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Researching Relationships Between Truck Travel Time Performance Measures and On-Network and Off-Network Characteristics

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Sarvani Duvvuri, MS
Srinivas S. Pulugurtha, PhD, PE, F.ASCE

A nation's freight transportation system is a direct indicator of its economy. E-commerce and trade practices (involving physical movement of goods) have witnessed significant growth in recent years, amplifying freight transportation activity. The growth in the freight industry and associated truck traffic raises concerns in an already congested highway network. Analyzing truck travel times and identifying performance measures corresponding to trucks would help to better understand the influence of trucks on the transportation system and identify potential areas for truck priority zones and truck traffic signal priority. However, the literature documents limited to no research dedicated to truck travel time performance measures or their correlation with on-network and off-network characteristics. There is a need to examine the relationships between truck travel time performance measures and on-network and off-network characteristics to proactively develop transportation plans, improve mobility, and reduce congestion on roads. The objectives of the research, therefore, are (1) to compute, evaluate, and compare the truck travel time performance measures by time of the day and day of the week, (2) to examine the relationship between the selected truck travel time performance measures and on-network characteristics like speed limit and traffic density condition, and (3) to examine the relationship between the selected truck travel time performance measures and off-network characteristics like land use and demographic characteristics.

Study Methods

Truck travel time data for the year 2019 were obtained and processed at the link level for Mecklenburg County, Wake County, and Buncombe County in North Carolina, United States. To account for the temporal aspects of the truck travel time performance measures, four times of the day by day of the week were considered. The on-network (road) characteristics were captured at the link level while the off-network (land use and demographic) characteristics were captured using 0.25- and 0.50-

mile buffer widths. Various descriptive travel time measures, travel time percentile measures, and travel time reliability measures were computed by time of the day (peak and off-peak hours) and day of the week (weekday and weekend) using truck travel time data. Pearson correlation coefficient analysis was performed to examine correlations and select suitable truck travel time performance measures. Pearson correlation analysis was then performed to examine their associations with on-network and off-network characteristics.

The areas susceptible to higher truck travel times or lower operational performance are arterial streets, urban areas, and roads with high traffic volumes or number of through lanes.

Findings

Some of the key findings from the study are:

1. Based on the Pearson correlation coefficient analysis and scores, the average travel time, travel time index, buffer time index and planning time index are recommended as suitable truck travel time performance measures.
2. The areas susceptible to higher truck travel times or lower operational performance are arterial streets, urban areas, and roads with high traffic volumes or number of through lanes.
3. Agricultural, light commercial, heavy commercial, light industrial, single- or multi-family residential, office, transportation, and medical land uses in the near vicinity of a road could significantly influence truck travel times or related operational performance measures.
4. An increase in population density in a region is associated with an increase in truck travel times and related reliability performance measures.
5. The correlations with the off-network characteristics differ depending on the buffer width used to capture the data in addition to the time of day and day of the week.

Policy/Practice Recommendations

It is recommended to use the developed methodology, selected truck travel time performance measures, and their associations with on-network and off-network characteristics to develop transportation plans, improve mobility, and reduce congestion in the study area. The methodology can also be applied to other study areas. The findings could be proactively used in identifying factors influencing truck travel time performance measures as well as potential areas to serve as truck priority zones, for truck traffic signal priority, and in planning decentralized delivery locations.

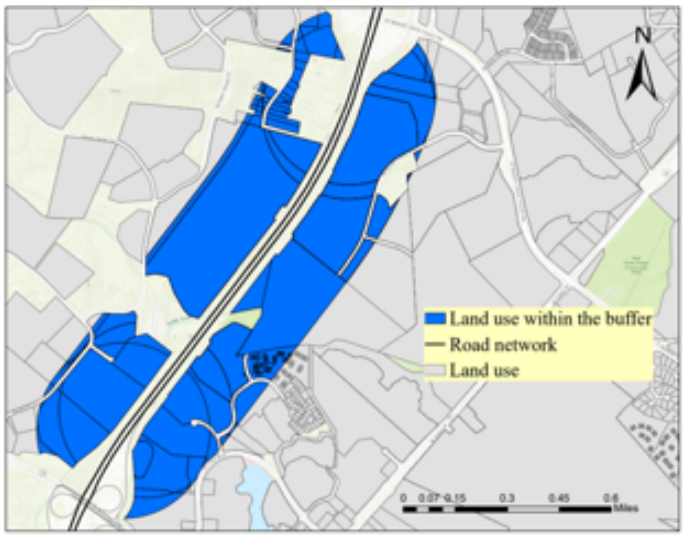

Figure 1. Land use.

About the Authors

Ms. Sarvani Duvvuri is pursuing her PhD in the Infrastructure and Environmental Systems (INES) program at the University of North Carolina at Charlotte, where she earned her Master's degree. Her areas of interest are transportation planning, traffic operations, and traffic safety. Dr. Srinivas S. Pulugurtha, PE, F. ASCE is currently working as a Professor & Research Director of the Department of Civil and Environmental Engineering at the University of North Carolina at Charlotte. He also directs the Infrastructure, Design, Environment, and Sustainability (IDEAS) Center at the University of North Carolina at Charlotte.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/1946

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