

ASSESSMENT OF PEDESTRIAN ATTITUDES AND BEHAVIOR IN SUBURBAN ENVIRONMENTS

Michael J. Demetsky and Michael A. Perfater, University of Virginia and Virginia Highway and Transportation Research Council

Suburban area pedestrianism was examined from the points of view of the walking and nonwalking public. Nine case studies were conducted to determine the role of walking as an exclusive mode of travel. The sites examined comprised the 3 major types of pedestrian facilities: overpasses, tunnels, and at-grade crossings. Locations where new pedestrian facilities are anticipated also were examined. In each case, linkages between land uses were established to define reasons for local travel. The data then were analyzed to show how pedestrian facilities act to sustain the linkages. Various pedestrian characteristics were found to be related to walking activity. For example, age has a direct bearing on walking behavior, and children constitute the largest walking group. Acceptable walking distances of up to 0.25 mile (0.4 km) were given for adults. Distances of up to 1 mile (1.6 km), however, offer little impedance to children. Along with distance, fear of attack is a primary impedance to potential adult walkers, especially women. Overpasses were cited as the most desirable pedestrian accommodation to bypass traffic. The public showed little enthusiasm for tunnels because of the mischief they attract. People have also shown that, if the reason exists, they will cross heavy traffic to travel by foot. The results of this study give general principles for successful pedestrian planning in suburban areas, and they support the idea of combined pedestrian and bicycle ways.

•PEDESTRIANISM, as well as bicycling, is attracting the attention of transportation planners as a mode of travel that can satisfy many personal and social needs. Reasons for the resurgence in the popularity of walking are varied, but they generally reflect a growing awareness that urbanized areas cannot forever accommodate the rate of automobile growth experienced in the 1950s and 1960s. They also reflect a realization that automobile domination has many adverse effects on life-styles and the environment. The new-town concept, which emphasizes local activity and focuses on economic and social self-sufficiency within a planned community, is an attempt to alleviate the difficulties of life in major metropolitan areas where the typical resident must drive a considerable distance to reach his or her place of work, the shopping center, and major recreational facilities.

Pedestrian studies conducted before and during the 1960s concentrated on walking movements in densely populated areas, primarily central business districts (CBDs). These investigations were conducted from a traffic-engineering perspective; that is, pedestrian movements and relationships of traffic flow to volume were examined to measure the performance of facilities such as sidewalks and crosswalks (1). Also pedestrian safety studies examined pedestrian-vehicle accidents so that guidelines could be developed to reduce pedestrian-vehicle conflicts by channelization and signalization (2). In outlying areas, pedestrian structures have been built where a major transportation facility such as a freeway would otherwise create a barrier to pedestrians (3). Such structures, in most cases, connect residential neighborhoods with

local schools and often have been built without a comprehensive plan. Public requests for such pedestrian accommodations continue to be treated in a relatively subjective fashion by government agencies.

Accident studies from 11 major cities have shown that only 14 percent of all pedestrian casualties occur in CBDs despite the heavy concentration of walking trips within these areas (1). This can be attributed to the low speeds of the slow-moving traffic in the CBD and driver awareness of the heavy pedestrian traffic. It is therefore appropriate that pedestrian facilities outside the cities, where 86 percent of the pedestrian accidents occur, be investigated. Accordingly, this study focused on travel needs in suburban environments.

OBJECTIVES AND SCOPE

The research reported here had 2 primary objectives: (a) to relate pedestrian attitudes and behavior to the dimensions of the walking system and (b) to recommend a set of guidelines and procedures for pedestrian system planning and design. Pedestrian attitudes and behavior were studied together to ascertain general guidelines. By examining the data obtained through various means, we determined those environmental features that are deterrents to walking and suggested means by which such deterrents can be removed or minimized. In addition, those features that improve the walking environment were identified. It is hoped that this paper will aid in the future development of walking systems that will enhance pedestrian activity and encourage walking as an efficient, expedient, and safe mode of transportation.

METHODOLOGY

The case study method was employed to meet the research objectives. The selected sites in suburban areas featured the 3 major types of pedestrian facilities: overpasses, tunnels, and at-grade crossings. Three of the sites contained no pedestrian accommodations, but in each case such an installation was anticipated.

Two methods were used to obtain data on pedestrian movement. First, hour-by-hour observation and volume counting were performed to determine usage patterns, frequency of use, and user characteristics. Second, attitudinal surveys were administered to random samples of residents within the vicinity of each pedestrian facility being studied. The survey approach was varied among the case studies to determine the best strategy for obtaining data. The methods employed included home interviews, on-site interviews and observations, and questionnaire distributions.

Because pedestrian movements derive generally from activity participation, land use at trip origin and destination points was specified to define the predominant trip purposes, which will be referred to here as the linkages, associated with pedestrian travel within a study area. Pedestrian facilities were examined to demonstrate how they act to sustain such linkages.

CASE STUDY FINDINGS

Each of the study sites was examined individually. However, in our discussions of them, the findings are synthesized into specific facts and principles that are basic to pedestrian planning.

Pedestrian Behavior in Suburban Virginia

The data derived from the case studies provided insight into the habits, desires, and attitudes of suburban pedestrians and, consequently, much about the characteristics of pedestrian accommodations that will best serve them. It is important to note that the

generalizations made here are based on behavior exhibited by suburban pedestrians as well as on perceptions expounded by them. Thus an accurate picture of the relationship between the suburban walker and the suburban walking environment is presented.

Certain characteristics about pedestrians must be taken into account. In short, who are the pedestrians to be accommodated and what are their life-styles? In the suburban areas represented in this study the majority of the walkers fell into 2 age groups. One group consisted of 20- to 30-year-olds, the majority of whom were women who used walking primarily to get to shopping destinations. The second and larger group consisted of individuals between 8 and 16 years of age. The younger group depended on walking as a primary means of transportation, especially to school and friends' homes, and was not particular about the type of pedestrian facility to be used. The older group, however, preferred to walk where they never had to be enclosed from view. Neither group's walking activity appears to be related to family size, length of residency in the area, or type of dwelling. As family automobile ownership increased, walking declined in importance as a travel mode more in the younger group than in the older group.

The roles of walking and automobile and bus transportation in providing access to particular activities in a representative suburban area are given in Table 1. Comparison of such data from a number of sites revealed that modal use was related to the accessibility provided. For example, if the school was over 1 mile (1.6 km) away, few walking trips were taken, but if the activity sites were within 0.5 mile (0.8 km) of the residences, more walking was evident. Ninety percent of the people who reported low walking frequencies reported that destinations were too far away: 19 to 30 percent cited inadequate accommodations as the reason for infrequent walking travel.

Impedances to walking derive from both the pedestrian system itself and the characteristics of the pedestrians. Age has a direct bearing on walking frequency. Very few old people use walking as a primary travel mode. A few of them make short trips, but distances rarely exceed 0.25 mile (0.4 km). This underrepresentation of elderly people can be attributed partially to the fact that most people in this group live in areas other than those examined in this study. Children, on the other hand, travel up to 1 mile (1.6 km) on foot and ride bicycles even farther.

Typical perceptions of reasonable walking distances are given in Table 2. They indicate that approximately 50 percent of the people were unwilling to walk more than 0.5 mile (0.8 km). There appears to be very little difference between what adults consider to be a reasonable walking distance and what they feel is reasonable for their children. A chi-square test on the data given in Table 3 showed that a significant difference existed between the reasonable walking distance distributions for men and women. Men were willing to walk farther, but the 1-mile (1.6-km) limit on most walking held true for both sexes. Furthermore, a chi-square test of the data given in Table 4 revealed that a significant difference existed between the reasonable walking distance distribution for those families with high walking frequency and those with low walking frequency. As expected, the high frequency walkers were willing to walk farther. The

Table 1. Activities and access modes.

Activity	Walk (percent)	Bus (percent)	Automobile (percent)
School*	36	10	86
Work	5	33	85
Church	8	0	60
Shopping	33	5	96
Recreation	36	4	77
Visit friends	53	3	80

Note: Totals are greater than 100 percent because respondents were allowed to indicate more than 1 activity per mode.

*Children.

Table 2. Reasonable walking distances for home-based trips.

Distance	Adults (percent)	Children (percent)
1 block	4	4
0.25 mile	11	17
0.50 mile	37	26
0.75 mile	18	25
1 mile	22	18
More than 1 mile	7	11

Note: 1 mile = 1.6 km.

Table 3. Reasonable adult walking distances by sex.

Distance	Men (percent)	Women (percent)
1 block	4	5
0.25 mile	5	21
0.50 mile	38	35
0.75 mile	19	14
1 mile	26	19
More than 1 mile	8	6

Note: 1 mile = 1.6 km.

Table 4. Reasonable adult walking distances by frequency of walking.

Distance	Frequency (percent)	
	Low	High
1 block	5	2
0.25 mile	11	12
0.50 mile	44	23
0.75 mile	19	15
1 mile	16	36
More than 1 mile	5	12

Note: 1 mile = 1.6 km.

majority of the high frequency walkers were willing to walk at least 0.75 mile (1.2 km) to some activities.

Fear of attack, as well as distance, acts as a primary impedance to potential adult walkers, especially women. Crime in our society has forced many potential walkers to resort to the automobile, even for short trips. Roughly 20 percent of the 80 percent of the respondents who reported that they never or seldom walked stated that they did not walk because they feared attack. The case study areas in Northern Virginia exhibited the greatest incidence of fear of attack as a deterrent to walking.

A few additional impedances to walking were reported by those surveyed. As would be expected, active pedestrians related that they did not walk at night because lighting was often inadequate. However, when they were asked what effect lighting improvement would have on their walking at night, most stated that they would not walk unless they had no other mode choice. Night walking, then, even with adequate lighting provided, will not occur often in suburban areas. Of course, this will depend on trip purpose. For example, if the linkage is from household to school, a lighted facility is probably necessary and desirable because many activities associated with school occur at night. On the other hand, if the linkage is merely among households, the installation of expensive lighting may not be justified. Suburban pedestrians are, on the whole, daytime walkers.

Naturally, weather conditions affect pedestrian activity in almost any setting and the suburban setting is no exception. Roughly 81 percent of the adults surveyed stated that weather altered their walking behavior. A differentiation is made here between adults and children because the children surveyed reported that weather conditions had absolutely no effect on their walking habits. So shelter from the elements may be an unnecessary consideration for facilities that will be used primarily by children.

Several other impedances to walking, such as poor health, fear of traffic, and inconvenience, were occasionally mentioned by the respondents. However, the incidence of these responses was so widely distributed throughout the cases surveyed that no conclusions could be derived from them. These are impedances that occur occasionally, but they are ones with which pedestrian planners should not be overly concerned. One important impedance that appeared often throughout the surveys was inadequate pedestrian facilities.

Pedestrian Facilities

Pedestrian Tunnels

Three pedestrian tunnels were examined during this study, and several methods were used to gather data reflecting the opinions and activities of individuals concerning these tunnels. Volume counts were made at each site from daylight until dusk on 2 successive days. Individuals traversing the tunnels were interviewed to determine their

attitudes as users. In addition, at 1 site, interviews were conducted in nearby apartment buildings with a random sample of individuals so that opinions from nonusers could be collected.

Several generalizations can be made concerning the public's opinion of both tunnel facilities and the walking environment. It was apparent to the research team that pedestrian tunnels are unsightly. All were damp and poorly illuminated. When asked what improvements could be made to enhance these tunnels to increase pedestrian activity, every respondent cited maintenance improvements, such as better lighting and drainage, as being most important. About 67 percent of those interviewed related that they never used tunnels at night mostly because they feared attack. Respondents indicated that they felt that tunnels provide a prime location for muggers and vandals. Several instances of such incidents had been recorded but the number and frequency were not overwhelming. It is interesting to note, however, that at 1 tunnel site a military guard is stationed at 1 entrance. This tunnel had the highest pedestrian volume at night and a very low incidence of pedestrians choosing to cross the highway at street level instead of using the tunnel. Nevertheless, about 50 percent of those interviewed displayed an interest in an alternative pedestrian facility in place of the tunnel; the most frequently mentioned was a pedestrian overpass. The main reasons cited for choosing this type of facility were its better visibility and better drainage. A few respondents preferred tunnels (with certain improvements) to overpasses because they provide shelter from bad weather and are less of an eyesore than overpasses. Almost all respondents agreed that improvements to tunnels would enhance walking as a travel mode.

Several items concerning a tunnel that is located near the junior high school are worthy of note. The students surveyed indicated that their reasons for not using the tunnel were slightly different than the reasons adults gave for the other 2 tunnels. Only 14 percent of the students surveyed used the tunnel daily; 44 percent said they would avoid using it if at all possible. Of the latter group, 47 percent cited safety as their reason because the tunnel often was occupied by ruffians and was the site of much mischief. In fact, 51 percent of the students related that they would rather take their chances crossing the highway than traverse the tunnel; about 25 percent preferred a pedestrian overpass. It was noted during the course of 1 day that 135 crossings were made at street level directly atop the tunnel. This observation seems to indicate that many individuals choose to take their chances with the traffic rather than use the tunnel to reach the same destination. The principal and vice principal of the school in the area have received several reports of criminal behavior in the tunnel. Both felt that a pedestrian overpass would be much more desirable than the tunnel. Planning for pedestrian facilities near schools should not include tunnels as a consideration.

A consensus exists on improvements to pedestrian tunnels that would enhance the degree of pedestrian activity in and around them. More adequate drainage, better lighting, and cleaner appearance were the most frequently mentioned improvements. Pedestrian tunnels also should not be a haven for would-be attackers. This could be accomplished by eliminating hidden areas within tunnels and by constructing more open approaches to them. The tunnels should be as wide as possible to allow a maximum of sunlight. Another consideration would be the elimination of the step entrance where possible. Ramped entrances would allow both bicyclists and handicapped persons to use tunnels.

Pedestrian Overpasses

The physical condition, environment, and usage of 3 pedestrian overpasses were analyzed. On-site observations, volume counts, and either pedestrian or household interviews provided data for each case. The primary linkage served by each of the overpasses was residence-to-school travel. Secondary purposes included residence-to-shopping and residence-to-residence travel.

In general, overpasses were considered to be adequate by the individuals surveyed. People used them if they had reason to. However, only specialized trips such as those

to school and shopping made up most of the reported travel. Less than 50 percent of the people contacted felt that an overpass compensated for the barrier created by recent highway construction, but they stated that the local overpass was an attractive feature of their community. Because all of the pedestrian overpasses were open to view, the security problem that was critical to tunnels was not a serious constraint on overpass travel. Complex ramps at the ends of the overpass considerably increase walking distances, but steep stairs are a poor alternative.

Thus the problems concerning overpasses were minor compared with those concerning tunnels. (Most of the criticisms were related to the mischief of children.) Wire mesh enclosures are unpleasant sights and alternatives should be considered in future designs. Various types of creative structures that match the local environment as much as possible should be investigated. Routine maintenance should be conducted to remove debris and ensure adequate lighting.

Anticipated or Nonexistent Facilities

Other case studies concerned areas where no pedestrian accommodations exist but there is an acknowledged physical barrier to walking travel. Observations derived from analysis of the following pedestrian travels:

1. Between an office building and a shopping center that are separated by a 4-lane arterial highway.
2. Between a new high school and a middle income residential area that are separated by a 4-lane, limited-access bypass.
3. Between a park and a residential area that are separated by a 6-lane Interstate highway.

Data used to analyze activity of pedestrians near their workplaces consisted of questionnaires completed by 270 persons and on-site observations. The data generally showed that if good reason exists people are not deterred from walking by having to cross a traffic stream between intersections, particularly if there is a safety median. Desired improvements in order of preference were an overpass, a traffic signal with a pedestrian phase, a crosswalk, a police guard, and lower traffic speeds. Some respondents stated that no improvements should be made. Thirty-eight percent stated that improved walking conditions would generate more walking trips. Useful accommodations were perceived as those that provide a direct route between origin and destination.

A survey was administered to residential households on the side of the highway opposite the high school who had children currently attending the high school or planning to do so within the next 5 years. Most stated that the proposed overpass was needed or desirable. If the facility were built, 89 percent would use it during the day and 52 percent would use it at night. These responses indicated that an overpass would generate 22 percent and 34 percent more walking trips to the new high school per day and night respectively. Good lighting and accommodations for bicycles were cited as necessary dimensions for an acceptable facility.

In the area where an overpass will be constructed between a residential area and a park, 157 households were surveyed. Site investigation revealed that most of the walking trips to the park via the overpass would be well over 1 mile (1.6 km), which is somewhat beyond a reasonable walking distance. At present, 25 percent of the families surveyed visit the park; 92 percent stated that they will use the park after more recreational facilities are available. Ninety-six percent said that an overpass was needed. Because distance is an apparent constraint on the walking trips that might be generated by an overpass, 2 questions were asked that deal with the problem of multimode facilities. First, respondents were asked to indicate whether they approved of bicycles and pedestrians on the same facilities and whether their response was based on a pedestrian's or a bicyclist's point of view. Sixty-six percent of the bikers and 48 percent of the pedestrians approved. Second, respondents were asked whether bikes and auto-

mobiles should operate on the same facilities. Forty-four percent of the bicyclists and only 20 percent of the drivers approved. Based on these findings it would appear that bicycle-pedestrian systems appear more desirable to users than do bicycle-automobile facilities. However, caution must be taken in interpreting these findings because the respondents were speaking from experience in denouncing bicycle-automobile facilities and probably from frustration because of the lack of accommodations for bicycle-pedestrian facilities.

BICYCLE-PEDESTRIAN-FACILITY CONCEPT

Local travel in suburban areas as previously examined in this report showed relatively low volumes compared with those witnessed in areas of concentrated activity such as the central business district. However, the need for accommodating pedestrian activity between specific origin-destination pairs was evident.

Bicycle-pedestrian systems exhibit common needs. The earlier case study analysis revealed that combined bicycle-pedestrian facilities were preferred to combined bicycle-automobile facilities. Because no consensus exists on exactly what pedestrian and bicycle systems are, this paper considers only major accommodations such as tunnels and overpasses that are usually impossible to justify solely with benefit-cost measures.

Table 2 indicated that very few people walked more than 1 mile (1.6 km) per trip, and 50 percent of them considered 0.5 mile (0.8 km) to be their limit. Thus the maximum potential walking market of an attractor within a given radius is shown in Figure 1. The actual market area for the 1-mile (1.6-km) and 0.5-mile (0.8-km) limits is much smaller because of impedances, which are indicated by the dashed area. If the bicycle market were established, it would extend the market for nonvehicular travel to a site and create more usage for a given accommodation. Typical reasonable biking distances have been given in a study of the Atlanta metropolitan region based on 10-min travel-time increments (4). For each walking distance of 0.5 mile (0.8 km), the bicycle pro-

Figure 1. Travel ranges.

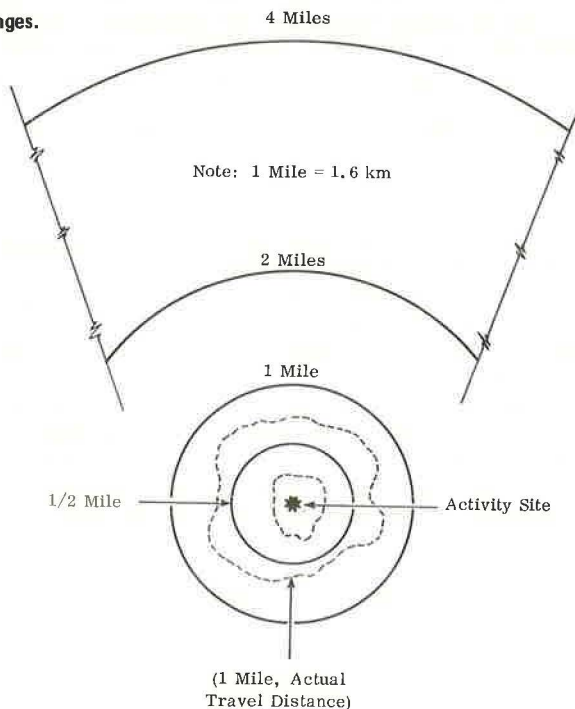


Table 5. Time and distance for pedestrian and bicycle travel.

Mode	Operating Time Tolerance (min)	Travel Distance or Capture Radius (miles)	Capture Area (square miles)
Walking	10	0.5	0.8
	20	1	3.1
Bicycling	10	2	12.6
	20	4	50.3

Note: 1 mile = 1.6 km, 1 square mile = 2.59 km²

vides 2 miles (3.2 km) of travel (Table 5). Thus the area served is increased by a factor of 16 for both short- and long-range local travel (Figure 1).

The survey strategy previously described could be implemented to establish the potential for joint bicycle and walking travel for a given area; then the feasibility of joint major facilities could be examined. For the purposes of this discussion, major access facilities for the respective modes are not considered because sufficient secondary roads, sidewalks, and footpaths usually exist in suburban areas to accommodate such needs.

Many of the requirements for pedestrian accommodations also apply to bicycle facilities. For example, safety, security, directness, adequate entrances and ramps, and lighting are probably as important to the bicyclist as they are to the pedestrian. However, in order that the problem be properly documented similar case studies and literature reviews on bicycle travel should be conducted. When sufficient information is obtained for both modes, the findings should be synthesized to establish guidelines for joint bicycle-pedestrian facilities.

Additional important issues that must be resolved with respect to the bicycle-pedestrian-facility concept include evaluating ramp access designs for accommodating both modes and alternative model integration or separation strategies for movements on the facility. Also any legal restrictions that prohibit pedestrian and bicycle integration must be resolved.

Thus analysis of pedestrian travel in suburban areas supports the need to investigate the possibility of joint use of major facilities by bicyclists and pedestrians. The bicycle-pedestrian-facility concept could be a major step toward optimizing the usage of major nonvehicular travel facilities in suburban areas.

PLANNING PROCEDURES

The experience gained from this study indicated that the most efficient method for obtaining input into the planning process is a questionnaire hand-delivered to a random sample of the population living within a certain radius of the proposed facility. The questionnaire should be accompanied by a self-addressed stamped envelope. This strategy provided a return rate of 52.3 percent from 300 questionnaires in this study. A systematic appraisal of the potential of a future pedestrian facility should include the recommended survey, a comprehensive land use study, and an in-depth monitoring of existing pedestrian travel patterns within the vicinity of the site. If this strategy were employed for a sufficient number of cases, the planner would become efficient in assessing pedestrian needs, and proficient at estimating the usage of proposed facilities. This approach to pedestrian planning also provides for a maximum citizen input and a clear definition of local travel needs.

SUMMARY OF FINDINGS

This study revealed certain dominant factors that influence the interrelationship between pedestrians and the facilities within their walking system. These important considerations are interpreted to establish certain principles to assist in planning future

pedestrian accommodations in suburban areas.

General Pedestrian Attitudes and Behavior

Most walkers in suburban areas are between 8 and 16 years old. The remainder consists primarily of individuals less than 30 years old.

Trip lengths for the elderly pedestrian rarely exceed 0.25 mile (0.4 km). Approximately 50 percent of the population exhibit a maximum walking distance of 0.5 mile (0.8 km). Very few people wish to walk more than 1 mile (1.6 km).

Walking activity increases as the number of accessible activities increases.

The household-to-school and household-to-shopping linkages provide the highest potential for walking travel. Household-to-household travel is secondary.

The suburban pedestrian, for the most part, travels in the daytime.

Fear of attack is a major deterrent to pedestrian travel in suburbia.

As age increases, the effect of weather on walking activity becomes more significant.

Attitudes and Behavior Toward Specific Facilities

Roughly 25 percent of all suburbanites feel that pedestrian accommodations are inadequate.

Proper maintenance of pedestrian facilities, particularly with respect to lighting and cleanliness, will enhance pedestrian activity.

Most tunnels exhibited inadequate design for drainage, which inhibits usage.

Security is a serious problem in tunnel facilities.

In general, overpasses are preferred to underpasses.

If the attraction is great enough, pedestrian travel will not be deterred by the necessity to cross roads with heavy traffic and few, if any, provisions for pedestrian travel.

Construction of overpasses will encourage travel to recreational areas.

It appears that bicycles and pedestrians are able to share facilities successfully.

CONCLUSIONS

Walking should be considered as a feasible travel mode in comprehensive transportation planning. Its importance to a community can be discovered in the proportion of total travel demand that it takes up. In suburban areas, potential walking demand can be associated with the number of activity linkages. When local travel desires are established, the results of this research can be interpreted to provide general principles for developing pedestrian facilities. These principles relate to a procedural method for diagnosing individual attitudes and behavior concerning pedestrian travel and to definitions of those characteristics that pedestrian systems must have to be accepted by the public.

The experience of this study suggests that the most efficient method for obtaining citizens' input regarding the preliminary planning of a pedestrian facility in a suburban area is through a questionnaire hand-delivered to a random sample living within a certain radius of the proposed facility. Before and after studies employing a similar survey strategy also should be conducted as new projects become implemented. Such comprehensive information on pedestrian attitudes and behavior provides the potential for estimating the usage of proposed facilities. In this respect, evaluations of pedestrian activities can be made concerning the relationship between what people say they will do and what they actually do.

Pedestrian facilities should exhibit features that make them attractive to the community. The important pedestrian system criteria have been diagnosed relative to functional aspects, design and planning considerations, and operational and maintenance requirements.

Functional Requirements

Clearly defined linkages should be connected and joint bicycle and pedestrian usage provided for.

Design and Planning Requirements

If possible, overpasses rather than tunnels should be planned for. Direct travel paths, protection from weather, adequate drainage, and pleasing aesthetics should be included in the design. Components of major accommodations and adjoining walkways should be interconnected.

Operational and Maintenance Requirements

The facility should be kept clean, security should be provided, and loitering should be prohibited.

RECOMMENDATIONS

The following recommendations are presented to assist in the development of better pedestrian facilities:

1. Because night walking is infrequent in most suburban areas, careful consideration should be given before installing extensive lighting on and around pedestrian overpasses.
2. Caged overpasses are unsightly so alternative designs should be considered.
3. If an overpass will be used extensively by adults, consideration should be given to overhead shelter because inclement weather appears to discourage adult walkers.
4. Construction of tunnels should be avoided unless there is no other alternative.
5. If tunnels are built they should have adequate drainage and vandal-proof lighting and should be wider than the typical 6 ft (1.8 m) to allow daylight illumination.
6. All facilities should include ramp access to accommodate bicyclists and handicapped people.
7. Angles and curves should be eliminated in tunnels to provide a line of sight from one end to the other.
8. Future planning for pedestrian accommodations should consider bicycle travel as well as walking. The concept of the structure that accommodates both bicyclists and pedestrians should be thoroughly investigated.
9. Where feasible, a questionnaire to a random sample of households within a certain radius of the proposed facility should be employed so that public opinion can be assessed.

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