

SOME PROBLEMS WITH ACCESSIBILITY STANDARDS:
A COMPARISON OF HOUSEHOLD PREFERENCES TO
STANDARDS FOR WORK, SHOPPING AND
SCHOOL TRIPS¹

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ABSTRACT

Empirically measured accessibility preferences of a national sample of metropolitan households are compared to three time distance standards recommended by the American Public Health Association and generally accepted within the urban planning profession. Data analyses suggest that accessibility desires are related to actual trip time to work, shopping center, and elementary school and to broader measures of residential satisfaction. However, the commonly accepted maximum time distance standards are inadequate measures of people's accessibility desires. Preliminary attempts to account for the variation in accessibility desires left unexplained by the standards are made by dividing the total sample into more homogeneous subgroups, but this approach largely failed.

The purpose of this paper is to compare the empirically measured accessibility preferences of a national sample of metropolitan households to three accessibility standards generally accepted within the planning profession. The standards tested are those developed in 1948 by the American Public Health Association's (APHA) Committee on the Hygiene of Housing. After the depression of the 1930's and World War II, the Committee saw a great need and potential for reconstruction. They also saw a concomitant need to crystalize health objectives "in the form of definite and concrete standards of performance"² in order to guide decisions, particularly in the area of housing and in the design of the physical environment. To this end, the Committee developed standards which technicians could use in the design of environments and which non-technical policy makers could use in environmental evaluation.

Among the standards of environmental design suggested by the Committee were accessibility standards which specified a maximum acceptable distance to an activity and were based on "the avoidance of fatigue, protection from traffic and other accident hazards, and positive encouragement to use the facilities."³

A lack of systematic empirical testing of accessibility standards has led one Detroit newspaper to label them "...utopian goals translated into nice round figures based upon guesswork."⁴ Yet, despite an absence of empirical tests, and despite the criticisms leveled against them--perhaps because they are simply handy--the standards were republished in 1960 and continue to be used by urban planners at the local level for evaluating existing and proposed environments and continue to play an indirect role in public in-

vestment planning for schools, parks, urban highways, and shopping centers.

This paper will examine three important accessibility standards: the time of trips to work, to school, and to a shopping center. These three activity destinations were most often mentioned by respondents in our national sample of metropolitan households as the most important destinations to be near should they move again. Specifically, the standards to be evaluated in this paper are:

1) Elementary school: APHA standard recommends 1/4 to 1/2 mile distance,⁵ which we have converted to 15 minutes by assuming a walking speed of 2 miles per hour.

2) Shopping center: APHA standard recommends 20 minutes maximum time-distance.⁶

3) Work: APHA standard recommends 30 minute maximum time-distance.⁷

In examining these three accessibility standards, we are assuming that they serve as proxies for people's accessibility desires. We are therefore not providing a complete or explicit test of APHA's stated criteria. For example, the criterion of "protection from traffic and other accident hazards" is only slightly related to individual desires to be closer to or farther from destinations. Nor does the "positive encouragement to use facilities" relate directly to individual desires to be closer or farther. We are not using counts of traffic accidents, indications of facility use, or measures of driver fatigue in our tests. Thus, it should be clear from the start that the paper provides only a comparison of these three accessibility standards to household preferences and not a complete test based on the original APHA criteria of fatigue, safety, and user rates of facilities.

Nevertheless, it seems to us that the application of any convenience standard is more strongly justified if it is in line with the desires of individuals to whom the standard is applied. As proxies for actual measures of accessibility desires and applied as policy guides to urban development decisions they could serve to reflect the preferences of future residents before they arrive and become able to state their own preferences. In such a framework for considering accessibility standards, the success of their application is directly related to the proportion of a population whose accessibility desires are correctly reflected in the standards.

More specifically, given our partial test, it is our contention that an accessibility standard is more valid and useful if it meets the following criteria:

1) There should be a clear relationship between accessibility desires and distance from an activity destination; i.e., the desire to be closer to a destination should increase with distance.

2) The accessibility standard should reflect the above relationship between desires and time-distance.

3) The standard should reflect any relationship between accessibility desires and broader measures of environmental satisfaction such as overall neighborhood satisfaction and overall accessibility satisfaction.

THE DATA

The data of this study is drawn from interviews conducted in 1966 with

members of 1,476 households in 43 metropolitan areas across the United States. The survey sample was based on a multistage probability sample to the level of small areas containing one or more city blocks. The sample design assured proportional representation of each of four major census regions and of each of three SMSA size classes, and equal numbers of interviews in central cities and the remainder of the SMSA. At the block level, quota sampling was used to obtain a representative proportion of respondents by age, employment status, and head/spouse relationship to the household.

Respondents were asked "About how many minutes does it take you to get from here (place of residence) to the head's place of work? ... to a shopping center? ... to an elementary school?" Thus our accessibility measure is not physical distance but time distance, which might actually be more meaningful. Respondents were also asked "If you were to move, would you rather be closer, about the same, farther away, or doesn't it make any difference?" This response we refer to as "accessibility desires" in this paper. Thus, the accessibility preferences or desires that are measured, analyzed, and reported in this paper are simple responses to a question that does not require the respondent to consider paying any cost for obtaining accessibility, or to select between accessibility and some other desirable residential characteristic (i.e., there is no trade-off required). However, our respondents were apparently aware of at least some of these trade-offs since 1) relatively few indicated a desire to be closer to the selected destinations, and 2) the propensity for people to indicate a desire to be closer increased as distance increased. We have restricted analysis of work accessibility to those households where the head of the family was employed and we have restricted the analysis of elementary school accessibility to those households with children.

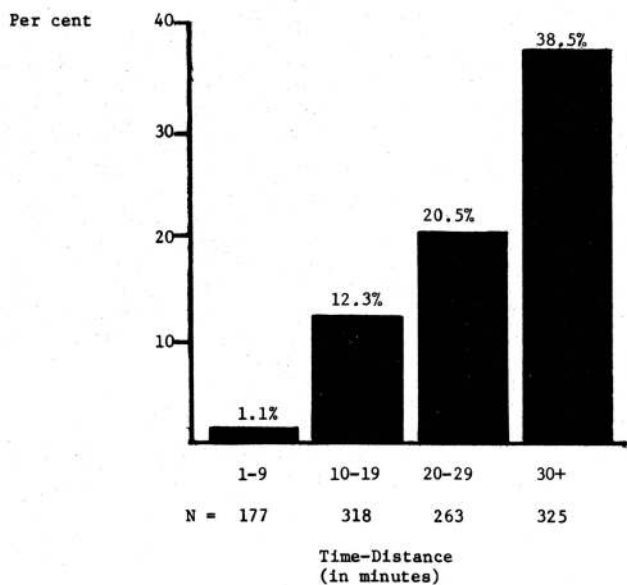
ACCESSIBILITY DESIRES AND TIME DISTANCE TO AN ELEMENT

We begin our examination of accessibility standards by observing the association between a desire to be closer to an activity destination and the current reported time distance to the destination. Since, in general, APHA accessibility standards do not account for variables other than time or physical distance to a destination, a very strong relationship is required in order for the standard to be applied validly without adjustment to surrounding circumstances.

As can be seen in Figures 1, 2, and 3, there is a clear relationship between time distance from an activity destination and the percentage of people desiring to be closer to that activity. The association as measured by the statistical index γ^8 is fairly strong, supporting the visual relationship evident in these three figures.

However, the figures also show that for every distance category over 10 minutes there are both a sizable group who express a desire to be closer and at the same time an even larger group who express no such desire. Thus, there is evidence of a great deal of variation in sensitivity to time distance to work, shopping and schools, or at least in our respondents' willingness to judge the distance as being too far. The source of that variation might be due to several factors. It may be due to systematic variation in sensitivity to travel time by household characteristics such as income, age, care ownership, mode of transportation and size of the metropolitan area all of which are tested later in the paper. It may also be due to the respondents' association of more accessible locations with such undesirable environmental conditions as physical blight, crime, pollution, and increased density and loss of privacy. There may make the overall residential package at the more accessible locations less desirable than their current less accessible locat-

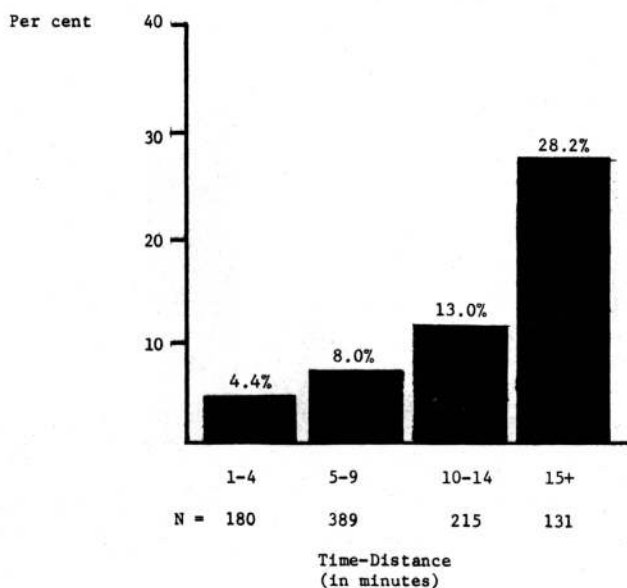
FIGURE 1
PER CENT OF RESPONDENTS WITHIN INDICATED TIME-DISTANCE CATEGORY
DESIRING TO BE CLOSER TO WORK



Gamma = -.605

FIGURE 2

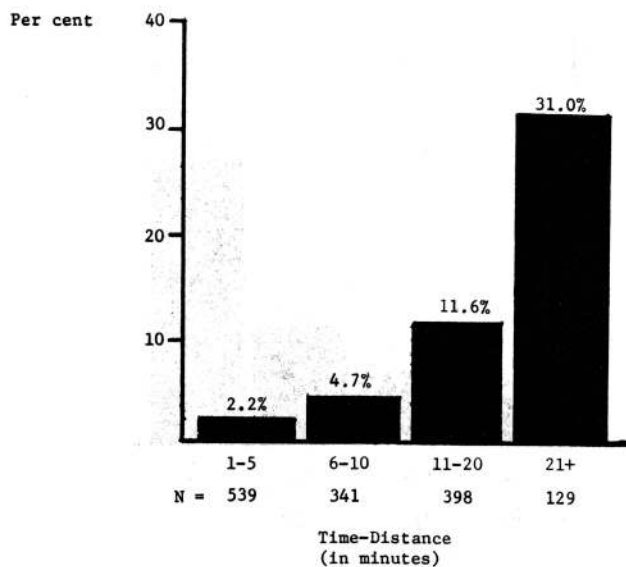
PER CENT OF RESPONDENTS WITHIN INDICATED TIME-DISTANCE CATEGORY
DESIRING TO BE CLOSER TO ELEMENTARY SCHOOLS



Gamma = -.479

FIGURE 3

PER CENT OF RESPONDENTS WITHIN INDICATED TIME-DISTANCE CATEGORY
DESIRING TO BE CLOSER TO SHOPPING CENTERS



Gamma = -.650

ion, but we cannot address this question with our data. We do, however, test the relationship between accessibility desires and neighborhood satisfaction.

ACCESSIBILITY STANDARDS AND ACCESSIBILITY DESIRES

Having verified that there is a relationship between the length of shopping, work and school trips and residents' accessibility desires, we now turn to the second criterion: do the APHA standards adequately reflect this relationship?

To pursue this question households living within the recommended APHA standard for maximum distance are placed in one category; those whose trips exceed the standard are placed in a second category. As shown in Table 1 we then compared this classification with the respondent's statement about whether he wanted to be closer to work, closer to a shopping center, or closer to an elementary school. If the standards are good proxies we would expect that, at the very least, most of those households violating the standard would want to be closer. If the majority of households exceeding the maximum trip length express no desire to be closer, then the standards may be judged poor proxies for the accessibility desires of U.S. metropolitan households.

In spite of the fact that the relationship of APHA standards to household accessibility desires is statistically significant, errors in classification are disappointingly large. For example, over half the households whose work trips exceeded the APHA standard expressed no desire to be closer. Similarly, the percentage classified incorrectly for shopping trips are elementary school trips are 68 percent and 80 percent respectively. These are very high percentages in a direction contrary to our expectations. The APHA standards for work, shopping center, and elementary school trips are clearly not central to an individual's interpretation of acceptable travel time.

ACCESSIBILITY DESIRES, STANDARD AND SATISFACTION

Thus far we have determined that a moderate relationship does exist between accessibility desires and time distance from an activity destination, but that either the commonly accepted accessibility standards fail to reflect this relationship adequately or the relationship to time-distance is not sure enough to be reflected in a simple standard specifying a maximum distance.

We now investigate the relationship of time distance and accessibility desires to two broader measures of environmental satisfaction--overall accessibility satisfaction and neighborhood satisfaction. (Respondents were asked the following questions: "Are you entirely satisfied, or dissatisfied with the ease of getting to other places from here?" and "Taking all things into consideration, are you satisfied or dissatisfied with this neighborhood?")

We first attempt to establish whether a relationship exists between expressed work, elementary school and shopping center accessibility desires and general accessibility satisfaction and neighborhood satisfaction. Clearly, if accessibility desires to these destinations are not related to broader measures of residential satisfaction, we have evidence that accessibility to these destinations is not important to metropolitan households.

Table 2 summarizes the results of these tabulations. As indicated in this table, the relationship of elementary school and shopping center accessibility desires to both general accessibility satisfaction and neighborhood satisfaction is very strong. People who are satisfied with their accessibility

Table 1. Indications of APHA Standards' Capacity To Measure Respondents
Satisfaction With Trip Times

Accessibility Desires:	<u>Meets APHA Standard of trip time maximum</u>			<u>Violates APHA Standard of trip time maximum</u>		
(Respondent's statement about present trip time)	Head's place of work (30 min.)	Shopping center	Elementary school (15 min.)	Head's place of work (30 min.)	Shopping center (20 min.)	Elementary school (15 min.)
Satisfied	84.9%	94.2%	89.6%	54.8%	69.0%	72.0%
Wants to be closer	15.1%	5.8%	10.4%	45.2%	31.0%	28.0%
N =	(895)	(1278)	(865)	(188)	(129)	(50)

to these two destinations also tend to be satisfied with their overall accessibility package and neighborhood quality. Accessibility to the destinations is apparently significant to our respondents.

Interestingly, in terms of this partial test, elementary school and shopping center accessibility desires are more highly correlated with overall accessibility satisfaction and neighborhood satisfaction than are work accessibility desires. This finding conflicts with the significance traditionally attached to the journey to work in accessibility literature.⁹

Having established some relationship between accessibility desires and broader measures of residential environmental satisfaction, we now examine the relationship between accessibility standards and these same measures of environmental satisfaction. Our respondents are dichotomized on the basis of whether they meet or exceed the APHA standard and the results are cross-tabulated with their response to the environmental satisfaction questions.

Ideally, the relationship between accessibility standards and environmental satisfaction would equal that between accessibility desires and those same measures of satisfaction. If this were the case, we could say that the APHA standards fully reflect the observed significance of accessibility desires to these broader measures of environmental satisfaction.

Observation of the first row of table 2 indicates that the association between work accessibility standards and environmental satisfaction closely approximates that between work accessibility desires and environmental satisfaction. This finding suggests that the APHA work accessibility standard adequately reflects the significance of the work trip destination, supporting our statement above attributing some validity to the APHA work accessibility standard.

For shopping center and elementary school destinations, however, the APHA standards are less able to reflect the relationship between accessibility desires and environmental satisfaction. For example, the association (gamma) between elementary school accessibility desires and general accessibility satisfaction was .72, but the corresponding association between distance (dis) was .15 (not significant at the .01 level).

Hence, where the relationship between accessibility desires and environmental satisfaction is strongest, the existing APHA standards on maximum time-distance inadequately reflect this relationship. Conversely, where the relationship between accessibility desires and broader measures of environmental satisfaction is relatively weak, the existing APHA standards adequately reflect the relationship. While there is no statistical technique to evaluate the extent of the shortcomings of the standards in this respect, the magnitude of these shortcomings for the elementary school and shopping center destinations is conceptually significant.

RELATING HOUSEHOLD, DWELLING, WORK PLACE AND SMSA CHARACTERISTICS TO THE VARIATION IN ACCESSIBILITY DESIRES LEFT UNEXPLAINED BY TIME DISTANCE

Earlier, we showed that although a relationship is evident between time distance and accessibility desires, there still exists substantial variation in households' accessibility desires which is left unexplained by their time distance to work, school and shopping centers. In seeking some explanation for this remaining variation in accessibility desires, we have measured their relationship to household, dwelling, and work place characteristics after

controlling for time distance as dichotomized by the APHA standards. In time manner, we have examined such household characteristics as income, race, auto-ownership, attitude toward traffic and public transportation as metropolitan problems, and preferences for a higher quality neighborhood vs. a more accessible neighborhood; and such residence and work place characteristics such as dwelling unit type, its location in the SMSA, (central city vs. suburb) and work place location in the SMSA; the mode of transportation used; and the size of the metropolitan area. The results of the analysis are shown in Table 3.

Work Accessibility

Differences in accessibility desires were found to be associated with income, auto ownership, and mode of transportation. Households with lower income, without autos, or otherwise relying on public transportation are likely to want to be closer. However, the percentage differences, after being standardized on the control variable of time distance, are only 10 to 13 percentage points in each case. For example, 28 percent of those earning less than \$5,250 annually desired to be closer compared to 18 percent of those earnings over \$5,250. None of the remaining variables had a significant effect on accessibility desires regarding the work trip.

Shopping Center

Differences in accessibility desires were found to be associated with four of the variables: income, auto ownership, race and dwelling type. Households most likely to express a desire to be closer had lower incomes (12 percent vs. 6 percent for those earning over \$5,250), had no auto (15 percent vs. 6 percent of those with autos), were nonwhite (12 percent vs. 7 percent for whites), and lived in the central city (9 percent vs. 7 percent for suburbanities). Though lower income households and those with no autos are twice as likely as others to want to be closer to shopping centers, the absolute differences are actually even smaller than those for work accessibility desires. None of the remaining variables affected shopping center accessibility desires.

Elementary Schools

Differences in accessibility desires were found to be associated with auto ownership, race, dwelling type, and SMSA size. Households most likely to desire to be closer were nonwhite (21 percent vs. 10 percent for whites), had no car (17 percent vs. 15 percent for those with one car and 5 percent for those with two or more cars), lived in an SMSA over one million (14 percent vs. 10 percent for SMSA's between 250,000 and one million population and 2 percent for those in SMSA's of under 250,000 population), and did not live in a single family house (16 percent vs. 9 percent for those in single family houses). Again the differences for those four variables, though statistically significant, were not great in absolute percentage points. No significant differences were found for the remainder of the variables.

Respondent attitudes toward accessibility vs. neighborhood quality, and toward public transportation and traffic as metropolitan problems were tested but found not significant for all three destinations; these variables were not included in Table 3. Neither was work place location significant for the work trip desires, the only trip for which that variable was applicable.

Our findings concerning the effect of household characteristics, residence characteristics, location in the SMSA of dwelling and place of work, or even SMSA size are that these variables appear to have limited effect on house-

Table 2. Accessibility Desires And Accessibility Standards With General Accessibility Satisfaction and Neighborhood Satisfaction, Gamma Measures of Association

Destination	General Accessibility Satisfaction		Neighborhood Satisfaction	
	Desires	Standards	Desires	Standards
Head's place of work	.38	.37	.34	.31
Shopping center	.75	.51	.56	.35
Elementary school	.72	.15 ^a	.52	.39

^aNot significant at .01 level. All other relationships in this paper are significant at .01 level.

Table 3. Association (Gamma) Between Accessibility Desires And Household Variables, Controlling For Time-Distance Dichotomized By APHA Standards^a

Variable	Work	Shopping Center	Elementary School
Income	.32	.45	--
Auto ownership	.21	.47	.44
Race	--	.35	.48
Dwelling type (single family vs. other)	--	--	.32
Dwelling location (central city vs. suburb)	--	.29	--
Work place location (central city vs. suburb)	--	not applicable	
Mode of transportation	.29	--	--
SMSA size	--	--	.34

^a All partial gammas in the table are statistically significant at the .01 level, two tailed test. Signs have been deleted, values indicate strength of relationship but not direction.

holds' accessibility desires. Thus, they contribute little to our explanation of accessibility desires, and they do not suggest sliding standards keyed to various sub-groups of the urban population or sub-areas within the metropolis.

These results do concur with some previous research executed along similar dimensions. Lansing and Barth attempted to explain differences in accessibility desires in terms of desired distance from the central city. They found no relationship between those desires and life cycle, income or life style variables.¹⁰ Using a larger sample and different destinations, we also have found but limited relationship between sub-population attributes and accessibility desires.

What is implied by our findings? One interpretation might be to discourage the concept of accessibility standards *per se*. Such an argument would point to the tremendous variation in our respondents' translation of trip time into accessibility desires and our lack of ability to account for this by household characteristics, or location of home or work place in the SMSA. One could argue that relaxing the standard (increasing the time-distance specified) might decrease the number of satisfied violators of the standard; but such a change would increase the number of people who meet the standard but nonetheless desire to be closer. Making the standards more severe would have the opposite effect.

Another interpretation would suggest continued attempts to revise the current standards so that they are better proxies for accessibility desires. As noted above, a single, universally-applied standard is probably insufficient to account for the wide variations in expressed accessibility even within rather homogeneous population sub-groups. Apparently, variables other than distance alone are shaping accessibility desires; a valid standard should account for these variables, including the other dimensions of the accessibility concept in addition to distance.

We conclude that accessibility desires are related to residential satisfaction, but that current APHA time distance standards are a poor proxy for stated desires of metropolitan households. These standards fail to account for a significant proportion of actual accessibility desires. Nor does disaggregating the population to more homogeneous sub-groups seem to improve the capacity to fit a standard to accessibility desires. Our understanding of accessibility, and the variables that influence a person's satisfaction with a given time distance, is not yet adequate to construct standards which suitably reflect a preferences of the variety of individuals to whom the standard might be applied, nor does the analysis we have conducted indicate any easy path to such accessibility standard.

FOOTNOTES

¹The data reported in this article were collected under two separate research grants. The 1966 survey was supported by the National Academy of Sciences (NCHRP Project 8-6). Co-Principal Investigators for this first study were Edgar W. Butler, F. Stuart Chapin, Jr., George C. Hemmens, Edward J. Kaiser, Michael A. Stegman, and Shirley F. Weiss. Detailed findings from the first wave are reported in Bulter, *et. al.*, Moving Behavior and Residential Choice: A National Survey, National Cooperative Highway Research Program Report 81 (Washington Academy of Sciences, Highway Research Board, 1969). The 1969 survey was sponsored by the National Science Foundation (Grant GS-2427). Edgar W. Bulter and Edward J. Kaiser and Co-Principal Investigators. Grateful acknowledgement is made by the authors of this article to the funding agencies and to the other investigators in the original survey.

²American Public Health Association, Planning the Neighborhood, (Chicago: Public Administration Service, 1948), p. v.

³Ibid., p. 43.

⁴Cited in George D. Butler, "Recent Trends in Space Standards," in Planning Recreation Facilities, (New York: National Recreation Association, 1959), p. 15.

⁵Op. Cit., APHA, p. 44.

⁶Ibid., p. 9.

⁷Ibid., p. 9

⁸Gamma (γ) is a measure of association for ordinal data developed by Leo A. Goodman and William H. Kruskal. Its values range from -1 to +1, with 0 indicating no association. See L.A. Goodman and W.H. Kruskal, "Measures of Association for Cross-Classifications," Journal of the American Statistical Association, 59 (December): 732-764; and H.L. Costner, "Criteria for Measures of Association," American Sociological Review, 30 (June): 341-353.

⁹See: John F. Kain, The Journey to Work as a Determinant of Residential Location (Santa Monica: RAND, 1961) and William Alonso, Location and Land Use (Cambridge: Harvard University Press, 1964).

¹⁰John B. Lansing and Nancy Barth, Residential Location and Urban Mobility: A multivariate Analysis (Ann Arbor, Michigan: Institute for Social Research, 1964), p. 21.