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Project Summary Report 0-4221-S
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Project 0-4221: Benefits of Access Management

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PROJECT SUMMARY REPORT

Summary of Access Management Impacts: Access Point Density and Raised Medians

Research across the United States has found that access management techniques, such as raised medians and low access point densities (i.e., access points per mile) typically provide for safer roads with lower crash rates than roads without access management. As the Texas Department of Transportation (TxDOT) recently continued making progress toward developing and implementing an access management program, it desired to identify crash rates specific to Texas.

TxDOT is also interested in knowing what type of benefits can be estimated by using micro-simulation of access management techniques on arterial streets. Being able to estimate the impacts of an access management technique can assist decision makers in developing and selecting projects, as well as in communicating benefits of projects to the general public.

What We Did…

Researchers identified three case study locations for simulation analysis in Texas. Micro-simulation was performed on traffic performance before and after raised medians were implemented. The three case study locations were:

- Texas Avenue in Bryan,
- 31st Street in Temple, and
- Broadway Avenue in Tyler.

Researchers manually collected the necessary geometric information. They also collected traffic volumes on the mainlanes and turning movement counts at the signalized intersections and the driveways along the corridor, as well as signal timings for the signalized intersections on the corridor. Finally, the team completed travel time runs using the floating-car method in both directions on the corridor during the peak hour for model calibration purposes.

The research team also studied 12 corridors (11 in Texas and 1 in Oklahoma) to estimate relationships between crash rates and access point densities, as well as the presence of raised medians or two-way-left-turn lanes (TWLTLs). Researchers obtained crash history and traffic volumes for each of the corridor segments. The Texas Department of Public Safety (DPS) provided crash reports for each of the corridors that are state-maintained roads. For the other corridors in Texas, city police departments provided crash information. Researchers calculated crash rates measured in crashes per million vehicle miles traveled (VMT) using the length of the corridor segments, traffic volumes, and numbers of crashes.

What We Found…

The research team obtained valuable insight into micro-simulation by using VISSIM to estimate the impacts of transportation alternatives that include access management treatments. The VISSIM model has a steep learning curve because there are many details to learn when considering how to input data into the model. There are often numerous runs and visual inspections to ensure that the corridor is running correctly. One finding is that VISSIM results should be based on numerous runs of the same conditions along a corridor. This is because VISSIM is a stochastic model in which the numerous input variables are modeled—often according to distributions (e.g., speed, acceleration characteristics, vehicle types, motorist behavior). Therefore, each simulation run provides one estimate of each performance measure. The results shown in this report are based upon three simulation runs after which the results were averaged for a given measure.

Table 1 illustrates the geometric and traffic characteristics as well as the analysis results for the three study corridors. It provides a comparison between the different geometric characteristics, conflict point reductions, and changes in travel time and speed along the corridor. The percent change in conflict points shows the difference in conflict points on the study corridors when a raised median replaces a previous TWLTL. Each corridor has nearly the same percentage reduction of conflict points. The percent change in travel time and speed varies by corridor. This difference is between a TWLTL and the raised

Table 1. Characteristics and Results of Case Study Corridors.

Case Study	Corridor Length (miles)	Signals per Mile/ Access Points per Mile[1]	Median Opening Spacing (feet)[2]	Number of Lanes Each Direction[3]	Percent Difference in Conflict Points[4]	Estimated Existing ADT[5]	Estimated Future ADT[6]	Future Percent Difference in Travel Time[4]	Future Actual Difference in Speed (mph)
Texas Avenue (Bryan)	0.55	3.0 / 91	690 to 1,320	2	−60	18,200	21,800	−11	2 (increase)
							48,000	−38	7 (increase)
31st Street (Temple)	0.71	5.6 / 66	350 to 850	2	−56	13,300	16,000	3	1 (decrease)
Broadway Avenue (Tyler)	1.47	4.1 / 46	500 to 1,500	3	−60	24,400	29,300	2	<1 (decrease)
							48,000	57	6 (decrease)

[1] Access point density includes both directions and includes driveways, streets, and signalized intersections.

[2] Median opening spacing is the range for the raised median alternative with the most openings. Five alternatives were investigated along 31st Street and two alternatives along Broadway. See Report 0-4221-2 for more details.

[3] The Texas Avenue and 31st Street corridors were not widened in the micro-simulation because VISSIM allows vehicles to perform U-turns with two lanes, and this study was intended to investigate the differences between the TWLTL and the raised median. From a practical perspective, flared intersections and slightly widened mid-block location(s) would facilitate the U-turns.

[4] The percent difference values are from the conversion from a TWLTL to a raised median. Negative values imply a decrease when converting to the raised median. These differences are based upon the weighted average of three micro-simulation runs.

[5] Estimated from road tubes or videotapes. The ADTs are estimated by assuming a K and D factor to apply to the observed peak-hour volume when daily counts were not available.

[6] The lower ADT value is a 20 percent increase over existing conditions. This represents an approximate 2 percent increase over 10 years. The higher ADT value was run to estimate higher-volume conditions. The ADTs are estimated by assuming a K and D factor to apply to the observed peak-hour volume.

median in the future condition. A negative value implies that the travel time was reduced with the installation of the raised median.

The number of conflict points was reduced by 56 to 60 percent with the installation of a raised median in place of a TWLTL. Along the Bryan corridor, the speed increased by 2 mph at the lower average daily traffic (ADT), and it increased by 7 mph at the ADT of approximately 48,000 when converted to a raised median. The travel time along the Temple corridor increased 3 percent (approximately 1 mph decrease). Along the Tyler corridor, the speed decreased less than 1 mph at the lower ADT, and it decreased by 6 mph at the higher ADT.

Raised median installation and driveway consolidation were investigated for different traffic volumes with theoretical scenarios. Increases in travel time on the theoretical corridors when the raised median was installed were similar to those for the study corridors. The actual reduction in speed was, on average, approximately 3 mph when a raised median replaced the TWLTL.

The increase in speed on Texas Avenue with the raised median treatment is likely attributed to prohibiting U-turns at a major signalized intersection. This change forced vehicles to make U-turns at locations farther along the corridor—allowing more through-movement green time at the signals. The decrease in speed with the installation of a raised median in Temple and Tyler is likely due to the median opening spacings and an overall increase in traffic on the corridor because some U-turning vehicles must travel farther to reach their destinations. The additional vehicle-miles of travel are likely causing travel time and delay increases. Delay may also increase slightly at the signalized intersections.

In general, the more circuitous travel and increased U-turn traffic can cause the raised median treatment to have slightly lower speeds. However, it is likely that these decreases in speed, and increased delay, are offset by the reduction in the number of conflict points and increased safety. When raised medians are present, there are typically fewer head-on and swideswipe crashes that cause more severe injuries and property damage. The safety advantages of raised median treatments were also highlighted in this research project.

Though not analyzed, it is hypothesized that further analysis would find that additional median opening(s) could reduce the percent differences between the TWLTL and raised median even further. The research found that the results of access management treatments can be very corridor specific. The numerous operational interactions can be investigated in a micro-simulation tool that allows for analysis of these elements.

Through the crash analysis, the research team found that there is a correlation between access point densities and crash rates on the case study corridors. Figures 1 and 2 indicate the decrease in mid-block crashes when the access point density decreases. These photographs are of adjacent segments of Camp Bowie Boulevard in Fort Worth. The segment in Figure 1 has a lower access point density (50 per mile) than the segment

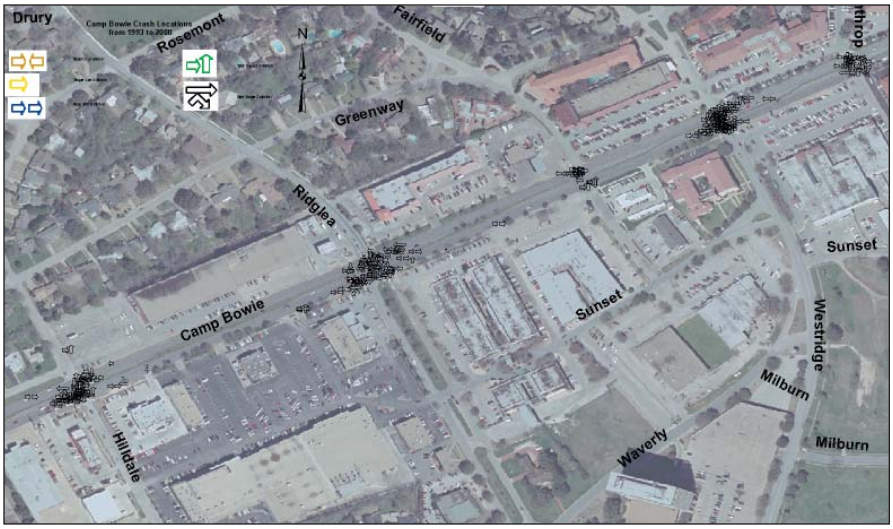

Figure 1. Crash Density on Corridor with Low Access Density.

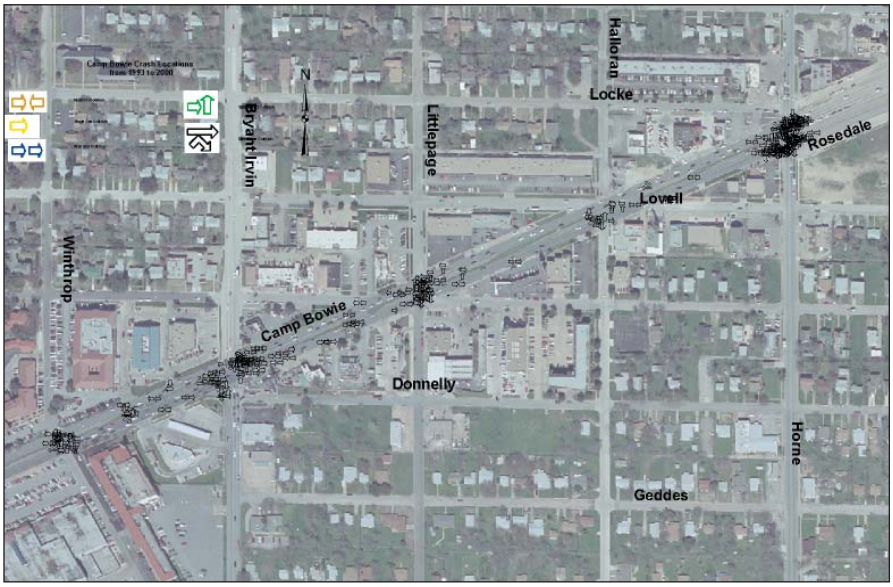

Figure 2. Crash Density on Corridor with High Access Density.

in Figure 2 (110 per mile). Not only are fewer mid-block crashes observed in the Figure 1 segment, but that segment has an overall lower crash rate of 5.9 crashes per million VMT compared to 8.8 crashes per million VMT for the Figure 2 segment.

This project also identified the differences in quality of crash information provided by different agencies. The crash reports provided by DPS typically appear to be very accurate, with occasional discrepancies between block numbers indicating where the crash occurred and maps of cities. The diagrams on the reports help pinpoint the exact locations of the crashes for mapping purposes. Cities and the Oklahoma Department of Transportation provided summary crash information, usually listing the crashes, types of impacts, and block number locations. Some city lists had numbers of injuries, while others did not. The best research can apparently be performed when using roads that are on Texas' state-maintained system.

The Researchers Recommend…

More research is needed to further identify the impact of access management treatments over a range of traffic volumes. Though this project identified many valuable findings, primarily related to the potential implementation of raised medians, the combination of access management treatments along a corridor could be further investigated.

For example, the presence of acceleration and/or deceleration lanes at heavy driveway or cross-street locations could facilitate traffic movement. Insights could also be gained from further study of the relationship between the median opening spacing and travel time differences between the TWLTL and raised median. In addition, along the actual test corridors it is difficult to identify the precise origin-destination patterns of vehicles without an extensive origin-destination study to identify vehicle patterns that are either within or through the study corridor. It would also be valuable to investigate longer corridors with the combination of access management techniques as the corridors studied here were relatively short (0.5 to 1.5 miles).

The product of this project, *Investigation of Access Point Density and Raised Medians: Crash Analysis and Micro-simulation* (Product 0-4221-P1), provides planners and engineers with specific findings related to access point densities and crash rates. Figure 1 in that document presents a relationship between observed crash rates and access points per mile. Planners and engineers can use that information to determine desirable access point density thresholds to improve safety on existing or future roads. These findings can also be also used to support goals and policies related to access point densities. Likewise, Table 2 in that document—Crash Rate Comparison of Corridors "before" and "after" the Installation of a Raised Median—includes the decreases in crash rates after raised medians were installed on case study roads. This information can be used to support efforts to install raised medians on high-volume roads. That document also includes detailed explanations of the use of the VISSIM micro-simulation model, including applicability and limitations.

For More Details...

This research is documented in the following reports:

4221-1, *Estimating the Impacts of Access Management Techniques: Methodology and Preliminary Findings*
0-4221-2, *Estimating the Impacts of Access Management Techniques: Final Results*
0-4221-P1, *Investigation of Access Point Density and Raised Medians: Crash Analysis and Micro-simulation*

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The researchers were very thorough in investigating the impacts that can be anticipated if certain access management treatments are implemented on arterials. Two technical reports and the product, *Investigation of Access Point Density and Raised Medians: Crash Analysis and Micro-simulation,* have been published and are available for those who want to receive a copy.

For more information, contact Andrew Griffith, P.E., RTI Research Engineer, at (512) 465-7403.

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