THE ROLE OF ACCESSIBILITY IN BASIC TRANSPORTATION
CHOICE BEHAVIOR

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ABSTRACT

Accessibility measures reflect the level of service provided by transportation systems to various locations. Basic transportation choice behavior is defined to include those decisions of how many automobiles to own and how many trips to which destinations to make by automobile and by public transit. Here, these decisions are assumed to be made jointly by urban households and are conditional upon residential location decisions. It is the purpose of this paper to explore the role of accessibility as a causal factor in such basic transportation choice behavior.

An economic utility theory model of choice behavior is postulated in which the benefits from making trips to specific destinations are reflected by measures of destination attraction. Through determination of utility-maximizing trip frequencies, indirect utility functions are developed which include accessibility concepts. Behavioral implications of these concepts are proposed and contrasts are drawn to accessibility measures used in conventional segregated models of trip distribution, modal choice, and automobile ownership.

Sensitivity analyses of alternative empirical definitions of accessibility in the choice model are conducted using data from the Detroit Regional Transportation and Land Use Study – covering counties in southeastern Michigan. These analyses employ a multinomial logit estimation technique and focus on definitions of trip attraction. Results of these analyses indicate that more complicated attraction measures can be replaced by measures involving the proportion of either urban area population or urban area employment within a traffic analysis zone. Also, evidence is found that decision-makers in the case study area consider trips of up to 60 or even 90 minutes duration when evaluating accessibilities offered by alternative public and private transportation systems.

Introduction

Accessibility denotes the ease with which any land-use activity can be reached from a location using a particular transportation system. This
definition suggests that the service provided by transportation is indeed accessibility, or the potential for interaction with land-use activities. The availability of an automobile or automobiles to members of an urban household can be considered as influencing this interaction with activities in two ways.

Because public transit systems have fixed routes and schedules or have limited service areas, certain destinations within an urban area might necessarily be excluded from consideration if an automobile is not available to a trip maker. Furthermore, since travel time, comfort, and convenience factors of travel by automobile are often perceived by trip makers to be superior to those of travel by public transit, ease of interaction by automobile is often considered to be greater.

It is plausible, then, to hypothesize that a household’s decisions of whether or not to own an automobile and what trips to make at what times by either automobile or public transit are highly dependent upon individual household members’ perceived accessibilities to various opportunities by using public transit and automobile. The household increases accessibility by owning one or more automobiles, but sacrifices other consumption by incurring capital and maintenance costs. The model presented in this paper for studying accessibility effects upon both intermediate and short-term travel demand is based upon such a concept of trade-offs between accessibility and consumption.

**Background**

Measures of accessibility have traditionally been constructed measures based upon a priori assumptions about factors influencing travel demand (Harris, 1966). In general, these measures have taken one of two forms: opportunities weighted by a decreasing function (viz., an impedance function) of the interaction costs in time or money of reaching those opportunities (e.g., Harris, 1966), or cumulative functions of the opportunities which can be reached within a specified travel time (Wickstrom, 1971; Wachs and Kumagai, 1973; Falcocchio et al., 1973). These measures have little or no strong underlying theory from which causality in transportation decision making can be inferred.

To attempt to assess such causal mechanisms in urban households’ automobile ownership decisions and, in particular, to identify the role played by accessibility in these decisions, an economic theory of automobile decision-making behavior has been developed by the authors in previous publications (Beckmann et al., 1973; Burns et al., 1975). In this theory, direct utility functions are formulated for households in various states of automobile ownership (i.e., owning no automobiles, one automobile, two