An agent-based dynamic transit network model under real-time transit passenger information

Feng Zhang, Department of Urban Planning and Design, The University of Hong Kong

Abstract
More and more transit agencies are striving to provide passengers with real-time transit information, e.g. estimated bus/train arrival time, as a strategy to improve transit services. With such provided information, travelers' may adjust their pre-trip and/or en-route behaviors accordingly, such as change of mode, departure time, or path. These behavioral adjustments, no matter how small individually, will have significant influence on transit network in the aggregate. However, traditional transit assignment models can not capture such network effects of new technology, because they are static in nature in the sense that they are mostly insensitive to dynamic service variations or passenger responses to real-time transit information. A new framework is needed to account for dynamics and complexity of transit service supply and passenger behaviors under real-time information.

The purpose of this study is to build a generic agent-based dynamic transit network modeling framework that explicitly incorporates effects of real-time transit information, and implement such framework under GIS environment. First, using agent-based approach, I will propose a generic conceptual framework for modeling dynamic transit network under the influence of real-time transit information. This innovative framework will have an explicit treatment for 1) passengers' pre-trip and en-route decision making in the context of real-time information provision, including mode choice, departure time choice and path choice, 2) within-day and day-to-day stochastic variations of transit service supply and user learning process on network attributes, and 3) congestion effects due to insufficient capacity of system. The understanding regarding passenger behavior under real-time information that I gained through my dissertation project is the key to constructing the framework.

Second, I will implement the conceptual modeling framework under ArcGIS environment and develop an operational software system that can be customized and applied to different real-world cases by different users. Agent Analyst, an agent-based modeling extension to ArcGIS, will be used to develop the system. Finally, to demonstrate the feasibility of the framework, I will apply the software system to the case of University of Maryland Shuttle-UM evening service network. Most data have been collected, including population, run-based ridership tallies and shuttle onboard survey data. And based on the results obtained from the behavioral models I have estimated, the parameters can be identified and their values calibrated.

This research would deepen our understanding about how real-time transit information has influence on transit network flow. Moreover, the software system that is to be developed within ArcGIS would serve as a tool for users to model their transit networks and evaluate ITS policies and technologies in a variety of cases.