

# **STRIDE**

Southeastern Transportation Research,  
Innovation, Development and Education Center

## **Technology Transfer Final Report**

### **STRIDE Project I2**

## **Mitigating Network Congestion by Integrating Transportation Network Companies and Urban Transit**

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July 2022

## **DISCLAIMER**

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## **ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS**

*This work was sponsored by a contract from the Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE), a Regional University Transportation Center sponsored by a grant from the U.S. Department of Transportation's University Transportation Centers Program.*

## 1. Project Overview

Transportation Network Companies (TNCs) like Uber and Lyft, provide a transportation option that offers a higher level of availability, reliability, and convenience than traditional taxi and transit services. However, there are widespread concerns about their impacts on urban congestion and their threat to public transit and taxi services, some of which are affirmed by recent case studies. Other studies, including one in Los Angeles, CA, reported benefits from integrating transit and TNCs. These contradictory findings motivate further research and investigation to examine and document effects of transit and TNC operations on transportation network performance. Moreover, they call for the development of new methods and models for assessing the mobility impacts of TNC presence and multimodal integration.

Using the MATSim agent-based simulation platform and two cities in the Southeast (Birmingham, AL and Miami Beach, FL) as test sites, this study closely examined: (a) perceptions and predictors of TNC use; (b) mode choice shifts in the presence of transit, TNC, and road pricing options; and (c) impacts of various levels of public transit and/or TNC presence on transportation network performance.

Overall, this research work provides valuable contributions to the current body of knowledge related to multimodal modeling using an open-source large-scale agent-based transportation simulation platform. The findings of the case studies reported herein provide evidence on the benefits of adopting transit, TNC, and road pricing strategies in small- and medium-size urban settings and can assist transportation decision makers, urban planners, transit agencies, and TNC providers in their efforts to optimize their operations and serve the needs of the traveling public.

## 2. Research Goals

- Examine determinants of TNC use in the Southeastern U.S.;
- Develop and demonstrate novel methods for calibrating MATSim models using a regionally approved mode split behavioral model and real-world traffic counts;
- Collect and process Uber trip-level data using crowdsourcing to address the lack of publicly available TNC data;
- Demonstrate the feasibility of modeling ride-hailing, transit, and automobile trips in the same simulation testbed using MATSim, an agent-based simulation platform; and
- Quantify the impacts of mode choice shifts between automobile, transit, and Uber on traffic congestion.

## 3. Findings

Case study 1: In the Birmingham metro area, the typical TNC users are 25-34 years of age that use the ride-hailing services for commuting or entertainment purposes for short to medium range distances (or average of 5 miles). In the Miami Beach area, typical TNC users are 18-29 years of age that use the ride-hailing service primarily for entertainment purposes, especially during weekends in order to get to the tourist-attraction locations.

Case Study 2: Modal shift towards transit in the Miami Beach network is greater when the new transit option is introduced in combination with a road pricing strategy (4.1% shift towards transit), rather than alone (0.5% shift towards transit).

Case Study 3: The current level of transit ridership in the Birmingham region does not have any significant impacts on traffic operations under low demand traffic conditions. However, increase in transit ridership from 1.1% (current) to 5.7% (future) will result in traffic flow reductions that are statistically significant.

Case Study 4: Examination of speed and volume data confirmed that the availability of Uber services did not result in additional congestion in Birmingham, compared to the base case scenario (no TNC service).

## 4. Performance Metrics

Metric	# Completed
<b>OUTPUTS</b>	
<b>Product(s)</b>	3 completed 1) FL user survey 2) Miami Beach activity-based model 3) Comprehensive Birmingham activity-based model integrating cars, transit and Uber trips
<b>Technical Report:</b> Number of client-based technical reports published	STRIDE Final Report
<b>OUTCOMES</b>	
<b>Body of Knowledge:</b> Number of trainings for transportation professionals	6
<b>Professionals Trained:</b> Number of professionals participating in trainings	246 (plus 90 YouTube views)
<b>IMPACTS</b>	
<b>Stakeholders:</b> Number of stakeholders you met with to encourage adoption or implementation of product(s)	1
<b>Adoption/Implementation:</b> Number of incidences outputs of research have been implemented or adopted	0

## 5. Products

### Product 1: User questionnaire survey on transportation user behaviors

The product is a questionnaire survey that documents transportation users' mode choices and demographics. It can be used by researchers and analysts interested in documenting users' preferences, attitudes, and mode choices in markets where transit options and Transportation Network Services (TNS) are available. The survey can also inform transportation planners and TNC providers about determinants that drive people towards the use of TNCs services.

### Product 2: Miami Beach, FL MATSim model

This activity-based simulation model was developed using the MATSim platform and was extensively calibrated. It can be used for testing what-if scenarios that incorporate transit and automobile options. Results can inform local transportation agencies and transit providers of impacts that transit ridership changes have on transportation network performance.

### Product 3: Birmingham, AL MATSim model

This comprehensive activity-based model was developed using the MATSim simulation platform and integrates cars, transit, and Uber trips. It is a refined and expanded version of the prototype Birmingham MATSim model proposed in STRIDE Project B. It can be used by local transportation planners and researchers interested in studying the impact of shifts in travel demand due to applications of shared-use economy and/or changes in transit on local and regional congestion. Details on model development including data collection, generation of population data, and integration of the public transit and taxi modules into the baseline simulation model can benefit researchers that are interested in developing multimodal agent-based simulation models and using them to study transportation network performance at other locations.

## 6. Who benefits/will benefit from your products?

- Transportation agencies
- MPOs
- Transit authorities
- TNC providers
- Urban planners
- Transportation researchers

## 7. Body of Knowledge & Professionals Trained

- 1) Technical Presentation – March 24, 2022. Morshed, S.A., Hadi, M., and Sisiopiku, V.P. “A Novel Multi-Agent Based Simulation Study on the Extension of Metrorail in Miami Beach Region”. 7<sup>th</sup> Annual Conference for the Southeastern Region, Boca Raton, FL (25 attendees).
- 2) STRIDE Products Showcase – November 16, 2021. Sisiopiku, V.P. “Transit and Mobility Options”. (38 attendees)
- 3) STRIDE Webinar Presentation – May 13, 2020. Sisiopiku, V.P. “Technology Influence on Travel Demand and Behaviors (53 attendees, 90 YouTube views)
- 4) Technical Presentation – November 13, 2019. Guo, G., Khalil, J.M., Yan, D., and Sisiopiku V. (2019). “Realistic Transport Simulation: Tackling the Small Data Challenge with Open Data”, International Workshop on Big Data Tools, Methods, and Use Cases for Innovative Scientific Discovery, 2019 IEEE International Conference on Big Data, Los Angeles, CA. (35 attendees)
- 5) Technical Presentation – April 1, 2019. Sisiopiku, V.P. and Sarjana, S. “Mobility Patterns and Mode Preferences of Birmingham Travelers”, 2019 SDITE/MCDITE Annual Meeting in Arlington, VA (80 attendees)
- 6) Technical Presentation – October 24, 2019. Sultana T., Salman, F., and Sisiopiku, V.P. “Simulation Options for Modeling Shared Mobility” at the 2019 AlaSim M&S Conference, Huntsville, AL (15 attendees)

## 8. Stakeholder Engagement

MEETING DETAILS		NARRATIVE DESCRIPTION
<b>STRIDE rep.</b>	Virginia Sisiopiku	Communicated with Mr. James Fowler, Director of the Department of Traffic Engineering of the City of Birmingham via email. Presented the project
<b>Date of Activity</b>	7/30/19	
<b>Type of Activity</b>	Meeting/presentation	
<b>Location</b>	Birmingham, AL	

<b>Stakeholder(s)</b>	James Fowler, Director, Department of Traffic Engineering, City of Birmingham	objectives and progress and requested collaboration between UAB and the City on this and related follow up STRIDE research initiatives.
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## 9. Adoption/Implementation

The products developed in this study have not been yet adopted. Efforts planned to encourage adoption/implementation of the product(s) include demonstration of the pilot studies' findings through presentations including a STRIDE webinar planned for November 2022 and publication of the STRIDE I2 final report.

## 10. Broader Impacts

The products developed in this study and the results from the 4 case studies that demonstrated these products provide valuable guidance to MPOs, TNC and public transit providers and localities that help them better plan and operate the transportation system as a truly mode integrated environment.