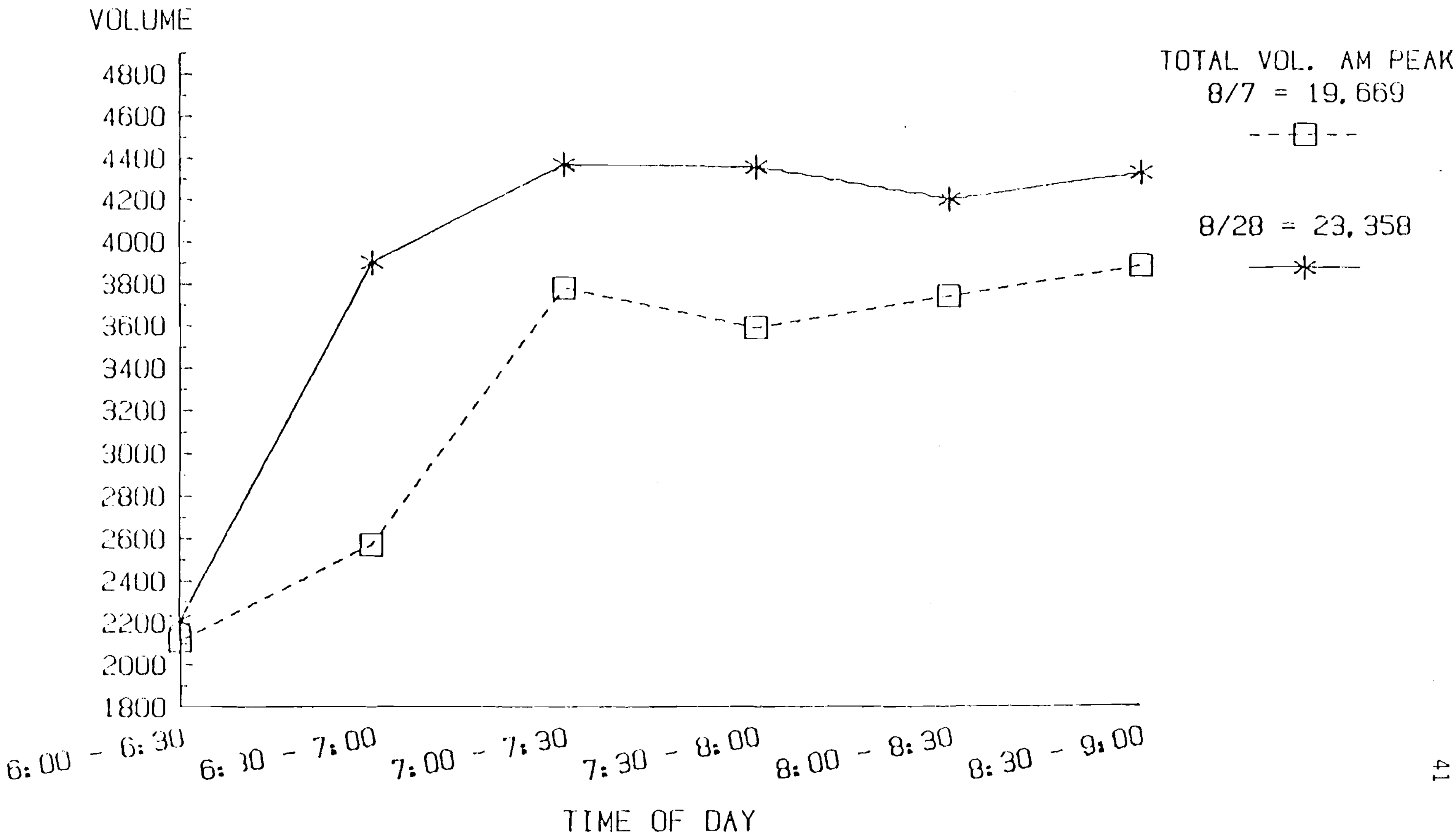


Figure 3.17

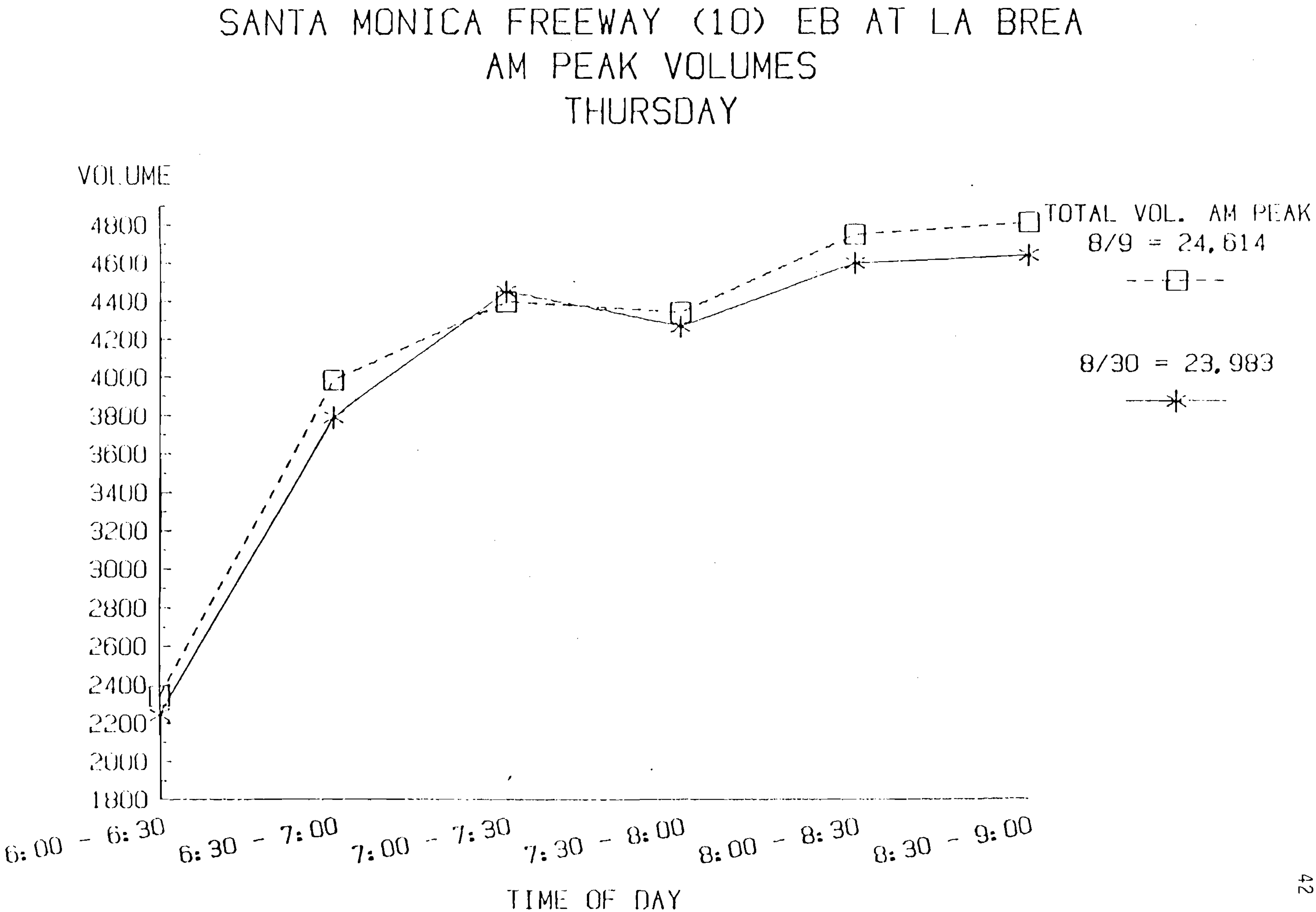

SANTA MONICA FREEWAY (10) EB AT LA BREA
AM PEAK VOLUMES
THURSDAY
VOLUME
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
TOTAL VOL. AM PEAK
8/9 = 24,614
8/30 = 23,983
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY

Figure 3.18

volumes were most likely due to reductions in the number of people going to work.

III.A.3.c. <u>Santa Monica Freeway at National</u>

The fourth screenline selected on the 42 mile loop is the Santa Monica Freeway (WB) just west of National Blvd. The freeway has four general purpose travel lanes in each direction; there are no auxiliary lanes. Review of the traffic volume data indicates that this portion of the freeway also operates at or near capacity all day, and that there is no discernable peak. The westbound direction is selected for analysis.

Figure 3.19 presents Olympics vs. non-Olympics 24 hour traffic volumes, and the corresponding numbers are given in Table 3.5. At this

Table 3.5

Daily 24 Hour Volumes for National Boulevard Screenline

	Monday 8/27	Tuesday 8/28	Wednesday 8/29	Thursday 8/30	Friday 6/30
Olympics	124,823	124,375	126,393	129,405	131,336
Non-Olympics	117,148	121,604	122,412	125,167	116,203
Difference	+6.6%	+2.3%	+3.3%	+3.4%	+13.0%

screenline traffic volumes were consistently higher during the Olympics, with the difference ranging from 2.3% to 13.0%. It should be noted, however, that the relatively low non-Olympics Friday traffic volume is unusual, and may have been due to a traffic incident, highway construction, or some other condition.

Figures 3.20 through 3.22 present hourly traffic volume graphs for Monday, Tuesday, and Thursday for the 5 AM to 8 PM period. Traffic

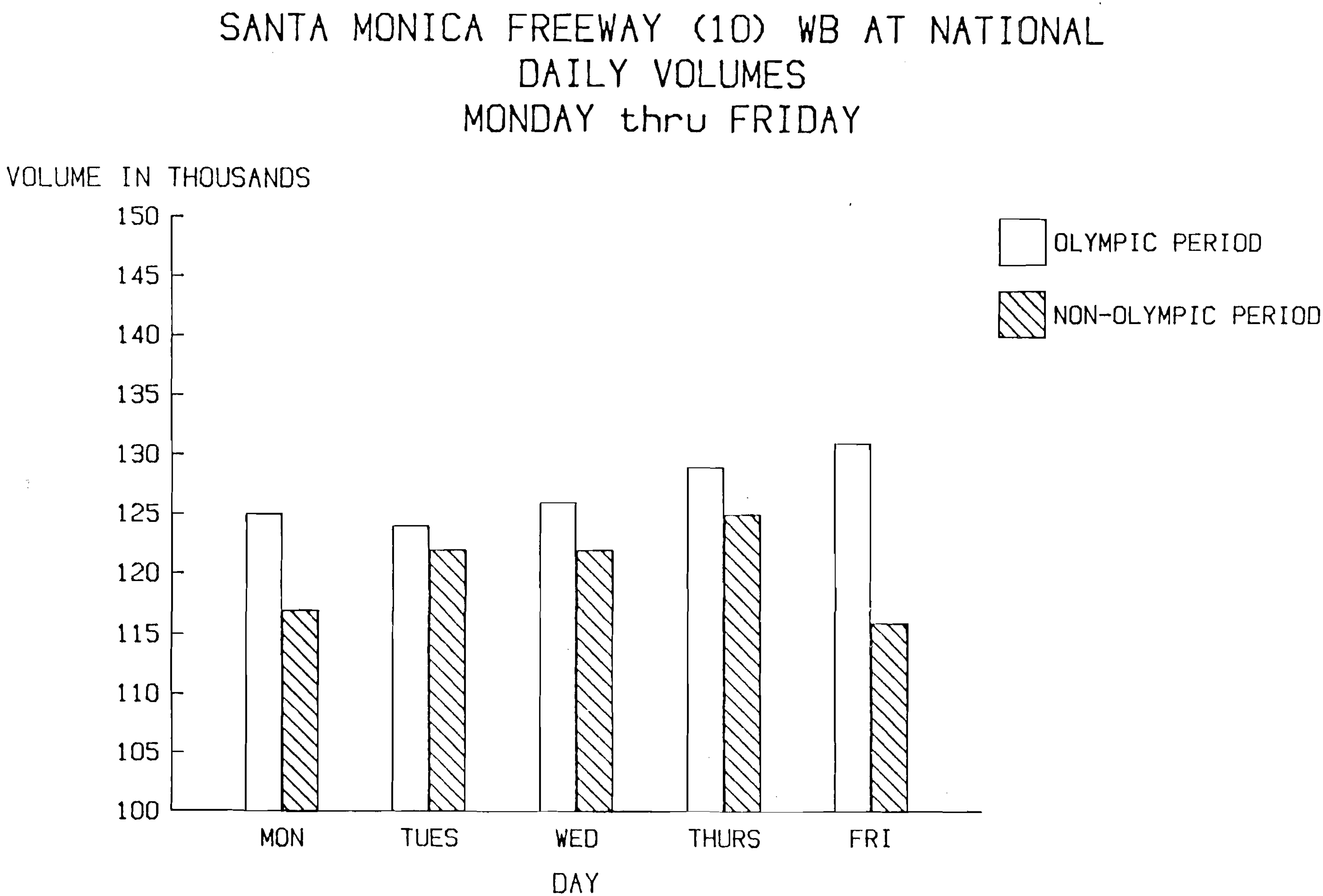


Figure 3.19

OLYMPIC PERIOD: AUGUST 6-10
NON-OLYMPIC PERIOD: AUGUST 27-30, JUNE 30

SANTA MONICA FREEWAY (10) WB AT NATIONAL
HOURLY VOLUMES
MONDAY

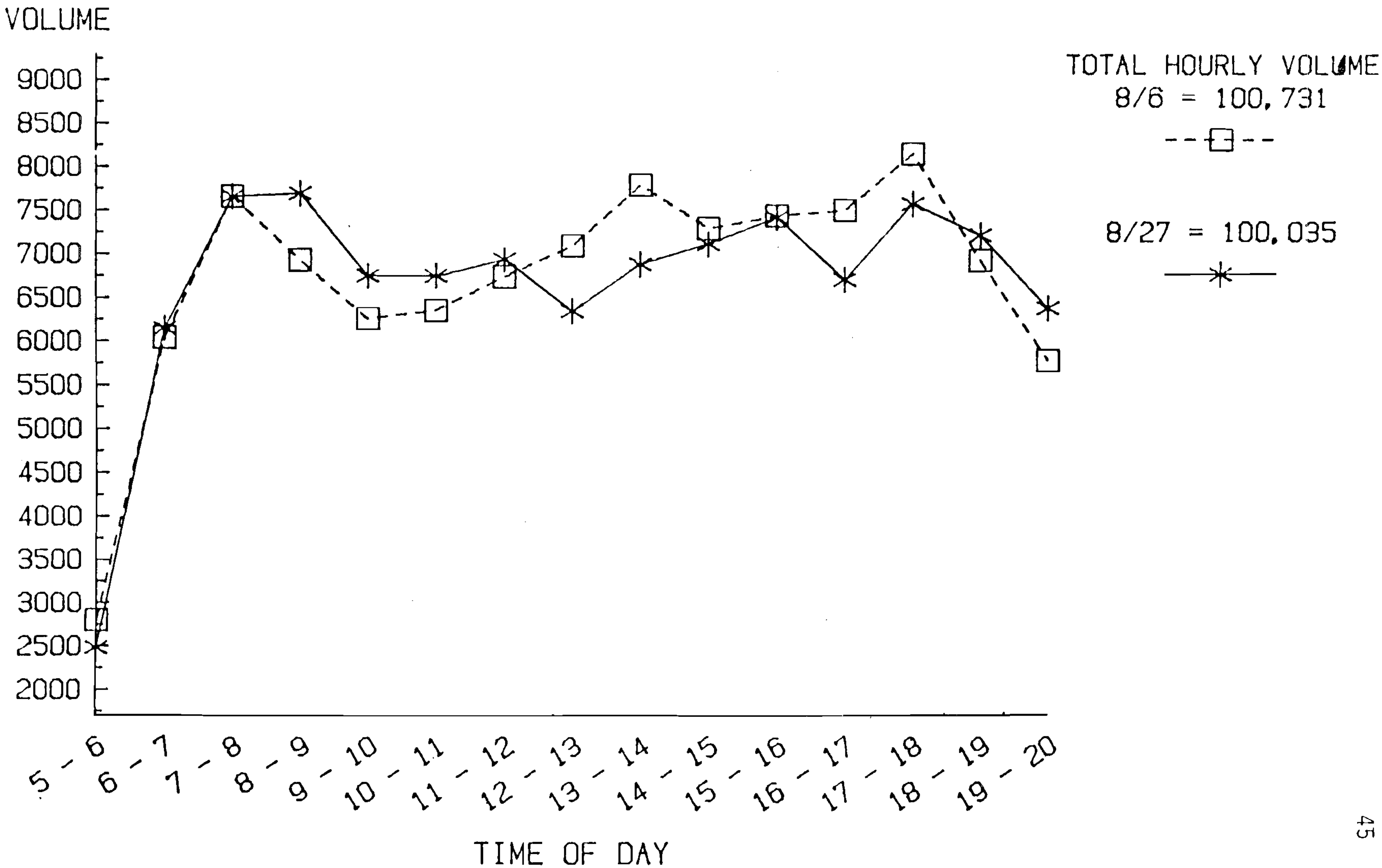


Figure 3.20

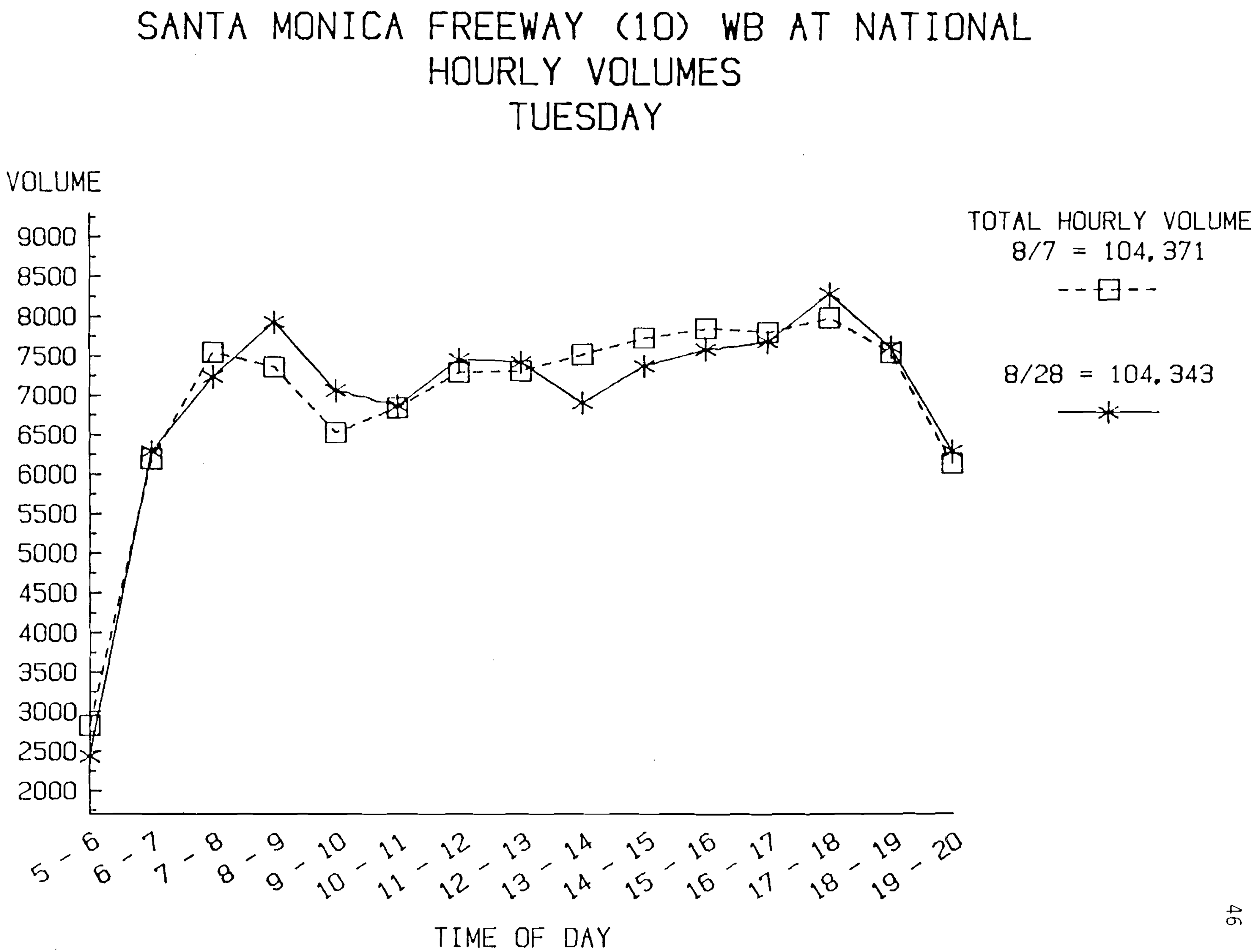

SANTA MONICA FREEWAY (10) WB AT NATIONAL
HOURLY VOLUMES
TUESDAY
VOLUME
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TOTAL HOURLY VOLUME
8/7 = 104,371
8/28 = 104,343
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY

Figure 3.21

SANTA MONICA FREEWAY (10) WB AT NATIONAL
HOURLY VOLUMES
THURSDAY

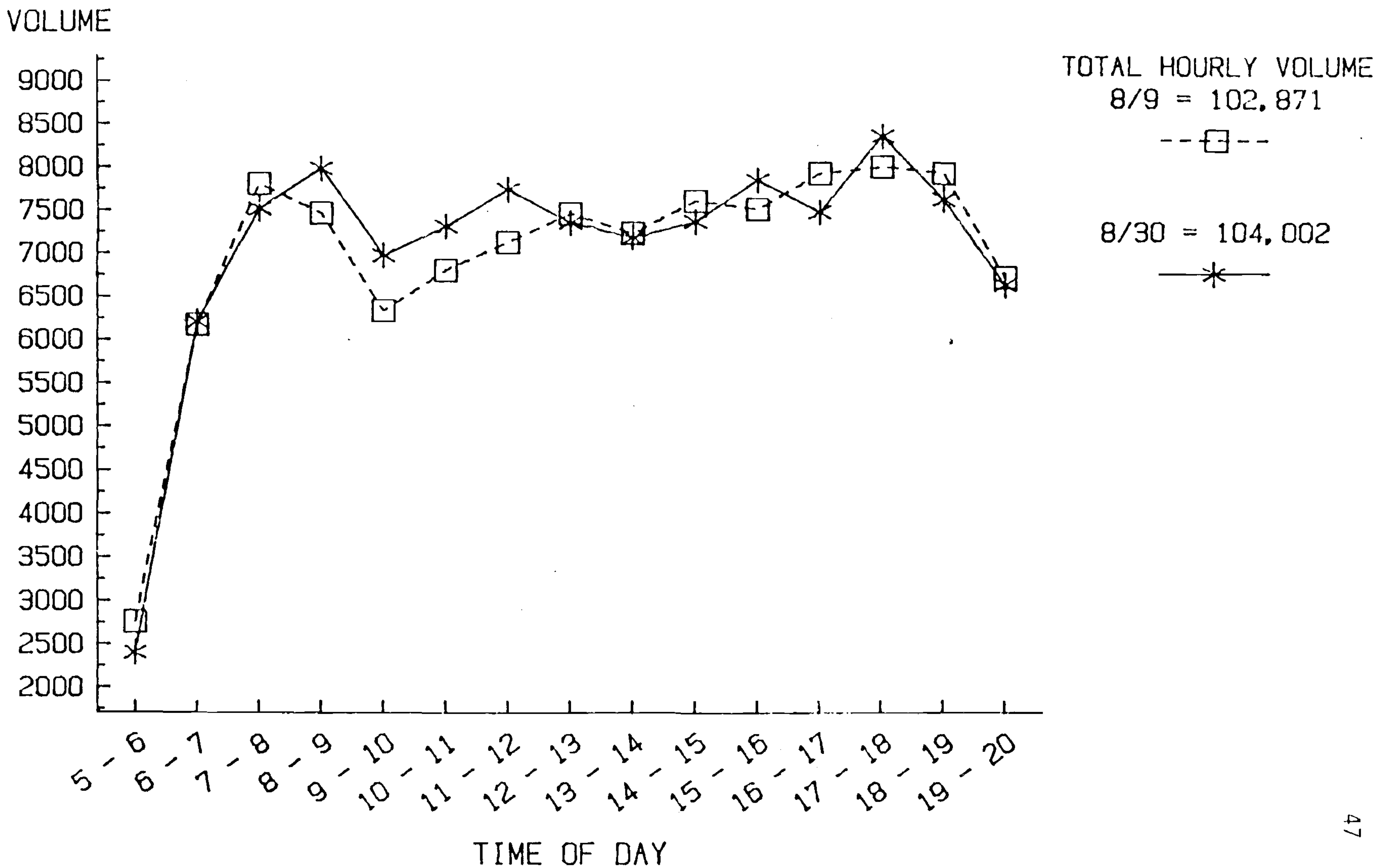


Figure 3.22

volumes for Olympics and non-Olympics are virtually identical for Monday and Tuesday, indicating that the Olympics 24 hour volume increase occurred in the late night or early morning hours. This phenomenon is even more apparent on Thursday, when 5 AM to 8 PM Olympics traffic was down by about 1%, while 24 hour traffic was up 3.4%. While this temporal shift does not seem unreasonable given the number of evening Olympics events and other activities, it is somewhat surprising that it is observed only at this screenline.

It is difficult to discern any consistent differences in the Olympics vs. non-Olympics daily pattern. Late morning Olympics traffic is somewhat lower, while early afternoon traffic is somewhat higher. The highest hourly volume occurs consistently at 5 to 6 PM, but volumes nearly as high occur at several different hours, and the pattern is different from day to day. Given the variability of traffic flow discussed earlier, we may conclude that there were no significant differences in traffic flow at this screenline during the Olympics.

The lack of any change in traffic patterns is further illustrated in figures 3.23 through 3.25 which graph half-hourly AM peak (6-9 AM) volumes. These figures clearly show no change in the AM peak pattern: traffic volumes do not build any earlier, and three hour volumes are very similar for each day. Based on the evidence of the two Santa Monica freeway screenlines, then, it would appear that peak patterns did <u>not</u> shift on this facility.

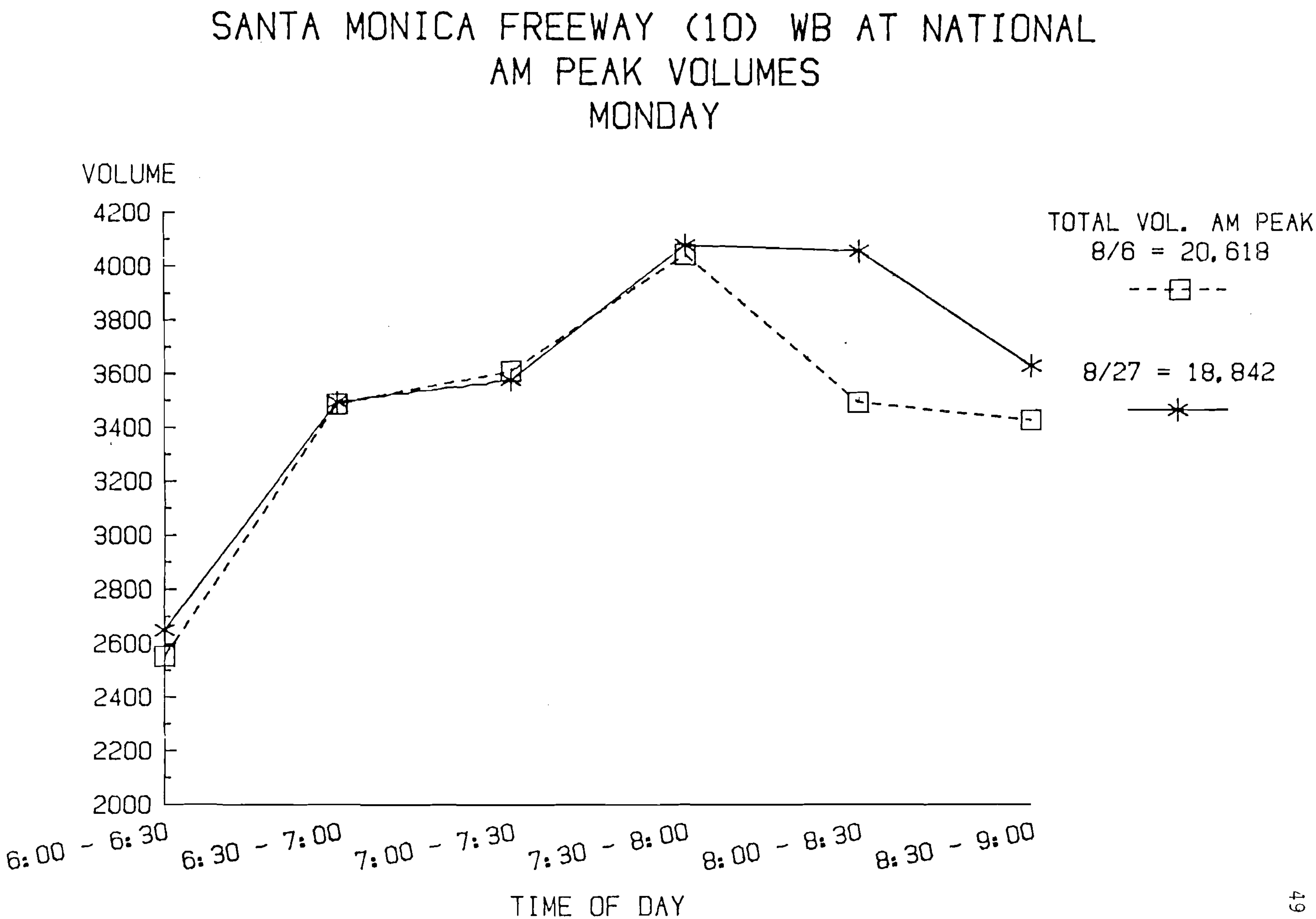

SANTA MONICA FREEWAY (10) WB AT NATIONAL
AM PEAK VOLUMES
MONDAY
VOLUME
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
TOTAL VOL. AM PEAK
8/6 = 20,618
8/27 = 18,842
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY

Figure 3.23

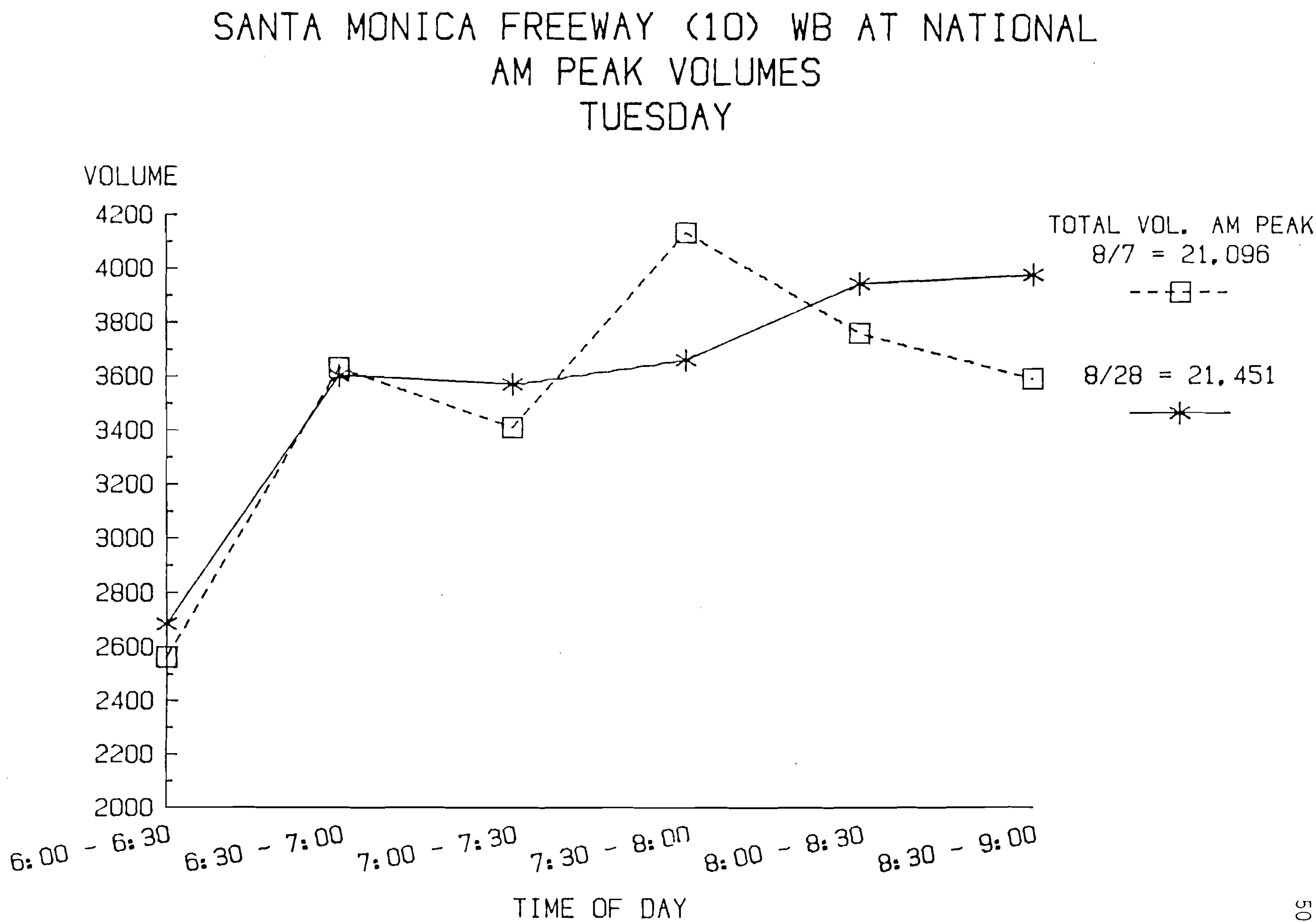

SANTA MONICA FREEWAY (10) WB AT NATIONAL
AM PEAK VOLUMES
TUESDAY
VOLUME
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
TOTAL VOL. AM PEAK
8/7 = 21,096
8/28 = 21,451
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY

Figure 3.24

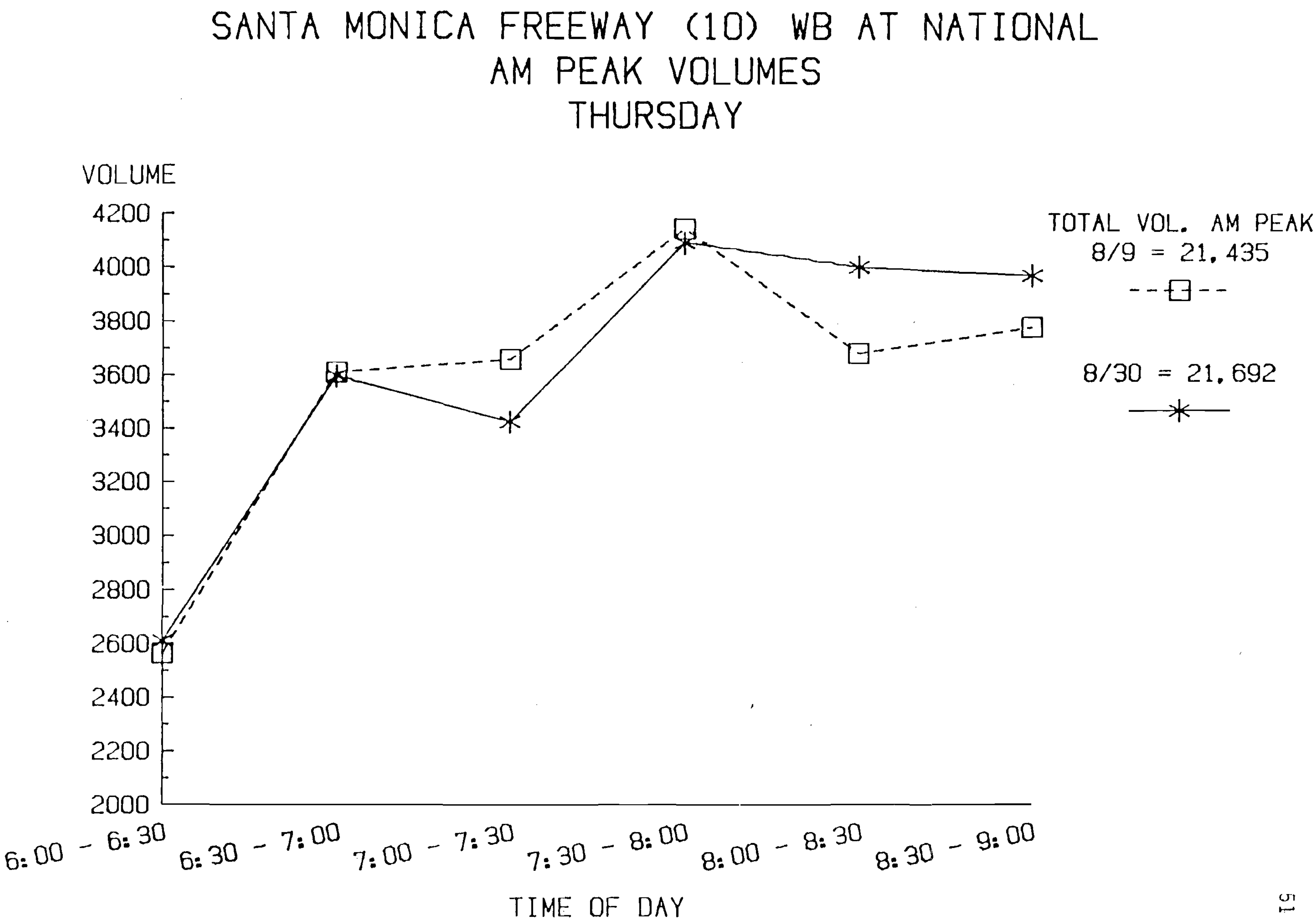

SANTA MONICA FREEWAY (10) WB AT NATIONAL
AM PEAK VOLUMES
THURSDAY
VOLUME
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
6:00 - 6:30
6:30 - 7:00
7:00 - 7:30
7:30 - 8:00
8:00 - 8:30
8:30 - 9:00
TIME OF DAY
TOTAL VOL. AM PEAK
8/9 = 21,435
8/30 = 21,692

Figure 3.25

III.A.3.d. Traffic Volumes and Congestion

The preliminary analysis performed by Caltrans indicated that traffic volume was up by 3% to 5% on the weekdays of the second Olympics week. Table 3.6 gives the Olympics and non-Olympics total traffic volumes for the four screenlines. In all cases where a measurable change occurred the Olympic totals are lower, and the difference ranges up to 5.7%.

Table 3.6

Combined Screenline Traffic Volumes by Day

	Monday	Tuesday	Wednesday	Thursday	Friday
Olympics	408,827	423,435	441,990	447,689	457,485
Non-Olympics	432,480	449,049	454,849	446,160	470,085
Difference	-5.5%	-5.7%	-2.8%	insig	-2.7%

Since these figures include only four screenlines, the results cannot be generalized to the entire system. It bears noting however that Caltrans used a summer 1983 baseline, while a 1984 baseline was used here. The 1984 pre-Olympics data in the Caltrans preliminary report (June 19 and 26; July 10 and 24) implies a traffic volume increase of about 8% over the 1983 baseline, and thus the numbers reported here are actually quite comparable.

Turning now to the issue of congestion, there was a widespread perception that congestion was much less severe during the Olympics. The Caltrans preliminary analysis concluded that congestion never reached normal levels, even when traffic volumes climbed towards the end of the Olympic period. Using speed as our indicator of congestion, Table 3.7 gives estimates of speeds less than 45 mph for Monday, Tuesday, and

Table 3.7

Estimated Speeds by Day and Screenline

	Monday		Tuesday		Thursday	
	< 45 mph	< 25 mph	< 45 mph	< 25 mph	< 45 mph	< 25 mph
I-110/El Segundo						
Olympics	.50		.50		.25	
Non-Olympics	0		0		.75	
Difference	large +		large +		-67%	
I-110/Century						
Olympics	2.25	1.25	1.25	.75	.75	0
Non-Olympics	3.50	3.25	3.00	2.25	2.25	1.25
Difference	-36%	-62%	-58%	-66%	-66%	large -
I-10/La Brea						
Olympics	5.75	4.75	5.25	4.50	5.50	4.50
Non-Olympics	4.25	N/A	6.50	6.25	3.25	3.00
Difference	+35%		-19%	-28%	+69%	+50%
I-10/National						
Olympics	.25		1.50		.75	
Non-Olympics	1.00		1.25		.75	
Difference	-75%		+20%		0	

Thursday at each of the four screenlines, Olympics and Non-Olympics. Estimates of speeds less than 25 mph, an indicator of heavy congestion, are given for the Century and La Brea screenlines.* Comparing first the two different speeds, the data indicate that movement is always in the same direction (e.g., differences are consistent), and the 25 mph measure tends to be associated with larger differences than the 45 mph measure. This implies that where congestion was down, heavy congestion was down by a larger proportion than moderate congestion. Where congestion was up, heavy congestion increased less than proportionately to moderate congestion.

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*The National and El Segundo screenlines had no occurrences of speeds less than 25 mph.

For the twelve observations in Table 3.7, the speed estimates show that congestion was lower in six cases, higher in five, and unchanged in one. The direction of change is consistent only for the I-110/Century screenline, where traffic volumes were significantly lower during the Olympics.

It may be noted that the duration of estimated speeds was measured over the entire day, rather than during the peak period. It may be argued that this is not correct, because congestion is really a peak period problem, and changes in traffic volumes and speeds which occur during the off-peak are not relevant. If a screenline operates well below capacity most of the day, then large changes in volume could occur with no change in peak traffic conditions. That is, the additional traffic could be accommodated in the non-peak periods, and have no effect on peak traffic or on non-peak level of service. As discussed earlier, however, traffic volumes tend to be fairly high throughout the day at these screenlines. Thus limiting the analysis to the traditional peak period would be arbitrary (how would the peak be identified?) and incomplete. In other words, the traffic volume profiles indicate that the peak extends through most of the day, and thus the entire day is the proper unit of analysis.

Table 3.8 compares changes in ADT with changes in the duration of < 45 mph speed for Monday Tuesday, and Thursday by screenline. The four possible combinations of changes are tabulated at the bottom of the Table. In four cases both volume and < 45 mph speed duration went up: in five cases both measures went down. Thus in 9 out of 12 cases, or 75% of the time, both volume and congestion (as measured by speed) moved

Table 3.8

Changes in Traffic Volume and < 45 mph speed, Olympics vs. Non-Olympics

	Monday	Tuesday	Thursday
I-110/El Segundo			
ADT	+13.6%	+3.3%	+4.5%
Speed	large +	large +	-67.0%
I-110/Century			
ADT	-19.6%	-26.0%	-10.5%
Speed	-36.0%	-58.0%	-66.0%
I-10/La Brea			
ADT	-16.4%	-2.6%	+2.1%
Speed	+35.0%	-19.0%	+69.0%
I-10/National			
ADT	+6.6%	+2.3%	+3.4%
Speed	-75.0%	+20.0%	0

		< 45 mph speed: up	< 45 mph speed: down
volume	up	4	2
volume	down	1	5

together. Volume and congestion would move in opposite directions only when the highway is over capacity (e.g., on the lower half of the speed/volume curve). Thus the results in Table 3.8 are not surprising. We would expect that most of the freeway system operates <u>near</u> but not at or beyond capacity. Further, the results imply that reductions in congestion during the Olympics were largely due to reductions in traffic volumes, rather than shifts in volume patterns. This observation is also supported by the hourly volume graphs discussed earlier.

III.A.3.e. Conclusions on Traffic Volumes and Congestion

This screenline analysis indicates that there was a great deal of variation in traffic volumes and patterns not only from day to day but also between different areas. The Harbor freeway screenlines showed much greater change than the Santa Monica freeway screenlines, implying that response to the Olympics was highly localized. Data from the MODCOMP system also supports this idea. Figue 3.26 gives 8 hour volumes (12 PM to 8 PM) for rte 101 (NB) at Rampart on selected Olympics and non-Olympics weekdays. Figure 3.27 gives Thursday hourly volumes for the same screenline. Figures 3.28 and 3.29 give similar data for rte 91 (WB) at Wilmington. Traffic volumes tend to be quite consistent for Olympics vs. non-Olympics, even for the first Olympic week Wednesday (Aug. 1). Hourly volumes also do not reveal any consistent pattern. It should be noted that on the rte 101 screenline the northbound direction is the PM peak direction. Figure 3.27 shows that on the Olympics Thursday AM peak traffic is lighter and PM peak traffic is heavier. Again, this seems to imply that work-related travel was down somewhat, while total travel was slightly higher.

According to the screenline data, then, it appears that very little change in traffic volumes (and therefore congestion) occurred outside the downtown Los Angeles/Coliseum area. It is not surprising that the most visible changes occurred on the Harbor Freeway. Public attention was focussed on the Downtown/Coliseum area, and the Figueroa/Flower one-way streets provided an alternate route through the area. In contrast, the Santa Monica freeway serves both downtown and the Westside, as well as

HOLLYWOOD FREEWAY (101) NB AT RAMPART
PM VOLUME (12:00 - 8:00)

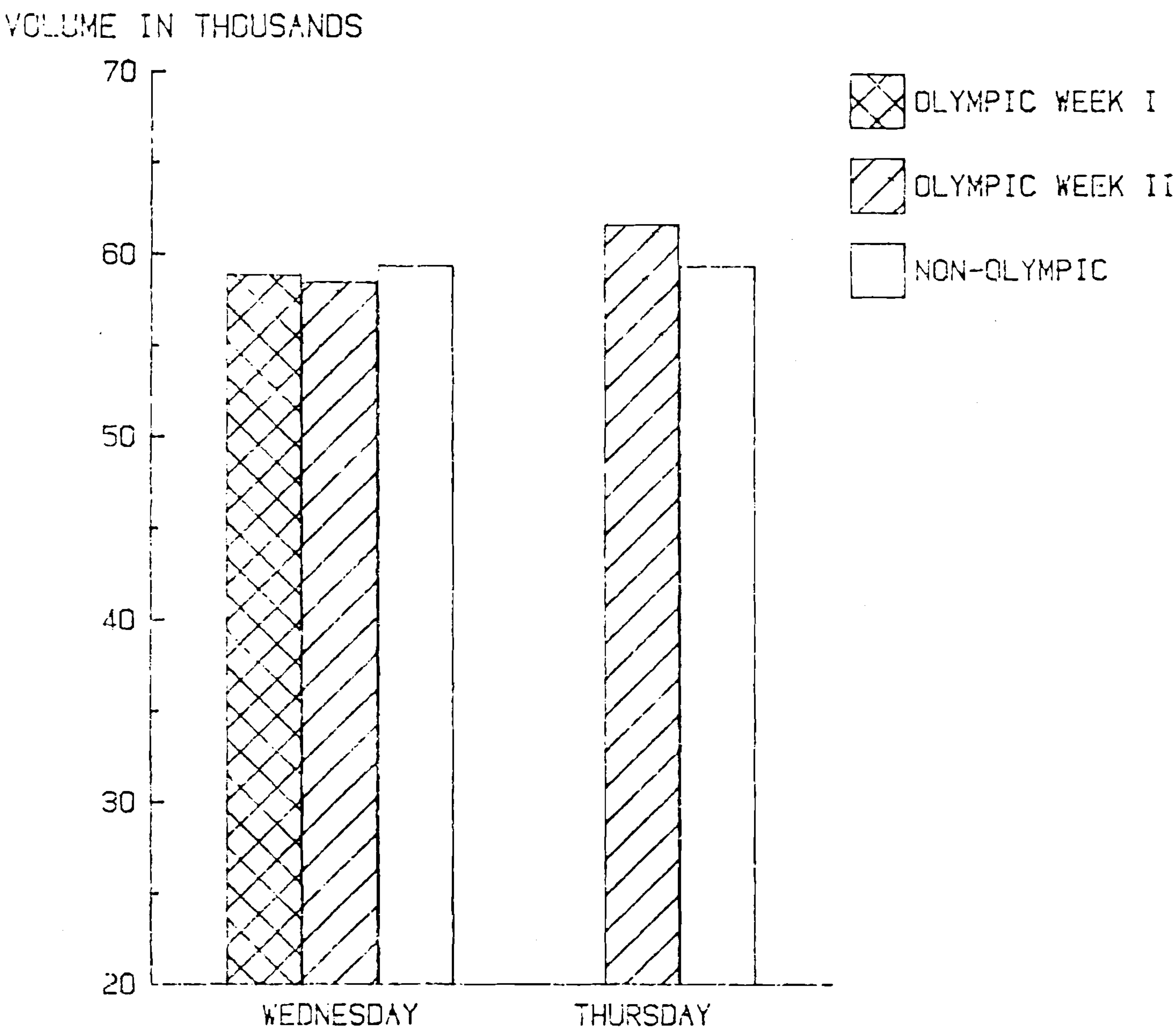
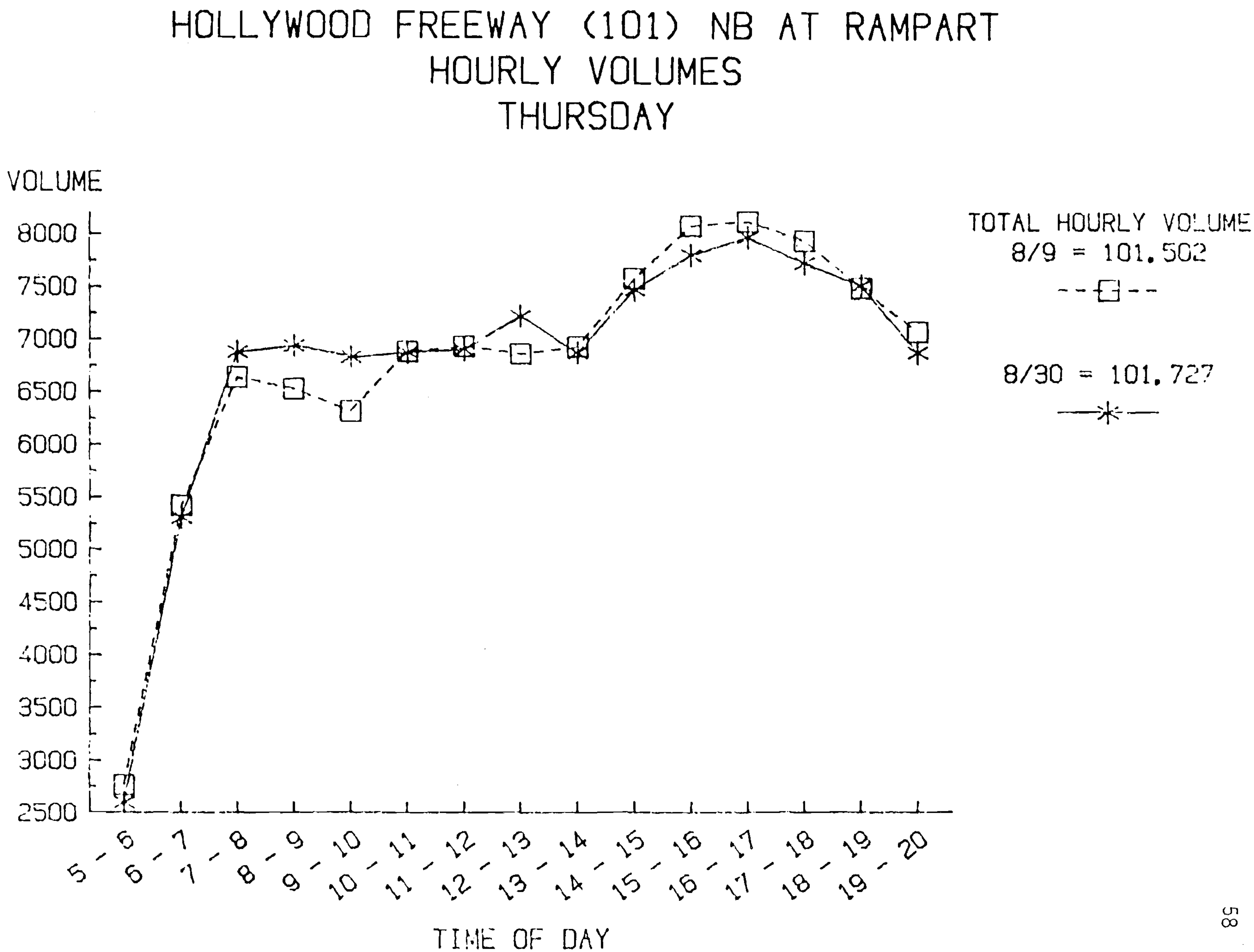


Figure 3.26

WEDNESDAYS = 8/1, 8/8, 8/29
THURSDAYS = 8/9, 8/30


HOLLYWOOD FREEWAY (101) NB AT RAMPART
HOURLY VOLUMES
THURSDAY
VOLUME
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
TIME OF DAY
TOTAL HOURLY VOLUME
8/9 = 101,502
8/30 = 101,727
Figure 3.27

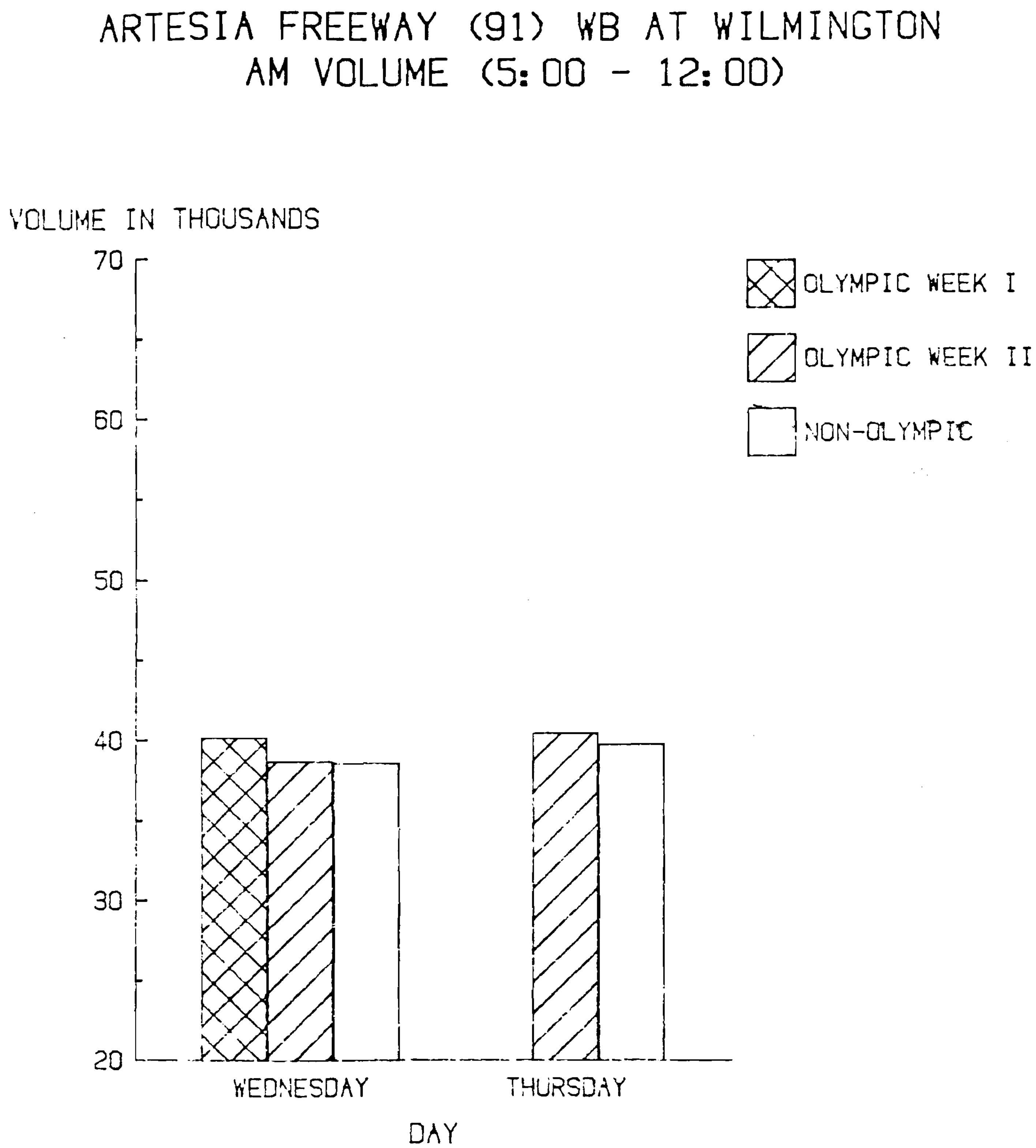


Figure 3.28

WEDNESDAYS = 8/1, 8/8, 8/29
THURSDAYS = 8/9, 8/30

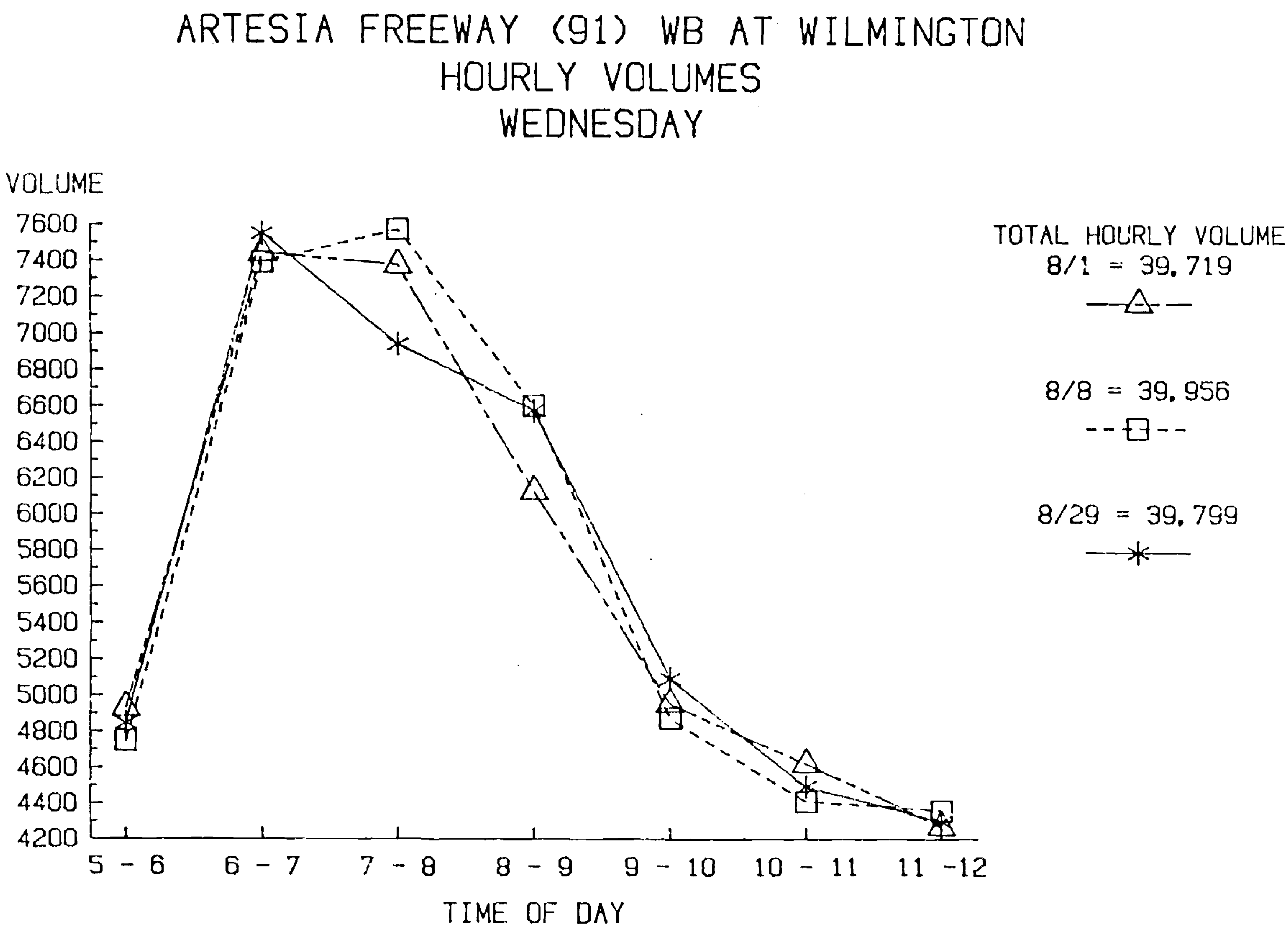

ARTESIA FREEWAY (91) WB AT WILMINGTON
HOURLY VOLUMES
WEDNESDAY
VOLUME
7600
7400
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 -12
TIME OF DAY
TOTAL HOURLY VOLUME
8/1 = 39,719
8/8 = 39,956
8/29 = 39,799

Figure 3.29

the Wilshire corridor commercial area. A much larger set of destinations and activities is served by the Santa Monica Freeway. In addition, the Santa Monica Freeway is clearly operating near capacity most of the day. Consequently, we would not expect much change in traffic volumes during the Olympics. The changes in Table 3.7 for the two I-10 screenlines are therefore not surprising; the large and inconsistent changes in < 45 mph speed duration are an indication that the freeway is operating at a highly unstable level.

The limited data available on the Hollywood Freeway (SR 101) shows similar results. The Hollywood freeway was not expected to be heavily impacted by the Olympics, and, like the Santa Monica Freeway, it serves a high density corridor. Thus, the absence of significant change is to be expected. Finally, the Wilmington area is clearly beyond the Olympics venue area of impact, and once travelers discovered that traffic was no different than normal, there was no incentive for making any changes in travel behavior.

The screenline data also has shown that changes in congestion were linked with changes in traffic volumes: when traffic was down, congestion was down, and when traffic was up, congestion was up. No conclusions can be drawn regarding total system congestion on the basis of screenline data, however, because there was no way to properly measure it.

III.B. Truck Traffic

Section I above described the Operation Breezeway program which was aimed at reducing truck traffic during peak periods on both the freeway system and local streets. In order to facilitate truck deliveries during off-peak periods, the City of Los Angeles temporarily withdrew restrictions on night deliveries, and the Teamsters Union agreed to accept regular wage rates for night work. In addition, special legislation was passed to permit certain commodities to be delivered at night. A public information campaign was utilized to persuade the intercity trucking industry to adjust routes and activities to avoid the most congested freeway periods and locations. This section discussses truck traffic on the freeway system during the Olympics.

III.B.1. Influence of Trucks on Traffic Flows

Trucks and other large vehicles have an adverse effect on highway capacity because of their size and operating characteristics. In terms of size, one truck is roughly equivalent to two passenger cars; thus each truck takes up as much road space as two cars. In free flowing traffic on level highway, the impact of trucks is limited to the extra space they consume. Truck operating characteristics become a factor on grades and at merge points. Truck acceleration and deceleration is much inferior to that of automobiles; thus as trucks enter and leave the freeway they impose delay on other vehicles. Under congested conditions, trucks probably have more impact because of their limited maneuverability. As the proportion of truck traffic on a roadway increases, driver behavior also becomes a factor. Faster vehicles tend to completely avoid the right-most lane, disproportionately loading the remaining lanes. The purpose of Operation Breezeway was to minimize truck traffic in highly congested areas. Caltrans reasoned that removal of truck traffic would marginally increase capacity, thereby improving traffic flow.

There is very little information available on truck traffic in the Los Angeles area (or in the U.S.). Such information is difficult and time consuming to obtain. The automated vehicle counting system cannot distinguish between different types of vehicles; thus the only way to gather truck data is by visual counts. In order to evaluate the effect of Operation Breezeway, it was therefore necessary to conduct visual counts during and after the Olympics. In order to do this as efficiently as possible, it was decided to incorporate the truck count with vehicle occupancy counts already scheduled for selected screenlines. The screenlines included I-110 northbound at 42nd St., I-10 eastbound at 6th Ave. (near Arlington); SR-91 westbound at Lakewood Blvd., and I-5 southbound at Griffith Park. Due to the short start-up time available prior to the Olympics, the non-Olympics comparison data was collected after the Olympics. Comparable weekdays could not be chosen because of manpower scheduling constraints. Thus the non-Olympics baseline data is not as comparable as the traffic volume data utilized in the previous section.

The truck count data collected with the vehicle occupancy counts are for two hours of the AM peak, from 6:30 to 8:30. In order to obtain daily truck traffic information, CCTV was utilized to videotape daily traffic at I-10 just east of the I-110/I-10 interchange. The videotapes were taken on 8/6 (Monday) and 8/30 (Thursday). Visibility allowed a count from 7:30 AM to 7:30 PM.

In all cases, the total number of trucks was counted, but there are some minor differences between the visual counts and the videotape data. The visual counts include all trucks of three or more axles. The count is conducted in 5 minute segments with 1 minute rests. The total count is then factored up to account for the rest periods. The videotape enabled a constant count (since the tape could be stopped). Due to visibility problems, however, it was not possible to make the three axle distinction, and all trucks were counted.

Table 3.9 presents the results of the visual screenline counts. In three out of four cases, truck volume was lower during the Olympics. The

Table 3.9

Truck Traffic at Selected Screenlines for Two Hour AM Peak

Truck Count	I-110/42nd St.	I-10/6th Ave.	91/Lakewood*	I-5/Griffith Park*
Olympics	188	239	712	720
Non-Olympics	258	174	734	757
Difference	-27%	+37%	-3%	-5%
Trucks as % of Total Traffic				
Olympics	1.5%	1.2%	5.3%	5.0%
Non-Olympics	1.8%	.9%	5.5%	4.6%

*same day of the week comparisons

most comparable counts are probably SR-91 and I-5, since they were taken on the same day of the week. The I-110 count is not too surprising, given the reduction in overall traffic observed near the Coliseum during the Olympics. The I-10 count is probably the least reliable, since it compares an Olympics Monday with a non-Olympics Thursday.

The second part of Table 3.9 gives trucks as a percent of traffic volume. This enables us to look at whether the difference in truck traffic was associated with a general drop in traffic. On I-110 and SR-91, truck traffic dropped more than proportionately, while on I-5 the drop was less than proportional. It is doubtful, however, that any of these changes are statistically significant. It may be noted that I-5 and SR-91 carry a much larger proportion of trucks than I-110 and I-10. On the whole, Table 3.9 indicates that a slight drop in AM peak, inbound truck traffic occurred during the Olympics.

The videotape truck count data is given in Table 3.10. At this screenline, the AM peak is in the westbound direction, and the PM peak is in the eastbound direction. Several interesting changes are evident in this Table. First, total truck traffic in both directions was reduced

Table 3.10

Truck Traffic on I-10 east of I-110
by Day, Direction, and Time Period

Eastbound

Time	Olympics	Non-Olympics	Difference
0730-0900	457	441	+3.6%
0900-1500	2527	2860	-11.6%
1500-1800	435	857	-49.2%
1800-1930	268	190	+41.0%
0730-1930	3687	4348	-15%

Westbound

Time	Olympics	Non-Olympics	Difference
0730-0900	623	693	-10%
0900-1500	2395	2891	-17%
1500-1800	629	511	+23%
1800-1930	194	98	+98%
0730-1930	3841	4193	-8.4%

during the Olympics. Second, truck traffic was down quite significantly in the peak directions: 49% eastbound in the afternoon and 10% westbound in the morning. It is somewhat surprising that there is such a large difference in these numbers. It is possible that arrival times are more uncertain than departure times, and thus the level of inbound traffic was less likely to change. Third, there was a significant increase in evening truck traffic in both directions, implying that truck activity was deferred to evening hours as advocated by the Operation Breezeway program. Finally, it may be noted that the temporal shifts in truck traffic are of much larger magnitude than the reduction in total truck traffic. Because this comparison is between a Monday and a Thursday, the extent to which truck traffic actually declined from a typical Monday is uncertain. If this screenline is representative, it can be concluded that Operation Breezeway was quite successful. The trucking industry made significant changes in travel patterns, and did indeed avoid peak period congestion areas.

No conclusions regarding the overall level of truck traffic during the Olympics can be drawn from this information because of its limited scope. The California Highway Patrol conducts truck counts at each of its weigh stations. Of the four weigh station in the Los Angeles Area, two showed an increase and two showed a decrease in truck counts for the month of August, 1984. The CHP comparison was based on a 9-month average as the baseline. While the increases were larger in magnitude than the decreases, it is not possible to conclude that there was an actual increase in truck traffic during the Olympics. Since the baseline is a 9-month (January through September) average, seasonality is not taken into account. Also, the weigh-station locations do not form a cordon around the region, and thus changes at specific locations may be due to changes in route choice rather than actual changes in volumes. Finally, the counts are monthly, and thus do not separate out the Olympic period. The evidence we have available seems to indicate that notable adjustments were made in the Los Angeles central area, where the worst traffic problems had been expected. At the regional level, however, it is likely that very little change occurred.

III.C. Vehicle Occupancy

A major public information effort was aimed at encouraging commuters to carpool or take transit during the Olympics in order to reduce anticipated congestion problems. Ridesharing has historically been considered a primary means of increasing the (person-trip) capacity of the transportation system in congested areas. Recent research indicates that the rate of ridesharing is quite significant in central city areas. Commuter computer estimates that about 40% of Los Angeles downtown commuters engage in some form of ridesharing: carpools, vanpools, or public transit. The Olympics survey of 4 downtown employers indicated that 25% of those surveyed carpool or vanpool and 16% use some form of bus transit as their regular means of travel to work. Thus a rather high rate of ridesharing already exists in the central Los Angeles area.

In order to determine whether there was any significant change in carpooling and vanpooling during the Olympics, Caltrans conducted a series of vehicle occupancy counts. Caltrans has an ongoing program of monitoring vehicle occupancy, and consequently has established a well-defined procedure for doing so. Regular counts at selected screenlines in Los Angeles and Orange County have been conducted since 1979. Therefore, baseline data is extremely good. Under normal conditions, the vehicle occupancy rate (on general purpose travel lanes) in Los Angeles County averages 1.21 for August, and ranges from 1.15 to 1.24. According to Caltrans research, the occupancy rate has been quite stable over the past two years.

Four screenlines surrounding the central Los Angeles area were selected for analysis. It was reasoned that in view of the congestion problems anticipated in the central area, there would be a lot of incentive for increased ridesharing during the Olympics. The screenlines are I-5 at Giffith Park Blvd.; I-10 at 6th Ave. (near Arlington); I-110 at 42nd St., and SR-91 at Lakewood Blvd. The Griffith Park screenline has been identified by Caltrans as the most representative for Los Angeles County. The 6th Ave. and 42nd St. screenlines typically have lowest and highest occupancy rates respectively, and also are located in the vicinity of the Coliseum area. The Lakewood screenline is furthest away from the central L.A. area.

Occupancy counts are conducted in the inbound direction during the AM peak from 6:30 to 8:30 AM. This count tends to capture the "peak of the peak." Counts do not begin before 6:30 because of visibility problems, and the 8:30 cut-off time is chosen because the proportion of work trip traffic drops considerably after 8:30. During the Olympics, however, some counts were continued until 9:00.

Table 3.11 gives Olympics and non-Olympics occupancy counts for the four screenlines. Two non-Olympics baselines are presented: August 1983 and September 1984. Day of the week is also presented.

Table 3.11

Vehicle Occupancy Counts, Olympics vs. Non-Olympics, Two Hour AM Peak

	I-5/Griffith Park	I-10/6th Ave.	I-110/42nd St.	SR-91/Lakewood
August 1983	1.17	1.15	1.24	1.20
September 1984	1.17 (Wed)	1.13 (Thurs)	1.25 (Tues)	1.13 (Tues)
Olympics	1.19 (Wed)	1.29 (Mon)	1.27 (Mon)	1.19 (Tues)

Vehicle occupancy during the Olympics is higher in all cases than the September 1984 baseline. At Lakewood Blvd., however, the Olympics count is not as high as the August 1983 baseline. Caltrans previous research indicates that August vehicle occupancy is always higher because of the influence of auto vacation travel. Thus the August baseline is probably more appropriate. Compared to August 1983, we observe an increase in vehicle occupancy at the three "in town" screenlines.

At first glance, it would seem that commuters did indeed do more ridesharing during the Olympics. However, when we look at the pattern of occupancy during the peak, it becomes clear that the observed increase was due largely to Olympics-oriented traffic. Table 3.12 gives half-hourly vehicle occupancy for three screenlines. In each case there is a trend toward higher occupancies towards the end of the peak. The difference is most pronounced at the I-10/6th Ave. screenline. The I-10 tends to have a lower than average occupancy rate, making the Olympics spectator traffic influence more obvious. The counts for 6th Ave. and 42nd St. were taken on Monday, August 6. Coliseum activities began at 9:30 AM, and their effect seems quite clear. It may be noted that the

Table 3.12

Vehicle Occupancy by Time Period,
Olympics vs. Non-Olympics

	I-5/Griffith Park		I-10/6th Ave.		I-110/42nd St.	
	Olympics	Non-Olympics	Olympics	Non-Olympics	Olympics	Non-Olympics
630-700	1.20	1.21	1.18	1.14	1.22	1.41
700-730	1.18	1.17	1.16	1.10	1.28	1.21
730-800	1.21	1.13	1.24	1.15	1.23	1.21
800-830	1.25	1.17	1.34	1.10	1.32	1.20
830-900	N/A	N/A	1.40	N/A	1.40	N/A

6th Ave. screenline was located upstream from the signed spectator route, while the 42nd St. screenline was downstream from the route. It was anticipated that spectator traffic would therefore not be a factor at 42nd St., but the numbers indicate that this was not the case. It should also be noted that Aug. 6 was a particularly light work day, and thus the proportion of work-trip travel was probably lower than normal.

On the basis of the screenline occupancy counts, then, it appears that there was little change in the level of ridesharing during the Olympics. The employee survey results also support this conclusion. It is interesting to speculate on the reasons why so little change occurred. In the downtown area particularly, many different strategies were proposed to cope with anticipated traffic volumes. These included the 4-day work week, recognition of Admission Day on Aug. 6, flexible work hours, etc. For a short period of time, these other options may have been easier to implement.

III.D. Traffic Incidents

Traffic incidents are a major source of congestion and delay on the state highway system. When an incident occurs, delay is associated both with the duration of the incident itself as well as the time it takes for traffic flow to recover to normal levels. Caltrans estimates, for example, that 4 minutes of delay are generated by each minute of an incident. The impact of traffic incidents depends on their duration and the traffic conditions in which they happen. A minor incident, say a flat tire, at 3:00 AM will have little or no effect on traffic flow, while at rush hour it would have a significant adverse effect. A major incident, say a hazardous materials spill, can result in freeway closure and cause substantial delay at any time of the day or night. Incidents span the whole range between these two examples, and it is difficult to generalize about the impact of any given type of incident. Caltrans does define a special category of incidents as major incidents. These are incidents which affect two or more lanes of traffic for two or more hours. Obviously, an incident which affects 3 or 4 lanes of traffic for 1 1/2 hours will also have a major impact. The definition is thus used more as a rule of thumb in determining response to an incident, rather than on any particular characteristic of the incident itself.

The possibility of the occurrence of major incidents creating significant impacts on Olympics traffic was a great concern for CALTRANS. Anticipating much higher levels of congestion in many areas, it was evident that a major incident could bring traffic to a halt. Even relatively minor incidents could substantially affect system capacity if they occurred at the wrong place or the wrong time. Caltrans therefore made a special effort to be prepared for all incidents. These efforts included the monitoring activities described earlier in Section I.

The actual record of incidents during the Olympics is quite interesting. For the month spanning the Olympics (7-25-84 to 8-25-84) there were 33 major incidents, 20 of which involved trucks, within the District 7 area. For a comparable period in 1983 (7-27-83 to 8-27-83), there were 25 major incidents, 19 of which involved trucks. For the two week period of the Olympics, there were 10 major incidents (5 involving trucks) compared to 6 (4 involving trucks) for the same period in 1983.* Thus there were more major incidents during the Olympics.

Table 3.13 provides information on each of the incidents. As can be seen, only two of the incidents occurred at times and in locations which could have impacted Olympic traffic. The August 7, 0640 incident was a multi-vehicle accident involving a semi-truck on the southbound I-110 near Exposition Blvd. Fortunately, August 7 was a non-Coliseum day, and the accident occurred in the non-peak direction. In addition, southbound spectator traffic headed for swimming and diving events were directed off the freeway prior to the I-110/I-10 interchange. The incident at 1455 on Aug. 12 was the famous helicopter crash which occurred on the southbound I-110 just prior to closing ceremonies. The rapid response and clearing of this incident was credited for averting a major traffic tie-up. It may be concluded that while more major incidents occurred during the Olympics, they occurred mostly at non-critical times and locations. When

*This information is based on MITMT and TOC data only, and may not be complete. It is a complete list of all major incidents which involved CALTRANS participation.

Table 3.13

Major Incidents during the Olympics

Date	Time	Location	Cleared	Duration	Olympic Conflict
TRUCK					
7/30	1117	7 south 405	1236	1.5 hrs.	None
7/31	1100	405 fwy/Vly.Vsta	1435	3.5 hrs.	None
8/2	1026	5 fwy, S of 2	1058	.5 hrs.	None
8/5	1257	405/7	1630	2 - 4 hrs.	None
8/7	0640	110 SB/Expo Pk	0820	1.67 hrs.	Swimming & Diving USC 1000 AM
OTHER					
8/7	1737	Imperial/S7	1813	.75	None
8/10	1402	60/Diamond Bar	1515	1.25	None
8/10	1737	N/A	N/A	N/A	N/A
8/10	1840	5/Western	1930	.5	None
8/12	1455	110/Expo Pk.	1613	1.25	Closing ceremonies 6:30 PM Coliseum

time and location were critical, the identification-detection-response-clear procedure was exceptionally rapid due to the high level of preparedness on the part of both Caltrans and CHP.

Although more major incidents occurred, the total number of traffic incidents was down on all the major freeways during the Olympics. Table 3.14 presents total accidents for Olympics and the comparable

Table 3.14

Total Accidents on Five Freeways
Olympics vs. Non-Olympics

Freeway	Total	Fatalities	Injuries	PDO*	Large Trucks	Small Trucks
I-10 (from Bundy to Santa Fe)						
Olympics	46	0	13	33	6	10
Non-Olympics	48	0	14	34	6	15
Difference	-4%					
I-110 (from El Segundo to end (Pasadena))						
Olympics	83	0	28	55	9	22
Non-Olympics	104	0	29	75	10	27
Difference	-20%					
I-101 (from 7th St. to rte 170)						
Olympics	50	1	13	36	3	13
Non-Olympics	67	0	25	42	7	15
Difference	-25%					
I-5 (Slauson to Los Feliz)						
Olympics	77	0	28	49	27	23
Non-Olympics	85	0	35	50	30	24
Difference	-9%					
I-60 (L.A. River to Wilcox Ave.)						
Olympics	14	0	6	8	3	3
Non-Olympics	16	1	4	11	3	5
Difference	-13%					

*PDO = Property damage only

non-Olympics period in 1983. Information is given on injuries and truck involvement, although these factors are not an indication of the duration or seriousness (from the point of view of system impact) of the incidents. The total reduction in traffic accidents ranged from 4% on I-10 to 25% on Rte 101. The small change on I-10 is not surprising, given the lack of change in traffic volumes discussed earlier. In contrast, we observe a substantial reduction on I-110, where traffic volumes were also down significantly. Table 3.14 shows that truck involvement was also down during the Olympics, but not necessarily in proportion to the change in total accidents. Thus while trucks were involved in more major incidents during the Olympics, they were involved in fewer total accidents. Finally it is interesting to note the high proportion of truck involvement on I-5, no doubt because trucks make up an exceptionally large proportion of total traffic on that facility.

This systematic reduction in traffic accidents could be a significant cause of reduced congestion observed during the Olympics. If accidents add disproportionately to total delay on the system, then they would also have a disproportionately beneficial impact on delay reduction. Moreover, if the duration of these incidents was shorter than usual because of Caltrans and CHP's higher than normal level of preparedness, additional delay reductions were gained.

IV. CONCLUSIONS

The broad scope and intensive nature of the Olympics TSM program provided two very important factors for Los Angeles region travelers: a large number of alternatives and timely information. Prospective travelers, iuncluding spectators, commuters, shoppers, and others, were presented alternative routes, trip times, and modes. In addition, information on both anticipated and current highway conditions was widely circulated. These factors provided a great deal of flexibility, e.g., many ways to adjust to anticipated travel conditions. This ability to adjust was very evident during the Olympics.

One of the most notable adjustments during the Olympics was the change in traffic volumes from day to day. As mentioned earlier, the decision to collect data during the second week of the Olympics was made on the assumption that travel behavior would not significantly change. This was certainly not the case. Rather, traffic volumes were highly variable, starting out much below normal levels during the first week and gradually increasing. This pattern is quite evident in the screenline data discussed here. By the end of the week, traffic was at normal levels except around the Coliseum area.

Geographic location was a second dimension of traveler adjustment. The screenline data clearly showed that the most significant travel adjustments took place in the vicinity of the downtown/Coliseum area. The Harbor Freeway traffic volumes were much below normal levels in the Coliseum area throughout the Olympics, while no other freeway had consistently low traffic volumes. The truck count data also indicated substantial changes in the downtown area, while other counts showed mixed results.

In addition to the daily and geographic variation in traffic conditions, this analysis suggests four significant areas of behavioral change. First, there was a consistent drop in work trip travel, as indicated by the difference in AM peak volumes early in the week. This difference implies a drop in work trip travel of approximately 10 percent. The downtown employee survey also provides corroborating evidence, as the absence rate during the Olympics averaged about 23%, or about 1.5 times the typical summer rate. Moreover, absence rates were particularly high on Monday (8/6) and Friday (8/10).

Second, there was a notable shift in truck traffic, at least in the downtown area. Truck traffic was down during peak periods and up during the evening hours. On an areawide basis, however, the reduction in peak truck traffic was quite small -- 3 to 5 percent. Again, the change took place where the need was expected to be greatest.

The third significant change was the reduction in traffic indicents. Incidents were down on all five freeways surveyed, but again the range of change was large. The greatest reductions occurred on the Harbor and Hollywood freeways. As discussed earlier, the Harbor freeway reduction is not surprising given the drop in traffic, but the Hollywood freeway reduction occurred without a substantial drop in traffic.

Finally, there were some shifts in daily traffic patterns. These occurred on a highly selective basis, and included shifts in work travel to earlier schedules and a shift in other travel to evening hours. Given the limited extent of these shifts, however, it is doubtful that they had a significant impact on traffic flow and congestion.

One question remains now to be considered: why did the highway system perform so well during the Olympics? This analysis suggests several possibilities. First, the increased capacity provided during the Olympics probably made a difference. There are no estimates available on the proportion of capacity taken away by routine highway maintenance activities, but it may be significant, particularly on highly congested facilities. Second, the reduction in traffic incidents, coupled with enhanced response and clear time, also must have contributed to reducing congestion. Third, the reduction in work-related travel "made room" for Olympics-related travel. Given the high rate of participation in Olympic activities by Los Angeles area residents, it is only reasonable to conclude that large numbers of people had taken the day off in order to attend the Olympics. The impact of truck traffic and temporal shifts in traffic is more uncertain. In any case, the relative effectiveness of these factors can only be assessed through the use of simulation models. Once the simulation analysis is completed, the effectiveness of the Olympics TSM program can be more completely evaluated, and implications for future applicability can be addressed.