Roadway Improvements and Traffic Circulation Patterns for the 1982 World's Fair in Knoxville, Tennessee

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ABSTRACT

The 1982 World's Fair in Knoxville, Tennessee, was a major special event for which a variety of transportation improvements and programs were implemented in the hope of averting severe traffic congestion. Historically, Knoxville's road system was inadequate to handle existing regional and local traffic, so planners, engineers, and administrators had to assume an aggressive posture to effect needed improvements. The nature of these improvements, including their expected and actual impacts, is explored. Also included is an analysis of daily and hourly traffic distribution patterns. Overall the transportation system surrounding the 1982 World's Fair performed excellently. Many roadway improvements initiated for the fair will have residual benefits to Knoxville for several years to come. Other projects implemented solely for the fair performed well. The capital improvements were complemented by a favorable transportation modal split and temporal traffic distribution characteristics. Planners of future special events can benefit by applying some general principles that arose from the Knoxville experience including realistic estimates of travel demand and transportation modal split, providing motorists with guidance to parking areas, gate location and number, knowledge of the event's expected arrival and departure patterns, and fostering a high degree of agency cooperation.

The information presented in this paper was prepared as part of a project funded by UMTA entitled 1982 World's Fair Transportation System Evaluation. This project was conceived in August 1982 as an UMTA Section 8 Planning Grant during the height of the 1982 World's Fair. At that time, the successful operation of the transportation system for the World's Fair and the need to document planning efforts prompted UMTA officials to initiate the project. Heretofore there had been little transportation-related study of large-scale special events, and the results could be used in preparing for the forthcoming Olympics in Los Angeles and the New Orleans World's Fair (both in 1984).

All aspects of the transportation system were studied, including roadway improvements, parking, access, tour and shuttle buses, local bus service, interagency involvement, and design parameters. The study was divided into two phases. Phase I was a quick overview of the lessons learned by the various agencies involved and was completed within 90 days of the start date. Phase II covered the same material in much greater detail and included analysis of the available data. For a complete picture of the transportation system the reader is referred to those reports (1,2).

SETTING OF THE 1982 WORLD'S FAIR

Knoxville is located in the geographic heart of the eastern United States in a broad valley between the Cumberland Mountains to the northwest and the Great Smoky Mountains to the southeast. It is located at one of the Interstate system's busiest intersections, I-40 and I-75; it is served by an inland waterway and surrounded by five of the Tennessee Valley Authority (TVA) lakes on the south. Figure 1 shows the area's road network and the location of the fair site adjacent to the Knoxville central business district (CBD). Nearby institutional energy resources, including TVA, the University of Tennessee, and Oak Ridge National Laboratory, helped precipitate selection of the fair's energy theme. In 1980 the populations of the city of Knoxville, Knox County, and the Knoxville standard metropolitan statistical area (SMSA) were 175,045, 319,694, and 476,517, respectively.

During the planning stages of the 1982 World's Fair many citizens and government officials feared that the fair would cause 6 months of constant traffic congestion. This fear was based on the more than 60,000 people per day that had been projected to attend the fair. This was compounded by the inadequacy of Knoxville's Interstate and street system, which historically had not been able to meet traffic needs even without such an event occurring in town. Further, the traffic problems that occur in conjunction with University of Tennessee home football games, which take place in the 94,000-seat Neyland Stadium, led many people to equate the fair with a 6-month long football game. These perceptions strongly motivated fair organizers and city and state officials to take an aggressive posture in implementing planned roadway improvements before the opening of the fair. Fair planners strove to provide good access to the fair and its bus terminal and parking facilities while maintaining good levels of service on central area streets. As it turned out, the roadway improvements were well planned and traffic operations were aided by the traffic patterns that materialized during the fair.

ROADWAY PROJECTS IMPLEMENTED FOR THE WORLD'S FAIR

Table 1 lists the various roadway improvements and projects that were planned and implemented for the fair; these can be located by number on Figure 2. In some cases, the projects were part of the long-range transportation plan for the Knoxville area but schedules were advanced for the fair. This was a positive impact of the fair on the overall transportation system; Knoxville received several large-scale road improvements in a short span of time that will continue to operate efficiently well into the future. Table 1 gives project scheduling and costs, as well as the approximate increase in capacity effected by the projects. Also included are comments about what the projects were expected to do and reflections on their effectiveness. The remainder of this section will deal with the most important projects listed in Table 1.

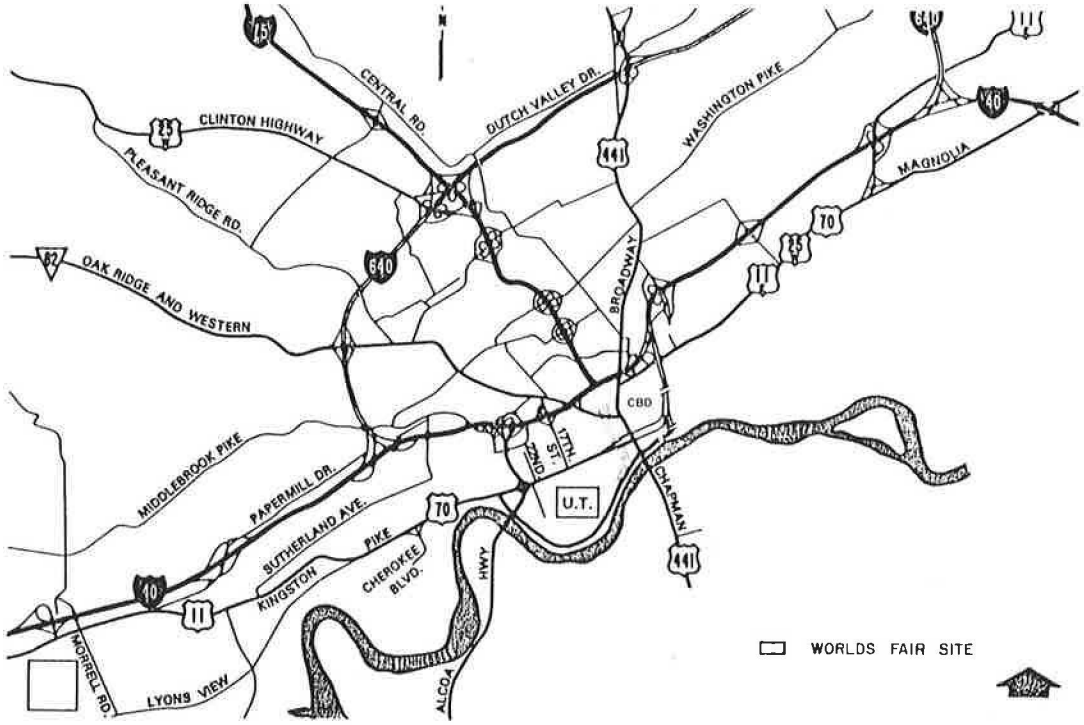

FIGURE 1 General setting of 1982 World's Fair site.

Interstate Improvements

By far the most important set of transportation improvements to occur in conjunction with the 1982 World's Fair were those to the Interstate system. To understand their significance it is necessary to know what conditions were like before the fair.

When the Interstate system was constructed in Knoxville it followed the alignment of an already existing expressway system located on the northern border of the CBD. It was heavily traveled because I-40 (an east-west route) traversed the midtown area and I-75 (a north-south route) interchanged with I-40 immediately north of the CBD. As both regional

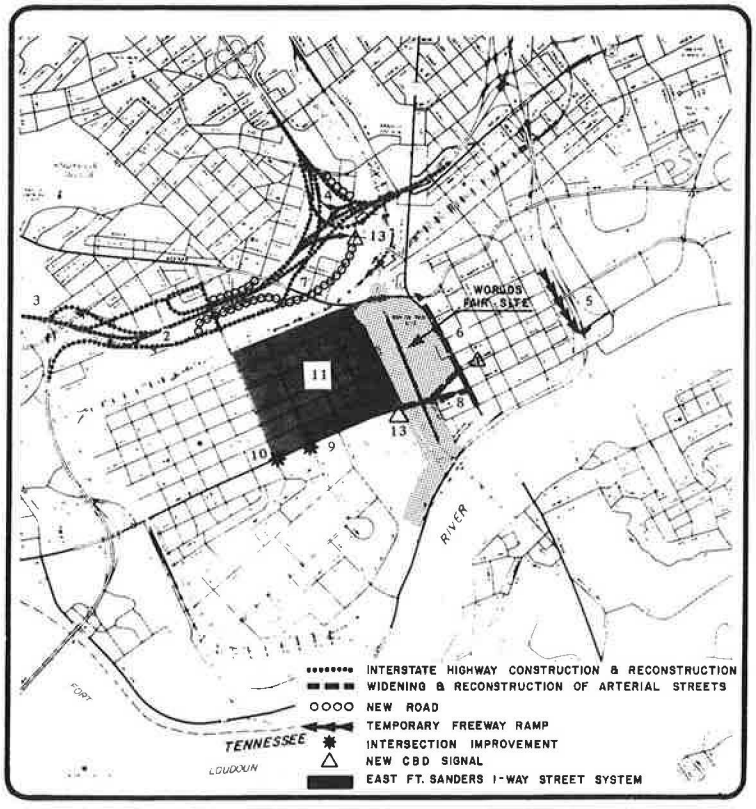

FIGURE 2 Local roadway improvements.

TABLE 1 Summary of Transportation Projects Implemented for the World's Fair

ROADWAY/ PROJECT	DESCRIPTION	SCHEDULING START	SCHEDULING END	SCHEDULING COST	EXPECTED IMPACT RELATED TO FAIR	ACTUAL IMPACT INCREASE IN CAPACITY	ACTUAL IMPACT COMMENTS
1. I-640	Construction of 6 lane bypass route around central city.	10-77	4-82	State $115 million (includes interchanges)	Remove through I-75 traffic from central area; provide alternative for through I-40 traffic.	(new route)	Although completed before Fair, I-640 will have long range benefits to area; worked well during the Fair; handled all through trucks during Fair.
2. I-40	Widening to 4-5 lanes each direction between I-275 and Alcoa Highway; redesign of interchanges between I-275 and Alcoa Highway; construct Dale/ Ailor one-way pair as a frontage road for the interstate.	11-79	4-82	State $57 millinn	Increase freeway capacity. Reduce conflicts at interchange due to short weaving sections.	3500-5250 vph (one direction, mainline only)	Worked well during the Fair. Total number of interstate accidents reduced.
3. I-40	Widening to 3 lanes each direction between Alcoa Highway and Papermill Road.	11-79	4-82	State $6 million	Increase freeway capacity.	1750 vph (one direction)	Worked well during the Fair.
4. Temporary Interstate Ramps	Addition to entrance ramps to I-275 North and I-40 West and exit ramp from I-40 East.	10-81	3-82	Included in item (2)	Increase access to Fair and CBD; distribute traffic over larger area.		Valuable additions to interstate system that will continue to function well into the future; much Fair-related traffic used them.
5. Temporary Ramp from Business Loop	Addition to exit ramp from Business Loop to Hill Avenue.		N/A		Provide access to Coliseum Parking Area.		Used during Fair; probably reduced accidents; removed after Fair.
6. Henley Street	Widen to 3 basic lanes each direction with a median; addition of exclusive left turn and dual left turn lanes at intersections.	9-80	10-81	$1,613,000	Increase capacity; limit driveway access; increase pedestrian safety; improve main entrance appearance.		Worked well during the Fair even with drastic increases in volumes. Reduced total accidents; median provided refuge for pedestrian crossing; acquisition of ROW for east side of Fair, which was also used to widen Henley, greatly helped in the completion of this project.
7. Blackstock Avenue	Construct new roadway from Dale Avenue to Oak Street	11-81	5-82	State $102,000	Improve access to north gate (tour bus terminal).	(new route)	Essential for tour bus access; residual use as a frontage road.
8. Cumberland and Main Avenues	Realign and reconstruct between Henley and 11th Streets; add a Texas U-turn.	9-80	10-81	Cost included under item 6	Provide adequate site for U.S. Pavilion; reduce separation of north and south sections of Fair site.	N/A	Reduced travel time along the Cumberland/Main one way pair. Better connection for pedestrians between the UT main campus and CBD since an industrial slum was removed.
9. Cumberland Avenue/16th Street	Widen Cumberland on west side of intersection to provide left turn storage for east bound vehicles.	7-81	10-81	State $47,000	Increase roadway, capacity; reduce accidents.	600 vph	Provided some of the necessary capacity increase for the Fair. This allowed prohibition or left turns at 17th which assists in reducing travel time along the corridor.
10. Cumberland Avenue/17th Street	Prohibit left turns from both approaches to Cumberland Avenue.				Increase roadway capacity. Reduce accidents.	600 vph	Reduced travel time along Cumberland Avenue.
11. One-way street designations (includes Eastern Fort Sanders, Poplar Street, Heins Street, Tulip Street, Blackstock Avenue and Ramsey Street.	Convert existing two way streets to alternating one-way streets.			N/A	Increase roadway capacity and curb parking potential.		Seemed to work well during the Fair; possibly held down accidents; promoted pedestrian safety.
12. Prohibition of through I-40 trucks.	Require through trucks to use I-640 bypass.	4-82	5-82	$8,000	Increase CBD freeway capacity; decrease truck/automobile conflicts near CBD interchanges. Safety from potential hazardous materials accidents.		Required trucks to travel an extra 4 miles; prohibition ended with Fair.

TABLE 1 (continued)

ROADWAY/ PROJECT	DESCRIPTION	SCHEDULING START	SCHEDULING END	SCHEDULING COST	EXPECTED IMPACT RELATED TO FAIR	ACTUAL IMPACT INCREASE IN CAPACITY	ACTUAL IMPACT COMMENTS
13. Traffic signal installations	1. Cumberland/Locust 2. Cumberland/11th 3. Blackstock/Oak/ I-40 Exit.				Decrease delays; increase pedestrian safety.		Blackstock/Oak/I-40 Exit signal facilitated tour bus movements. Blackstock Oak/I-40 signal removed after Fair. Cumberland/ Locust and Cumberland/11th may be removed depending on World's Fair site development.
14. Computerized traffic signal control system.	Coordination of traffic signals adjacent to World's Fair site.	5-79	10-83	Fed/State/City $3,500,000	Decrease delays at signals; promote progressive traffic flow.		Improved air pollution and energy use; travel time was decreased even through the traffic volumes increased on major arterials.
15. CBD street system.	Resurface and replace pavement markings.	10-81	11-81	City $250,000	Improve appearance and driving quality; increase inter-section capacity.	Additional left turn capacity and less delay to thru traffic.	Pedestrian crosswalk marked for safety.
16. Replace 500 street name signs; add block address numbers.	---	12-81	3-82	$40,000	Improve appearance and tourists' orientation.	N/A	Primarily on amenity.
17. Install 1400 regulatory and traffic control signs (mostly "Parking/No Parking").	---	2-82	5-82	$42,000	Provide adequate information to motorists.	N/A	Parking regulatory signs were essential to facili-tate traffic movement on important access routes.
18. Upgrade street lighting in CBD.	---	6-81	4-82	City $10,000	Increase pedestrian security.	N/A	More efficient lighting sources (high pressure sodium) were installed.
19. CBD Land-scaping, Street Furniture and Sidwalk Improvements.	27,000 sq.yds. of sidewalk, trees, benches, and trash receptacles.	2-81	4-82	City $375,000	Reduce pedestrian vehicle conflicts; improve appearance.	N/A	Only necessary sidewalk improvements were immediately adjacent to Fair site.
20. Pedestrian signals at selected locations.		1-81	12-81	City $40,000		N/A	Provide protection for pedestrians.
21. World's Fair trailblazer signing.	Install signs on major approach routes direc-ting tourists to parking areas (over 80 locations).	1-82	4-82	State $60,000 City (includes removal $40,000)	Distribute traffic to various parking areas.	N/A	People tended to follow the first trailblazer exit that they encountered; overall very useful, but certain improvements could have made trailblazing work better (see text).
22. New taxi, passenger, bus loading, and no-parking zones.	---	3-82	4-82	City $3,000	Facilitate necessary curb usage.		

and local traffic grew during the late 1960s and 1970s the sections of interstate adjacent to this cloverleaf design interchange experienced frequent and severe traffic congestion. This led to its nick-name of "malfunction junction."

Figure 3 shows the CBD section of I-40 before and after improvements were made. Some of the major dif-ferences are the redesign of the I-275 and I-40 interchange (formerly malfunction junction), the elimination of the Western Avenue interchange, the incorporation of Dale and Ailor avenues as a one-way pair of frontage roads, and the redesign of the Alcoa Highway interchange.

The addition of Blackstock Avenue had a specific use during the fair as an access route to the tour bus terminal and north parking lot and is now func-tioning as a frontage road to the temporary Inter-state ramps. These ramps were constructed to provide access to the CBD area during the fair because it was not possible to build the final I-275 and I-40 interchange, which was designed with several ramps tying directly into Henley Street, before the fair opened. The ramps were not designed to FHWA stan-dards but were allowed to be constructed as tempo-rary ramps. They will remain until the final design is implemented.

Another change that occurred in the CBD section of the Interstate system was that signs were placed on I-75 along the western leg of I-640, the semi-circumferential bypass route. This removed through

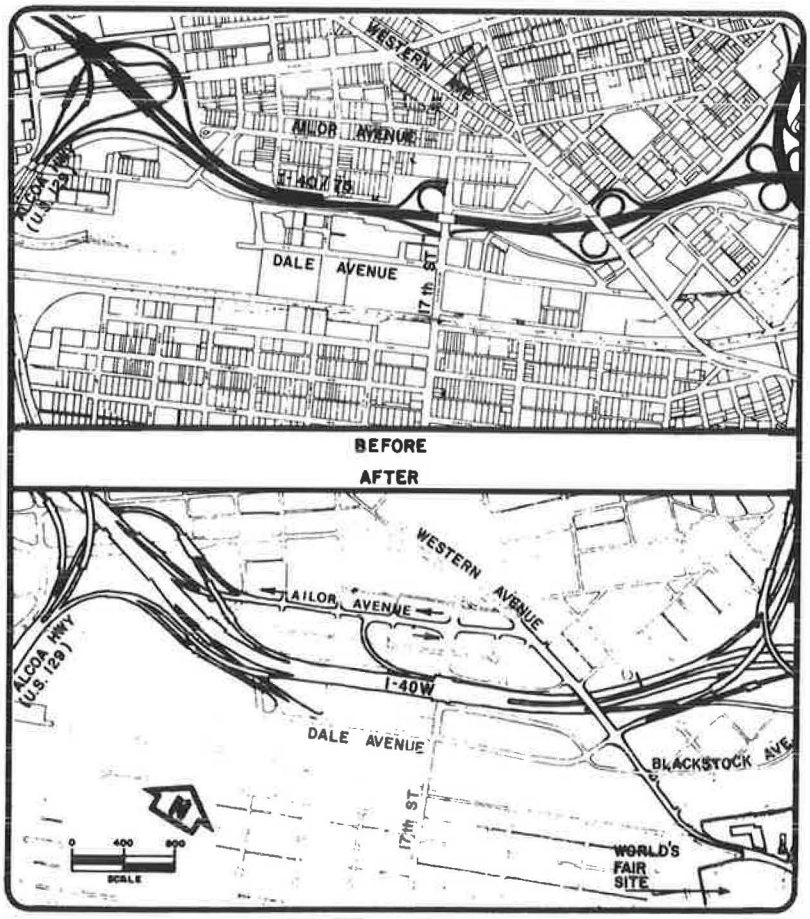

FIGURE 3 Comparison of CBD Interstate system before and after World's Fair.

I-75 traffic from the downtown area. The section of Interstate that previously had been I-75 was designated as I-275 (see Figure 3).

Local Street Improvements

Perhaps the most important of the local street improvements in the vicinity of the fair were those to Henley Street, which forms most of the eastern border of the fair site. Prior to the fair this street suffered from congestion due to the large number of signalized intersections with inadequate numbers of lanes (the old cross section was five lanes, undivided, with a continuous center turn lane). The improvements on Henley Street were crucial to handle the substantial amount of fair-related traffic.

The "trailblazer" signing system was developed to direct motorists, particularly those arriving by the Interstate, to parking areas. The intent was to distribute traffic and to keep vehicles from unnecessarily cruising by the fair site. The system consisted of two separate signs placed side by side: one with the fair's logo on it (a symbolic flame design) and one indicating parking. These were placed at more than 80 locations on fair approach routes and local streets. Two problems arose in relation to the trailblazer system, however. First, vandalism and theft were considerable; apparently many people regarded the signs as ideal souvenirs. Second, motorists tended to follow the first occurrence of the trailblazers even though several exits were signed with them. This resulted in an uneven distribution of traffic and parking lot use. Although serious problems did not arise, this is a noteworthy item for future special events planning; it is generally agreed by fair planners that more time should be devoted to the conception and installation of a guidance system of this type.

ANALYSIS OF TRAFFIC PATTERNS

Daily Traffic Volume Comparisons

Figure 4 shows the projected and actual daily increases in traffic on major approach routes to the 1982 World's Fair. During the planning stages of the fair, traffic was projected to increase by approximately 33,000 vehicles per day on major approach routes (4). This figure was determined by first estimating a design day, based on the 90th percentile of expected attendance variation, and applying estimates of transportation modal split (attendance variation data were borrowed from previous world's fairs of similar size).

Table 2 gives a comparison of expected and actual values for modal split. The "actual" percentages are estimates based on daily counts of tour buses, selected counts of shuttle bus passengers, and changes in local transit use (no formal modal split study was conducted). Modal utilization was observed to vary during the course of the fair. In the first 2 months the use of tour bus and shuttle bus service was high, but this decreased over the final 4 months in favor of increased personal vehicle use. This pattern may be attributable to patrons' prior per-

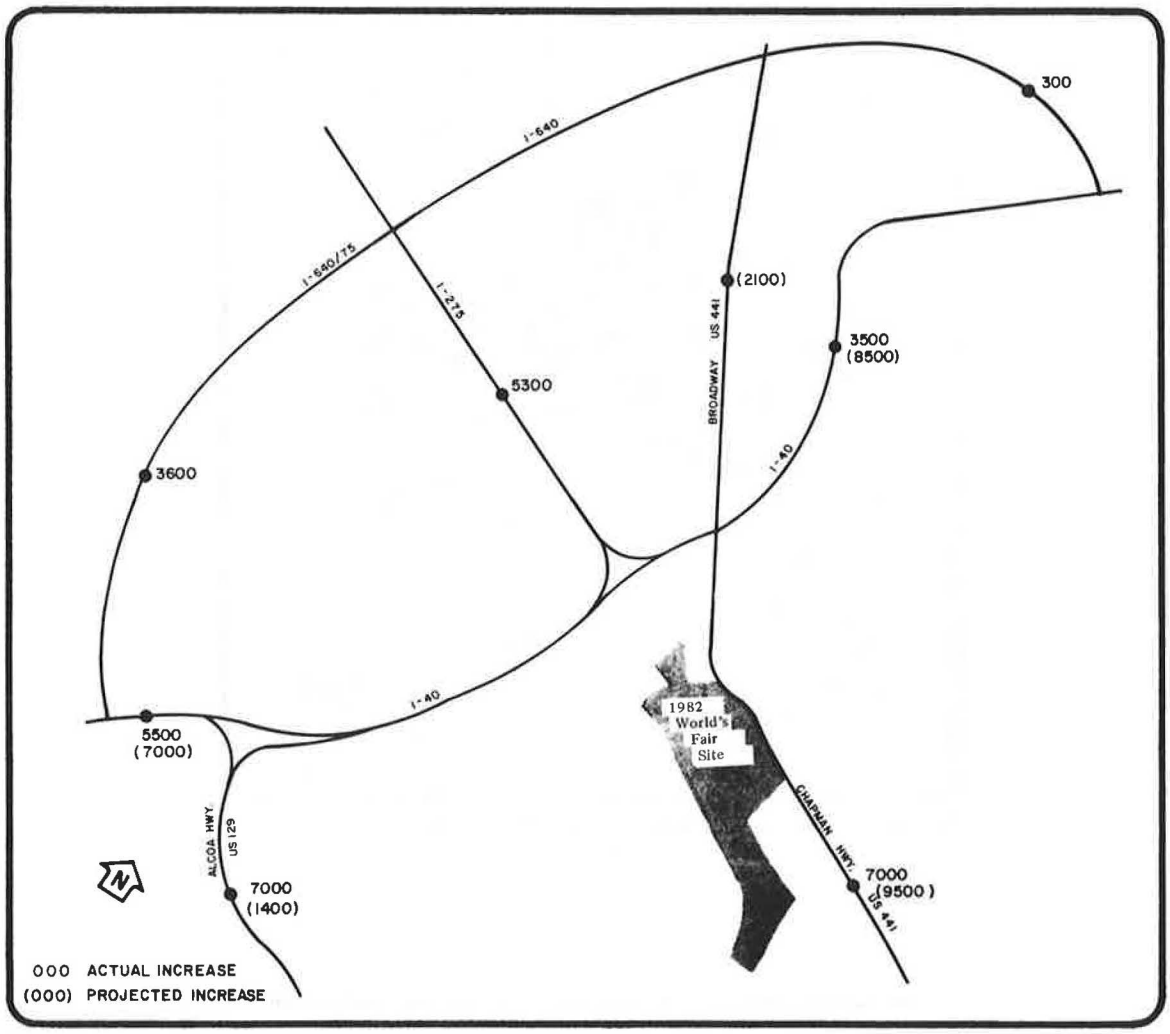

FIGURE 4 Projected versus actual traffic increases (vehicles per day) on major approach routes.

TABLE 2 Percentages of Projected and Actual (Estimated) Modal Split for the 1982 World's Fair

Mode	Projected (%)	Actual (%)[a]
Personal vehicle	65	65
Tour bus[b]	15	18
Shuttle bus[b]	15	7
Local transit	2	2
Walk	3	8

Note: The larger than expected use of tour buses can be traced directly to the fair's strong marketing in this area.

[a] Estimated using available data.
[b] Tour buses were defined to be organized group tours from outside of the Knoxville area; shuttle buses carried patrons who had previously driven to the area and parked at remote lots.

ception of severe traffic congestion; when this did not materialize, they chose to drive instead of using tour and shuttle buses. Overall, when the values in Figure 4 and Table 2 are compared, it is apparent that the estimates of modal split and total vehicles on all approach routes were highly accurate. (Although there were discrepancies on individual routes between projected and actual volume increases, total volume increase was well estimated.)

Extensive traffic count data were available for the local street system. These data were collected by the City Department of Engineering during and after the fair in two forms: (a) tube counts at selected locations and (b) one-way counts made downstream from intersections by the newly installed computerized signal control system. Figure 5 shows overall average daily traffic (ADT) volumes on the local street system adjacent to the fair site during and after the fair (these are average counts for both weekdays and weekends). Fair planners had originally expected slight gains in volume in the immediate vicinity of the site because of the distribution of parking space (4) but, as can be seen, significant increases materialized. Much of this can be attributed to people driving close to the fair site to get a glimpse of it before parking. This situation was perpetuated by the overall lack of traffic congestion around the site. (As will be shown later, the increases did not significantly affect traffic operations because of roadway improvements and fair arrival and departure patterns.)

The comparison of overall ADT counts does not give a full picture of the impact of fair traffic on daily commuting and business travel by area residents. Figures 6 and 7 show the ADT volumes derived from weekday and weekend counts during and after the fair. In nearly every case, the difference in weekend traffic is far greater than the difference in weekday traffic. This indicates that the differences shown in Figure 6 are attributable to large increases in weekend traffic during the fair. The weekday ADT map shows that, in most cases, the weekday effects of fair traffic are minimal. For ex-

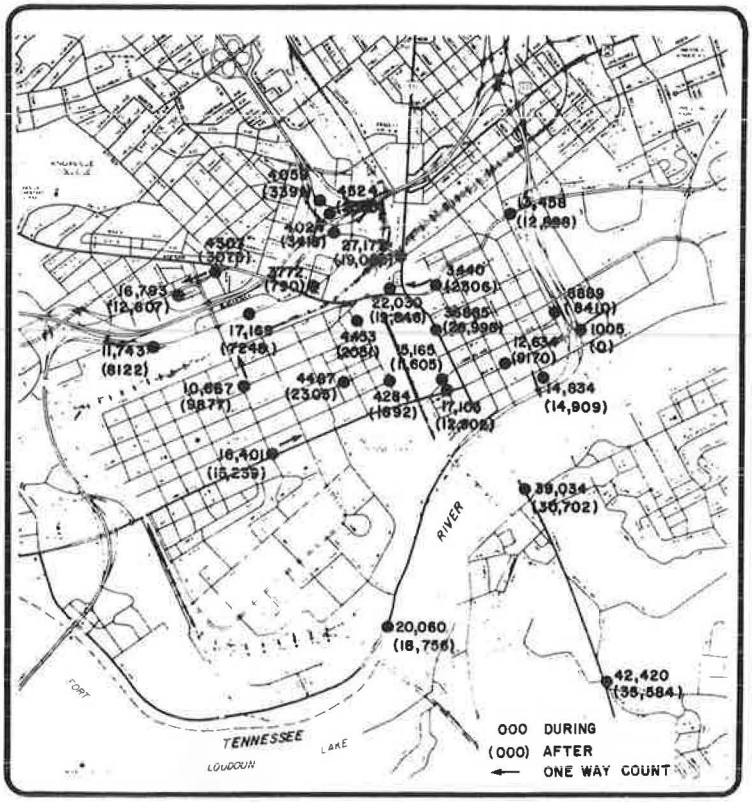

FIGURE 5 Overall average daily traffic on selected routes.

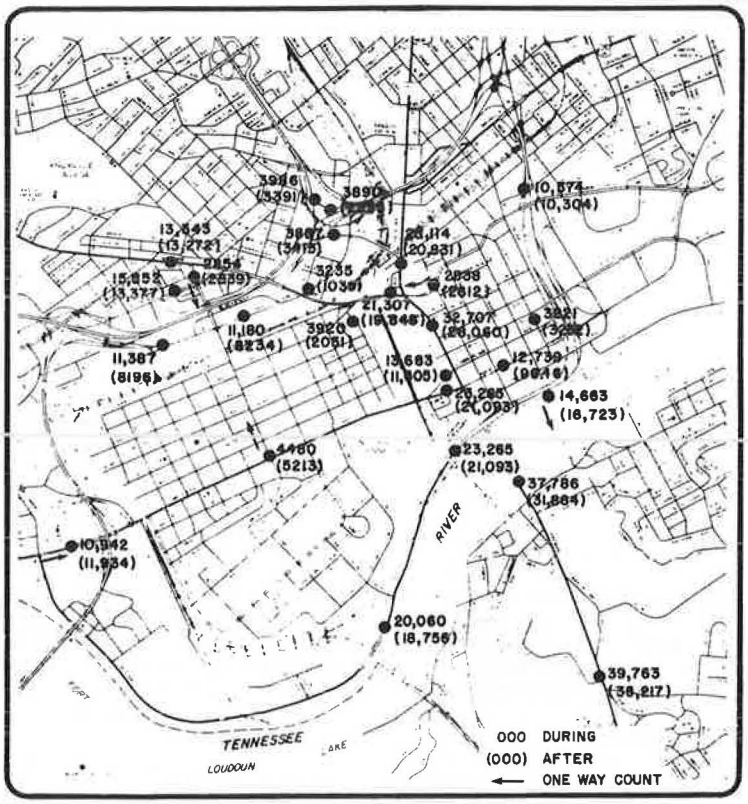

FIGURE 6 Weekday average daily traffic on selected routes.

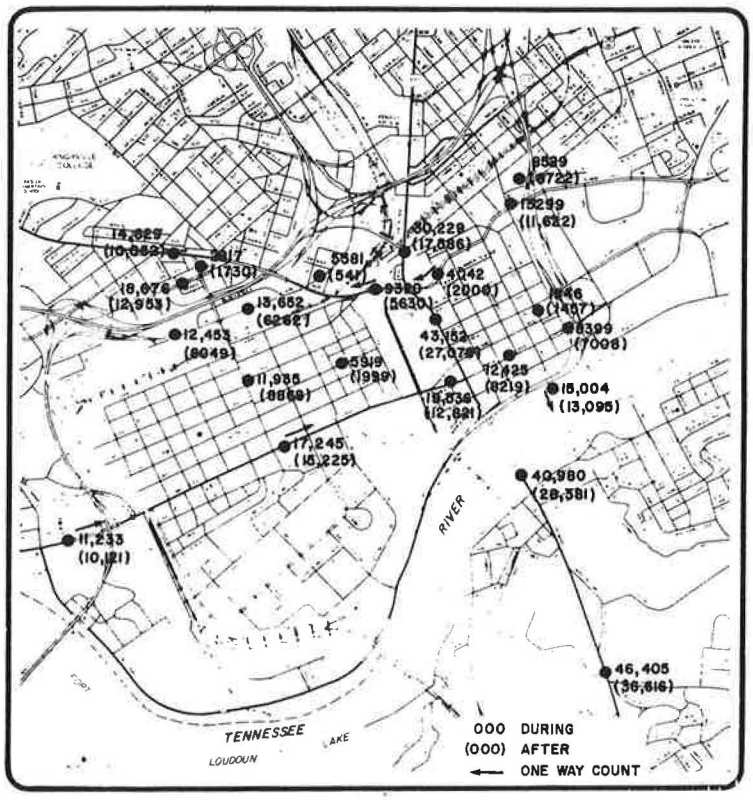

FIGURE 7 Weekend average daily traffic on selected routes.

ample, the weekday increase on Henley Street was 17 percent but the weekend increase was 60 percent.

If weekday versus weekend ADT counts during the fair are compared with weekend versus weekday ADT counts after the fair, it is found that traffic varied much more after the fair than during the fair. This implies that traffic during the fair distributed itself more evenly through the week. Thus, the excess in capacity that normally exists on weekends because of lack of commuters and business travel was used by fair traffic. Weekend fair traffic was generally higher than weekday fair traffic because weekend attendance was higher than for weekdays (the average weekday accounted for 13.8 percent of total weekly attendance whereas weekend days experienced 15.5 percent).

Hourly Traffic Volume Comparisons

Graphs of hourly variations in traffic during and after the fair were compiled from both tube and com-

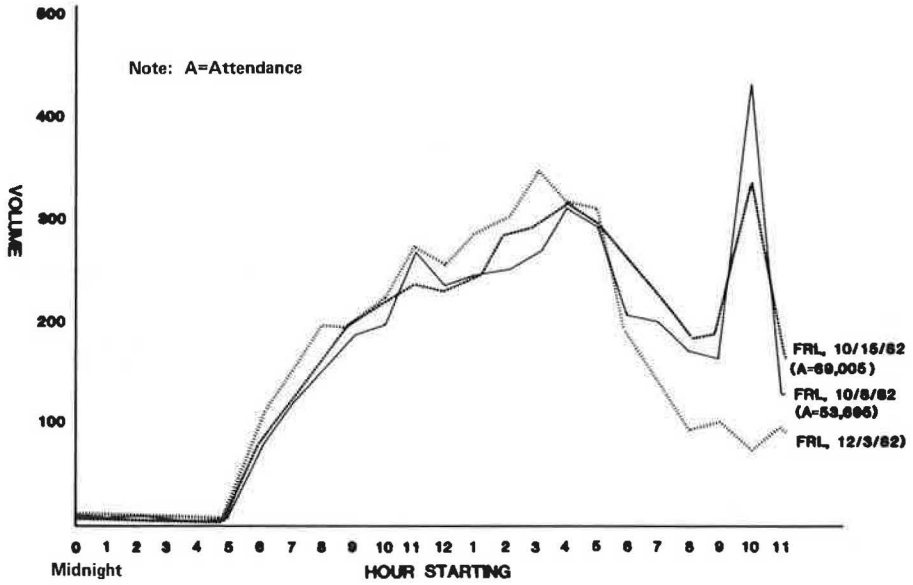

FIGURE 8 Traffic volume variations for Ailor Avenue at Western Avenue, westbound weekdays (street serving outbound fair traffic).

puter counts and they represent traffic volumes factored for day and month. These show the variations in traffic patterns caused by the fair.

Figure 8 shows Friday traffic on westbound Ailor Avenue just west of its intersection with Western Avenue. As previously mentioned, this route serves as a collector and distributor to I-40. Hourly variations were similar for low and high fair attendance days as well as for after the fair. The exception is the sharp peak between 10 and 11 p.m. during the fair. This represents traffic leaving the fair after it closed at 10 p.m. Figure 9 shows westbound Summit Hill Drive just west of Locust Street one block from the fair site. This also exhibits the 10 to 11 p.m. peak as well as the normal afternoon peak around 4 p.m. However, the 10 to 11 p.m. peak is more pronounced for Ailor Avenue, which was expected because it leads away from the site. The increased traffic during the fair between 8 a.m. and noon on Summit Hill Drive represents the morning CBD inbound peak and visitors arriving at the fair.

Figure 10 shows southbound Henley Street at Clinch Avenue. Again there are the normal morning and afternoon peaks, the morning inbound visitor peak, and the 10 to 11 p.m. peak. As with Summit Hill Drive, there is the continuation of the morning peak during the fair, indicating that most fair visitors arrived after morning rush hour traffic had cleared (opening time for the fair was 10 a.m.). This contention is verified by gate information that showed nearly 60 percent of inbound attendees arrived before noon. These graphs are typical of weekday hourly variations of traffic at locations that showed increases during the fair in that (a) the morning peak was extended over several hours to accommodate visitors arriving to the fair, (b) the afternoon peak was generally not affected, and (c) many fair visitors tended to leave around fair closing time causing a third traffic peak between 9 and 11 p.m.

Figure 11 shows the variation in traffic on southbound Gay Street at Church Avenue. As mentioned

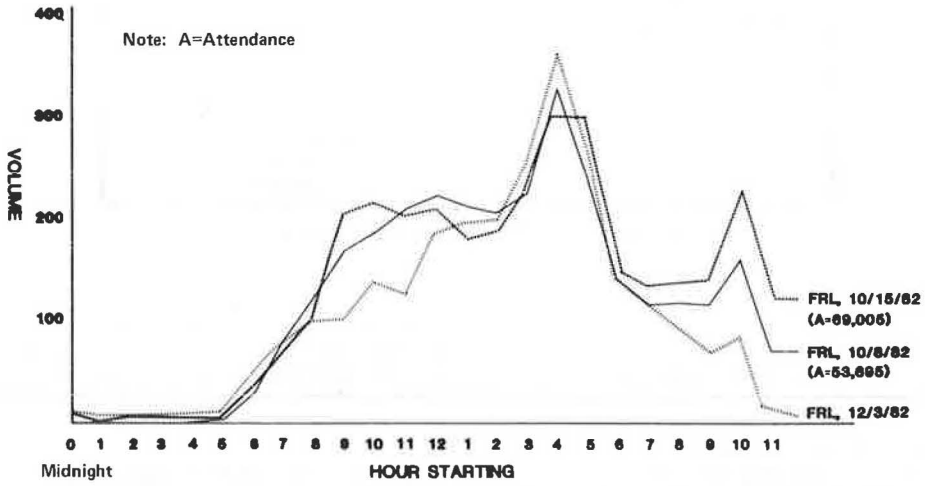

FIGURE 9 Traffic volume variations for Summit Hill Drive at Locust Street, westbound weekdays (street serving inbound fair traffic).

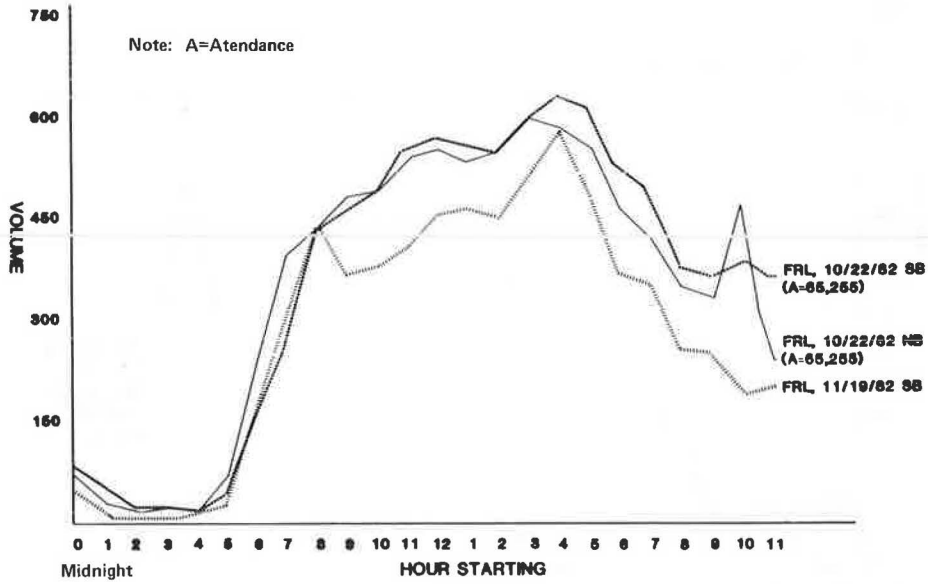

FIGURE 10 Traffic volume variations for Henley Street 200 feet north of Clinch, southbound weekdays (major arterial adjacent to fair site).

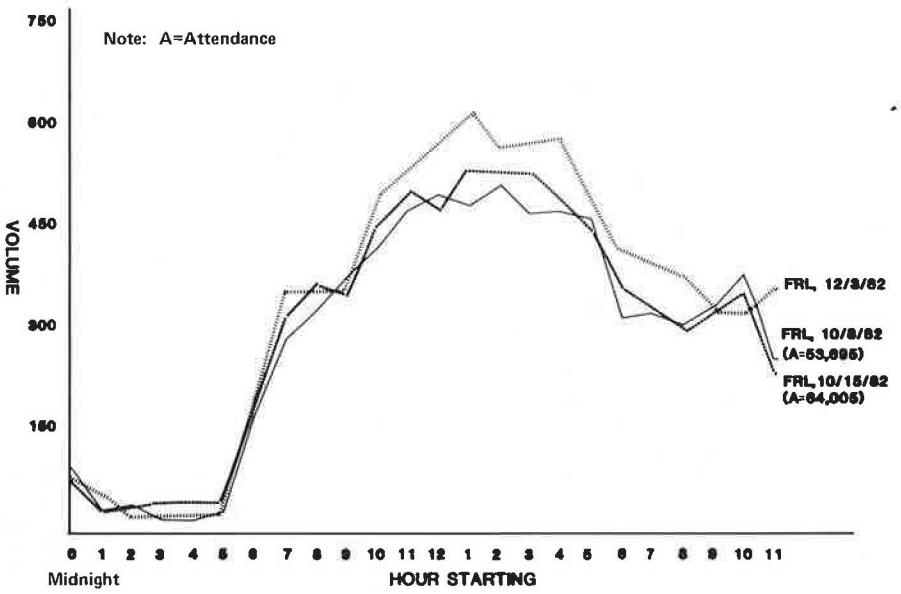

FIGURE 11 Traffic volume variations for Gay Street at Church Street, southbound weekdays (major CBD street not serving as fair approach or departure route).

in the previous section, traffic impacts on the CBD were minimal. The small differences in variations during and after the fair imply that fair visitors concentrated their driving on the fair approach routes and around the fair itself rather than the CBD.

CONCLUSIONS

The capacity of Knoxville's street system was greatly increased during the 1982 World's Fair because of aggressive planning and construction efforts. Planners, engineers, and administrators from a variety of agencies cooperated in identifying and implementing needed projects. Almost all of the major improvements will have residual benefits to Knoxville. Many of these projects were necessary to accommodate future traffic; however, the presence of the World's Fair accelerated their implementation. Certain other improvements that were conceived specifically for the fair functioned very well (e.g., Blackstock Avenue and temporary Interstate ramps). Most of these projects were in the immediate vicinity of the several gates used for access to the fair site.

Analysis of traffic during and after the fair reveals that the hourly and daily distribution of traffic patterns worked in conjunction with roadway and system improvements to avert the serious congestion that many anticipated. The results of this analysis can be summarized as follows.

1. Traffic volumes on the Interstate system increased only between 2 and 9 percent. The mainline improvements that were implemented, including completion of the I-640 loop and widening of I-40 in the downtown area, were more than adequate to meet the needs of fair-generated traffic. The exception was tour buses backing up onto the mainline of I-40; this was rectified by staggering arrival times. Overall, forecasts of increased traffic on major approach routes and modal split were accurate.

2. Traffic volumes generally showed significant increases on roadways in the vicinity of the fair site. New roadways constructed to handle fair traffic, such as the temporary Interstate entrance ramps and Blackstock Avenue, were heavily used during the fair. Non-Interstate approach routes including US-129 and US-441 also showed marked increases.

3. There were main arterials in the area that did not exhibit notable increases in traffic. The western portion of Cumberland Avenue (an east-west arterial) and 17th Street (an Interstate collector) saw little change, probably because the trailblazer system directed traffic elsewhere. Gay Street (a major CBD street) also did not experience increases in traffic because most fair visitors concentrated on the fair. This contradicts early expectations that the fair would cause not only a growth in traffic but also in business in general. Neyland Drive (an arterial on the southern border of the fair site) showed only marginal increases, even though it was on the trailblazer system and used by shuttle buses for access to their terminal.

4. Traffic in the Fort Sanders residential neighborhood increased markedly because of its location adjacent to the fair site and the abundance of small parking lots and curb parking.

5. Most of the traffic generated by the fair occurred during weekends, which minimized interference with local commuting and business travel. Analysis of weekday hourly variations in traffic reveals that arriving and departing trips generated by the fair occurred after the normal morning peak and did not conflict with the afternoon peak. Hourly distributions of weekend traffic during and after the fair were similar, although volumes during the fair were much heavier.

IMPLICATIONS FOR FUTURE SPECIAL EVENTS

Based on the experiences of the 1982 World's Fair in Knoxville several general guidelines for the planning of future large-scale special events can be formulated. These are given below.

1. Some estimate of expected travel demand needs to be made. This process is simplified for transportation planners because attendance estimates are usually available from other sources (e.g., the economic feasibility study). The planners task then is to derive modal split and regional arrival patterns.

Planners need to be aware that the modal split can be affected by the event's promoters, at least to a small degree.

For instance, the Knoxville World's Fair developed an aggressive marketing program geared toward attracting organized tours. Other factors affecting modal split are the provision of remote parking lots and shuttle services; hotel accommodations in the vicinity of the site; the extent to which local fixed-route transit can be used; and decisions concerning the supply and price of parking in the vicinity of the site. [The information for the 1982 World's Fair (2), as well as data from past events of similar scope, can be obtained and adapted to local conditions.]

2. There appears to be a two-tiered system for which transportation improvements must be made. The first is concerned with providing regional access to the general area where the event occurs. In Knoxville this was focused on improvements to the Interstate system, namely, completion of the I-640 circumferential highway and improvements to the Interstate system near the CBD. The second tier involves improvements to local streets in the immediate vicinity of the site. These improvements need to consider not only access to parking lots close to the site but also that many patrons will choose to drive by the periphery of the site particularly if the site is noticeably visible. The interface between the two tiers of improvements can be achieved by using some sort of guidance system. The trailblazer signing system in Knoxville proved not to be very effective because of sign vandalism and people's inclination to follow the first sign they saw. Ideally a system of variable messages could be implemented directing motorists to the proper places at the proper time. However, such a system would be costly to construct and operate and would be advisable only when traffic congestion is expected to be great.

3. The number and location of access gates can affect the distribution of traffic on surrounding local streets. Further, by targeting different gates for specific modes, separation of buses and cars can be obtained; this is especially important when space is at a premium. In Knoxville four gates were used for general access to the fair site (there were also gates expressly for employees and service and delivery). The north gate was used by tour buses; the east and west gates were serviced by local transit; and the south gate was used by shuttle buses (auto parking facilities were located close to all gates).

4. Knowledge of the peaking characteristics of an area can be used to avoid conflicts between commuter and event traffic in that opening and closing times can be arranged so that event traffic arrives and departs after normal peak periods. In Knoxville, the 10 a.m. and 10 p.m. opening and closing times caused little conflict during peak hours (although the morning peak was in effect extended) and created a third but smaller peak around closing time. Further, although more attendance can be expected on weekends, normal excess capacity can usually absorb the increase in traffic (if indeed it exists). Also, the Knoxville experience indicates that fair patrons tend to concentrate on the fair itself and devote little time to other activities.

5. In planning for projects with the scope of a world's fair many projects will cross jurisdictional boundaries necessitating that there be a high degree of cooperation between agencies. This means that representatives of federal, state, and local governments, as well as event promoters and providers of private transportation, must all work together to ensure efficient operation of the transportation system.

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