Joint Transportation Research Program

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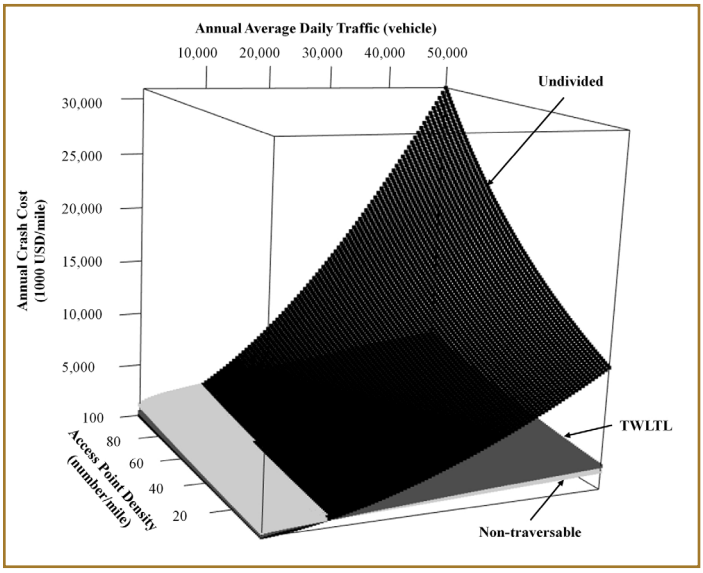
SPR-4736 2025

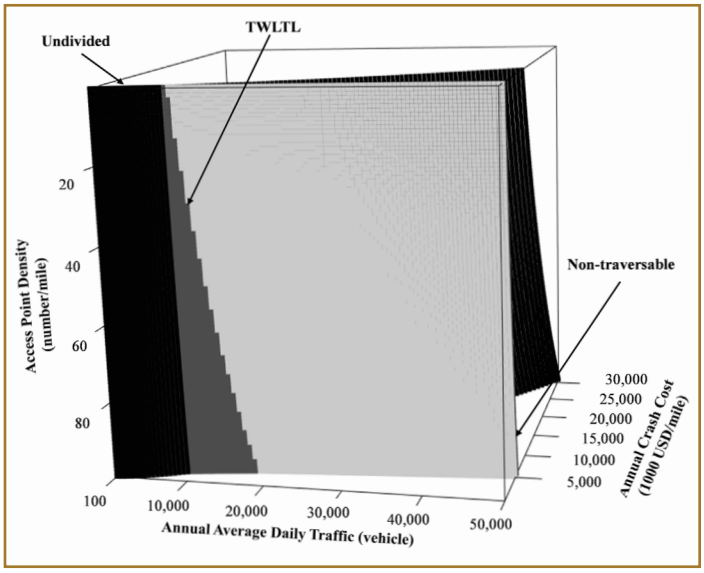
A Study of Suburban Arterial Safety Performance Based on Median Type

Introduction

Suburban arterial roadways serve two conflicting functions: (1) mobility to pass traffic through the abutting area and, to some extent, (2) accessibility to allow local traffic from neighboring areas access the road. Among design alternatives that road designers and traffic engineers consider, selecting the median type is among the most important design decisions. Three alternative median types (undivided cross-section, two-way left-turn lane, and non-traversable median) offer different access control levels on the road. Although higher control levels of access usually lead to better safety performance, the lower control level median treatments might perform equally well under certain operational conditions. To quantify the relationship between median treatments and their safety outcomes under various operational conditions, this project used advanced statistical analysis to analyze roadway geometrics (median treatments), traffic, and safety along 200 suburban and urban road segments across Indiana. A comprehensive crash cost-oriented analysis framework was applied to help identify the most appropriate median treatment under the land use and traffic conditions.



Crash cost (1,000 USD) per mile vs. AADT and density of access points under 45 mph speed limit in 3D space: horizontal view.



Crash cost (1,000 USD) per mile vs. AADT and density of access points under 45 mph speed limit in 3D space: bottom view.

Findings

On the methodology side, the challenging endogeneity between crashes and speed limits was identified and treated with simultaneous equations, in which the crash counts and speed limits were assumed to be correlated one with another.

On the knowledge side, the important risk factors that significantly affect arterial road safety were quantified in the developed models.

1. Traffic volume increased crash frequency, while the road geometric standards, represented with a speed limit, generally had a positive effect on safety.
2. The density of roadside access points via driveways and unsignalized intersections was found to increase crash frequency.
3. Median treatments affected crash frequency to an extent that varied across various local conditions, including traffic volume, speed limit, and access point density.
4. Six-lane roadways had drastically fewer severe crashes when a median was a non-traversable type.

Implementation

The estimated statistical models were applied to obtain results in convenient formats for the end user—crash cost tables, graphs to select the median treatment, and tables that reveal alternatives closest to the best one.

1. *Crash Cost Tables:* A comprehensive crash cost-oriented analysis framework was applied to transform the estimates of the models into comparable expected crash cost per mile for the three investigated median treatments. The crash cost tables with the expected crash costs per mile for three median treatments, access point density (multiples of 10 access points/mile), and AADT (multiples of 2,000 veh/day) were calculated under different speed limits (30 mph, 35 mph, and so on). These tables provide the expected crash costs for the three median treatments under various conditions and for a direct comparison of alternative median treatments.
   - *Selection Graphs:* A set of 2D graphs (AADT on x-axis, access point density on y-axis) for individual speed limits (30–55 mph) were developed to facilitate a convenient selection of the median treatment with the lowest cost.
2. *Comparable Alternatives Tables:* Considering the randomness of crashes and the associated uncertainty of the estimates, a treatment may be considered comparable to the best one if its associated crash cost is not significantly higher than the lowest cost. Following this idea, tables are provided that list median treatments that are performing slightly worse than the best one within a user-selected margin.

Recommended Citation for Report

Tarko, A. P., Guo, Q., Narayanan, P. D., Romero, M. A., & Bandaru, V. K. (2025). *A study of suburban arterial safety performance based on median type* (Joint Transportation Research Program Publication No. FHWA/IN/JTRP-2025/07). West Lafayette, IN: Purdue University. https://doi.org/10.5703/1288284317848

View the full text of this technical report here: https://doi.org/10.5703/1288284317848

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