



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# PROCEEDINGS —

## Fifteenth Annual Meeting

Theme:

“Transportation in Focus”

October 10-11-12, 1974

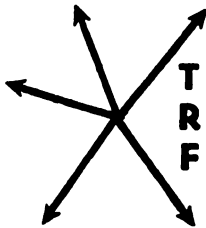
Fairmont Hotel

San Francisco, California



Volume XV • Number 1

1974



THE UNIVERSITY  
OF MICHIGAN  
NOV - 5 1974  
ENGINEERING  
LIBRARY

**TRANSPORTATION RESEARCH FORUM**

**I**N MOST conventional mode choice models, the LOS variables, time and cost, have been used as factors involved in the mode choice decision. However, several user perception surveys have identified many other aspects as more important to the traveler (General Motors, Stanford, University of Maryland). Obviously, the range of mode choice considerations needs to be expanded to sufficiently represent transit behavior. One particular aspect, safety, has received little consideration until recently when it had been incorporated into the LOS vector, especially in off-peak transit operations. However, "the effect on modal split, choice of destination, and obstacles to trip making in general which are generated by fear for personal safety is undetermined and largely unexplored . . . A description of the complex social framework within which this operates, and its various effects on all modes of transportation would be a useful tool for operators and planners of public and private transportation facilities." (Soloman, 1968)

In this research, therefore, it was proposed to investigate the safety aspect of a public transit facility through a user-perception survey.

#### Selection of Survey Area

Safety is but one level of service variable involved in the decision-making process of mode choice. In order for this variable to take an active role in the mode choice decision, all other variables should be equal between the modes and safety should be relatively different. Obviously, this situation cannot exist, for the technologies themselves possess limitations for attaining various degrees of service characteristics. Frequency of service, adaptability to demand changes, comfort in traveling and aesthetic acceptance depend heavily on the technology. For this reason, the choice of a test area for this research project necessitated a situation in which most level of service variables were comparably equal and hopefully safety was different.

The Chicago Transit Authority operates the major public transit facilities in the Chicago area and as such received first consideration. Both bus and rapid transit facilities charge a fare of 45¢ making cost equal between the modes. It was desirable to find an area in which residents would have both modes available, i.e., within walking distance. Since travel times were also to be almost equal, an express bus was thought to provide the closest alternative to the rapid transit system and the investigation proceeded from there.

Conveniently, an area exists in the Chicago city limits which exhibits many

#### Routes of the Outer Drive Express (151) and Howard Street Elevated

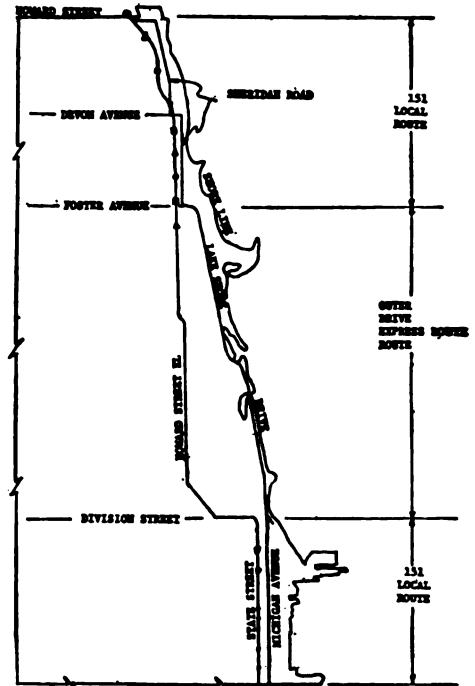


FIGURE 1

of the properties above (See Figure 1). The Sheridan Outer Drive Express (ODX), No. 151, serves the northern side of Chicago traveling along Sheridan Road where it runs as a local and the Outer Drive where it becomes express. Before it becomes express, the farthest distance between the bus route and the el section of the North-South line is 3 blocks and once downtown the subway is only 2 blocks away. Obviously, residents within this area have a choice of modes easily accessible at the same fare and approximately the same travel time. Table 1 displays travel time data as supplied by the CTA for both the express bus and the el-subway.

Except for the extreme distances (Howard to Randolph) the travel times are fairly close for a large section of the test area. Convenience, when defined as not having to walk a long distance to the access point, is just about equal in this case, for both modes are available to a large group of residents who live between the routes of the two modes. Comfort, too, is about equal with both bus and el providing cushioned seats and a slightly jostling ride. The difference between the modes is that the el provides slightly better protection from adverse

# Personal Security on Public Transit

by Neil D. Ferrari\* and Michael F. Trentacoste\*

## Comparison of Transit Travel Times (Minutes)

ODX	
Howard-Chicago	40
Devon-Chicago	26
Wilson-Chicago	16
Howard-Randolph	49
Devon-Randolph	35
Wilson-Randolph	25
El-subway	
Howard-Chicago	24½
Loyola-Chicago	21½
Wilson-Chicago	14½
Howard-Washington	26½
Loyola-Washington	23½
Wilson-Washington	16½

TABLE 1

weather conditions and the bus, besides being less noisy, uses a more aesthetically pleasing route having the lake's shoreline for a view.

### Questionnaire Design

Upon the identification of the Sheridan Outer Drive Express as the target for our study, a questionnaire was designed to obtain as much useful information from its riders as possible without creating a long, tedious series of questions.

The questions dealt with both factual and attitudinal information about the respondents. Knowledge of bus and el availability, of access distances to the modes, and of instances of harassment and criminal attack on the transit system were questions which determined respondents' attitudes and perceptions against which the actual figures could be compared. The user's views on both existing conditions and possible improvements for both the bus and the el were also obtained. The questions were predominately of a ranking or scaling type which facilitated obtaining the user attitudes based upon the mean response for each question. Furthermore, specific subgroups such as different sex or age groups were isolated and studied for unique or distinctive patterns.

### Survey Techniques

The step subsequent to the selection of the survey area and the development of the questionnaire was the administering of the survey and the compiling

of data. Two survey methods were employed in the questionnaire distribution.

After observing the ODX bus route on Sheridan Road between Foster Street and Devon Avenue, it was noted that a substantial volume of the bus riders exited in this location and entered the apartment buildings on the east side of Sheridan Road (Figure 2). Survey distributors were therefore positioned at the apartment buildings away from the bus stops to hand out the questionnaires to persons seen alighting from the ODX. 593 questionnaires were distributed in this manner during the afternoon rush hour (3:45 to 6:15 P.M.) to northbound riders.

The second method of data accumulation was through a mailout-mailback technique. A seemingly ideal area was identified within the above mentioned east-west streets and between the ODX route of Sheridan Road and the CTA el, three small blocks to the west (Figure 2). The 1973 Haynes Criss-Cross Ad-

## UPTOWN SURVEY AREA

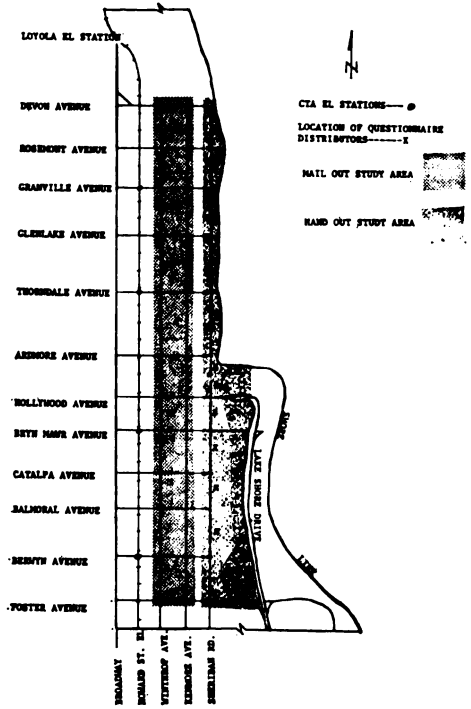


FIGURE 2

\*New York State Department of Transportation, Planning and Research Bureau.

dress Directory was used to identify 2,000 residents on Kenmore and Winthrop Avenues and a total of 1,984 questionnaires and accompanying explanatory letters were mailed first class to these residents.

**Data Organization**

Table 2 is a summary of the number of surveys distributed and returned, the number returned by the post office due to moved or unknown addresses (henceforth known as unusables) and the rates of return for each method of distribution and the total return. Nine mailing days was chosen as the extent of time needed for an adequate return due to the decline in return rate and the need to begin the analysis of the data. The final totals show a marked advantage to the distribution of surveys personally (33.1% return) rather than by mail (12.4% return) especially when the distributors are courteous and try to explain the meaning of the survey to the potential respondent. This personal contact adds a sense of importance to the survey that a mailed form just cannot equal.

**MODE CHOICE DISCUSSION**

**Variable Rankings**

To research the possibility of service characteristics affecting behavior, two

**SURVEY DISTRIBUTION AND RETURN**

Distribution:

Method	Number Distributed
By Mail	1984
On Street	393
<b>Total</b>	<b>2377</b>

Resolves: 373

Returns (by Distribution Method):

Day	By Mail		On Street		Total	
	Number	% Return	Number	% Return	Number	% Return
1	3	0.2	43	10.7	46	3.3
2	36	2.7	53	9.3	93	4.7
3	42	3.0	24	4.1	66	3.3
4	34	2.4	19	3.2	53	2.4
5	15	1.1	10	1.6	25	1.2
6	21	1.5	8	1.4	29	1.4
7	12	0.8	8	1.4	20	1.0
8	3	0.3	4	0.7	9	0.5
9	6	0.4	4	0.7	10	0.5
<b>Total</b>	<b>174</b>	<b>12.4</b>	<b>193</b>	<b>33.1</b>	<b>371</b>	<b>18.3</b>

TABLE 2

questions were specifically designed for an investigation of mode choice. One simply asked the bus user if the el could be used for their work trip, and the other requested a ranking of factors considered in choosing the bus for that trip. The former revealed whether the user knew if there was an alternative available because the el was known to be no more than three blocks away from any resident. The second question delved more deeply into what characteristics were important to the user. When broken down by age groups, over 70% of those who answered "no" to the question of mode choice were older than 50 years of age, thus leading to the conclusion that the el is an unacceptable means of transportation for many older citizens. The actual availability of the el is shown by the fact that the mean distance to the el stop from any bus user's home is 2.8 blocks with 90% of the respondents within 4 blocks. For the destinations, the mean distance is 3.26 blocks—still a relatively short distance.

The question now raised is "With the el available to such a large percentage of the bus users, why are people choosing the bus rather than the el?" The answer to this question is determined by ranking the factors considered in the mode choice decision. The method chosen for the analysis of this question was to treat each characteristic of the system as a variable and determine the mean of that characteristic's ranking; that is, first second, third . . . ninth and tenth. The mean ranks can then be put into ascending numerical order to determine the order of importance of the transit characteristics presented to the typical bus user for his journey-to-work trip. The results of this ranking are shown in Table 3.

Convenience, as expected, was chosen as most important for it was defined as "not having to walk a long distance to

**Ranking of the Mode Choice Variables**

(Mean scale of 1 to 10)

Rank	Variable	Mean	Standard Deviation
1	Convenience	2.806	2.223
2	Frequency	3.126	2.098
3	Safety	3.745	2.727
4	Travel Time	4.010	2.364
5	Reliability	4.710	2.131
6	Weather	5.850	2.371
7	State of the Vehicle	6.311	2.361
8	Fare	6.316	3.037
9	Auto Availability	6.613	3.297
10	Comfort	6.768	2.763

TABLE 3

the station." This is substantiated by the fact that the mean home-to-bus stop distance (1.62 blocks) is almost one-half that of the home-to-el station distance (2.84 blocks) which is also true for the bus stop-to-destination (1.75 blocks) and el station-to-destination (3.26 blocks) distances. Frequency was chosen as most important the second most number of times, and the small difference between the means of convenience and frequency indicates a small difference in importance for both of these characteristics. It is interesting to note that the variables most commonly used in mode choice models and journey-to-work discussions, travel time and fare, are ranked fourth and eighth respectively. This supports the basic premise underlying this research that other factors influence the user's travel decisions. One such factor is safety which was ranked third and is normally taken for granted in the journey-to-work trip. Its appearance so early in the list warrants some further discussion.

**Crosstabulations**

Two general areas can be pursued in this discussion of mode choice and safety. One is the sex, age, and income variations in the importance of variable considerations and the other is a discussion of off-peak travel behavior. To isolate any possible trends within age, income, or sex differences, crosstabulations between these three user characteristics and the four top-ranked service variables were run. Due to the number of cases (217) and the large number of possible classifications for age (10 ranks by 7 age groups equals 70 cells) and income (10 ranks by 5 income groups equals 50 cells), no notable patterns can be recognized. The sparseness of the table makes any conclusions highly doubtful.

Examining the variable of sex in Table 4, the twenty cells were large enough to distinguish a few interesting relation-

ships. For one, men held frequency (2.72) and convenience (3.08) as quite a bit more important than travel time (4.05) or safety (4.55). Women, on the other hand, viewed safety almost as important as the other two with travel time falling to fourth place. Secondly, the difference between the male and female ranking of the variable of safety was greater than one point (1.19)—a difference found in none of the other variables! This finding raises the question as to why so great a difference between the sexes exists in this variable and not in the others. Both sexes experience the same crowded and therefore equally "safe" conditions during these peak hours; nevertheless, this facet of public transportation is significantly more important to one sector of the population (females) than the other. Two questions still need to be answered: First, is the difference in perceived safety attributed to the attitudes of one sector alone or is there a real difference? Secondly, what situations have created this difference?

**Transit Use and Non-Use in Off-Peak Hours**

It has been found that the peak hours are relatively safer than the off-peak hours due mainly to the increased density and frequent service during the peak period (ATA, 1973). It is possible, therefore, that female unfavorable opinions of peak hour service are derived from their off-peak safety opinions. The area is still in doubt, however, so the factors or system characteristics affecting mode choice decisions in the off-peak period and the users they affect need further study.

To facilitate the comparisons between age and sex groups, cross-tabulations were performed to investigate how specific parts of the sample answered the questions pertaining to el or bus use in the off-peak periods (7:00 P.M. to 7:00 A.M.). Table 5 contains the actual number of respondents in each classification. Two patterns can be readily noted: First, both the young (ages 1-29) and the old (ages 60 or greater) tend not to use any form of public transit during the off-peak period. Second, when comparing the relative use between the el and the bus (Table IV-6), it is very evident that there is a shift in usage; that is, more people in a particular age group (say 30-39) would ride the bus (21 persons) during that period than the el (14 persons). In addition, a greater number of respondents answered the el-use question rather than the bus possibly indicating that for some reason people had stronger feelings about the el or they wished to strongly convey some opinion they felt would otherwise be missed.

**Crosstabulation of Sex and the Top Four Mode Choice Variables**

Variable	Sex	
	Male	Female
Convenience	3.08	2.70
Frequency	2.72	3.31
Safety	4.55	3.36
Travel Time	4.05	3.97

**TABLE 4**

Generated at University of Minnesota on 2021-10-07 16:17 GMT / https://hdl.handle.net/2027/mdp.39015023117/992  
 Creative Commons Attribution-NonCommercial-NoDerivatives / http://www.hathitrust.org/access\_use#cc-by-nc-nd-4.0

**Crosstabulation of Age and Off-Peak Transit Use**  
(actual numbers)

Age	Question			
	Use El	Don't Use El	Use Bus	Don't Use Bus
1 - 19	1	4	2	4
20 - 29	13	51	23	40
30 - 39	14	29	21	24
40 - 49	11	14	13	12
50 - 59	7	45	16	33
60 - 69	11	42	18	33
70 or greater	3	28	6	22

TABLE 5

The above questions were also cross-tabulated with sex, and the results were just as striking as those with age (Table 6). First, neither the bus nor el are used by the majority of the sample in the off-peak hours, with the el being used even less (22.7%) than the bus (36.7%). Second, when divided into sex groups, the trends for male and female take opposite turns. Females drastically increase their usage of the bus service over the el (percentages using are 39.6% to 13.9%) whereas males are less likely to take the bus than the el (30.0% to 41.8%)! This reverse shift on the part of the male population makes the female trend even more pronounced considering it was large enough to affect the overall pattern (bus to el is 36.7% to 22.0%). Third, even with the larger number of females in the sample (71.3%) the men are in the majority of those who would use the el in the off-peak. These three points, along with those found in the age group discussion, center around one gnawing question—why? This behavior must have some explanation. Thus, in an attempt to explore the reasoning behind such actions, the questions on the use of the el and the bus were each followed with a list of possible reasons for the respondents' decision for use or non-use.

The respondent was then asked to rank the nine possible choices from most important to least important. The result allows for the selection of groups of either males or females who do nor do not use the el or the bus. In this way each subgroup can be better understood with respect to its travel behavior—an understanding that could greatly benefit the transit operator in his management of service.

**Crosstabulation of Sex and Off-Peak Transit Use**  
(actual numbers and row percent)

Sex	Question			
	Use El	Don't Use El	Use Bus	Don't Use Bus
Male	33	46	24	56
	41.8	58.2	30.0	70.0
Female	27	165	74	112
	13.9	85.1	39.6	60.4
Total	60	211	98	168
	22.0	78.0	36.7	63.3

TABLE 6

For this reason, the variables ranked as important by males and females who do or do not use the bus or el in the off-peak period were tabulated. Several of the results are rather interesting. Fare was ranked number nine in every single category, and safety was number one in seven out of eight cases. These patterns indicate that the latter can no longer be ignored as a serious consideration in mode preferences. Only in the males' use of the el did safety rank as number two. Yet even in that case, 44% ranked it as number one. The nonusers particularly considered safety as an important reason for not using the el. In their case, 72.3% of the men and 74.0% of the women chose safety as their number one reason for nonuse.

In this discussion, it must be noted that safety was also the most important reason for females using the el and for either sex not using the bus. The nonuse of the bus can be explained by the overall reluctance of the respondents to use public transit in the off-peak hours. Their conviction, however, was not as strong as in the case for not using the el, for the mean ranking was higher for both sexes towards not using the bus than not using the el. Thus, although reluctant to use either mode, users perceive the bus as safer than the el. The interesting twist in the trends appeared where the highest ranked mean of the reasons for using the el by females is safety. This contradicts all the other relationships that lead to the conclusion that the el is safer than the bus. A possible explanation is that the respondents might not have understood the question. Although answering it as if they wouldn't use the el, they stated in the previous question that they would, thus producing erroneous tables.

#### Other Variables

Lastly, the other variables showed a somewhat stable ranking throughout most of the categories. Fare, as previously mentioned, was always ranked as

least important. The mean of this variable for those who used each mode was lower than for those who do not, possible signifying an increased importance of cost when the individual is actually required to pay it. Most of the variables tended to have their distributions clustered about their means, yet a few had noticeably diverse subgroups. In the case of service hours, on the average, one-third of each category chose it as most important and one-third as least important with the remainder spread evenly between these points. This would indicate that the respondent either had no knowledge of the term's meaning or was very familiar with the service timetable of the transit facility. Travel time also exhibited this dichotomy, for 25% ranked it either number one or two and another quarter as one of the bottom three. Assuming all the respondents understood the term, the reason for this split is simply the user's attitude towards the importance of time during his off-peak trips; some viewed it as essential while others did not.

Finally, in all the ranking categories of the reasons for transit use or nonuse by females, the mean value of safety is ranked far higher than any second choice. For males the pattern is not as pronounced but still evident except for the use of el category. This one case ranks safety as a close second, while all the variables are ranked closer than in any other category. Obviously, the actual ranking could easily vary if the sample size was larger, shifting the means higher or lower.

#### Summary

To conclude this discussion of mode choice, a few general comments are in order. First, there exist service variables that affect transit user's travel behavior enough to entice a significant sector of the population to utilize one mode rather than another. Travel time and cost are the variables that have heretofore been most widely used. The results of this attitude survey in the Chicago Uptown Lake Shore area of bus users and nonusers alike reveals that these two factors may not be the most important to the traveler. Indeed, the variable most frequently chosen as the most important reason for using or not using the bus or el respectively is safety, i.e., freedom from personal attack, harassment, etc. Secondly, attitudes towards personal safety and other variables vary with different subsets of the population, notably sex and age. Due to the various perspectives each of these subsets possess, the degree of freedom from criminal actions varies from virtual unimportance, as in the case of younger males, to utmost importance, as perceived by

elderly females. Lastly, once the important reasons for the traveler's choice of transportation have been isolated, the specific circumstances that have led to the development of those opinions should be identified and studied. In this vein, the next section will contain an analysis of the user perception of safety—its basis for users' opinion, influence on mode choice, and finally possible improvements.

#### SAFETY ASPECTS OF THE ATTITUDE SURVEY

The preceding section has presented the findings of the mode choice decision of the ODX bus riders and off-peak el and bus riders. For three of the mode choice decisions in the off-peak hours, el nonusers, bus users and bus nonusers, passenger safety was ranked number one. To further investigate the ODX user's perception of the safety variable, this section will contain an analysis of those questions dealing with safety.

#### Seasonal Variations

The crime data from the Chicago Police Department (Conlisk, 1971) reveals a slight variation of street crime for the different months of the year. September, October, and December appear to be high crime months while February and August seem to rank lower. Whether this fact is based on climatic changes, day-light hour variation, or educational institution schedules is yet unknown, but how the transit rider perceives the seasonal safety variation and subsequently forms his mode choice decision is of prime importance to and able to be determined by the transit planner.

Of the ODX bus patrons, 55.9% indicated a changing perception of safety levels for the different seasons of the year. The breakdown was quite similar with respect to sex, for 53.2% of the males and 57.4% of the females questioned expressed such a variance. The age cross tabulations did show a significant variance for those riders 50 years of age and older. In the younger age groups, the seasonal difference was uniform, as opposed to the 50-59 year and 60-69 year groups which answered yes 75.0% and 60.8%, respectively. For the income variable no trend was observed when isolating particular groups.

Respondents to the survey indicated that winter is perceived as the most feared season with 78.3% of the responses selecting winter as least safe. Summer, on the other hand, was regarded as safest 67.8% of the time. Through further investigation by sex of those responses which specified a seasonal difference of winter and summer being least safe and safest, respectively, it was evident from these responses that fe-



males especially perceive the winter as the worst season.

There are several reasons possible why climatic differences between the summer and winter may be the cause of the perceived safety variation of those seasons. Tramps, drunks, and other bothersome persons use the transit systems in the winter months to shelter themselves from the uncomfortable outside conditions. During winter months darkness comes in the early evening and since most people would prefer traveling in daylight, their perception of safety during the winter is decreased. The CTA has had an overall decline in ridership of 6.5% between 1960 and 1970 and an additional 6.4% decline to 1972. Table 7 contains figures for the time of day when these changes occurred possibly strengthening the hypothesis that more and more people are eliminating their night trips due to early winter darkness. Obviously, further investigations are warranted.

**User Awareness of Crime and Harassment**

Besides the possibility of potential transit riders being affected by seasonal safety variance, the knowledge of crime or harassment on public transit may likewise influence travel behavior. As initially assumed, almost all of the sampled group knew of some type of crime on transit, for 92.0% answered this question affirmatively. The means by which they obtained this information was evenly distributed between radio, TV, newspaper, and word of mouth.

The knowledge of crime and harassment on public transit, however, seems to have no effect on el use or bus use. The percentage of people who knew of such incidents was similar for el (91.7%) and bus (93.6%) users and nonusers (91.6%) alike. Thus the news media seems to reach most of the city's residents and although safety is an important mode and route choice variable, the knowledge of criminal acts on the system is not peculiar to nonusers alone.

**Access and On Board Safety**

A comparison of the access and on board safety locations was undertaken next. Five areas: origin stop, walk to el, walk to bus, on board el and on board

bus, were posed on attitude scales. Three of the locations (stop, buswalk, and busboard) were perceived much safer in relation to the others. However, there seems to be no relationship between these items and sex, age or income for uniform distributions were evident in all cases.

On the other hand, the walk to the el and the safety on board the el have significant similarities. First of all, the distributions are quite skewed towards the unsafe (1) attitude as seen in Figure 3. In this group, a response of unsafe for elwalk revealed a sex breakdown of 35.4% for males and 54.6% for females. So too for elboard, 41.5% and 62.7% of the males and females respectively answered unsafe. Age also exhibited strong relationships towards perceived unsafeness. For the two areas (on board and access to the el), certain age groups (50-69 years) possessed negative safety perception 50% of the time and in some cases as much as 65%.

The last items pertaining to elwalk and elboard are the relationships to el usage. The perception of safety varies drastically from those respondents who use the el and those who do not with the latter rating the el as much more unsafe than the former. Whether the el users have become accustomed to a possible safety problem or whether the nonusers are unjustifiably viewing the subway or el as exceptionally unsafe is not yet known. However, it is obvious that a substantial ridership market could be reached if the perceptions of the el non-users group could be improved. The last line of questioning, therefore, pertains

**Attitudes on Access and On Board Safety**

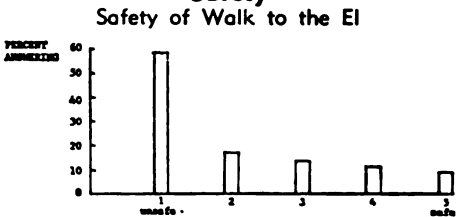


FIGURE 3(a)

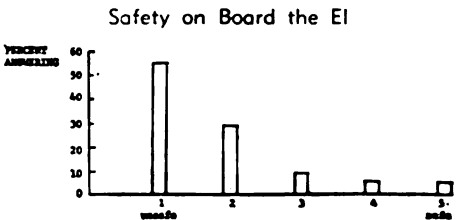


FIGURE 3(b)

**CHANGE IN RIDERSHIP (1955 - 1970)**

Time of Day	Rapid Transit	Bus
Midnight-6:00 a.m.	Stable	Stable
6:00 a.m.-9:00 a.m.	Stable	Stable
9:00 a.m.-3:00 p.m.	UP 16-19%	UP 21-24%
3:00 p.m.-6:00 p.m.	DOWN 35-32%	UP 1%
6:00 p.m.-Midnight	DOWN 15-12%	DOWN 16-14%

(Taken from CTA Report RP-271143)

TABLE 7

to those characteristics of the transportation system, environment, and operation which would improve transit's perceived security quality.

#### Possible Safety Improvements

To determine those changes in public transit which the commuter views as effective in bettering the transport safety aspect, eight possibilities for improvement were presented in the questionnaire. Space was provided in which other choices could be written. As previously mentioned, the items of this question dealt with transportation factors used to improve safety. A listing of these factors, along with their mean ranks appears in Table 8.

Increasing the number of police on the transit system and at the station appears to be the most desired improvement. The second most popular type of change is the initiation of a communication network or alarm system on the vehicles and at the stations. These signaling devices would be connected to some police or security control center. Although this communication system ranked third and fourth when disaggregated by sex, it is interesting to note that females rather than males preferred it over the police increased in their top two choices.

Although most desired as a transit safety improvement, an increase in the transit police force may not be truly as cost-effective as other alternatives. Several possibilities could be substituted for these actions while still maintaining the desired surveillance. Transit employees, such as fare collectors and platform engineers, could be situated such that their presence is felt throughout the entire station thereby reducing the passenger's feeling of "being alone" during low travel density hours.

So too, concession stands would be purposely located to provide an ever-

present watchful eye. Furthermore, these surveillance posts could be equipped with a communication system to summon help if needed. These changes after being made known to the public through an extensive public relations program, would probably not only reduce fear of transit travel by riders, but would also discourage the use of these systems by robbers and assailants.

#### Summary

Whether these changes are feasible or whether enough research has been undertaken about public transit is not known. However, the facts presented in this study on the ODX user survey questions pertaining to safety involving personal attack have established certain realities about the subject. First, there is a substantial number of riders who perceive a variation in safety during the seasons of the year which probably affects their transit usage in the unsafe seasons. Secondly, knowledge of crime and harassment on public transit, be it obtained through the news media or word of mouth, does not have a significant effect on ridership. The el in the Chicago North Side Area has also been established as being less safe either on board or walking to the system as compared with the express bus, and thus, transit riders use the bus instead of the el, if they do use transit at all. Finally, the improvements desired by transit users and nonusers alike are focused on providing added protection on the system, either by increasing the number of police on the stations and vehicles or by providing a communication and alarm system. The significance of these findings and the usefulness to transit operators and planners along with recommendations for future study will follow.

#### CONCLUSIONS

##### Shortcomings

To conclude this research effort, an analysis of the shortcomings and a discussion of future recommendations is warranted. The first assumption that could be questioned is the stability of the definition of crime and harassment between the two sexes. Whereas most males might define C/H as being robbed and/or physically assaulted, the mere encounter with an uncomfortable environment or person might constitute the female definition.

From the content of most of the comments received in the questionnaires, it was evident that the respondents recognized the subject matter of the questionnaire as safety. This may have possibly biased the results and altered the degree to which people perceived safety. However, due to the restrictions in questionnaire size, the investigation of safety

#### Ranking of Improvement Items

Rank	Improvement Item	Mean Rank
1	Increase the Number of Police at Stations	3.15
2	Increase the Number of Police on the Vehicles	3.24
3	Initiate a Communication Network	3.29
4	Initiate an Alarm System	3.62
5	Improve the Station and System Lighting	4.31
6	Increase the Frequency of Cars	4.52
7	Improve the Neighborhood Surrounding the Stations	4.72
8	Increase the Passengers per Car by Reducing the Number of Cars per Train	5.91

TABLE 8

was limited to a few direct questions. To provide a totally unbiased return, the questionnaire size would have been prohibitively lengthy in order to disguise the questions pertaining to safety.

#### Recommendations

Further information could have been useful to this discussion simply by expanding several questions, specifically those ranking the reasons for use of the el or bus in the off-peak period.

Possible future studies could attempt to produce a working relationship between actual and perceived safety aspects of transit services. If a uniform method of defining and reporting criminal actions on public transit and making this data available to the public were developed and implemented, this research effort could become feasible. For an effective impact of this proposal, a nationwide acceptance of this criminal data collection process is needed. With this common procedure many cities can utilize this framework for investigating personal safety on their transit system. Cities with varying socio-economic classes and areas with different crime rates would be able to follow a standardized methodology for transit planning and improvement with respect to crime elimination. Once established and linked with an effective perceived attitude survey, a relationship between crime statistics and user attitudes can be developed, as was performed by the Chicago Department of Public Works. In their innovative investigation of the entire City of Chicago sampling user and nonuser alike, they isolated recommendations for the improvement of public transit. Thus, their citywide efforts to determine desired transit services have already been attempted and completed successfully.

One area where a great deal of additional research with respect to transit safety should be undertaken is in terms of system design. Future study should attempt to learn how people perceive a facility, i.e., its structure, layout, equipment, etc., and upon that basis improve safety according to the undesirable attributes of the physical plant. One example would be to conduct a user-perception survey at individual el stations or along particular bus routes and improve conditions at specific locations according to what people who use those locations suggest. However, a particular technology should not be eliminated merely for the fact that a particular segment of the population feels that there is some attribute that doesn't appeal to them. It may be the only means of transportation for another group and its elimination would be favoring one group over another. Different people desire different mobility attributes. Thus, the transit

planner or operator must be mindful to provide multimodal alternatives. It must be fully understood that different segments of the market desire different services which more often than not can only be provided by different technologies.

In conclusion, this research has shown that other factors besides travel time and fare influence mode choice decisions. Personal safety is one of these factors, yet others, such as frequency and reliability, have been identified and require further investigation. Only after the impacts of each of these factors are known can the transportation planner or manager alter his operations and supply the services demanded by the present and potential transit market.

#### SELECTED BIBLIOGRAPHY

Adams, Joseph. *People, Crime and Public Transit*. (term report, Northwestern University, Evanston, Illinois) May, 1973.

American Transit Association. "Scope of Transit Crime and Vandalism," (Draft of Chapter Three of a Safety Report.) Washington, D.C., 1973.

Beckmann, Martin. *Studies in the Economics of Transport*. New York, 1955.

"Boston Plans to have own Transit Police," *Passenger Transport*. August 9, 1968.

"Cities Tries Numbers, Call Boxes in Subway to Speed Policy Help," *Chicago Police Star*. March, 1968.

Conlisk, James B. "Chicago Police Department Annual Report, 1971," Chicago Police Department, 1971.

Dow, Janet. "Mass Transit Unit of the Special Operations Group," *Chicago Police Star*. September 1971.

Gilkey, Jim and George Byrne. *System Evaluation of Victim-Activated, Silent Alarm Systems*. Lexington, Kentucky. Proceedings of 1970 Carnahan Conference on Electronic Crime Countermeasures.

Gustafson, R. C., H. N. Curd and T. F. Golob. *User Preferences for a Demand-Responsive Transportation System: A Case Study Report*. General Motors Research Publication. Warren, Michigan.

Harris, Oscar L., Jr. *A Methodology for Developing Security Design Criterion for Subways*. Pittsburgh, Carnegie-Mellon University, October, 1971.

Hoel, Paul G. *Introduction to Mathematical Statistics*, 3rd Edition. New York, John Wiley and Sons, Inc., 1966.

McDonald, William Frank. *The Victim: A Social Psychological Study of Criminal Victimization*. Berkeley, 1970.

Manheim, Marvin L., Earl Ruiter, and Kuran Bhatt. *Search and Choice in Transport System Planning: Summary*

**Report.** Cambridge, Massachusetts. MIT Department of Civil Engineering. 1968.

Maryland, University of. *User Determined Attributes of Ideal Transportation Systems: An Empirical Study.* College Park, Maryland, University of Maryland, Department of Business Administration. 1970.

Nie, Norman H., Dale Bent and C. Hadlai Hull. *Statistical Package for the Social Sciences.* New York. McGraw-Hill. 1970.

"Our Police Go Into Action." *London Transport Magazine* (Feb. 1968).

Schnell, John B. and Arthur Smith. *Vandalism and Passenger Security in the Transit Industry.* 52nd Annual Highway Research Board meeting, Washington, D.C., January 1973.

Smith Wilbur and Associates. *Charlotte-Mecklenburg Public Transportation: Short Range Transit Needs—Phase I.* September 1971.

Solomon, Kathleen M., Richard J. Solomon, and Joseph S. Silien. *Sources of Information on Urban Transportation: Passenger Psychological Dynamics.* New York, Journal of Urban Transportation Corporation, American Society of Civil Engineers, June 1968.

Stanford Research Institute. *Future Urban Transportation Systems: Desired Characteristics.* Edited by Dan Haney. Menlo Park, California, 1967.

Straus, Peter. *Toward an Hierarchical Model of Attitudinal Indifference Preference and Choice: A Study of Intra-modal Mass Transportation Choice Behavior in Chicago: Urban Systems Engi-*

neering Center, Northwestern University, Evanston, Illinois, June 1972.

Straus, Peter and George Peterson. "Public Acceptance of an Attitudinal Transit Questionnaire," *Traffic Quarterly.* April 1972.

Trentacoste, Michael F., Gregory Sterns and Joseph Adams, "Review of Level of Service Variables," (term paper and pending research report for the Transportation Center, Northwestern University, 1973.)

Wallace, Paul. "Transit Police . . . A Specialty," *Illinois Police Association Official Journal.* April 1968.

Williams, Everard M. (a speech delivered by Dr. Robert Shellow) Pittsburgh, proceedings of the International Conference on Urban Transportation, *Control of Mass Transit Vandalism and Other Crime.* September 1971.

Williams, Everard M. and Robert Shellow. "A Systematic Approach to Mass Transit Security," proceedings of the Spring 1972 meeting of University Research and Training Grant Program, UMTA, Washington, D.C. June 1, 1972.

#### ACKNOWLEDGEMENTS

This research effort was made possible through the aid of the Urban Mass Transportation Administration (IL-11-0005DOT-UT495) to Northwestern University during the summer of 1973. We would also like to thank our fellow graduate students for helping collect the data for the study and special thanks to Dr. Edward Morlok for his continued guidance as our faculty advisor. Also, we would like to thank Rosemary DeLorenzo, Anna O'Connell, and Lillian Zanella of the NYSDOT for their aid in reproducing the report for the TRF, and the NYSDOT for sponsoring its publication.