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Enhancement of Multimodal Traffic Safety in High-Quality Transit Areas

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Walking and cycling provide immense health and environmental benefits. However, pedestrians and bicyclists are highly vulnerableon roadways. While numerous studies consider infrastructure facilities such as intersections, sidewalks, and bike lanes, there is a lack of sufficient research devoted to safety analysis regarding traffic accidents surrounding transit stations. Transit stations, which serve as the important modal interface for pedestrians and bicyclists, must be examined to improve safety.

This study aims to rank the importance and quantify the impact of different variables pertinent to multimodal traffic safety near the transit stations. These factors are imperative for the effective design of complete streets, integrated land use, and transportation planning policies. The results can furnish transportation professionals with insights to create safer access to transit and promote active transportation.

Study Methods

Based on an extensive literature review, this study developed advanced joint models based on the multivariate conditionally autoregressive (MCAR) priors with a distance-oriented neighboring weight matrix.We used data centered on high-quality transit stations for statistical analysis. Data included built environment characteristics, socioeconomic and demographic information, and crash data aggregated at the level of the 0.5-mile-radius zone surrounding high-quality transit stations across Los Angeles County. To obtain the different variables to each of the two active transportation modes and to increase the model flexibility, we conducted feature selection using both random forest and correlation analyses. For a comprehensive comparison of the predictive accuracy of models, we utilized four different evaluation criteria.

Findings

1. Pedestrian-involved accident counts and bike-involved accident counts are highly correlated. The models

that consider these correlations demonstrate superior performance. The advantage associated with models including correlation is accompanied by the dramatic increase in the model complexity due to the inclusion of correlation coefficients. The significantly better performance, accompanied by models with correlation, clearly justifies the benefits of addressing the transportation modes' correlation.

2. Household density, employment mix, and bus stop density positively impact pedestrian-involved crashes, indicating the propensity of pedestrians to be involved in collisions is higher with the increase of these variables, , which then increase the pedestrian exposure. However, retail job density has a negative impact on pedestrian-involved crashes.

3. Similarly, an increase of population, employment, or the number of bus stops leads to more bicyclist-involved collisions. On the other hand, block length and retail job density have a negative impact on bike-involved crashes.

Transportation professionals need to study and apply various engineering, education, and enforcement countermeasures to enhance walking and bicycling safety.

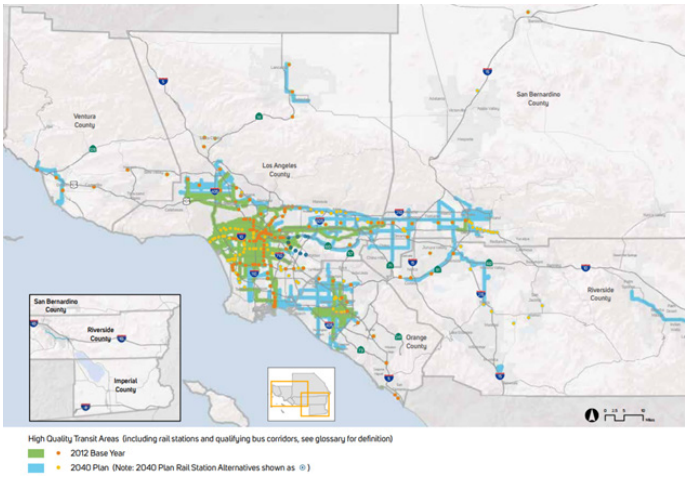
Policy/Practice Recommendations

Our findings indicate transportation professionals should consider walking and biking modes altogether in planning. Despite their unique travel behavior, pedestrians and bicyclists are highly correlated, and they share the same space and time when accessing transit stations.

If planned and designed well, a Transit-Oriented Development (TOD) with mixed land use can reduce mode share on cars and travel distance. By reallocating more resources to non-motorized modes, such as widening the sidewalks, adding bike lanes, adding physical barriers to separate motor-vehicle traffic from bicycle traffic, we can further reduce the potential collisions between pedestrians/bicyclists and vehicles and enhance the safety of active transportation users.

Our results also show that the close distance between transit stations increases pedestrian and bicyclist crashes. Transit operators can consider demand, distance, and other factors to improve safety by ensuring sufficient space for pedestrians and bicyclists to wait at stations.

Additionally, the model created in this study can be used to identify crash hot spots by ranking the frequency of the predominant crash type at each transit station, hence helping transit operators or city officials/planners prioritize improvements near the most needed stations. A variety of engineering, education, and enforcement countermeasures have proven effective in practice. Typical countermeasures include lighting improvements, auto turning restrictions, pavement marking, a comprehensive wayfinding system, and optimizing signal timing for non-motorists.



About the Authors

Drs. Wen Cheng and Xudong Jia are professors of Transportation Engineering at California State Polytechnic University, Pomona. Dr. Yongping Zhang, the principal investigator, is an assistant professor of Transportation Engineering at California State Polytechnic University, Pomona. During 2009-2015, Dr. Zhang worked as a Senior Transportation Modeler for the Southern California Association of Governments. Before that, he worked as a Transportation Analyst at Wilbur Smith Associates in the Chicago area for two years.

To Learn More

For more details about the study, download the full report at

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