

Pedestrian Perceptions Toward Various Pedestrian Treatments

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INTRODUCTION

As traffic congestion and air pollution are becoming growing problems in many U.S. cities, government agencies show an increased interest toward promoting non-motorized travel options. Many communities across the nation started seeking ways to increase pedestrian activities and discouraging automobile dependency, particularly for short trips in residential settings. Initiatives that promote pedestrian travel must provide potential users an assured level of convenience, efficiency, comfort, and security.

Literature review indicates that environmental designs and urban forms can play a very crucial role in pedestrian travel behavior. Proper design of facilities can encourage walking without compromising safety and convenience (1)(2). The major responsibility of providing physical facilities that encourage pedestrian travel and help protect the pedestrians resides with traffic engineers. Such facilities include roadways, sidewalks, traffic control devices, medians etc. Pedestrian friendly and safe environments include the following elements (3):

- separation of pedestrian and vehicle traffic;
- control of flow of pedestrians and vehicles;
- improvement of visibility;
- proper communication through signs, and
- assistance of pedestrians with special needs.

A variety of engineering options exist to assist pedestrian accessibility and ensure safety. Engineering improvements should be carefully evaluated after implementation to assess the effectiveness of the solutions implemented and their potential value for application in other locations with similar characteristics and limitations, and needs.

Users' perceptions toward the operation of pedestrian facilities are of great importance to such an evaluation process. Pedestrians themselves are the most appropriate group to identify treatments that create a safe and/or desirable environment for them and options that increase their likelihood to use pedestrian designated facilities properly. The latter is crucial toward the improvement of pedestrian safety. When pedestrians use sidewalks and cross at designated locations, the separation of pedestrians and vehicles increases and vehicle/pedestrian conflicts are minimized.

Although considerable research has been undertaken on the general problem of pedestrian safety, limited studies on pedestrians' perceptions and preferences are reported in the literature. Among them, the research of Tanaboriboon and Jing (4) studied attitudes of pedestrians in China toward sufficiency of crossing facilities and willingness to use the facilities. The study compared signalized intersection pedestrian crossings to overpass and underpass crossings and concluded that users prefer signalized crossings than overpass or underpass crossings. Rouphail (5) performed a user compliance and preference study on marked midblock crosswalks in downtown Columbus. The preference study indicated that users perceive the unsignalized marked midblock crosswalk to be unsafe. However, the same crosswalks are rated highest in crossing convenience.

The studies described above give valuable information about pedestrian perceptions but focus on one type of crossing at a time (signalized intersection crossings only in (4) and marked midblock crosswalks in (5)). Thus a need has been identified to assess the effectiveness of a variety of common types of pedestrian treatments based users perceptions and field data. These include signalized intersection crosswalks, unsignalized intersection crosswalks, marked midblock crosswalks and unmarked midblock crosswalks and are reviewed and evaluated in this study.

The results presented herein are from the evaluation of pedestrian perceptions and choices in the City of East Lansing, Michigan. East Lansing recently renovated a section of a major corridor in an effort to improve vehicular and pedestrian traffic flows, increase pedestrian safety, and enhance aesthetics. These renovations creating the perfect test bed for the subject research. Following the renovations, Michigan State University evaluated the various pedestrian treatments through a research study sponsored by the Michigan Department of Transportation.

The main objective of this research is to analyze users' perspectives toward various pedestrian treatments, including signalized and unsignalized intersection crosswalks, midblock crosswalks, physical barriers and more. Crossing preferences and habits of pedestrians are also analyzed to determine their current practices and explain the reasoning behind their choices. Information was obtained by surveying users of the study corridor. Reported results are based on the responses of 711 daily and occasionally users.

The paper is organized as follows. A description of the site characteristics is provided next, followed by a discussion on the data collection and reduction methodology. In the following section, a detailed analysis of survey results is presented. Finally, a brief summary and conclusions from the study are offered.

STUDY PROCEDURES

Study Site

The site selected for evaluation of pedestrian treatments was a section of Grand River Ave in East Lansing, Michigan. Grand River Ave is an east-west corridor in the boundary of Michigan State University (MSU) campus and the community business district of the city of East Lansing. The selected section is a 1-km long, divided boulevard extending from Abbott St to Bogue St. The average daily traffic (ADT) is 40,000 vehicles. The selected section has been recently renovated to include midblock crosswalks, deployment of "warning" signs at midblock crosswalks, utilization of physical barriers, and striping of designated midblock and intersection crosswalks. The site meets selection criteria in terms of variety of alternative designs offered for pedestrian use and pedestrian volumes.

The study section includes four signalized intersections (two 4-way intersections and two T-type intersections without a south leg). One of the 4-way intersections has crosswalks on both sides. In addition, there are two unsignalized T-type intersections with crosswalks on the east side of the intersection, four marked midblock crosswalks (two of which have shelters in the median) and two unmarked midblock crosswalks. At midblock crosswalks warning signs are posted that display the message: "Cross only when traffic clears". Based on the existing control, vehicles are assumed to have priority over pedestrians, unless a red traffic light indication is on.

Survey Design

Two important considerations were needed in order to conduct the survey of users:

- a. development of a survey instrument; and
- b. selection of an appropriate study group.

The development of the survey instrument met the following criteria:

- statement of study purpose and importance of participation;
- clear definition of questions;
- reasonable length;
- lack of personal or potentially offensive questions;
- format appropriate for distribution via E-mail; and

- format appropriate for easy data coding.

The questions contained in the questionnaire covered the following areas of interest:

- a. users' profile (age group, gender, and frequency of use of the facility).
- b. users' crossing patterns (crossing location, conditions, compliance);
- c. factors that affect pedestrian crossing choices (presence of certain types of control, user priorities); and
- d. users' perceptions with respect to right-of-way and safety.

The survey questionnaire was pre-tested to identify any unclear questions. The survey form included a total of eight (8) questions with several questions soliciting more than one answer. The questionnaire took approximately 2-3 minutes to complete.

The selection of the study group took under consideration the following criteria:

- familiarity with the study site;
- potential use of the site for pedestrian trips;
- reasonable mix of socioeconomic characteristics (such as age, sex, race, income), and
- willingness to participate.

The selected study group consisted primarily of undergraduate and graduate students, staff and faculty at Michigan State University, which compose the majority of pedestrian population using the facility. First, in vivo surveys were conducted from survey staff that randomly approached pedestrians at the site location. 52 pedestrians were approached and asked for their assistance in completing the survey, 22 out of which agreed to participate. Although the acceptance rate was good (42.3%) this data collection approach was found to be time consuming and costly. Thus a decision was made to distribute the survey instrument electronically instead. The survey was distributed to e-mail recipients selected randomly via the MSU computer network. The selection was made by assigning a serial number to each and every one of the e-mail addresses in the computer network (50,000 total). Then 5,000 e-mail addresses were selected for survey distribution using a random number generator. The return rate was 17.1%. Given that the typical return rate of mail in surveys reported in the literature is 5-30% the return rate of the subject survey was deemed acceptable. A total of 897 completed questionnaires were received and reviewed.

Data Reduction

Returned questionnaires were first screened to assess their completeness and ensure their uniqueness. During this process, duplicate copies and forms with several unanswered questions were eliminated. Eligible questionnaires were assigned a serial number. This allowed for future tracking of selected surveys to check for coding errors.

After eliminating duplicate and incomplete survey forms a total of 871 questionnaires remained. A decision was made to analyze responses from daily and occasional users only. Another 166 questionnaires were excluded from the study because they expressed opinions of non-users and, thus, could introduce some bias to the results. A total of 711 questionnaires were used in the analysis. The sample size was deemed adequate to provide a fairly accurate picture of the users' crossing habits, observations and perceptions toward the pedestrian facilities in the test site.

The Statistical Package for the Social Sciences (SPSS) program was used to create a file containing the responses from each questionnaire. This package has the capability to perform statistical analysis as well as produce graphs and data summaries. Each survey was coded to a single row and a serial number was assigned in order to track it later, if necessary. There were 22

fields per questionnaire and 45 sec to 1 min per survey were required to complete a typical data entry. The next section summarizes the results from the data analysis.

ANALYSIS OF SURVEY RESULTS

Out of the 711 pedestrians studied, 255 (36%) made pedestrian use of the study site daily and the rest (456 pedestrians, or 64%) were classified as occasional users. The percentage of respondents 21 years or younger was 32.7%, between 21 and 55 years of age was 61.6%, and the remaining 5.7% was over 55 years of age. The fairly normal distribution of age is an indication of a representative and properly diverse sample population. Given the fact that the study population primarily belongs to a university community, age distribution may be closely related to other socioeconomic factors such as occupation and income.

Users' Crossing Patterns

The location at which pedestrians select to cross a road, the conditions under which they decide to cross and their compliance with pedestrian traffic control are important factors both from the safety and operation perspectives.

As Figure 2 shows, the majority of pedestrians surveyed (59%) said that they typically cross at designated locations (24% at signalized crosswalks, 31% at unsignalized and midblock crosswalks, and 4% at crosswalks of any type). The remaining 41% replied that they typically cross at any convenient location.

Figure 3 depicts typical crossing conditions for respondents. 61 percent of the respondents admitted to cross when they perceive that an acceptable gap in vehicle traffic exists. On the other hand, 35% said they cross only when all traffic has cleared completely, and a mere 4% was willing to wait for a green pedestrian light indication in order to cross.

Pedestrians were also asked about the frequency of crossing at non-designated locations. Figure 4 summarizes the responses obtained. A 29% of the users replied that they rarely (or never) cross at a non-designated crosswalk. Approximately a quarter of the respondents said that they often or almost always jaywalk. 46% of the respondents appeared not having a predetermined crossing preference on the use of designated facilities in order to cross. These results are in reasonable agreement with the responses regarding preferred crossing location presented above and the users' willingness to divert from their path in order to cross at a designated location. A 38% of users replied that are willing to divert, 20% refused to do so, and 42% said that they would sometimes divert from their path in order to use a crosswalk.

It is also interesting to note that occasional users appear to be more conservative in their crossing choices. For example, only 18% of occasional users admit to cross frequently at non-designated locations compared to 34% of daily users. This leads to the conclusion that when pedestrian facilities are designed for primary use by commuters more intensive efforts should be made in order to discourage pedestrians from crossing at non-designated location. Such behavior may pose a risk for the personal safety of pedestrians and create undesirable disruptions of traffic flow.

Assessment of Factors that Affect Pedestrian Crossing Choices

Pedestrians were asked to state the main reason based on which they make a decision to cross at a non-designated crosswalk location. The answers to this question were indented to assess the users' priorities. Convenience is the number one priority cited by users (42%) while time savings was of major importance to 27% of the respondents. Interestingly enough, 30%

responded that they do not perceive any major risk crossing the facility at any convenient location since traffic is light enough to allow for safe crossing. These results are summarized in Figure 5.

The effect of the presence of certain types of control on the decision of pedestrians to use pedestrian facilities properly (or not) is of major importance to traffic engineers designing such facilities. Thus, the subjects were asked a series of yes-or-no questions about treatments that influence their decision to cross at a certain location. Such treatments included existence of pedestrian signal, presence of midblock crosswalk, red color brick pavement or shelter on the median at midblock crosswalk locations, vegetation or barriers on the median, and the location of the crosswalk relative to the desired destination.

The results indicate that the distance of the crosswalk to the desired destination is a major crossing choice determinant for the vast majority of pedestrians surveyed (90% of total), as is the presence of a midblock crosswalk and/or a pedestrian traffic light for 83% and 74% of survey respondents respectively (Figures 6 to 8). Vegetation and barriers influenced the decision to cross of a relatively significant number of pedestrians surveyed (65%). On the other hand, respondents had mixed opinions about shelters and red brick paving. Only 35% said that shelters positioned in the median influenced their decision to cross and 58% favored colored paving. Overall, these types of treatments may help pedestrians locate a crosswalk but appear not to have an important influence on their decision to cross at a certain location.

Furthermore, statistical tests were performed to study if there is any significant difference between responses obtained from responders in different age groups or gender classification. The results from the analysis are summarized in Table 1. In summary, it was found that differences in the responses obtained by age classification and gender are not statistically significant at the 95% confidence level. Thus the use of aggregate results appears appropriate. The only exception occurred to the question about the effect of the distance to the desired location on the decision of an individual to cross. 92% and 90% of respondents in the age group below 21 and between 21 and 55 years of age responded positively, while 74% of elderly gave a positive response to this question. The analysis indicated that the response of elderly pedestrians to this question was statistically different from the other two study groups at the 95th confidence level (significance level $0.005 < 0.05$).

Pedestrians' perceptions were cross-checked using actual pedestrian movement data that were collected in the field prior and during the time the survey was distributed to potential respondents. The data were obtained using eight video cameras. The cameras were placed consecutively (four cameras at each side of the study corridor) in such a way that their fields of view were slightly overlapping. This configuration allowed for all pedestrian movements in the study subsection to be captured. Each videotaping session lasted 30-minutes. Then the cameras were moved to capture the activity of another subsection. Overall, the system of the eight cameras had to be repositioned 8 times in order to collect 30-minute data for the entire study site.

Data reduction offered information about pedestrian crossing volumes, crossing locations, crossing behaviors and pedestrian to vehicle conflicts. Using the data obtained from the videotape reduction, values of the degree of pedestrian compliance were calculated for various types of crosswalks based on pedestrian activity in the area of influence of each crosswalk. The degree of pedestrian compliance was defined as the number of pedestrians crossing at a crosswalk location over the total number of pedestrians crossing in the area of influence of the subject crosswalk.

The pedestrian movement data analysis showed that the average degree of pedestrian compliance at midblock crosswalk locations was 71.2%. At signalized intersections, the average degree of pedestrian compliance to crossing location and green time indication was 42.6% (82.8% when compliance to signal indication was ignored). Results from basic statistical analysis on compliance rates are shown in Table 2.

Several conclusions can be drawn from the comparison of survey and movement analysis results. First, there is a relatively good agreement between the responses of users and their actual behavior in terms of their crossing choices. This observation is very encouraging because it shows that the survey analysis results can be trusted and that respondents, in general, answered the questions honestly and in good faith.

Second, both survey and movement data indicated that midblock crosswalks are more effective in accomplishing their design purpose compared to signalized crosswalks. Signalized intersections, on the other hand, appear the most efficient method for pedestrian channelization. However, a large number of pedestrians that select to cross at signalized crosswalks tend to disobey the pedestrian signal indication in an effort to decrease their delay.

Finally, with respect to the distance between the crosswalk location and the desired destination, it is clear that traffic engineers should pay extra attention to land uses that may generate increased needs for pedestrian movement and consider these needs when making decisions on placement of pedestrian crosswalks at certain locations.

Users' Perceptions with Respect to Right-of-Way and Safety

A number of questions were asked in order to assess the perceived level of safety and users' opinions regarding right-of-way.

It was found that 45% of pedestrians using the study site believe that drivers typically yield to pedestrians in designated locations, especially at midblock crossings when stopped queues could otherwise occupy the crosswalk. It should be noted that, except from the pavement markings, motorists do not see any positive type of control indicating that pedestrians should be offered priority.

Interestingly, when asked "when should motorists yield to pedestrians", the majority (61%) of respondents answered that this should happen only at designated crosswalks. 31% felt that pedestrians should always have priority over motorized traffic, and 7% responded that vehicles should always receive the right-of-way. Pedestrian replies show that the majority of users understand the purpose of streets with mixed traffic and are willing to compromise in order to help create a fair and safe travel environment for all users.

With respect to turning vehicular traffic, half of the respondents complained that turning vehicles do not respect pedestrians that attempt to cross at signalized intersections during green. This has been, also, verified by field observations. In most cases pedestrians and right- or left-turning vehicles share the same green phase with pedestrians. This situation is cited as a reason for pedestrians choosing to cross the road at locations other than signalized intersection crosswalks during green. This is an important finding that demonstrates the important role of proper signal timing settings toward the improvement of safety and efficiency.

Moreover, only 35% of the users said that a pedestrian sign displaying the message "Cross only when traffic clears" made a difference in their decision to cross. Analysis of respondents' comments further indicates that this sign often confused or frustrated pedestrians that have selected to cross at a designated crosswalk under the impression that they can have the right-of-way.

As pedestrians often compete with bicycles for the same space, the subjects were also asked to provide their input regarding safety issues that may result from this type of interaction. 59% of the users were not concerned with the interaction between pedestrians and bicycles and did not perceive bicycles as a safety risk factor to pedestrians that cross at designated locations.

Finally, over two thirds of the respondents (68%) agreed that the study site is a safe corridor for pedestrians to use. This response is a sign of approval of the facility for pedestrian use and an indication that pedestrians appreciated the recent improvements along the study corridor and enjoy using it for pedestrian trips.

CONCLUSIONS

This research studied pedestrians' perceptions toward the operation of various pedestrian treatments such as signalized intersection, unsignalized intersection, and marked and unmarked midblock crosswalks, use of physical barriers, shelters and colored paving at medians, and pedestrian warning signs. Information was obtained through survey of users at a study site in East Lansing, Michigan. All the above mentioned treatments were present at the study site.

The following conclusions are drawn based upon the results:

- The results from the survey analysis support the notion that proper pedestrian facilities encourage users to cross at a certain location. Midblock crosswalk is found to be the most influential pedestrian facility. This finding is also supported by actual movement data analysis. Signalized intersections with crosswalks help channelize pedestrian traffic, however, prove to be unable to persuade pedestrians to comply with the signal indication, particularly under low traffic demand conditions.
- The most influential factor cited by pedestrians in making a decision to cross at a designated location is the distance of the crosswalk to the desired destination. Also, added convenience was rated as the number one factor for jaywalking. These results indicate that proper selection of the position of a crosswalk with respect to land uses that generate or attract pedestrian traffic has the potential to improve the rate of pedestrian compliance significantly.
- Pedestrians disapprove of the use of warning pedestrian signs at midblock locations. Although such signs may not be popular among pedestrians they often have a safety value while used as means of positive enforcement. Additional crash and conflict analysis is recommended to assess clearly the value of these signs and provide warrants for their use.
- The vast majority of turning vehicles fail to give priority to pedestrians during the pedestrian green phase. This increases the chances that pedestrians will not select to cross at signalized crosswalks during green, if they have a crossing alternative that reduces their delays and provides safer crossing conditions. To improve the situation, leading pedestrian intervals may need to be considered when significant turning vehicular and/or pedestrian crossing volumes exist. Leading pedestrian intervals are expected to assist in reducing the number of conflicting movements with a potential to improve safety as well as pedestrian crossing compliance. Significant enhancement of pedestrian traffic flow may be possible through signal coordination (6). Careful design of signal phasing plans and proper installation of signs can greatly help to improve travel conditions for pedestrians and turning motorists alike. Furthermore, it is recommended that additional surveys be conducted to examine differences between drivers and pedestrians regarding right of way at intersections.
- It should be noted that although user preferences are important they may not correlate highly with safety considerations. It is recommended that additional analysis be performed to examine the relationship between safety and pedestrian acceptance in future research.

The findings from this study are expected to assist city planners, traffic engineers, and advocates interested in promoting walkable communities and provide the foundation for future research toward the development of guidelines for pedestrian control at corridors with major pedestrian crossing volumes.

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REFERENCES

1. Handy, S.L. Urban Form and Pedestrian Choices. In *Transportation Research Record 1552*, TRB, National Research Council, Washington, D.C., 1996, pp. 135-144.
2. Shriver, K. Influence of Environmental Design on Pedestrian Travel Behavior in Four Austin Neighborhoods. In *Transportation Research Record 1578*, TRB, National Research Council, Washington, D.C., 1997, pp. 65-73. U.S. Department of Transportation, AAA, and National Safety Council. Walk Alert. National Pedestrian Safety Program Guide. FHWA-SA-94-042, Washington, D.C., 1994.
3. Tanaboriboon Y. and Jing Q. Chinese Pedestrians and Their Walking Characteristics: Case Study in Beijing. In *Transportation Research Record 1441*, TRB, National Research Council, Washington, D.C., 1994, pp. 16-26.
4. Roupail N.M. Midblock Crosswalks: A User Compliance and Preference Study. In *Transportation Research Record 959*, TRB, National Research Council, Washington, D.C., 1984, pp. 41-47.
5. Virkler M.R. Signal Coordination Benefits for Pedestrians. Presented at the 77th Transportation Research Board Meeting, Washington, D.C., 1998.

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TABLE 1 Effect of age and gender on survey responses

Most influential factors	Age Group			Gender		
	Chi-square	Significance level	Comment (95% CL)*	Chi-square	Significance level	Comment (95% CL)*
Distance to destination	10.780	0.005	0.005<0.05 differences statistically significant	0.892	0.345	0.345>0.05 differences statistically not significant
Midblock crosswalk presence	4.550	0.103	0.103>0.05 differences statistically not significant	0.433	0.510	0.510>0.05 differences statistically not significant
Pedestrian signal presence	1.223	0.542	0.542>0.05 differences statistically not significant	1.799	0.180	0.180>0.05 differences statistically not significant

*: Confidence level

TABLE 2 Descriptive statistics of compliance rates

Compliance rates (based on crossing location)					
	N	Mean	Std. Error	Std. Dev.	95% Conf. Interval
Midblock x-walk	28	71.2	2.091	11.062	66.896 – 75.475
Unmarked midblock x-walk	12	64.2	1.007	3.487	62.009 – 66.441
Unsignalized x-walk	14	67.5	1.721	6.438	63.733 – 71.167
Signalized x-walk	36	82.8	1.387	8.321	79.951 – 85.582
Compliance rates (based on crossing location and green time)					
Signalized x-walk	36	42.6	1.555	9.328	39.441 – 45.754

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FIGURE 1 Grand River Avenue Pedestrian Study Survey

1. How often do you cross on Grand River Ave between Abbot and Bogue St. on foot? (Please mark your answer by X).
☐ 1. Daily ☐ 2. Occasionally ☐ 3. Almost never
2. Where do you typically cross on Grand River Ave?
☐ 1- on designated signalized crosswalks
☐ 2- on designated midblock and unsignalized crosswalks
☐ 3- at any convenient location
3. When do you typically cross on Grand River Ave?
☐ 1- only when pedestrian traffic light is green
☐ 2- when traffic clears completely
☐ 3- whenever I feel that I can cross with little interference with automobile traffic
4. How often do you cross at a non-designated crosswalk?
☐ 1- never ☐ 2- rarely ☐ 3- sometimes ☐ 4- often ☐ 5- almost always
5. If you choose to cross at a non-designated crosswalk, what is the main reason?
☐ 1- convenience ☐ 2- to save time ☐ 3- traffic is light, there is no risk
6. In your opinion, when should vehicles yield to pedestrians?
☐ 1- always ☐ 2- at designated crosswalks ☐ 3- never, vehicles should have priority
7. Are the following statements true for Grand River Ave.?
☐ 1 ☐ 2
Y__ N__ a- motorists typically yield to pedestrians at designated crosswalks
Y__ N__ b- left-turning vehicles typically yield to pedestrians during pedestrian green
Y__ N__ c- pedestrians typically cross at designated locations
Y__ N__ d- bicycles do not pose a safety risk to pedestrians at designated crosswalks
8. Do the following influence your decision to cross at a certain location?
☐ 1 ☐ 2
Y__ N__ 1- existence of pedestrian signal
Y__ N__ 2- presence of a midblock crosswalk
Y__ N__ 3- red color brick pavement
Y__ N__ 4- shelter over a midblock crosswalk
Y__ N__ 5- "cross only when traffic clears" sign
Y__ N__ 6- presence of other pedestrians that attempt to cross
Y__ N__ 7- distance to the desired location
Y__ N__ 8- vegetation or barriers on median
9. How often are you willing to divert from your path in order to cross at a designated crosswalk?
☐ 1- always ☐ 2- often ☐ 3- sometimes ☐ 4- rarely ☐ 5- never
10. What is your age group?
☐ 1- less than 21 yrs ☐ 2- 22-55 yrs ☐ 3- over 55 yrs
11. What is your gender?
☐ 1- male ☐ 2- female
12. Do you perceive Grand River Ave between Abbott and Bogue St as a safe corridor for pedestrians?
☐ 1- Yes ☐ 2- No
13. If your answer in Q. 12 is No, what is the major problem from your point of view?

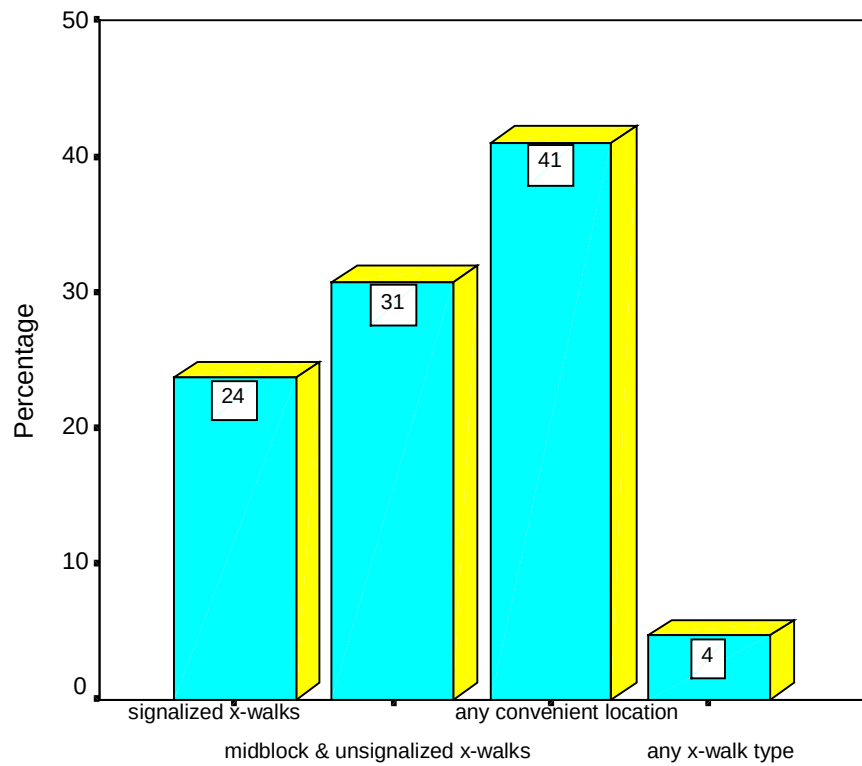


FIGURE 2 Typical pedestrian crossing locations

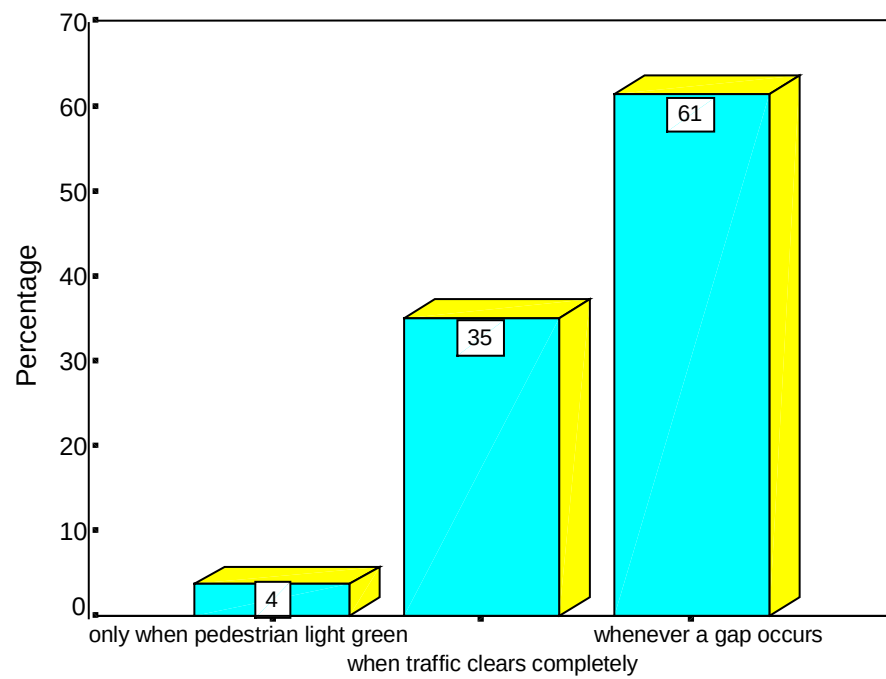


FIGURE 3 Typical pedestrian crossing conditions

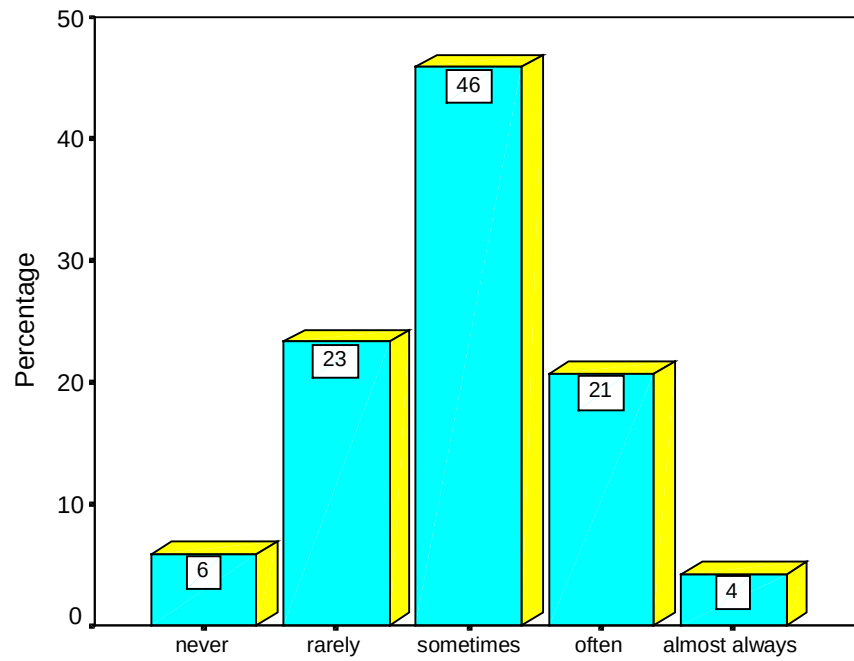


FIGURE 4 Frequency of crossing at a non-designated crosswalk

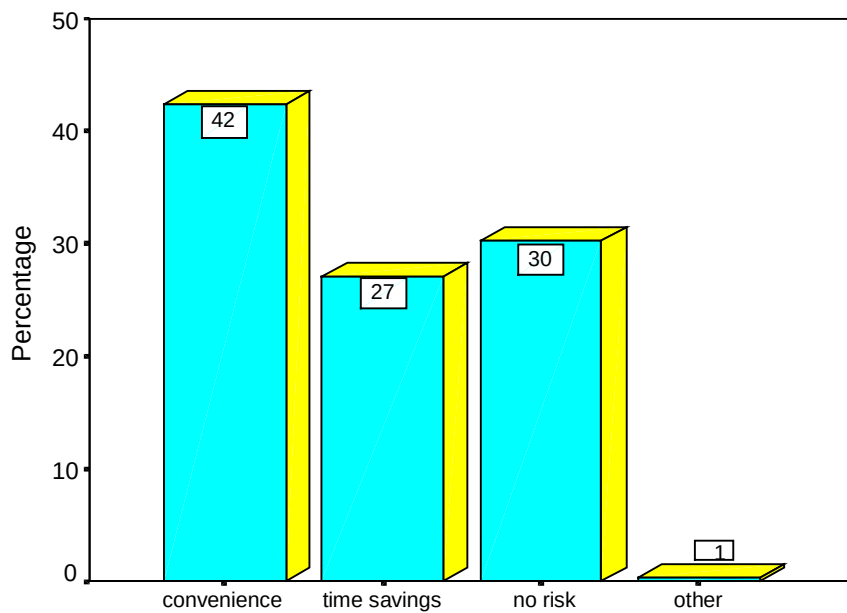


FIGURE 5 Main reasons to cross at a non-designated crosswalk

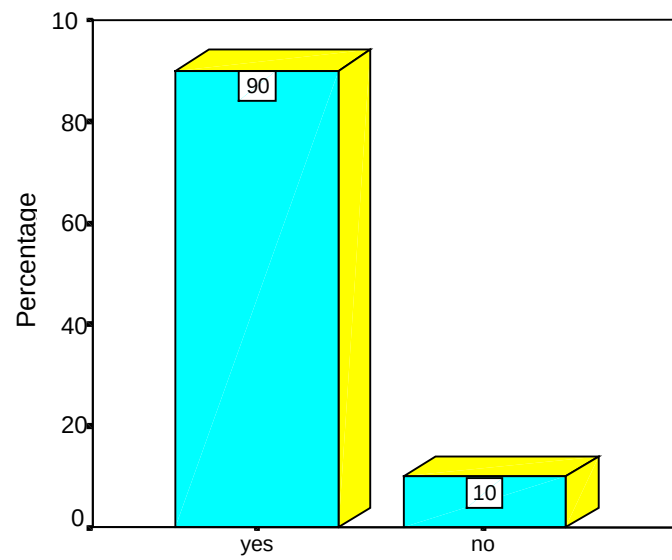


FIGURE 6 Distance to a desired location influences pedestrians' decision to cross at a certain location

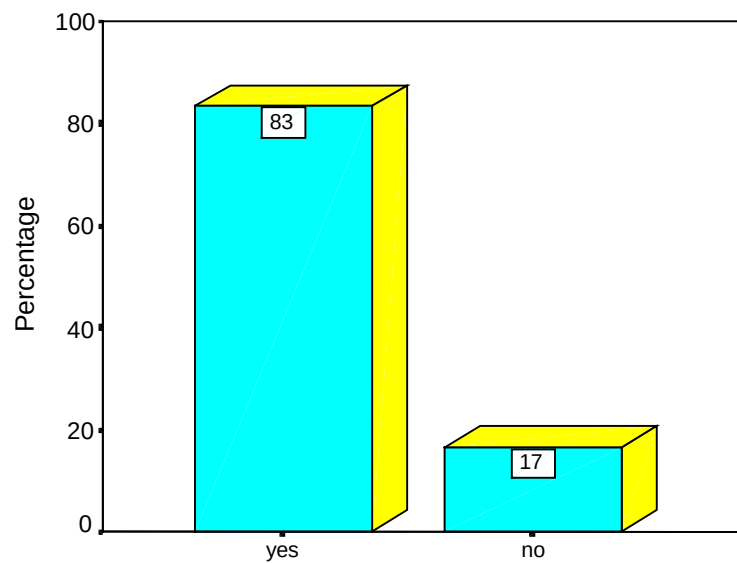


FIGURE 7 Presence of a midblock crosswalk influences pedestrians' decision to cross at a certain location

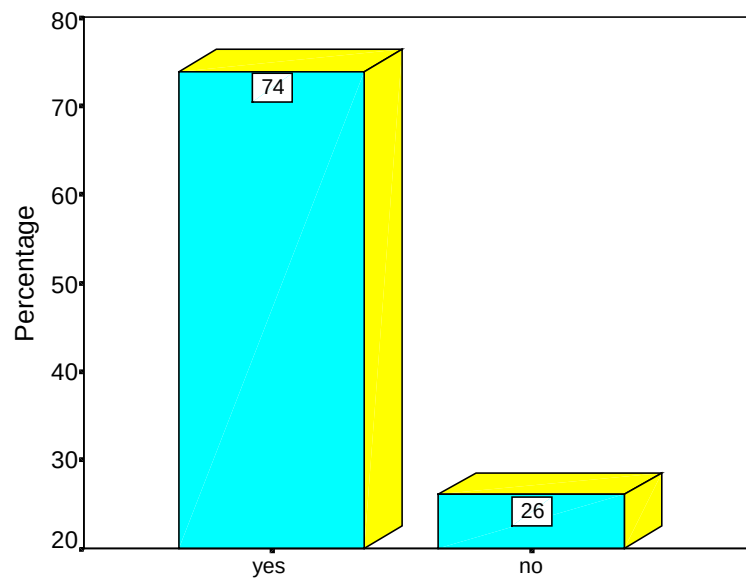


FIGURE 8 Existence of a pedestrian signal influences pedestrians' decision to cross at a certain location