Transportation Design Parameters for a World's Fair

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ABSTRACT

Limited information is available to assist professionals in designing transportation systems for special events. As a part of the planning effort for the 1982 World's Fair in Knoxville, data were gathered from past world's fairs. Data from the Knoxville Fair and additional data from past events were collected as a part of an UMTA-funded project to evaluate the transportation system for the 1982 World's Fair. The results of that analysis are discussed and additional information and conclusions are given. The design parameters for the transportation system for a world's fair include (a) design day attendance, (b) transportation mode split, (c) hourly distribution of the volume of inbound and outbound visitors, (d) on-site accumulation, and (e) gate distributions. These parameters can be used as a basis for the transportation system design. The transportation system serving a fair consists of (a) access routes to the fair, (b) parking supply and location, (c) facilities for loading and unloading shuttle and tour buses, (d) local transit, (e) local taxi and walk-in potential, and (f) specialized transportation modes such as ferry service or horse drawn carriages. Distributions of attendance, although variable on a day-to-day basis, follow similar patterns from fair to fair and provide a good basis for estimating design day attendance. The limited on-site accumulation data indicate a reasonable range that could be used for planning purposes. Data on hourly distribution of inbound and out-bound volumes are also limited but appear to follow similar trends, and thus could be used in estimating volumes for future fairs. Information on transportation mode split is only available for one fair and is highly dependent on local conditions. Gate distributions can be estimated from mode split but will be influenced by location of modal loadings and constrained by available capacity to accommodate transportation services at a given gate. Some guidelines are provided for use in designing a world's fair transportation system based on experience at past world's fairs.

The access, terminal, parking, and gate facilities for a special event are designed on the basis of several parameters. A special event is defined as an event that will generate significant numbers of visitors over a limited time period. Examples of special events are world's fairs, Olympic Games, and special "one time" exhibitions. Event centers such as theme parks and state fairs tend to have different design parameters than "one time" special events. These design parameters include

- Design day attendance,
- Transportation mode split,
- Hourly distribution of inbound and outbound volumes,
- On-site accumulation, and
- Gate distribution.

The statistical information provided in this paper was gathered from six world's fairs (Knoxville, San Antonio, Seattle, Spokane, Osaka, and Montreal) used to determine the appropriate design parameters. The methods for estimating each parameter are also reviewed, including the level of accuracy. Conclusions and recommendations for future design parameter estimates are provided based on the available information.

ATTENDANCE PATTERNS

Total Attendance

Although it is beyond the scope of this paper to describe how economic feasibility studies for world's fairs are performed, total attendance estimates are based on (a) the type of attraction, (b) past experience with market penetration for similar events, (c) distribution of population within the area of influence, and (d) other local factors that may affect attendance.

Transportation system planning for world's fairs accepts total attendance estimates, usually developed from economic feasibility studies, as a basic assumption. Given the total attendance and fair duration, an average day attendance can be determined. Transportation systems, however, are not typically designed for average day conditions. The 80th to 90th percentile days are generally used. The following sections briefly describe attendance patterns.

Daily Variations

Variations in attendance from day to day and month to month are substantial. Each fair appears to have followed its own general pattern, but actual attendance is not predictable on a day-to-day basis. The patterns are also not predictable from fair to fair. Figure 1 illustrates the daily pattern for the Knoxville World's Fair, as an example (1).

There was no consistency between fairs relative to the peak days either. For example, Spokane's two highest days were opening and closing day. Seattle's two highest days were the last Saturday and Sunday of the fair, and the next two highest days were non-holiday Saturdays in September and October. Opening day at Seattle was 1 percent below average. Knoxville's two highest days were Saturdays in mid-May and mid-October. Opening day in Knoxville was about 10 percent above average and the closing Saturday and Sunday were in the 15th to 20th highest day range. Low attendance days were equally inconsistent, although most have been in September.

Variations by Day of Week

Day of week variations were much more predictable. Table 1 shows such variations for world's fairs in Seattle (1962), Montreal (1967), San Antonio (1968), Osaka (1970), Spokane (1974), and Knoxville (1982)

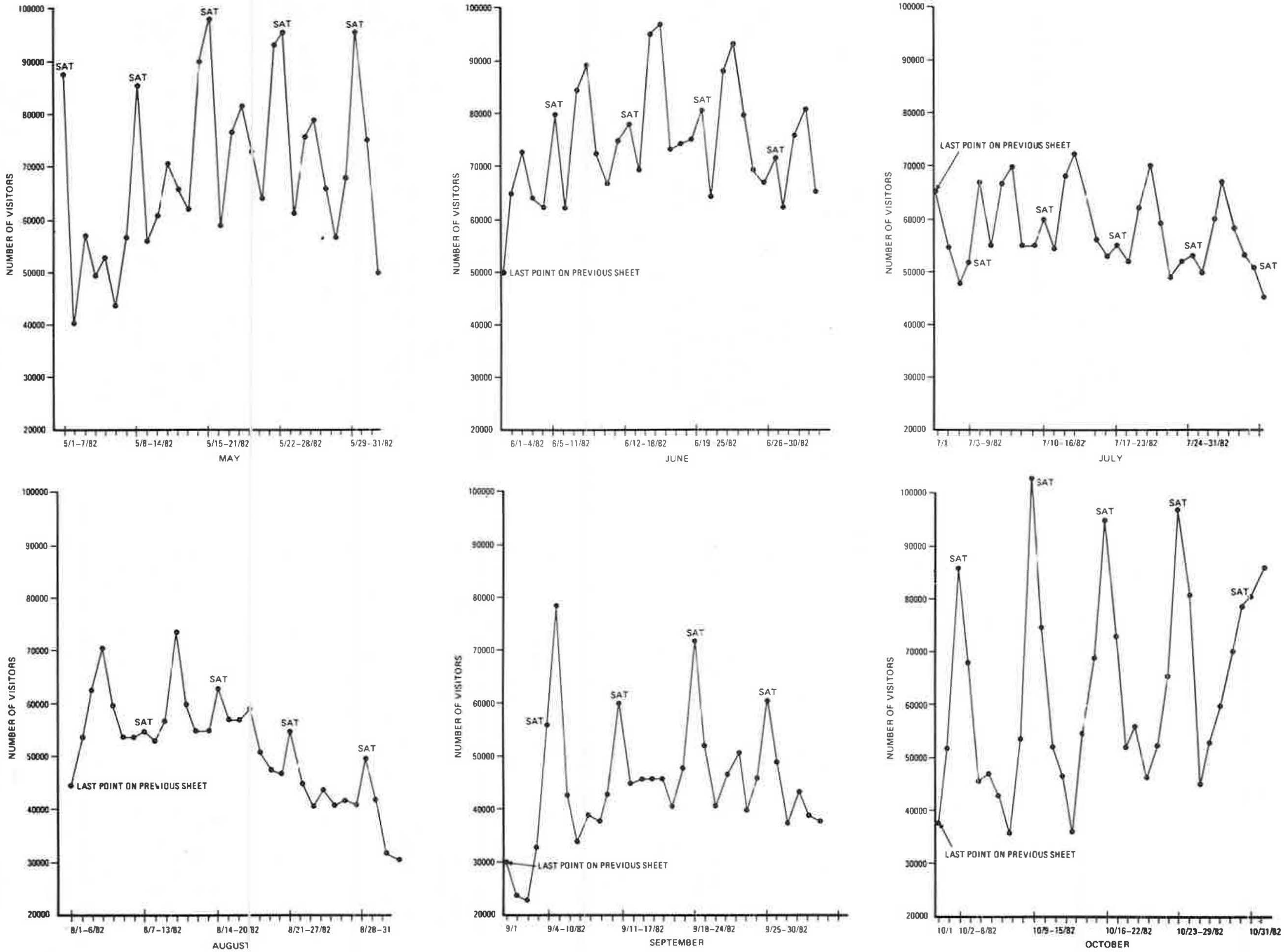

FIGURE 1 1982 World's Fair daily attendance pattern *(1)*.

TABLE 1 Variations in Attendance by Day of Week *(1)*

	Percent of Total Weekly Attendance						
Day	1962 Seattle	1967 Montreal	1968 San Antonio	1970 Osaka	1974 Spokane	1982 Knoxville	U.S. Composite
Monday	13	13	11	14	13	14	13
Tuesday	15	14	12	12	13	15	14
Wednesday	13	14	12	13	13	14	13
Thursday	12	12	11	12	12	12	12
Friday	13	13	12	14	13	14	13
Saturday	18	17	21	17	19	17	18
Sunday	16	17	20	18	17	14	17

(2-4). The Seattle, San Antonio, Spokane, and Knoxville fairs were similar in magnitude of attendance, drawing about 9.6, 6.4, 5.1, and 11.1 million visitors, respectively. The Osaka Fair drew more than 60 million visitors and its attendance patterns were generated in a different cultural setting. Montreal drew over 54 million visitors in a cultural setting similar to the United States.

The peak day of the week for the four U.S. fairs examined has been Saturday, which drew 17 to 19 percent of the weekly attendance. This averages about 25 percent above the average day. Tuesday was the peak weekday in both Seattle and Knoxville with about 15 percent of weekly attendance, which was about 5 percent above the average day. However, Spokane and San Antonio experienced flatter weekday patterns. Thursday was the low day at all four U.S. fairs, at 12 percent of average weekly attendance (about 15 percent below average day). Overall, weekdays generated about two-thirds of the weekly attendance at five of the six fairs. San Antonio's weekday attendance was well below that of other fairs. Even though Spokane experienced a flat weekday trend, it did not have total weekday attendance percentages lower than the other fairs.

Table 1 gives the composite daily distribution for the four U.S. fairs listed. With relatively minor variations, these patterns were consistent from week to week at each fair except San Antonio. Nearly all of the 10 highest attendance days at each occurred on Saturdays and Tuesdays.

Monthly Variations

Table 2 gives attendance variations by month. No two fairs have experienced strong similarities in monthly variations. However, with the exception of the Knoxville Fair, all started slowly, peaked during the summer, dipped in September, and finished stronger in October. The Knoxville Fair had May, June, and October as peak months, with its low in August; Spokane's low was also in August. A major factor contributing to the May-June peak in Knoxville was the heavy influx of tour groups, often amounting to more than 15,000 persons daily. Those numbers dropped by 50 percent or more during the summer. This was the first world's fair to market heavily to tour operators. Such a peak would not be expected for fairs if high tour volumes were not expected.

Design Day Attendance

Facilities must be designed for a certain level of activity. As has been demonstrated, specific attendance patterns are not predictable. It is customary to select a design day attendance that will adequately accommodate all but the highest attendance days.

Figure 2 shows the distributions of daily attendance for the six fairs. With the exception of the magnitude of the few peak days, all distributions are similar. In Knoxville the transportation system was designed for the 90th percentile day based on attendance distributions for Seattle and Spokane. Spokane was designed for what was expected to be the 95th percentile day. No information was available for the design days of the other fairs.

As is readily apparent from the distribution in Figure 2, there is a break in the curve near the 90th percentile. Above that level, each percentile increase represents only 2 days but large increases in attendance. It becomes very expensive to meet the additional facility needs above the 90th percentile attendance day, particularly in view of the few times they will be needed.

Table 3 gives the peak, 90th, and 80th percentile daily attendance for the fairs as a percentage of average daily attendance. The percentage by which peak days exceeded average days varied substan-

TABLE 2 Variations in Attendance by Month *(1)*

	Percent of Total Attendance						
	Seattle	Montreal	San Antonio[a]	Osaka[b]	Spokane	Knoxville	U.S. Composite (May-Oct.)
April	—	—	10	14	--	—	NA
May	11	17	15	13	13	19	14
June	16	16	17	16	20	20	18
July	19	19	19	12	21	16	19
August	20	20	20	18	19	15	19
September	16	14	14	27	11	12	13
October	18	13	5	—	14	18	17

(a) This fair operated between April 6 and October 6.

(b) Listed by consecutive 30 day periods versus calendar months since this fair operated between March 15 and September 13.

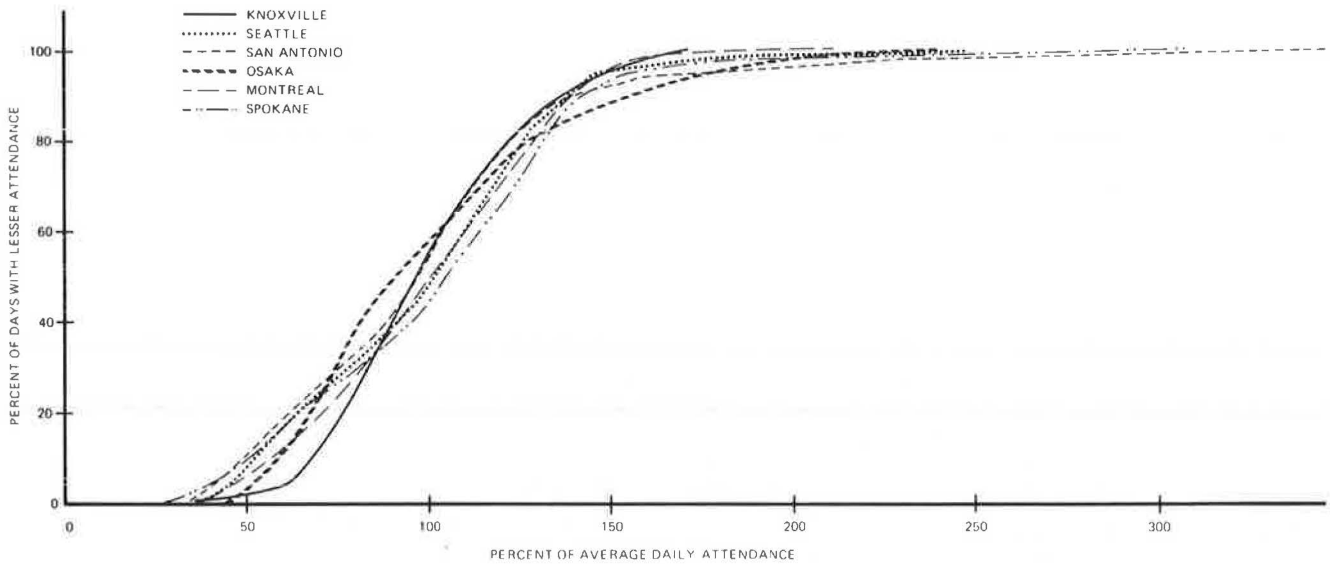

FIGURE 2 Frequency distribution of World's Fair daily attendance.

TABLE 3 Attendance Statistics

	Percent of Average Daily Attendance							
	Seattle	Montreal	San Antonio	Osaka	Spokane	Knoxville	North American Average	Recommended for Planning
Highest Days								
Day	246	208	349	239	462	170	287	—[a]
Weekday	180	175	154	196	160	160	166	160
Weekend Day	246	208	349	239	462	170	287	—
90th Percentile Days								
Day	136	139	148	165	131	138	138	138
Weekday	131	134	115	160	131	130	128	130
Weekend	146	155	225	187	164	158	170	160
80th Percentile Days								
Day	123	127	123	122	121	121	123	122
Weekday	120	122	100	120	122	116	116	120
Weekend Day	141	135	158	135	145	134	143	145

Note: Based on data acquired from unpublished World's Fair files and References (1), (2), (3), and (4).
[a]Varies according to average daily attendance.

tially. The highest attendance day at each fair was a Saturday. Peak weekdays were 60 to 80 percent above average. The relationships of the 90th and 80th percentile days to average days are consistent for Knoxville, Seattle, Spokane, and Montreal as shown in Table 3.

Because all four of the U.S. fair sites studied were in, or immediately adjacent to, downtowns, base weekday versus weekend transportation conditions represent a significant difference. In Knoxville the fair site was also flanked by the University of Tennessee, so there was even a difference between weekday conditions during regular sessions and the summer period. For that reason 80th or 90th percentile weekend and weekday attendance figures should both be used for downtown sites. Similarly, if the fair is adjacent to a seasonal land use (such as a university), attendance figures for weekends and weekdays for both in-use and not in-use seasons need to be generated.

It is advantageous and appropriate for fair transportation designers for downtown sites to use the 80th or 90th percentile weekday estimates for their design day attendance levels. It should be recognized that there will still be a number of peak days on weekends when the weekday system will not be adequate, even after allowing for capacity convertible from weekday central business district (CBD) use to weekend fair use.

CHARACTERISTICS OF ENTRY AND EXIT VOLUME

Fair entry and exit gates need to be sized to meet peak hour volumes. Entry and exit volume characteristics for the World's Fair in Knoxville were examined for the peak weekday (Tuesday) and weekend day (Saturday). Entry and exit information was available only for the Knoxville and Osaka fairs (the only fairs with outbound registering turnstiles). Figures 3 through 6 illustrate the inbound and outbound patterns for the Knoxville Fair, and the patterns for both days are similar. Entry peaks occurred between 10:00 a.m. and 11:00 a.m. when 23

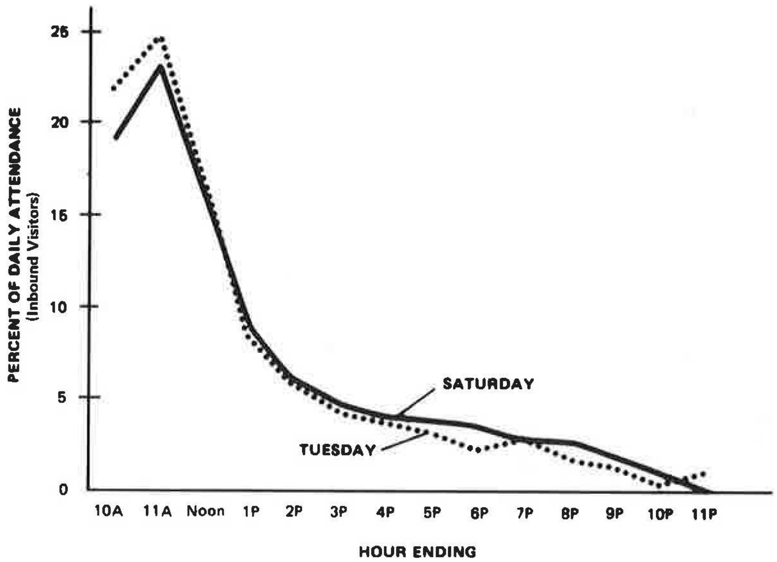

FIGURE 3 Hourly inbound visitor distributions *(1)*.

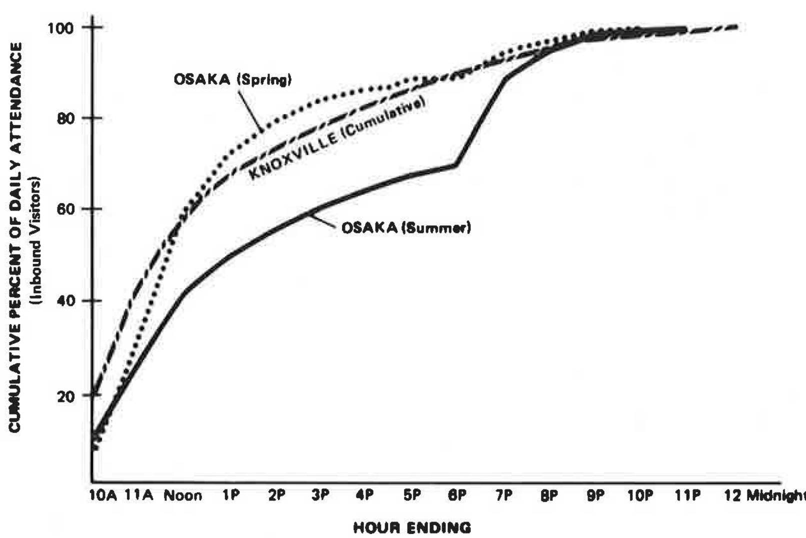

FIGURE 4 Hourly entry volume distributions *(1)*.

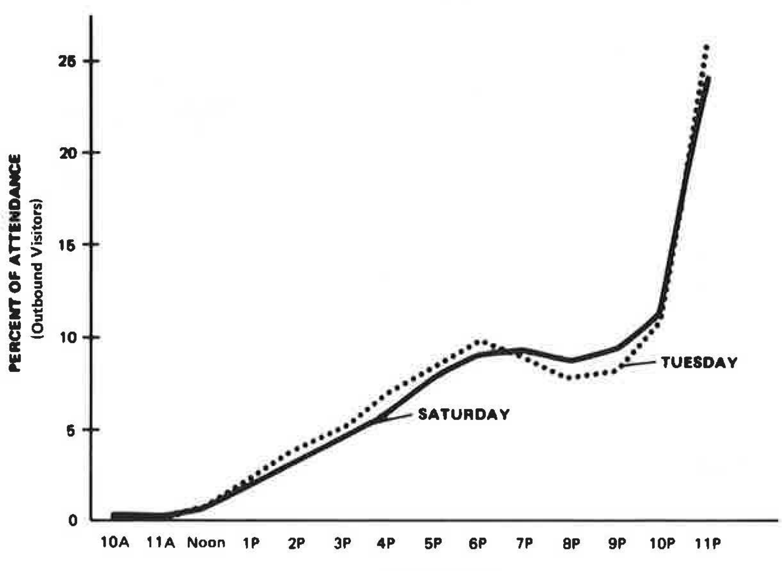

FIGURE 5 Hourly outbound visitor distributions *(1)*.

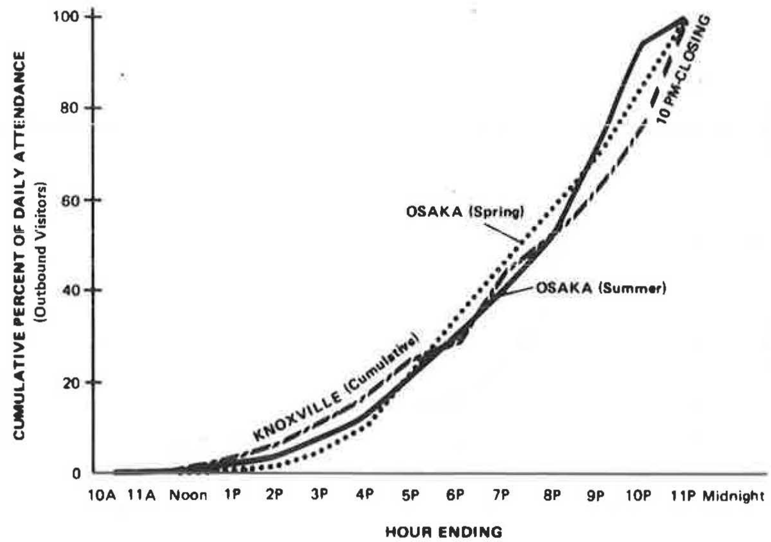

FIGURE 6 Hourly exit volume distributions *(1)*.

(Saturday) and 25 (weekday) percent of the daily attendance entered. Inbound volumes drop off rapidly after noon. Exits increased gradually starting at noon and reached a plateau of 9 to 10 percent from about 6:00 p.m. until closing at 10:00 p.m. then peaked at 24 to 26 percent during the hour following closing (10:00 p.m.). For late closings the total outbound volumes between 10:00 p.m. and 1:00 a.m. were only about 10 percent higher than the 10:00 to 11:00 p.m. hour on early closing nights. As with patterns for inbound volume, exit volumes for Tuesday and Saturday are distributed similarly.

Figures 4 and 6 show cumulative entry and exit volume distributions for Saturdays for Knoxville and Osaka. The cumulative inbound distributions for Knoxville are similar to the spring season pattern at Osaka. The summer in Osaka had an evening peak from 6:00 to 7:00 p.m.; otherwise the summer pattern is similar to Knoxville. The outbound cumulative curves are similar. Hence, these hourly patterns appear to be usable for estimating hourly volume distributions.

Two other available sources of hourly inbound and outbound distributions are data from theme parks and the State Fair of Texas. Table 4 gives these distributions and the actual hourly distributions found at the Knoxville Fair. The inbound estimates based on theme parks were not far off. However, the state fair inbound and outbound estimates were not similar. Nevertheless, all were reasonably close on the peak-hour volume in each direction. Hence, it can be concluded that the peak-hour volume magnitudes may be determined from several sources. The actual time of day when the peak will occur is not as easily determined except from world's fair data (Figures 5 and 6).

GATE SPLITS

The number of gates at recent world's fairs has varied. Gate information was available only for the Knoxville Fair and daily and peak-hour distributions for Knoxville are shown in Figure 7. As can be seen, the peak-hour and daily gate volumes were not evenly spread among the gates. Daily splits ranged between

TABLE 4 Hourly Volume Distributions for Alternate Sources, 1982

	Inbound (%)			Outbound (%)		
Hour	Theme Parks	State Fair of Texas[a]	Knoxville[b]	Theme Park	State Fair of Texas	Knoxville[b]
- 10:00 A.M.	21	0	19	0	0	0
10:00 - 11:00 A.M.	19	26	23	0	0	0
11:00 - 12:00 NOON	18	23	17	0	0	0
12:00 - 1:00 P.M.	11	17	9	0	1	2
1:00 - 2:00 P.M.	6	15	6	0	1	3
2:00 - 3:00 P.M.	4	5	5	0	2	5
3:00 - 4:00 P.M.	3	3	4	1	4	6
4:00 - 5:00 P.M.	2	2	4	45	7	8
5:00 - 6:00 P.M.	—	3	4	5	6	9
6:00 - 7:00 P.M.	—	4	3	10	5	9
7:00 - 8:00 P.M.	16	1	3	10	5	9
8:00 - 9:00 P.M.	—	1	2	20	8	9
9:00 - 10:00 P.M.	—	0	1	20	21	13
10:00 - 11:00 P.M.	—	0	1	—	23	—
11:00 - 12:00 MIDNIGHT	—	0	0	30	11	26
12:00 -	—	0	0	—	6	—

(a) Modified to meet projected average stay of eight hours over 10:00 A.M. to 12:00 Midnight operating day.
(b) Saturday.

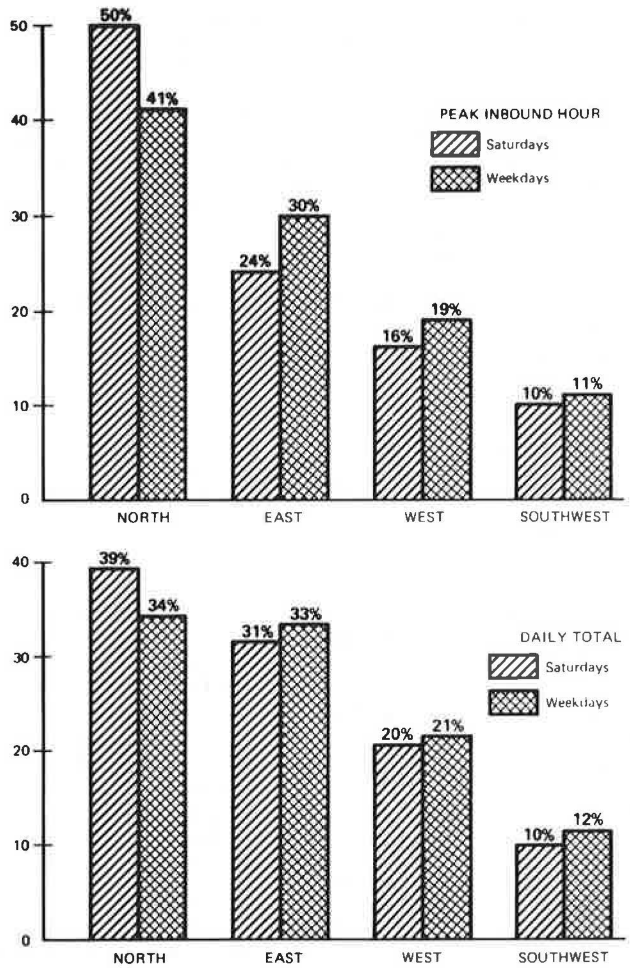

FIGURE 7 Peak hour and daily gate volumes for Knoxville *(1)*.

10 and 39 percent, whereas peak-hour splits showed an even wider spread between 10 and 50 percent of the hourly volume.

Attempts were made during early Knoxville planning stages to spread the volumes to meet capacity constraints at each gate, particularly the east gate. This was done by increasing or decreasing planned parking spaces near gates and locating bus terminals or parking areas at particular gates. Although this was a useful exercise, site and financial constraints ultimately played a bigger part in determining parking and terminal locations than the desired distribution of volume. Nevertheless, the decision to have four gates and the relative magnitude of volumes at each was planned. The procedure used was as follows:

1. Estimate volumes by primary mode of arrival (walk, drive, shuttle bus, local bus, tour bus, taxi, etc.).
2. Determine sources of walking visitors; distribute projected volume to each area; estimate numbers that will enter each gate.
3. From economic feasibility study and population (census) data, estimate distribution of arriving visitor population by approach route; determine probable parking location for each approach route, adjusting to reflect any capacity limitations on parking space; identify access gate for each lot; and estimate number to enter each gate.
4. Identify gate(s) where shuttle bus stops will be located; estimate shuttled visitors to enter those gates.
5. Identify gates near local bus stops; estimate patronage by route from distribution of fair visitors within local transit service area; estimate number to enter each gate based on the service provided by each transit route.
6. Identify gate where tour buses will unload; estimate number of visitors to enter gate.
7. Taxi and other volumes may be so low that gate distribution will not be affected. If necessary, estimate distribution of visitors by geographic location; determine approach routes and gates most likely to be used; estimate number of visitors to use each gate.
8. Sum volume (or percentages) by gate.

This procedure will yield daily gate volume splits. Peak-hour volumes must be estimated by using hourly distributions projected for visitors arriving by each mode.

At the Knoxville Fair the most severe peaking of inbound and outbound volumes was generated by tour buses, which used a terminal at the north gate. This gate operated at capacity many days starting between 9:30 and 9:45 a.m. Most buses arrived (or tried to) at about 10:00 a.m. Had not both the gate and terminal capacities constrained arrival patterns, it is possible that the peak-hour percentage at the gate would have been significantly higher. (Inbound north gate capacity was 12,000 per hour and as many as 25,000 were brought in tour buses as close to the 10:00 a.m. opening time as possible.)

ON-SITE ACCUMULATION AND DURATION OF STAY

The estimate of on-site accumulation is the basis for determining site size and quantity of facilities and parking space needs. These are based on maximum accumulation during the day. Maximum accumulation is strongly related to the average duration of stay on site. Unfortunately the average stay is dependent on many factors that are difficult to quantify. These include quality, variation, and number of attractions; entertainment; food service; rest facilities; amount of seating; protection from heat; and pricing. Because it is virtually impossible to determine the adequacy of each before the fair, assumptions about the duration of stay must be based on judgment. Figure 8 illustrates the maximum accumulation as a function of the length of stay experienced at several world's fairs.

Visitors

The average visitor duration of stay for the Knoxville Fair was 6.7 hours on Tuesdays and 6.6 hours on Saturdays. The Osaka Fair averaged 5.7 hours on Saturdays. For Montreal the average duration of stay was 5.5 hours. Spokane sponsors estimated an average duration of 7 hours. It appears that an average duration of 5.5 to 7 hours would be a reasonable estimate to use for world's fairs. Duration of stay has no planning value for the transportation system other than to help in generating an estimate of maximum accumulation (see Table 5).

On-site visitor accumulation curves for the Knoxville Fair are shown in Figure 9. Peak accumulations occurred on Tuesdays (70 percent) and Saturdays (67 percent) at 2:00 p.m. and 3:00 p.m., respectively. Osaka's Saturday peak was about 65 percent but was for a much larger attendance (64 million visitors). Montreal's peak ranged between 50 and 60 percent between 3:00 p.m. and 4:00 p.m., again for a much

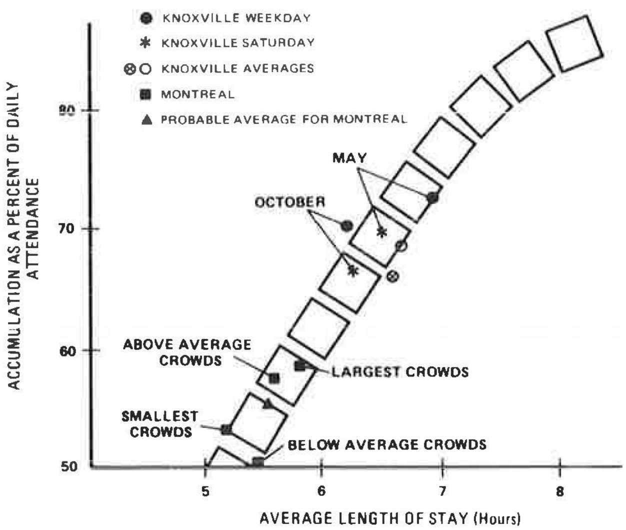

FIGURE 8 Maximum on-site accumulation as a function of average length of stay.

TABLE 5 Average Duration of Stay (hours)

Fair	Tuesdays	Saturdays	Overall
Knoxville	6.7	6.6	—
Montreal	—	—	5.5
Osaka	—	5.7 [a]	—

[a]Based on very limited data.

larger attendance (54 million visitors). Generally 65 to 70 percent should cover most accumulations, and 75 percent should be a safe high estimate. The figure used will directly affect development costs; using 75 percent instead of 68 percent will increase total development costs by about 10 percent.

Employees

Few data are available on employee arrival, departure, and accumulation patterns. Records are kept by individual employers. Although employees use special turnstiles or gates, some fair visitors use the same turnstiles (complimentary ticket holders, pass holders, etc.). On-site employee accumulations for the Knoxville Fair were estimated by requesting a few large employers to "guesstimate" their peak accumulations several months before the fair opened. Because scheduling had not been started, most employers had little idea; however, the information gathered indicated that maximum accumulation might be about 80 percent of daily (not total) employment.

Actual accumulation data are available for about 1 percent of the Knoxville Fair employees. It does, however, represent a cross section of most employees. Figure 10 shows the estimated on-site accumulation pattern based on employee parking lot arrival and departure times. This curve indicates a 75 percent maximum accumulation of daily employment. It appears reasonable to expect that daily employment will be 70 to 80 percent of total employment.

MODE SPLIT

Visitors

The mode split of arriving visitors is highly dependent on the amount of tour bus, shuttle bus, and local bus service to be provided. The volume from tour buses at the Knoxville Fair was high, amounting to 18 percent of total attendance. Other fairs have had very small percentages. Despite the extensive initial use of shuttle bus service in Knoxville, the total use was low because of the wide availability of convenient parking at a cost lower than two round trip bus fares. Other fairs have had little shuttle bus activity. Local bus service has been available to all World's Fair sites.

Usable data on transportation mode split were only available for the Knoxville Fair. Data available for other fairs combine mode of access to reach the city with the mode of access to the fair itself. As shown in Table 6, mode split at the Knoxville Fair for May and June was different from the following 4 months. It also was different on the peak days of Saturdays and Tuesdays. Tour bus volumes dropped off near the end of June and remained relatively stable, as a percentage of total attendance, during the July to September period. Shuttle buses provided

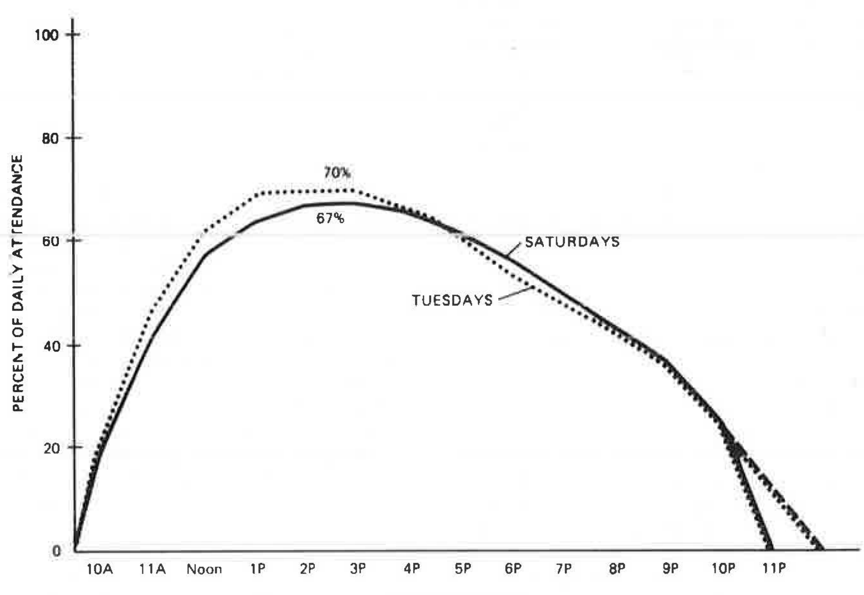

FIGURE 9 Hourly on-site visitor accumulation.

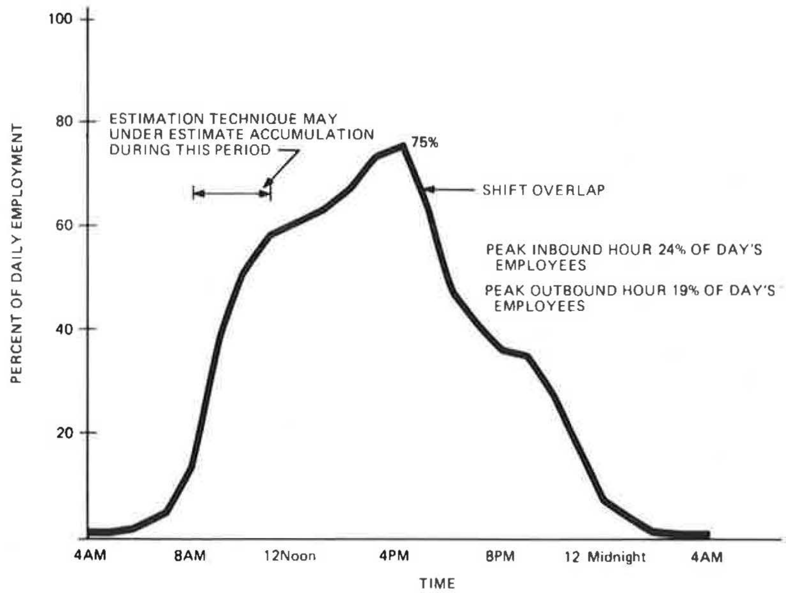

FIGURE 10 Estimated employee on-site accumulation *(1)*.

TABLE 6 Estimated 1982 World's Fair Visitor Transportation Mode Split (percent)

	May-June		July-October		
Mode	Tuesday	Saturday	Tuesday	Saturday	Total
Personal Vehicle	59	53	66	66	64
Tour Bus	19	30	17	21	18
Shuttle Bus[a]	11	5	6	2	7
Local Scheduled Fixed Route Bus	2	3	2	2	2
Taxi, Limousine, etc.	1	1	1	1	1
Walk	8	8	8	8	8
	100	100	100	100	100

(a) Excludes shuttle buses from remote (½ to 1½ miles) official World's Fair parking lots.

an extremely high level of service during the first days of the fair. Service quickly decreased with lower levels of demand and leveled off by midsummer. The use of local buses was lower than originally expected but was relatively stable, as were the taxi and walking modes of access.

It should be noted that the figures in Table 6 are estimates. Complete surveys necessary to make an accurate determination of transportation mode split were not conducted. However, daily counts of tour buses, selected counts of shuttle bus passengers, and changes in local bus use provided a basis for estimating use of those modes. Estimates of the numbers of walk-ins were based on variations in gate volumes under varying conditions. The taxi and limousine estimate is a guess based on observations of taxi operations and limited interviews with taxi companies. The remainder was attributed to personal vehicles; this was substantiated by a lot occupancy count in May. The estimates in Table 6 are consistent with the results of visitor interviews, which were compiled in a way that is not directly usable for transportation purposes.

On the basis of past experience, it is not probable that the May-June percentage of tour bus riders will be much higher at future world's fairs. The management of the Knoxville Fair aggressively pursued tour group business, and hired an experienced marketing staff who were highly regarded by tour operators. It is possible that the combination of shuttle and local bus percentages can be exceeded in the future. More crowded parking or traffic conditions, more local bus service to visitor lodging locations, and more effective and efficient (and less competitive) shuttle service could increase the local and shuttle bus share. Taxi and limousine access will be limited under most circumstances. Walk-ins will depend on the amount of lodgings within walking distance. Parking prices (generally $4 to $10 in Knoxville) do not appear to have deterred many people from driving because their other choices, except for local buses, would have been more costly and no more convenient.

CONCLUSIONS

The attendance and gate volume information presented in this paper provide a reliable basis for estimating transportation system design parameters for future world's fairs. On-site accumulation data are limited because of the absence of registering turnstiles at most previous world's fairs (world's fair managers have trusted their abilities to judge on-site accumulations for scheduling labor and entertainment instead of counting). Theme parks and state fairs appear to have somewhat different attendance patterns.

Gate volume splits can be estimated based on transportation mode splits; however, the estimates will be affected by available modal loading locations and directions of approach and constrained by the capacity to accommodate transportation services at a given gate. However, daily or monthly variations of mode split may well change gate splits (and percent of daily volume during peak hours). If adequate capacity cannot be provided at a given gate, it is desirable to shift some facilities for serving transportation vehicles to another gate where sufficient capacity can be developed.

Finally, the design of the site and the transportation system should be based on the 80th or 90th percentile of one day's estimated attendance (the number chosen depends on financial and physical capabilities), not on peak day of week percentage or peak month percentage as is commonly done in economic feasibility studies; this will provide more credible results.

Although the information contained in this paper is the most comprehensive to date, it represents only a small portion of what could have been available had arrangements been made to make appropriate counts and selected surveys. This effort should be included as part of future world's fair management activities, perhaps being encouraged by the U.S. Departments of Transportation or Commerce.

ACKNOWLEDGMENT

This paper is based on findings developed by the authors as part of an evaluation of transportation provided for the 1982 World's Fair (2,5). This work was conducted as part of a joint effort funded by the Urban Mass Transportation Administration. Participants in this evaluation effort were, in alphabetical order, Barton-Aschman Associates, Inc., the Knoxville International Energy Exposition, Inc., Knoxville-Knox County Metropolitan Planning Commission (project coordinators), and K-Trans. The authors wish to express their gratitude to each of these organizations and their participating staffs. Particular thanks are due to them for their assistance to future world's fair sponsors, transportation providers, and host cities in preparing for future transportation needs.

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The Transport Versus Land Use Dilemma

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ABSTRACT

The transport sector seems remarkably inflexible to changes in fuel prices and energy measures. The suggestion is made that the long-term land use and social effects of cheap motorized travel has produced a land use and transport system that is dangerously inflexible to changing needs and that planning and transport investment methods tend to unnecessarily heighten such problems. The degree of land use conflict between alternative modes of travel is examined in a case study of the British new towns. These have been built to a wide variety of land use and transport designs, some specifically intended to reduce the degree of transport conflict. The nature of this paper is necessarily strategic and general. It seeks to identify the key factors involved and broad social and planning principles rather than specific details. The case study of the British new towns suggests that it is possible to provide urban structures that are capable of accommodating wide variations in travel patterns and energy availability. Yet, 10 years after the 1973-1974 energy crisis there seems to be little political interest to take such ideas seriously. It was concluded that equitable and energy-efficient land use policies are entirely feasible, but the political status of planning is too weak for them to be implemented.

Ten years have passed since the 1973-1974 energy crisis signaled the end of an era in which it was confidently assumed that cheap motorized transport was a permanent feature of our society. Today, instead of seeking new and improved ways to accommodate high energy travel, transport planners are beginning to realize how unsustainable such a scenario is and are trying to promote more energy efficient transport methods. Yet, while energy conservation in most other fields has yielded significant savings, energy use in transport has increased (Table 1).

Two interrelated aspects of the inflexibility of the demand for motorized travel are examined in this paper. The first is the hypothesis that the long-term land use and social effects of low-cost motorized travel have produced a land use and transport system and cultural conditions that are dangerously inflexible to changing needs. A city structure that