Summary of Final Report, BD545-14
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DEVELOPMENT OF GUIDELINES FOR DRIVEWAY LOCATION AND MEDIAN CONFIGURATION IN THE VICINITY OF INTERCHANGES

PROBLEM STATEMENT

Driveways and/or signalized intersections installed close to interchange ramp intersections can interfere with the efficient movement of traffic at the interchange. The spacing of signalized intersections and resultant progression quality has probably the largest impact on arterial operations. However, the number of unsignalized driveways in the vicinity of an interchange, particularly if combined with non-restrictive medians, can also have a significant effect on arterial operations.

Excessive queuing, generally a by-product of inefficient arterial operations, can become a significant safety issue, particularly for interchange off-ramps. Queues that extend upstream to the freeway mainline present a very hazardous situation. Additionally, excessive queues at driveway locations promote riskier gap acceptance behavior by motorists.

FDOT has some relevant but general guidelines: they are neither comprehensive nor entirely based on quantitative findings. Consequently, Access Management review staff must sometimes base access permit review decisions on subjective judgments, which can lead to legal challenges by developers.

OBJECTIVES

The primary objectives of this project consisted of the following:

- Provide an overview of the relevant state and national references on access management guidance in the vicinity of interchanges.
- Provide an overview of diamond interchange design issues and their impact on access management.
- Provide a description of the different simulation models and analytical methods that can be applied to the analysis of arterial operations in interchange areas.
- Develop additional quantitative and objective-based guidance with respect to signalized intersection spacing and the impact of driveways on arterial operations in the vicinity of interchanges.

FINDINGS AND CONCLUSIONS

The emphasis of this project was on the development of additional quantitative guidance for access management decisions in interchange areas. To develop the additional guidance, researchers first considered signal spacing as it affects progression quality, and then the effect of downstream signal location on average arterial speed.

Signal spacing for the consideration of two-way progression quality is primarily a function of cycle length and arterial travel speed. However, other factors can affect arterial progression quality, such as the effective green time to cycle length ratio, percent turns from exclusive lanes, directional traffic distribution, and platoon dispersion.

To determine the effect of signal spacing on arterial speed, the research team developed a regression model. The independent variables of the analytical model are arterial volume, volume in and out of the driveways, number of driveways, distance to the downstream signal, percent of traffic turning left at the signal, and arterial free-flow speed. Researchers also examined the variables related to the type of median configuration but did not include them in the final model since the model could not accurately reflect these traffic features.

Researchers developed a software tool that incorporates the average speed estimation model and the recommended signal spacing based on progression quality. This software can provide average speed estimates as a function of specific arterial traffic parameters and signal distance. It can provide signal distance recommendations if an average target speed is specified. The software tool also provides a spacing index value that indicates how close to ideal the signal spacing is for optimal two-way progression. Another feature of the tool is that it can calculate the ideal signal spacing for a given cycle length and travel speed.

The research team used the analytical tools to develop recommended spacing guidelines. Based on different traffic/development levels, target design speeds consistent with the Highway Capacity Manual were identified. The general recommendation is that a minimum spacing (between the off-ramp taper and first downstream signalized intersection) of ¼ mile should be used to avoid significant deterioration of arterial operating speeds. For progression quality considerations, longer signal distances are usually necessary; however, the effects of signal coordination become greatly diminished beyond ½ mile due to platoon dispersion effects. Thus, the ideal range for signal spacing is between ¼ and ½ mile to provide for acceptable traffic operations at interchange areas under typical Florida development scenarios. These values are consistent with current FDOT guidance per Rule FAC 14-97 and other notable references, such as NCHRP 420 and TRB's Access Management Manual.

BENEFITS

This project resulted in the development of an analytical model and software tool that can provide an analyst with more quantitative guidance on assessing the impacts of access management factors in interchange areas. The research findings also give more objective support to the current guidelines provided by FDOT Rule, Florida Administrative Code 14-97, State Highway System Access Management Classification System and Standards. Additionally, overviews of relevant state and national references on access management guidance in the vicinity of interchanges, diamond interchange design issues and their impact on access management, and simulation models and analytical methods that can be applied to the analysis of arterial operations in interchange areas were provided as part of this project. These sections provide valuable background information for new analysts in the access management area.

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