

METHODOLOGY TO QUANTIFY THE EFFECTS OF ACCESS MANAGEMENT ON ROADWAY OPERATIONS AND SAFETY

(3 Volumes)

PROBLEM STATEMENT

As the nation's roadway system becomes more congested and the number of vehicular crashes increases, the importance of access management increases. Access management has been identified as one of the most critical elements in roadway planning and design; it has been defined as the process of managing access to land development while preserving the safety and efficiency of the surrounding roadway system. Access management helps to achieve the necessary balance between traffic movement and property access by carefully controlling the location, type, and design of driveways and street intersections. Highways are classified with respect to the level of access and mobility they are expected to provide, and then the most effective techniques to preserve those functions are identified and applied. The impacts of potential techniques on traffic performance and safety are important considerations when deciding which technique to implement.

Access management deals with the control and regulation of the spacing and design of medians, median openings, driveways, freeway interchanges, and traffic signals. Typical access management measures cover the type and design of medians and median openings; the location and spacing of intersections; the spacing and design of interchanges; and the location, spacing, and design of driveways and street connections. The location, the design, and the operation of driveways play a significant role in access management. According to the AASHTO Green Book, *A Policy on the Geometric Design of Highways and Streets*, driveways are considered at-grade intersections whose design should be consistent with intended use. However, the number of crashes at driveways is disproportionately high when compared to other intersections; thus, the design and the location of driveways merit special consideration.

OBJECTIVES

The objectives of this research are (1) to quantify the effects of access management treatments on roadway operations and safety, and (2) to provide tools to evaluate access management treatments.

FINDINGS AND CONCLUSIONS

This project evaluated the safety and operational impacts of two alternative left-turn treatments from driveways/side streets. The two treatments were direct left turns (DLTs) and right turns followed by U-turns (RTUTs). Ten sites were selected for field data collection, and each site experienced one or both of the left turn alternatives from the driveway or side street. Video cameras were set up on scaffoldings to achieve adequate viewing height, and all of the traffic movements at the selected sites were recorded.

Safety analyses of the alternatives were conducted using two major approaches: traffic crash data

analysis and conflict analysis. Operational analyses were conducted using empirical model development and simulation.

Volume I: Safety Evaluation of Right Turns Followed by U-Turns as an Alternative to Direct Left Turns—Crash Data Analysis

Two sets of sites, each corresponding to the left-turn median treatments, were selected from seven counties distributed throughout Florida. Sample sizes for DLT and RTUT sites were 133 and 125, respectively. All sites were located on major urban or suburban arterial roadways with raised medians and high through traffic volumes, sufficient driveway egress volumes, sufficient median widths, posted speed limits greater than 40 mph, prohibition against parking along the main road, moderate arterial segment lengths, and U-turns at directional or full median openings.

Crash data corresponding to these sites were extracted from the Florida Traffic Crash Database and combined with the site characteristics. Researchers conducted a cross-section comparison of the crash history of sites with DLTs and RTUTs, considering both the number of crashes and the crash rates. The average number of crashes for sites with DLTs and RTUTs were 16.35 and 13.90, respectively. When crashes per million vehicle miles were considered, the numbers were 3.2 and 2.63, respectively. Researchers also developed models to represent the distributions of the number of crashes and the crash rates, which were then compared to the two left-turn treatments. Model estimated 85 percentile crash rates for DLTs and RTUTs were 4.5 and 3.9, respectively. Thus, the results suggest that safety is greater for RTUTs than for DLTs.

Volume II: Safety Evaluation of Right Turns Followed by T-Turns as an Alternative to Direct Left Turns—Conflict Data Analysis

Nine different conflict types related to the left turn movements were considered. The data was used to estimate the *average number of conflicts* and *conflicts per thousand involved vehicles*. The average number of hourly conflicts for DLTs was 6.35, whereas the corresponding value for RTUTs was 4.2. When the results were separated by time period, the differences proved to be even more significant during peak periods. The average number of conflicts per thousand involved vehicles for DLTs and RTUTs were 30.2 and 18.7, respectively.

Researchers conducted a before and after comparison at a site that underwent a median closure, which upon completion allowed only RTUTs. The results demonstrated that the total average number of conflicts per hour was reduced by almost 50% when DLTs were replaced by RTUTs. Further, the median closure significantly lowered conflict severity.

After having employed several different approaches to evaluating traffic conflicts, researchers concluded that the RTUT movement was safer than the DLT movement.

Volume III: Operational Evaluation of Right Turns Followed by U-Turns as an Alternative to Direct Left Turns

Researchers developed delay and travel time models, which indicated that under high major road and driveway volume conditions, vehicles making a DLT experienced longer delay and travel times than those making a RTUT. The break-even points were also obtained for sample situations by using the models. Computer software was developed to represent the developed delay and travel time models so

that the corresponding values could be obtained under any given situation. Major road traffic experienced much lower speed reduction with RTUTs than with DLTs. Another model was developed to estimate the Ratio, which is the percentage of vehicles that select RTUT when both choices are available. More drivers made RTUTs when left-turn-in volume (>200vph) and through volume (>4000vph) were high. In all cases, field data confirmed the simulation models developed using CORSIM.

The pre/post-median closure study revealed that the weighted average delay and travel time were much smaller for RTUTs than for DLTs. Reductions in total delays during peak and non-peak periods were 15% and 22%, respectively. Considered from a traffic operations viewpoint, the findings suggest that under high volume conditions, RTUT has more merits than DLT.

BENEFITS

This project fulfills a long felt research need by traffic engineers, planners, and designers. The Florida Department of Transportation prohibits DLTs onto major arterials. However, regarding median closures at existing DLT locations, FDOT sometimes faces objections from the owners of commercial developments who prefer direct access. In addition, some drivers have expressed their concerns about the safety of U-turns in the RTUT process. The findings of this research provide FDOT with the quantified data to address such issues.

Results have indicated that under high volume conditions, RTUTs have beneficial effects both from the traffic operational and the safety fronts. For any selected location with similar characteristics, the volume cutoff point can be determined using the models developed in this study. If the actual volume is higher than this cutoff value, RTUT may be implemented by closing the full median opening or by making it directional and allowing only left turns to vehicles moving onto the driveway. This research showed that facilitation of directional median openings is more advantageous than full medians on high volume arterials with raised non-traversable medians. The findings also indirectly address the comparison between raised medians and two-way left turning lanes.

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