FSUTMS MODE CHOICE MODELING: FACTORS AFFECTING TRANSIT USE AND ACCESS

PROBLEM STATEMENT

In the Florida Standard Urban Transportation Model Structure (FSUTMS), software developed by the Florida Department of Transportation for long-range urban area transportation modeling, modal split is one important step in the modeling process to determine the market share of travel by different modes such as automobile and transit. The mode choice utility functions typically include variables such as travel times by automobile and by transit, terminal times, parking costs, and transit fares, which are components of generalized travel costs. Other factors may also influence the decision of transit use than travel costs alone. It has been widely recognized that socioeconomic characteristics of the population have an impact on the decision to use transit. Such characteristics, however, are not considered in modal split in FSUTMS. Inaccurate estimations of transit mode share will result in either under- or over-investment in transit or highway systems and inefficient use of the transportation systems and resources. Another concern is that the current method of evaluating transit accessibility, or the ability of transit users to reach transit services, is too simplified to accurately reflect the potential demand for transit services, such that it negatively impacts the accuracy and reliability of transit ridership forecasts.

OBJECTIVES

The purpose of this study was to improve the estimates of transit accessibility and to identify and analyze factors that have a significant effect on transit ridership. The goal was to recommend a set of variables that may be incorporated into the FSUTMS modal split procedure to improve its transit forecasting capability. The specific objectives included the following:

(1)   To obtain a good understanding of the current state-of-the-art and state-of-the-practice in transit ridership forecasting.

(2)   To identify available GIS data resources for improving the accuracy of analysis and to determine appropriate geographic units for data analysis and for modeling.

(3)   To develop a standard procedure that can be used to determine transit accessibility by pedestrians and automobiles.

(4)   To identify additional variables that further capture the underlying causes of transit use.

(5)   To develop practical recommendations for incorporating improvements into FSUTMS.

FINDINGS AND CONCLUSIONS

This research demonstrated by using GIS that more realistic estimates of transit walk accessibility could be obtained. Transit accessibility was much lower than that estimated by traditional buffer method when man-made and natural barriers and the effect of long walking distance on transit use are considered. Transit walk accessibility can also be forecasted based on data that are typically used by FSUTMS models. The only variable that needs to be determined for forecasting is a policy variable that determines the type of urban design to be adopted or envisioned. Additional findings from the study include the following:

- Auto access distance in traffic analysis zones may be assumed to be up to the longest transit trips likely from that zone (by considering premium transit modes and major activity centers), up to 14 miles. However, the result, based on data from Miami-Dade County, may not be applicable to areas with different urban structure, premier transit alignment, and parking availability.

- Regression analysis results identified the most influential factors on transit use to be transit supply variables, such as regional accessibility and number of daily bus runs, which, in turn, were the result of transit service supply being determined by demand. Some demand variables, such as density and land use mix, also appeared to be significant. Future effort will need to estimate the coefficients of the potential variables identified in this research for each travel mode's utility function utilized in the modal split process.

- For Miami-Dade County, the average number of bus runs per bus stop in a given tract and the percentage of tract area falling into a 0.25-mile transit buffer are relatively good indicators for predicting transit use at both production and attraction ends. Because these two kinds of data are easier to compile and more reliable than regional accessibility, they may be used as alternatives to regional accessibility measures. However, the newly developed *DECAY_POP* variable (i.e., percentage of transit service population after taking into account street layout and the negative effect of walking distance) seems to be a better indicator for transit production than does the percentage of transit service area.

- Compared to transit production trip models, the goodness-of-fit for attraction models was relatively poor. This may be the result of less reliable data on zonal employment. Furthermore, the models for Broward and Palm Beach counties showed similar effects of the accessibility variables on transit productions. Again, no other variables can be identified as the supplement/substitute of the accessibility variables.

- Transit accessibility analyses require bus stop locations and property locations. As it is becoming more common for counties to possess GIS parcel data, the availability of property location data is not foreseen as a problem for the application of the methodology developed in this research. Property tax records should include information on the number of bedrooms for each residential property and on the type of the property to indicate if it is a single- or multi-family dwelling. If the number of bedroom information is unavailable, then an average household size will have to be assigned to dwelling units that are of the same type (single- or multi-family). In recent years, some of the Florida MPOs have begun to use lifestyle models, which do not require data on dwelling types and zonal population by dwelling types. For the purpose of obtaining better estimates of transit service population and, possibly, other applications, MPOs should continue to maintain dwelling type and population information, which will not require significant effort.

- Finally, the transit accessibility analysis can be automated with a specially designed GIS program. This program will automate the process of matching properties to streets, assign household size, create transit service network, calculate the percentage of population with transit access in a traffic analysis zone, estimate the percentage of workers with transit access in a zone using land use information, and so on.

BENEFITS

This study showed that transit mode share estimates may be improved by taking advantage of the existing GIS data and GIS technology, which would allow a model to determine transit walk and auto accessibility. The methodologies proposed in this study also provide a way to forecast transit walk accessibility for a forecast year, given population and employment in a zone and a planning or policy decision on the choice of a street layout that is associated with a traditional transit-oriented neighborhood or an auto-oriented neighborhood with curvilinear roads and community walls. The study also points to future model improvement by possibly incorporating additional transit supply and demand variables as identified in this study. The results are available to MPOs as well as the State for use in future model development.

This project was conducted by Fang Zhao, Ph.D., P.E., of the Lehman Center for Transportation at Florida International University in cooperation with the National Center of Transportation Research at the University of South Florida. For more information, contact Ike Ubaka, Project Manager, at (850) 414-4532, ike.ubaka@dot.state.fl.us.