Changes in Travel Demand Characteristics During the 1984 Los Angeles Olympics

UCI-ITS-WP-86-3

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June 1986

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ABSTRACT

This paper presents results from a travel survey of downtown area employees conducted during the 1984 Los Angeles Summer Olympics. The Olympics provided a unique opportunity to observe travel demand responses to major anticipated changes in the level of service of the transportation system.

The survey examined all aspects of work trip travel including travel times, mode choice, work schedules, absences from work, and route choice. Nearly 2,000 surveys from four different downtown area employers were analyzed. Results showed that many different changes in work trip travel behavior occurred. These changes contributed to the reduced congestion experienced during the Olympics.

The most frequent changes include shifts in the work schedule and higher than usual absences from work. Modal shifts and change in route choice were much less common. Results also show that employers had a significant influence on the strategies chosen by employees. The paper concludes with a discussion of the significance of the research findings.

INTRODUCTION

The 1984 Summer Olympics presented Los Angeles area residents with a unique challenge: to get to work and perform other everyday tasks with an expected 1.2 million visitors, 6 million spectators, and nearly 25,000 athletes, media and Olympic family coming into the area to share an already overburdened regional transportation system. The Los Angeles downtown area was expected to be especially impacted due to activities at the Coliseum and other smaller nearby venues. Predictions of massive traffic snarls appeared in the media for several months before the Olympics, while local transportation planners conducted an extensive campaign urging residents to carpool, change work schedules, and avoid major venue areas. The dire predictions never came to pass, and one of the most memorable aspects of the Los Angeles Olympics was the remarkably smooth flow of traffic.

With the exception of special transit services to the larger events, no significant increases in transportation system capacity were made for the Olympics. Thus, changes in travel behavior must have played a role in reducing traffic problems.

Research was conducted at the Institute of Transportation Studies to evaluate the traffic management strategies employed during the Los Angeles Olympics.[1] The research included a survey of downtown employees. The purpose of the survey was to determine whether travel behavior among area residents (specifically downtown commuters) changed during the Olympics.

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1 The research was funded by the California Department of Transportation (Caltrans) under Contract No. RTA 13945-55B579.

The Olympics provided a rare opportunity to observe how travel demand is affected by major anticipated changes in the level of service of the transportation system. In this case, a significant deterioration in the system was anticipated. Responses to these expected conditions can provide greater understanding of the nature of travel demand, and guidance for addressing future transportation problems. This paper presents the results of the travel survey.

RESEARCH METHODOLOGY

The survey was designed to examine all aspects of work trip travel during the Olympics, and to determine how Olympics travel compared to normal conditions. The focus of the survey was on work-related travel, since the potential for severe traffic problems was greatest for peak-hour travel. Travel times, mode choice, work schedules, absences from work, and route choice were investigated. In most cases, behavior before the Olympics was compared to that during the Olympics. The survey also contained a daily work trip travel diary for the two-week period of the Olympics.

Four large downtown employers with a combined work force of about 9,200 employees participated in the survey. All four employers utilize ridesharing services provided by the local ridesharing agency and/or have an in-house employee transportation program. Survey questionnaires were distributed to a total of almost 5,000 employees in late August, 1984.[2] Distribution and collection procedures were at the discretion of the employer. At Sites B and C, surveys were distributed to all employees and at Site D the surveys were randomly distributed. All employees at three of five downtown work sites received surveys at Site A.

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2 Preparations for the Olympics precluded distribution of the survey prior to the Olympics.

The breakdown of the sample by employer is presented in Table 1. The response rate ranged from 23% at Site A to 73% at Site B. A total of 1,992 completed and verified responses were used in the analysis, yielding a response rate of 41% for the total sample. The sample was weighted according to the total number of employees. The weights were adjusted for both the different survey distribution methods and the different response rates.

TABLE 1

SAMPLE BREAKDOWN BY EMPLOYER SITE

Site	No. of Empl.	No. Surveys Distributed	No. in Sample	Response Rate
A	3,000	1,200	281	23%
B	1,100	1,100	799	73%
C	1,600	1,600	586	37%
D	3,500	1,000	326	33%
Total:	9,200	4,900	1,992	41%

SURVEY RESULTS

Work Force Participation

Anticipated difficulties as a result of the Olympics games led to numerous changes in the work week, choice of work site, and absences from work. Table 2 presents the absence rate during the Olympics. This rate includes all absences from the regular work place. The data show that the absence rate was slightly higher during the second week, and the highest absence rates occurred on Monday and Friday in both weeks. Table 3 shows that these variations are explained by the fact that more people were on vacation during the second week, and days off due to a modified work week occurred primarily on Monday and Friday. (Monday, August 6,

TABLE 2

PERCENTAGE OF PEOPLE WHO DID NOT COME TO WORK* FOR ALL REASONS

Date		Percentage
Monday	7/30	17.1
Tuesday	7/31	16.2
Wednesday	8/1	16.3
Thursday	8/2	15.9
Friday	8/3	21.4
Monday	8/6	19.5
Tuesday	8/7	16.9
Wednesday	8/8	19.0
Thursday	8/9	19.4
Friday	8/10	23.9

Total number of respondents = 476

*Did not work at the regular workplace.

TABLE 3

DISTRIBUTION OF THOSE WHO DID NOT WORK
AT USUAL WORK PLACE DURING THE OLYMPICS

Date		Vacation	Alt. Workplace	Mod. Week	Other*
Monday	7/30	9.6	2.8	1.8	2.9
Tuesday	7/31	9.9	3.2	0.1	3.0
Wednesday	8/1	9.5	3.3	0.2	3.3
Thursday	8/2	9.9	3.2	0.2	2.6
Friday	8/3	11.8	2.8	3.5	3.3
Monday	8/6	11.7	2.8	1.8	3.2
Tuesday	8/7	11.3	3.0	0.4	2.2
Wednesday	8/8	11.9	3.4	0.4	3.3
Thursday	8/9	11.9	3.7	0.3	3.5
Friday	8/10	13.8	3.3	3.0	3.8

Total number of respondents = 476

*Other is the sum of regular day off, sick leave, company holiday, and other reasons.

had also been designated an optional state holiday.) In contrast, those who worked at an alternate work place (counted as an absence from the regular work place), and absences for other reasons, remained fairly constant throughout the Olympics. Since vacation plans and work week schedules were most likely made in advance of the games, these shifts probably reflect efforts of employees and employers to avoid the anticipated traffic problems.

Work Trip Characteristics

Most analysts predicted serious traffic congestion in the downtown areas during the Olympic games. Such was not the case. Many roadways were less congested than at any time in recent memory. How then, did travel times for the commute to and from downtown change during the Olympics?

Travel to Work

The survey data show that travel time to work decreased significantly during the Olympic games. The average employee working in downtown Los Angeles travels 19.5 miles to work, and the average pre-Olympic trip to work took 42.4 minutes. During the games, the average commute to work took just 36.8 minutes--a time savings of 5.6 minutes or 14%. Each respondent was also asked to provide the longest time required to commute to work during the games. Even the average of these responses, 40.2 minutes, did not exceed the pre-games travel time figure.

Travel time for the trip home from work also decreased during the Olympics. Before the games the average commute home took 48.6 minutes. During the games this figure was reduced to 42.2 minutes--a savings of 6.4 minutes or 13%. The average maximum during the games was 46.0 minutes. Graphical representations of travel time to and from work are provided in Figures 1 and 2.

Time savings were experienced during the games in part because a high percentage of employees changed their time of departure during the games. The most frequent change was to leave home earlier than usual (23.3 percent), as shown in Table 4. About two thirds of all commuters left at their usual time, (in 15 minute intervals) and only 11.6% left later than usual. These shifts resulted in a "flatter" (e.g., more evenly distributed) peak travel period, particularly in the morning. Figure 3 gives the cumulative distribution of trip start times from home to work before and during the Olympics, and Table 5 gives the percentage distribution of start times. Note, for example, that about 10% of the sample had left for work by 6:00 AM during the Olympics compared to about 5% before the Olympics. Similarly, slightly more people left for work after 8:30 during the Olympics than before, while fewer left between 6:30 and 8:00 during the Olympics (68.3% before vs. 62.3% during).

TABLE 4

DEPARTURE TIME FROM HOME DURING OLYMPICS

	Minutes Relative to Usual	Percentage	
Earlier	-75 or earlier	3.7	23.3
	-60	3.8	
	-45	2.2	
	-30	5.6	
	-15	8.0	
	0	65.1	
Later	+15	8.3	11.6
	+30	2.6	
	+45	0.2	
	+60	0.1	
	+75 or more	0.1	

n = 1668

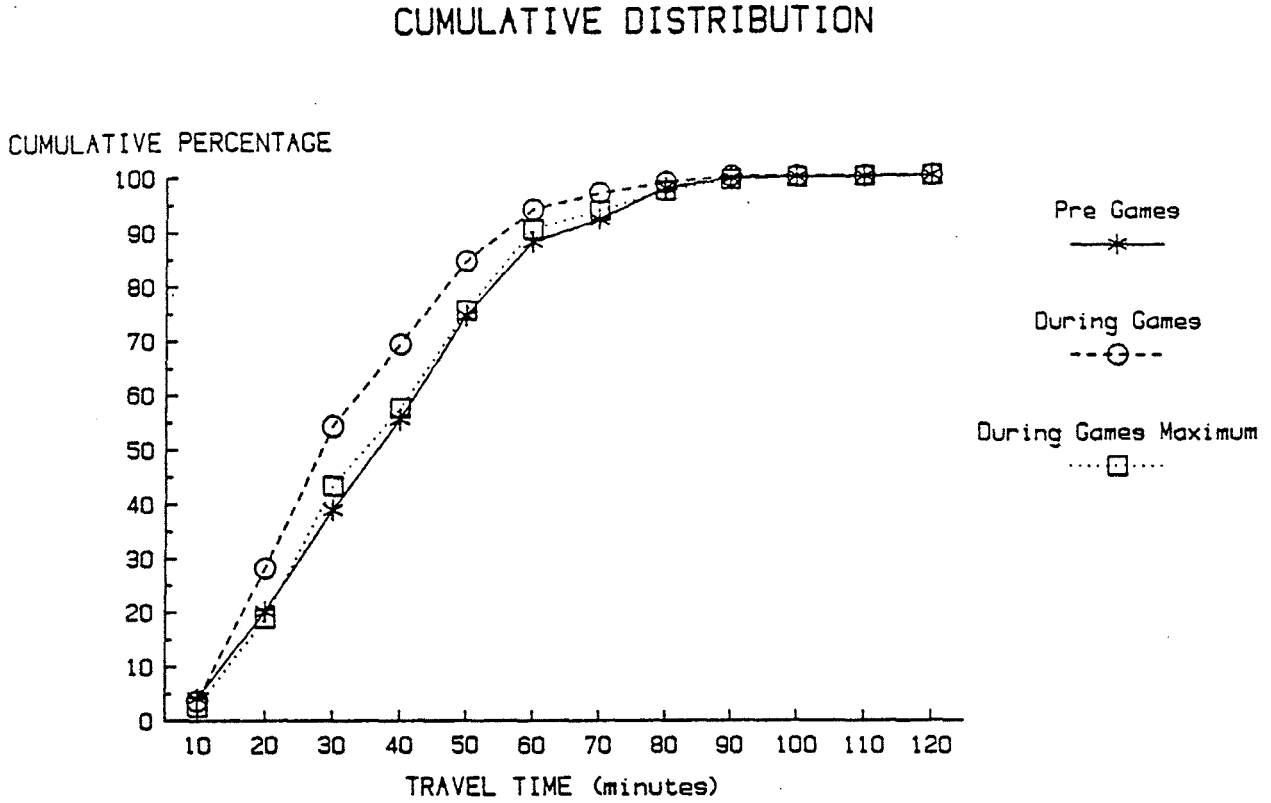


FIGURE 1
TRAVEL TIME TO WORK

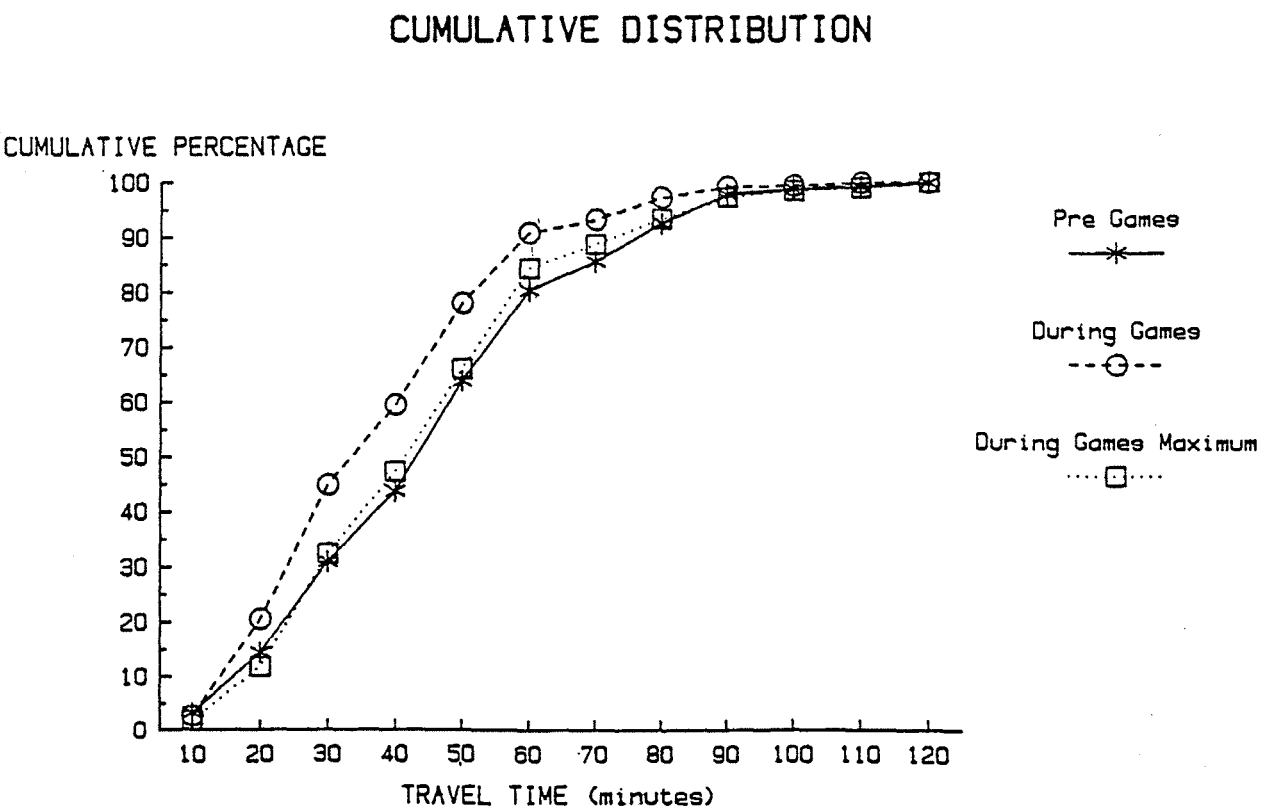


FIGURE 2
TRAVEL TIME FROM WORK

TABLE 5

PERCENTAGE DISTRIBUTION OF TIME:
LEAVE FROM HOME TO WORK

	Before Games	During Games
Before 5:00 AM	.2	.7
5:00 - 5:30 AM	1.0	2.6
5:30 - 6:00 AM	3.7	6.6
6:00 - 6:30 AM	11.7	14.2
6:30 - 7:00 AM	21.7	19.3
7:00 - 7:30 AM	24.4	23.0
7:30 - 8:00 AM	22.2	20.5
8:00 - 8:30 AM	12.8	10.5
8:30 - 9:00 AM	1.0	1.3
After 9:00 AM	.8	1.1

Further evidence of travel time savings is provided by comparing Figures 3 and 4. Note that the pre-games and during-games lines are closer to one another in the Leave Home For Work graph (Figure 3) than in the Arrive At Work graph (Figure 4), meaning that more people arrived at work earlier than usual during the Olympics than had left earlier than usual. The survey data indicates that 45.7% of all employees claimed to have arrived at work earlier than usual during the games, far more than had left earlier than usual (23.3%). Also, only 5.7% arrived later than usual, a smaller proportion than had left later than usual.

Travel Home

The Olympic games did not affect departure times from work as dramatically as departure times from home. Table 6 shows that a smaller proportion of commuters changed their departure time from work than had changed departure time to work. The pattern is the same, however, with greater shift towards leaving work earlier than usual. The difference in shifting patterns between the trip to work and the trip home suggests that the morning shift was made at least in part in

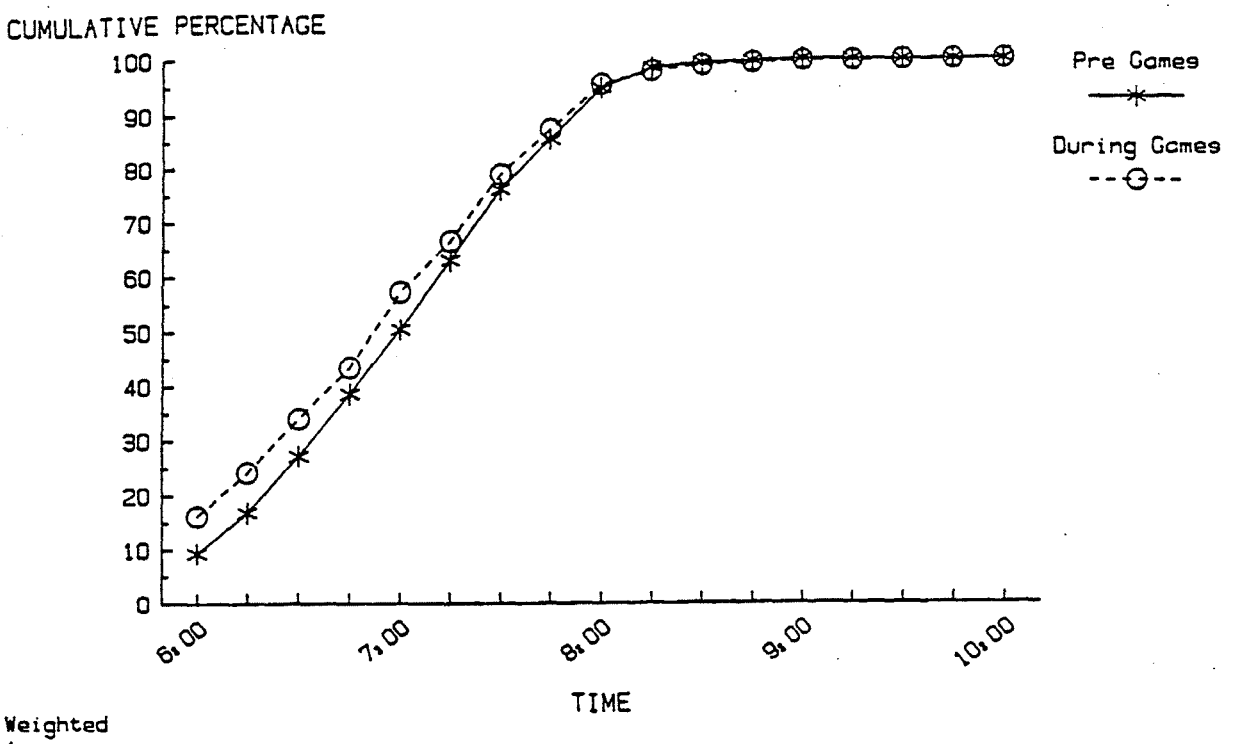


FIGURE 3
LEAVE HOME FOR WORK

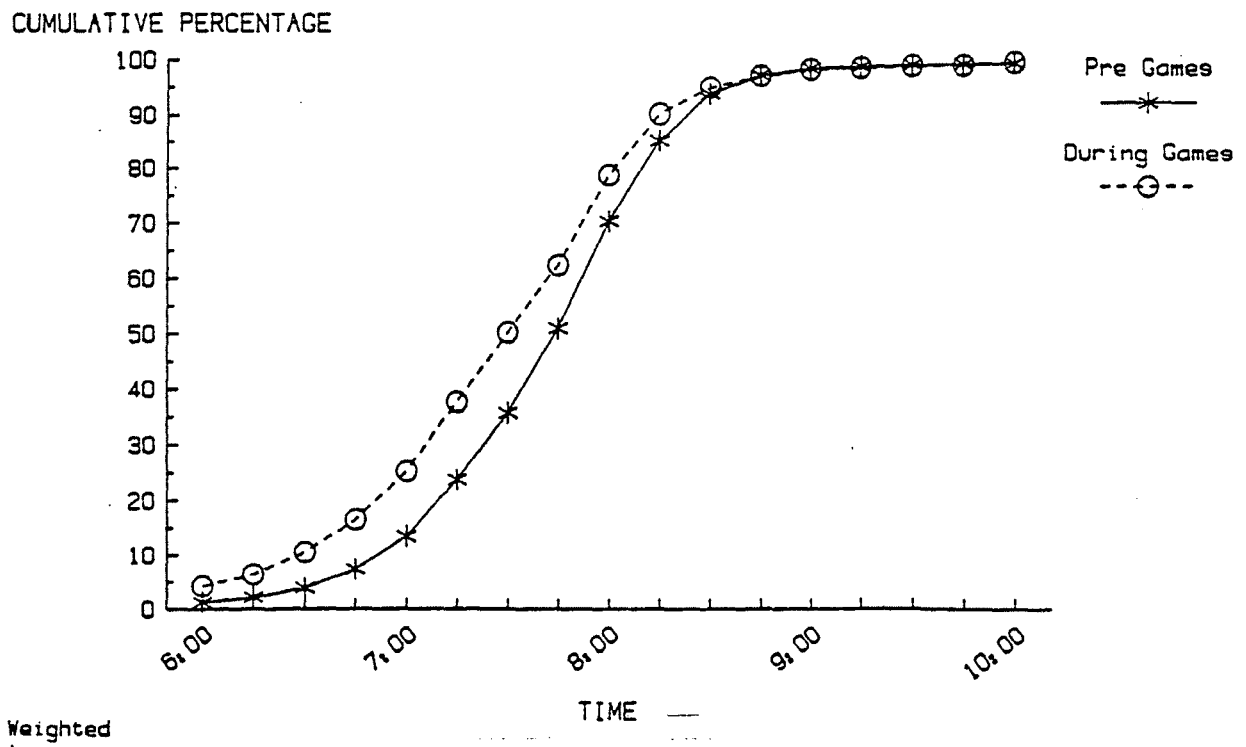


FIGURE 4
ARRIVE AT HOME

anticipation of heavier Olympics traffic. That is, people started for work earlier expecting that the trip would take longer than usual. A comparison of time leaving work and time arriving home provides further evidence of travel time savings during the Olympics. About 18% of the employees left work earlier than usual, while about 50% of all employees arrived home earlier than usual.

TABLE 6

DEPARTURE TIME FROM WORK

	Minutes Relative to Usual	Percentage	
	-75 or earlier	0.8	
	-60	2.8	
Earlier	-45	1.0	17.9
	-30	4.5	
	-15	4.8	
	0	72.6	
	+15	2.8	
	+30	2.7	
Later	+45	0.7	8.2
	+60	1.4	
	+75 or later	0.6	

n = 1676

Figure 5 gives the cumulative distribution of work departure times, and Table 7 gives percentage distributions. Again, a slight flattening of the peak is apparent: during the Olympics more departures occurred before 4:00 PM and after 5:30 PM, while fewer occurred between 4:00 and 5:30 PM. Figure 6 gives the cumulative distribution of arrival home times. Note that the greatest differences occurred between 4:45 and 5:45, suggesting that part of the travel time savings was due to the shift to earlier departure times.

TABLE 7

DISTRIBUTION OF TIME: LEAVE FROM WORK TO HOME

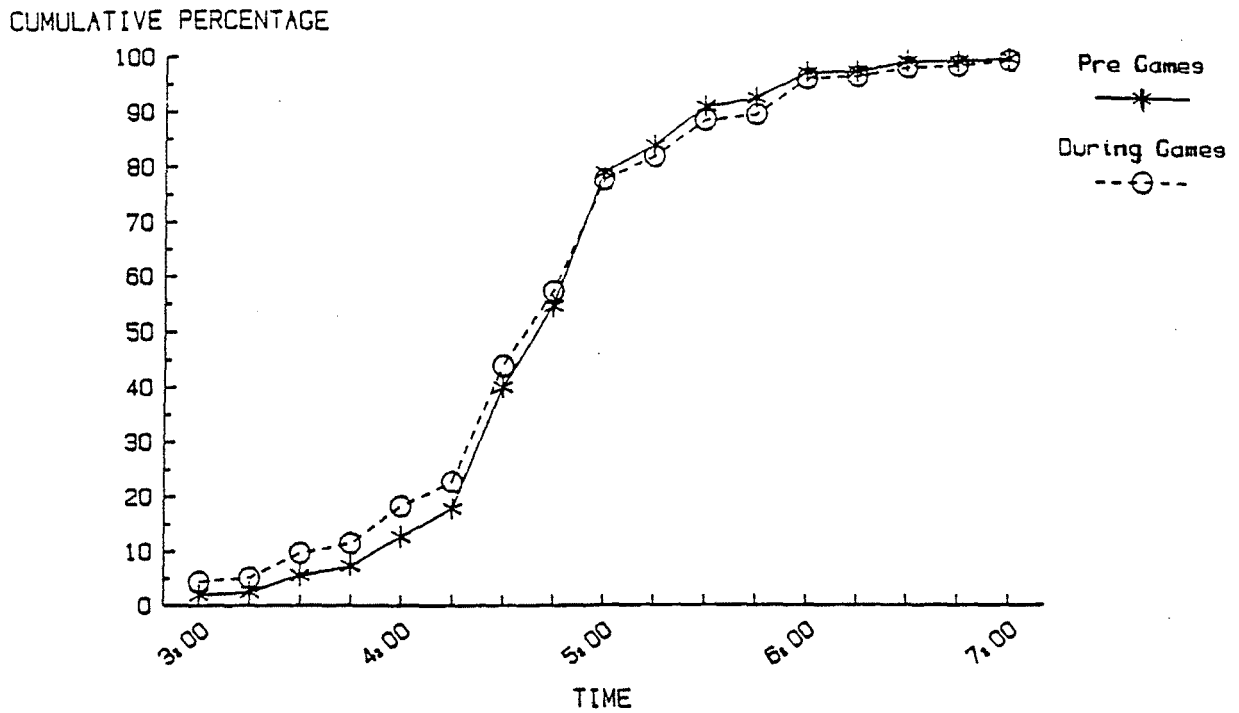
	Before Games Percentage		During Games Percentage	
Before 3:00 PM	1.2		2.2	
3:00 - 3:30 PM	1.0		2.8	
3:30 - 4:00 PM	4.9		6.2	
4:00 - 4:30 PM	10.5		11.2	
4:30 - 5:00 PM	36.7	76.5	34.4	70.1
5:00 - 5:30 PM	29.3		24.5	
5:30 - 6:00 PM	8.5		7.5	
After 6:00 PM	7.6		10.8	
	n = 1965		n = 1673	

Flexible Work Hours

Work trip schedule changes and the ensuing time savings were partially the result of increased flexibility demonstrated by employers with respect to work hours. Prior to the Olympics, employers specified the work hours for 56.2% of all employees, and 34.2% of all employees chose their own hours with the approval of their employer. During the games, employers specified the work hours of only 41.3% of their employees. Some 47.8% of all employees chose their own hours.

The permissible time intervals for beginning and ending work were also greater during the Olympics. The predominant shift was to earlier allowed start and end times as shown in Tables 8 and 9, but latest allowable start and end times shifted as well. Thus, the earliest allowed arrival time was earlier than usual and the latest allowed arrival time was later than usual during the games.

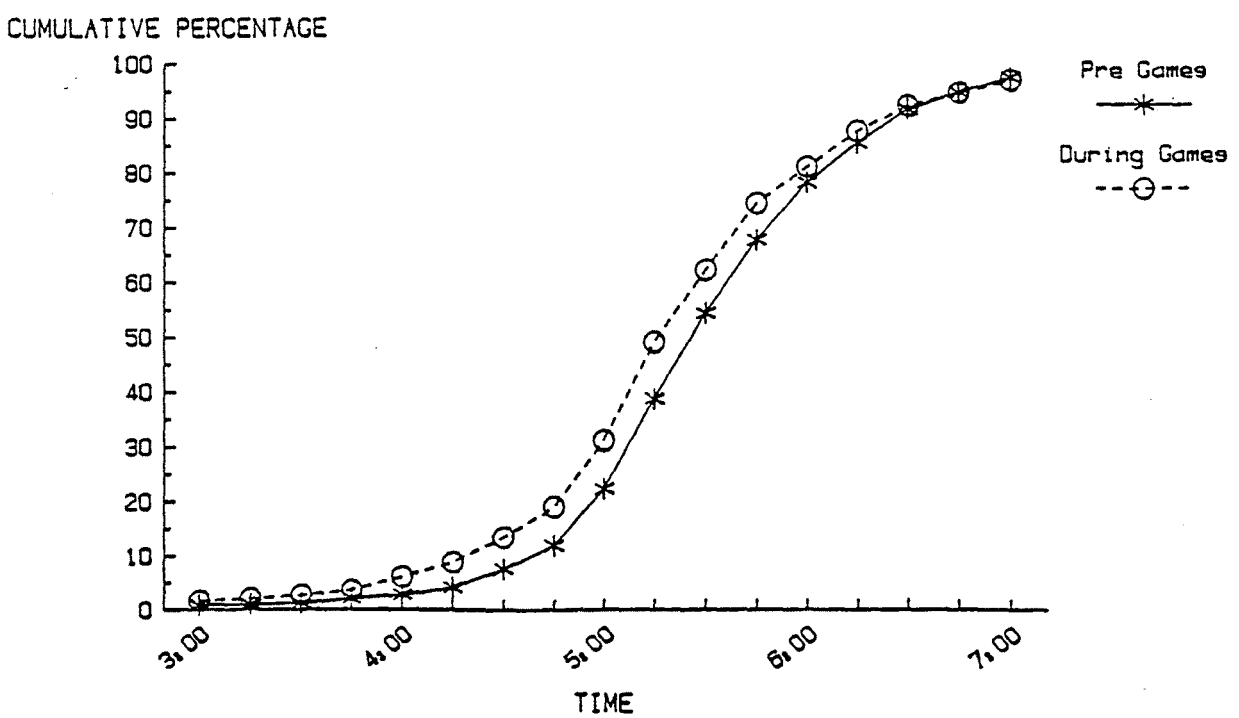
CUMULATIVE DISTRIBUTION



Weighted Average

FIGURE 5
LEAVE WORK FOR HOME

CUMULATIVE DISTRIBUTION



Weighted Average

FIGURE 6
ARRIVE AT HOME

TABLE 8

PERCENTAGE DISTRIBUTION OF ALLOWED ARRIVAL TIMES

	Earliest Allowed Arrival at Work		Latest Allowed Arrival at Work	
	Pre Games	During Games	Pre Games	During Games
Before 6:00 AM	1.8	6.5	0.1	0.3
6:00 - 6:30 AM	6.9	13.7	0.4	0.3
6:30 - 7:00 AM	4.6	5.1	0.1	0.4
7:00 - 7:30 AM	23.9	24.0	1.3	2.8
7:30 - 8:00 AM	13.3	9.4	3.5	3.4
8:00 - 8:30 AM	36.9	30.3	46.5	41.8
8:30 - 9:00 AM	11.5	9.1	28.6	25.9
9:00 - 9:30 AM	0.5	8.0	13.2	14.8
9:30 -10:00 AM	0.2	0.2	2.1	2.4
After 10:00 AM	0.2	0.6	2.3	6.4

TABLE 9

PERCENTAGE DISTRIBUTION OF ALLOWED DEPARTURE TIMES

	Earliest Allowed Departure from Work		Latest Allowed Departure from Work	
	Pre Games	During Games	Pre Games	During Games
Before 3:00 PM	2.7	9.5	1.6	1.1
3:00 - 3:30 PM	6.0	9.3	0.2	0.7
3:30 - 4:00 PM	11.9	12.0	0.2	0.6
4:00 - 4:30 PM	15.3	14.5	3.1	3.2
4:30 - 5:00 PM	38.8	34.0	23.7	21.2
5:00 - 5:30 PM	22.2	16.9	34.2	31.1
5:30 - 6:00 PM	1.9	2.1	12.3	10.8
6:00 - 6:30 PM	0.3	0.8	9.8	12.1
6:30 - 7:00 PM	0.0	0.1	3.2	4.5
After 7:00 PM	0.4	0.9	11.8	14.9

Similarly, the earliest allowed departure time was earlier and the latest allowed departure time was later during the games. The predominant shift to an earlier schedule was in keeping with the desire to avoid Olympics congestion. Coliseum events began around 9:00 AM and ended around 5:00 PM. Earlier work

schedules made it possible for commuters to avoid the peak travel times for event attendees.

Stops on the Trip to and from Work

Another factor which can greatly influence travel time is the number of stops made during the commute. The fact that the average trip to work takes less time than the commute home is due in part to the fact that fewer stops are made on the way to work than on the way home. Table 10 shows that stops on the trip to work were unchanged during the Olympics. Both the ratio of stops per respondent and the stops per person stopping are almost identical. Stops on the way home decreased

TABLE 10

PERCENTAGE OF PEOPLE WHO MADE STOPS DURING THE WORK COMMUTE

Trip to Work	Pre Games	During Games
Did Stop	27.3	27.4
Did Not Stop	72.3	72.6
Total Number of Respondents	1,982	1,693
Total Number of Stops	608	542
Ave. No. Stops/Respondent	.31	.32
Ave. No. Stops/Person Who Stopped	1.12	1.17
Trip From Work	**Pre Games**	**During Games**
Did Stop	39.9	37.5
Did Not Stop	60.1	62.5
Total Number of Respondents	1,966	1,678
Total Number of Stops	1,197	938
Ave. No. Stops/Respondent	.61	.56
Ave. No. Stops/Person Who Stopped	1.53	1.49

slightly during the Olympics, although the number of stops per person stopping remained almost constant.

Types of stops made on trips to and from work are presented in Tables 11 and 12. On the trip to work, shopping and social visits increased, while work related stops decreased and other categories were unchanged. On the trip home, a slightly greater proportion of stops were to pick up or drop off passengers, while work related business and "other" trips decreased. These changes suggest that business

TABLE 11

FREQUENCY OF STOPS BY CATEGORY, AS PERCENT OF ALL STOPS

Trip to Work

Characteristics	Before Games	During Games
Pick Up or Drop Off Passenger	57.1	56.1
Work Related Business	9.4	7.4
Shopping	5.6	8.7
Social Visit	1.3	2.8
Eating	6.9	6.3
Personal Business	8.9	8.5
Other	10.8	10.3

TABLE 12

FREQUENCY OF STOPS BY CATEGORY, AS PERCENT OF ALL STOPS

Trip From Work

Characteristics	Before Games	During Games
Pick Up or Drop Off Passenger	30.2	33.0
Work Related Business	5.2	3.6
Shopping	25.7	24.6
Social Visit	6.2	7.0
Eating	6.3	8.3
Personal Business	16.2	17.0
Other	10.2	6.4

related travel was curtailed during the Olympics, and that some stops were shifted from the PM to the AM work trip.

Route to Work

Another way that travel to and from work could be adjusted during the Olympics was to change the regular route used to and from work. The survey asked which downtown area freeways, if any, were used before the Olympics; whether the route to and from work changed during the Olympics; and if so, which freeways were chosen. Table 13 shows the route choice probabilities for the entire sample before the Olympics. Listed are the major downtown area freeways (see Figure 7). The probabilities sum to more than 100%, because more than a single freeway might have been used on the work trip. As might be expected (see Table 13), the most frequently used freeways are I-110, I-10 and Route 11 (Pasadena Freeway). About 31.6% of the sample used no downtown area freeways.

TABLE 13

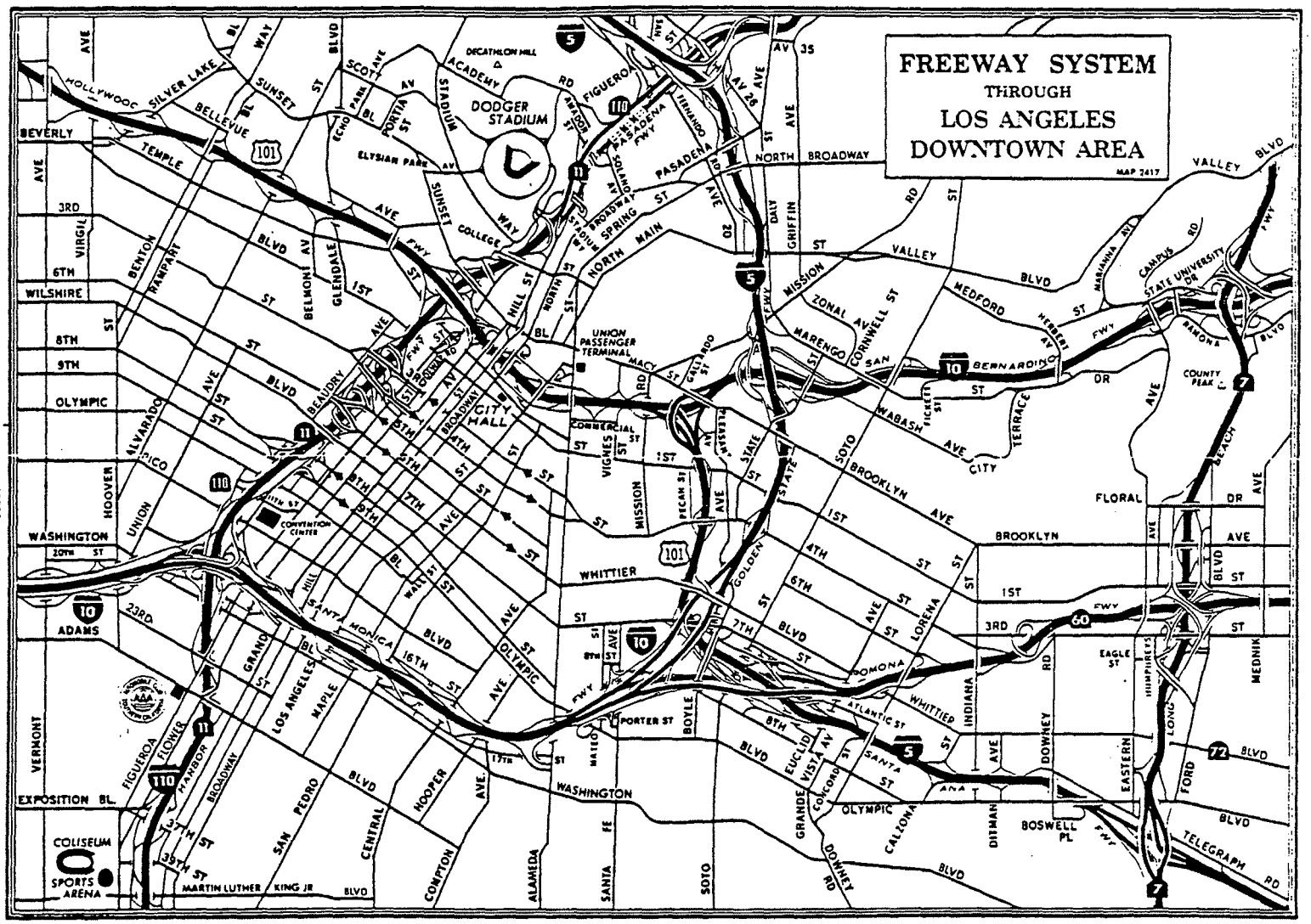
CHOICE PROBABILITIES OF FREEWAYS TO AND FROM WORK
FOR THE TOTAL SAMPLE BEFORE THE GAMES

Freeway	Choice Probability
Santa Ana (I-5)	5.5%
Santa Monica (I-10)	17.0%
Pasadena (Route 11)	9.1%
Pomona (I-60)	2.4%
Ventura (Route 101)	2.4%
Harbor (I-110)	15.0%
San Bernardino (I-6)	.8%
All Other Freeways	16.2%
No Freeways	31.6%

n = 253

FIGURE 7

MAP OF LOS ANGELES
DOWNTOWN AREA



During the Olympics, about 10% of the respondents changed their route to and from work. Table 14 gives the choice probabilities of the various freeways by people who changed their route during the games. The first column of Table 14 presents the choice probabilities before the games, the second column during the games. Note that among those who changed their route of travel, the choice probabilities of freeways I-110, I-10, and Route 11 (Table 14) before the game are much higher than in the total population (Table 13). All three were major venue access routes. Also, the probability of not choosing a freeway is lower (26.3%) in the group which changed its route than in the total population (31.6%), meaning that of those who changed their route during the Olympics, a greater proportion were normally freeway users than in the entire sample. The choice probabilities of freeways before and during the games for people who changed their route to work (Table 14) indicate that there was a large decrease in usage of I-110. This is consistent with the drop in traffic observed on I-110. During the Olympics, two parallel arterials were operated as a one-way couplet, providing an alternate route

TABLE 14

CHOICE PROBABILITIES OF FREEWAYS TO AND FROM WORK
FOR PEOPLE WHO CHANGED THEIR ROUTE DURING THE GAMES

Freeway	Before Olympics	During Olympics
Santa Ana (I-5)	10.5%	9.2%
Santa Monica (I-10)	21.2%	26.7%
Pasadena (Route 11)	16.3%	13.2%
Pomona (I-60)	4.3%	1.9%
Ventura (Route 101)	6.2%	3.9%
Harbor (I-110)	35.1%	24.3%
San Bernardino (I-6)	3.0%	1.4%
All Other Freeways	20.6%	23.0%
No Freeways	26.3%	38.6%

n = 159

for traffic in the area. In contrast, somewhat heavier traffic during the Olympics was observed on I-10, and Table 14 indicates somewhat higher choice probability for this facility. The other significant change was a shift from the freeways to arterials. Note that this shift is of the same magnitude as that of I-110 usage.

Mode of Travel

It was anticipated that many commuters would change their mode of travel during the Olympics to avoid driving in the expected heavy congestion. In fact, only a small number of all employees changed their commute mode during the Olympics. Those who did change cited numerous reasons for doing so, as shown in Table 15. The most frequently cited reasons were to avoid anticipated Olympic traffic (71.2%) and employer encouragement (52.4%).

TABLE 15

REASONS FOR CHANGING MODE

Characteristic	Percentage of Those Who Changed*
Employer Encouraged	52.4
Media Encouraged	29.9
Wanted to Help Reduce Congestion	34.2
Avoid Anticipated Olympic Traffic	71.2
Olympic Work Schedule Prevented Use of Regular Mode	8.0
Other	4.3

*Total is higher than 100% because more than one reason could be chosen.

Table 16 gives the mode choice distribution for each regular workday during the Olympics, as well as for before and after the Olympics. The data show that mode shares for drive alone, vanpool, and bus dropped, while the carpool share increased

TABLE 16

MODE OF TRAVEL

Date		Drive Alone	Carpool	Vanpool	Bus	Other
Before		50.2	22.0	5.5	20.6	1.6
Monday	7/30	48.7	23.9	5.1	20.4	2.9
Tuesday	7/31	49.6	23.7	5.1	19.7	2.3
Wednesday	8/1	49.2	23.6	5.0	20.1	2.3
Thursday	8/2	49.0	24.0	4.8	20.4	2.0
Friday	8/3	49.8	23.4	4.6	20.1	2.3
Monday	8/6	48.6	23.7	4.7	21.1	2.3
Tuesday	8/7	48.6	23.4	4.9	20.9	2.4
Wednesday	8/8	50.5	22.1	4.8	20.5	2.2
Thursday	8/9	50.1	22.7	4.8	20.5	2.2
Friday	8/10	51.9	23.0	4.2	18.8	2.6
Average during Olympics:		49.6	23.3	4.8	20.3	2.3
After		48.6	21.6	6.0	22.2	1.6

during the Olympics. When the mode choice data is partitioned by firms, it is evident that most of this shift took place at one firm, as will be further discussed below. Mode shares remained relatively constant during the Olympics. Fluctuations in vanpool and transit modes were likely due to vacations and other absences.

Commuters were asked whether changes in mode choice made during the Olympics were maintained after the Olympics. Not surprisingly, the data show that the games have had very little impact upon mode choice in the post-games period.

The Four Firms

The survey results indicate that response to the Olympics differed dramatically from firm to firm. These differences apparently reflect different strategies adopted by management to deal with the Olympics, as well as each firm's regular policies regarding employee work schedules.

As mentioned earlier, all four firms are involved to some degree in employee transportation programs. The extent of these programs differ widely, however. Firm A has one of the most extensive programs in the region; it sponsors employee vanpools and buspools, and promotes carpools. Firm C has the most intensive flexible work hours program among the four firms. Firms B and D have more traditional programs, concentrating primarily on ridesharing services provided by Commuter Computer, the local ridesharing agency.

Employers had a number of options for dealing with the Olympics. They could encourage vacations and grant extra time off, shift work hour schedules, and/or promote modified work weeks. They could also encourage employees to work temporarily at work sites closer to home, promote ridesharing and transit use, or do nothing.

Differing policies with respect to employees' time off is reflected in the individual firm absence data presented in Table 17. Firm C had the highest vacation rate, closely followed by Firms B and A. Firm D had the lowest vacation rate. Since Firm D anticipated being very busy during the Olympics, management did not encourage employees to take time off. Firm B had the largest number of employees working at an alternate work place, while Firm C was the only firm which had a significant number of employees on the modified work week (4 days, 10 hours/day).

Flexibility in work hour scheduling was increased during the Olympics by all firms. Table 18 presents data on choice of work hours for each firm, before and during the Olympics. The non-Olympics pattern was maintained during the Olympics; that is, the firm which gave employees the most freedom in choosing work hours under normal conditions also gave the most freedom during the Olympics, and the firm giving the least choice under normal conditions also gave the least choice during the Olympics. However, a large shift to giving employees

TABLE 17

DISTRIBUTION OF THOSE WHO DID NOT WORK AT USUAL WORK PLACE, BY FIRM

Firm A

Date		Vacation	Alt. Work Place	Mod. Week	Other
Monday	7/30	10.3	1.8	0.4	3.9
Tuesday	7/31	11.7	2.9	-	3.5
Wednesday	8/1	9.6	2.5	0.4	4.3
Thursday	8/2	10.0	3.2	0.4	2.1
Friday	8/3	13.9	2.2	1.1	3.2
Monday	8/6	12.5	2.2	0.4	3.2
Tuesday	8/7	11.7	2.6	0.4	1.8
Wednesday	8/8	12.1	3.2	0.7	3.9
Thursday	8/9	12.8	3.9	0.4	4.7
Friday	8/10	16.4	3.6	0.7	5.3

Firm B

Date		Vacation	Alt. Work Place	Mod. Week	Other
Monday	7/30	11.3	10.4	-	1.4
Tuesday	7/31	10.8	10.1	0.3	1.8
Wednesday	8/1	11.1	11.3	0.4	2.4
Thursday	8/2	12.0	9.7	0.3	1.9
Friday	8/3	14.1	10.4	0.3	2.5
Monday	8/6	15.1	9.8	0.3	1.5
Tuesday	8/7	13.3	10.0	0.1	1.8
Wednesday	8/8	13.4	10.6	0.3	2.0
Thursday	8/9	13.9	9.3	0.1	2.4
Friday	8/10	15.6	9.4	0.3	2.5

Firm C

Date		Vacation	Alt. Work Place	Mod. Week	Other
Monday	7/30	13.5	2.2	9.7	1.5
Tuesday	7/31	13.5	2.4	0.3	1.3
Wednesday	8/1	13.8	2.7	0.5	1.5
Thursday	8/2	14.8	2.6	0.2	1.9
Friday	8/3	16.7	2.2	16.0	2.2
Monday	8/6	16.2	1.7	9.4	2.9
Tuesday	8/7	15.9	2.4	1.4	1.9
Wednesday	8/8	16.9	2.4	0.7	1.6
Thursday	8/9	16.9	2.2	0.9	2.4
Friday	8/10	18.6	1.2	14.7	2.4

Firm D

Date		Vacation	Alt. Work Place	Mod. Week	Other
Monday	7/30	6.7	1.5	-	3.4
Tuesday	7/31	6.4	1.8	-	4.0
Wednesday	8/1	7.1	1.8	-	3.7
Thursday	8/2	7.1	1.5	-	3.7
Friday	8/3	7.1	1.2	0.9	4.3
Monday	8/6	8.0	1.8	-	3.7
Tuesday	8/7	8.3	1.5	-	3.1
Wednesday	8/8	8.9	1.8	-	3.7
Thursday	8/9	8.3	2.4	-	3.4
Friday	8/10	8.9	2.1	0.6	3.4

greater discretion in choosing work hours occurred at all the firms. Firm C provided the most flexibility during the Olympics, as is also evident by the large number of employees who worked on a modified week schedule during the Olympics.

TABLE 18

CHOICE OF WORK HOURS BY FIRM

	Before Olympics		During Olympics	
Firm	Employer Chose	Employee Chose*	Employer Chose	Employee Chose
A	58.5%	35.0%**	38.2%	51.7%
B	67.0	22.6	56.1	33.5
C	33.6	61.9	17.9	74.5
D	61.6	24.1	51.2	35.3

*With the approval of employer
**Row sums by firm do not sum to 100% as "other" response not included.

Changes in daily work schedules are reflected in the shifts in employee work trip times which took place during the Olympics. Table 19 gives changes in employee departure times from home to work during the Olympics for each firm. The change is measured in 15 minute intervals from the usual (non-Olympics) schedule. It should be noted that these shifts cannot be attributed entirely to work schedule changes; rather, as noted earlier, some of the shift was probably made in anticipation of heavier congestion and longer travel times during the Olympics. Table 19 shows that Firm A had the largest proportion of employees (76.1%) who did not shift home to work departure time. This is not surprising, given the large share of Firm A employees who participate in some form of ridesharing, as will be further discussed below. Shifts in departure time also were relatively limited at Firm D, where the permissible work schedule intervals (e.g., the earliest and latest work start times allowed) were not substantially altered during the Olympics. A majority

TABLE 19

DEPARTURE TIME FROM HOME, BY FIRM

Minutes Relative To Usual		Firm A Percentage		Firm B Percentage		Firm C Percentage		Firm D Percentage	
-75 and earlier		1.2		10.2		11.8		-	
	-60	1.2		4.3		11.0		2.7	
Earlier	-45	1.2	13.0	2.6	39.3	5.1	47.3	1.5	16.5
	-30	4.9		6.7		9.2		4.2	
	-15	4.5		15.5		10.2		8.1	
	0	76.1		47.8		43.9		69.9	
	+15	7.7		6.1		6.3		10.4	
	+30	2.4		3.8		1.8		2.7	
Later	+45	0.4	10.5	1.0	12.8	-	8.8	-	13.1
	+60	-		1.1		-		-	
+75 and later		-		0.8		0.7		-	

of employees at Firms B and C changed departure times, and for all firms the shift was predominantly to an earlier schedule. The most extreme change occurred at Firm C, where almost 23% left for work an hour or more earlier, in keeping with the use of the modified work week at that firm.

It was pointed out earlier that shifts in mode choice among commuters were minimal during the Olympics. Mode choice data by firm presented in Table 20 shows that significant changes took place only at Firms B and C. At Firm A, an extremely large proportion of employees commute by carpool, vanpool, or bus. Firm A already had an exceptionally efficient employee transportation program in place; thus there was little perceived need to make special adjustments for the Olympics. Moreover, since carpool, vanpool, and bus transportation require adherence to a schedule, it is not surprising that employee work hours changed very little.

The biggest change in mode choice occurred at Firm B, where large numbers of carpools were formed in response to strong encouragement by management. In fact,

TABLE 20

MODAL SPLIT BEFORE AND DURING OLYMPICS, BY FIRM

Before

Modal Split	Firm A Percentage	Firm B Percentage	Firm C Percentage	Firm D Percentage
Drive Alone	26.0	72.7	46.7	65.7
Carpool	27.0	19.1	24.6	17.3
Vanpool	12.8	.9	3.6	1.5
Bus	21.0	5.0	20.7	11.4
Park & Ride	11.0	.6	3.8	1.9
Bike/Walk/Other	2.1	1.6	.7	1.8

During

Modal Split	Firm A Percentage	Firm B Percentage	Firm C Percentage	Firm D Percentage
Drive Alone	27.9	54.6	52.9	65.2
Carpool	27.8	34.2	17.9	20.3
Vanpool	11.2	.8	1.4	2.7
Bus	20.7	6.7	10.8	18.5
Park & Ride	10.0	.5	3.1	4.2
Bike/Walk/Other	2.5	3.3	1.5	1.9

among all employees who changed modes during the Olympics, Firm B employees most frequently cited "employer encouragement" as their motivation. A decrease in ridesharing occurred at Firm C during the Olympics. The drive alone share increased, while carpool, vanpool, and bus decreased. This is most likely due to the shifts in work schedules (particularly to the modified work week) which made it impractical for some employees to maintain ridesharing arrangements. Interestingly, the employees of Firm C experienced greater travel time savings during the Olympics than did the average employee of any of the other firms surveyed, most likely because of unusual commute times and changes in mode

choice. Finally, at Firm D, the lack of change in mode choice is in keeping with the general "business as usual" approach taken by this firm during the Olympics.

CONCLUSION

The level of service provided by the Los Angeles transportation system increased during the Olympics. This surprising phenomenon can be at least partially attributed to the shifts in the schedule of travel activities which slightly reduced the peaking of demand, resulting in less congestion on the system. The Los Angeles highway system operates at or near capacity for several hours each day. Under these conditions, traffic flow is highly unstable, and a very small change in traffic volume at any given time interval generates a large change in the level of congestion. Thus the shifts in travel behavior documented by the survey likely made a significant contribution to the favorable traffic conditions.

The survey results indicate that an unusually high number of workers took vacation during the Olympics. Absences at downtown work places also increased due to the use of modified work week schedules and temporary assignments to alternative work sites. Work schedule flexibility for employees also increased during the Olympics, and many employees responded by shifting their work schedule. These shifts were predominantly to an earlier daily schedule, and were more pronounced in the morning (work start time) than in the evening (work end time). The commute trip was shorter during the Olympics, with an average travel time savings of 5.6 minutes or 14%.

Modal shifts were minimal during the Olympics, with employees at only one firm shifting from drive alone to carpools in significant numbers. Employer influence was evident in the varied responses to the Olympics made by each of the participating firms. The cumulative effect of these small changes made in trip

scheduling, route and mode choice, as well as trip making was much better than usual system performance.

These changes were possible because commuters were provided with a wide variety of choices. Employers gave employees greater freedom in selecting work schedules, while local transportation agencies provided detailed information on alternative commute options. Individuals were free to choose the alternative most suitable to their specific needs. Faced with the prospect of gridlock conditions, downtown commuters made adjustments which resulted in benefits to all travelers.

The survey results also provide some insight on relative preferences between alternative changes. The most frequent changes were in work trip scheduling and work attendance. It is reasonable that faced with a short-term situation, many would choose simply to avoid the problem completely by taking vacation or other time off.

Changes in trip scheduling are also a likely choice, particularly for the short term. Unlike carpool or transit, they do not require a cooperative effort or adherence to someone else's schedule. Moreover, work trip scheduling to avoid peak traffic will result in travel time savings. Thus the benefits of such a strategy, particularly for the short term, are clear.

Conversely, it is not surprising that few changes in mode choice occurred, except where the employer made a concerted effort to organize employee carpools. The financial benefits of ridesharing are inconsequential for a two week period, while costs in terms of longer travel times would be incurred. Thus while ridesharing is a most attractive long-term strategy for central city commuters, it was not an attractive short-term strategy.

One of the most frequently asked questions about the Olympics transportation experience is, can it be repeated? That is, can incentives be created which promote

changes in travel demand patterns on a long term basis? The answer is probably not. The changes made during the Olympics were in response to expected gridlock level conditions. Once these conditions failed to materialize, demand patterns began to shift, traffic volumes gradually increased, and congestion returned to normal levels. Incentives sufficient to substantially affect "normal conditions" (e.g., parking constraints, congestion fees) are probably politically infeasible. However, it might be interesting to conduct a follow-up survey of downtown commuters to determine whether their long-term travel behavior has changed in any way.

Finally, the Olympics experience seems to demonstrate the remarkable flexibility of the transportation system. In an area where traffic congestion is legendary, travel demand adjustments were made which resulted in better than normal conditions.