

# Modeling the Influence of Land Use Developments on Transportation System Performance

Project 1702A  
June 2019

Ajinkya S. Mane, PhD and Srinivas S. Pulugurtha, PhD, PE, F.ASCE



The induced traffic volume generated by new land use developments often results in increased traffic congestion and vehicular delay on the existing road network. This is typically assessed by conducting traffic impact studies (TISs). With recent advancements in technology, it is possible to capture continuous and comprehensive travel time data for most major roads in a city. As travel time influences travel patterns, activities of travelers, and can be easily understood by system managers and motorists, it is important to quantify the influence of new land use developments on travel time. This can be used as an alternate to currently adopted TIS approach. Therefore, the goal of this research is to research and understand the influence of land use developments on travel time to improve the mobility of people and goods.

## Study Methods

This research study comprised of two phases. In the first phase, the relationship between land use developments and travel time variations was examined using before and after analysis. The effect of spatial dependency was incorporated by considering the land use developments within 0.5 miles, 1 mile, 2 miles, and 3 miles of the selected road links. In the second phase, the relationship between land use developments and travel time was quantified using statistical models by considering spatial dependency, by classifying the road links based on area type [Central Business District (CBD), CBD Fringe / Other Business District (OBD), and urban area], and by classifying the road links based on the speed limit (< 45mph, 45 to 50 mph, and > 50mph). Along with the land use developments,

road network characteristics, day-of-the-week, and time-of-the-day were considered when generating the statistical models to understand their relationship with travel time. Data for the city of Charlotte, North Carolina (NC) was used for evaluation, analysis, and model development.

*The developed statistical models indicate that the magnitudes of connections between land use developments, road network characteristics and travel time vary over space and time.*

## Findings

Some of the key findings are listed as follows.

1. Land use developments have a significant influence on travel time at link-level. The influence of land use characteristics on the travel time of a link varies by the area type and posted speed limit.
2. Classifying road links by the posted speed limit (< 45 mph, 45 to 50 mph, and > 50 mph), capturing the land use developments within 1 mile from a road link, and then developing the statistical models would aid in better understanding the relationship between land use developments and travel time.
3. Typically, travel time on a selected road link is higher during the evening peak period compared to the morning peak and the afternoon off-peak period.
4. The results obtained indicate that the number of lanes and the posted speed limit are negatively associated with the travel time of the selected road links.

## Policy Recommendations

The influence of land use type, road network characteristics, time-of-the-day, and day-of-the-week on travel times based on the statistical models' aid professionals and planners in land use planning decisions and can proactively improve the mobility. The method can be used as an alternate or to complement findings from currently adopted TIS approach.

## About the Authors

Dr. Ajinkya S. Mane has completed his Ph.D. in Infrastructure and Environmental Systems at the University of North Carolina at Charlotte. He earned his master's degree in Transportation Engineering and a bachelor's degree in Civil Engineering from India. His areas of interest are transportation planning, traffic safety, and traffic operations.

Dr. Srinivas S. Pulugurtha, P.E., F.ASCE is currently working as Professor & Research Director of the Department of Civil & Environmental Engineering at The University of North Carolina at Charlotte (UNC Charlotte). He is also currently directing the Infrastructure, Design, Environment, and Sustainability (IDEAS) Center on UNC Charlotte campus.

## To Learn More

For more details about the study, download the full report at [transweb.sjsu.edu/research/1702A](https://transweb.sjsu.edu/research/1702A)



MTI is a University Transportation Center sponsored by the U.S. Department of Transportation's Office of the Assistant Secretary for Research and Technology and by Caltrans. The Institute is located within San José State University's Lucas Graduate School of Business.