

RIDERSHIP MODELS AT THE STOP LEVEL

PROBLEM STATEMENT

The Florida Department of Transportation (FDOT) has developed Transit Level of Service (TLOS), a software package that measures transit availability and mobility. Versions 1 and 2 of the software focused on transit availability (the TLOS indicator). Version 3 focused on transit mobility by measuring how much service is provided between the two stops and how long it would take to make the trip. The TLOS indicator makes two advances over the conventional measures of transit availability, which has three dimensions--service frequency, hours of service, and spatial service coverage. One advance is that it implements the conventional measures at the operations level. It allows more detailed analysis of transit availability. It can be calculated at a wide range of geographical levels--bus stop, route, corridor, neighborhood, or system—and of temporal levels—15 minutes, 1 hour, 1 day, or 1 week. The other advance is that it combines the three aspects of transit availability—service frequency, hours of service, and spatial coverage—into a single measure. There was a need to include in the software a predictive tool that could determine how many people would use the service at each stop. To do this, an accurate model of ridership prediction at the stop level needed to be incorporated into the current version of TLOS.

OBJECTIVES

The Department contracted with both the Center for Urban Transportation Research (CUTR) and Kittelson & Associates, Inc. (KAI) to incorporate into TLOS Version 4 a predictive tool that would determine how many people may board transit vehicles at individual stops as a function of the TLOS indicator. KAI collected the required data and provided CUTR with the data electronically. CUTR formulated and estimated ridership models using that data. Specifically, the objective of the CUTR effort was to develop the model for ridership prediction at individual stops within the constraints of five criteria: 1) address fixed-route and guideway transit services provided by the Jacksonville Transit Authority within a single model of stop-level ridership; 2) consider boardings by direction; 3) consider boardings on a daily basis; 4) consider park-and-ride lots in ridership estimation but should not develop a separate demand model for using park-n-ride lots; and 5) limit development of the model to input variables for which data are provided by KAI.

FINDINGS AND CONCLUSIONS

This project developed an Issue Paper in December 2001 that described the research design in terms of framework, data needs, and model estimation issues. In addition, the Issue Paper outlined alternative approaches to addressing the various issues encountered in formulating ridership models at the stop level.

The KAI data deviated from the specifications in the Issue Paper in a number of ways. Instead of address-level data for many variables, all usable data for social demographics were derived from aggregated data. Many variables on the specified list were missing, including auto accessibility, transit reliability at the stop level, stop categories, route types, special generators (e.g., park and ride

lots), square footage of commercial heated area at the address level, and residential property values as a substitute of income at the address level. Instead of using spatially unique stops as the unit of analysis, the KAI data used TLOS stops, which aggregate all spatially unique stops around intersections. Finally, instead of considering boarding by direction at spatially unique stops, the use of TLOS stops made it impossible to separate boarding by direction.

CUTR developed a final model of average weekday boarding for TLOS stops following a comprehensive statistical analysis of the usable data provided by KAI according to the conceptual considerations in the Issue Paper. The model is satisfactory in three important ways. First, in addition to the traditional characteristics of catchment areas, the TLOS indicator, the pedestrian environment, accessibility measures to population and employment, interactions with other modes, and competition from other stops in catchment areas all play a statistically significant role in average weekday boarding. Second, all of these variables have expected coefficient signs. Third, these variables, as a group, fit the data well. The presence of these variables improves the log likelihood value by 54 percent. Specifically, the final model of average weekday boarding at TLOS stops is as follows:

Average weekday boarding at TLOS stops =

- 0.2152
- 0.0045 * Median household income (000s) in catchment area
- +0.0001 * Jobs in catchment area by road
- +0.0028 * 0-vehicle households in catchment area
- 0.6122 * Share of persons under 18 (0 to 1) in catchment area
- +0.4978 * Share of persons 18-64 (0 to 1) in catchment area
- +0.5843 * Share of persons female (0 to 1) in catchment area
- +5.3349 * Share of persons Hispanic (0 to 1) in catchment area
- 0.5075 * Share of persons White (0 to 1) in catchment area
- +0.0458 * TLOS within one-minute walking (0 to 100)
- +0.0195 * TLOS within two-five minutes walking (0 to 100)
- +0.1203 * Pedestrian factor (0 to 1)
- +0.0026 * Persons up and downstream without transfer (000s) in 1 hr
- +0.0027 * Jobs up and downstream without transfer (000s) in 1 hr
- +0.2176 * Including a trolley stop (1 if present; 0 otherwise)
- 0.0783 * Number of other TLOS stops in catchment area

BENEFITS

The results of this research will improve a transit-planning tool, which can be used by transit agencies, local governments, MPOs, and FDOT in transit service planning, regional transportation demand forecasting, congestion management, concurrency management, and community planning. An improved planning tool should result in better use of resources.

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