

April 9, 1998

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CAMBRIDGE MA.

*Stephen H. Kaiser
191 Hamilton Street
Cambridge, Mass. 02139*

**Councilor Kathy Born
City Hall
Cambridge, Mass. 02139**

SUBJECT: Design and Process for North Mass Ave

Thank you for your patience in chairing the lengthy meeting on Wednesday night at the Fitzgerald School. Given that this project is less than 8 days away from advertising for construction, I think that you could sense the degree of diverse opinion which still exists. Clearly, 15 months after the design consultants were authorized to begin work, we do not have a design which achieves either consensus or general acceptance.

The meeting notice which was mailed out by the city Department of Public Works stated that the purpose of the meeting was a discussion of the "planning and community outreach process." By clear omission, they did not ask for citizen input -- which is understandable since their target of advertising the construction contract is less than 8 days away. If the stated purpose of the meeting was to discuss the process, why did Public Works not do so and instead use the evening as an effort to sell the project to those attending? At no point in the past year did city representatives ever state a desire to discuss the process -- they simply told us what it would be.

Clearly, the best time to discuss how the process did or did not work is after the sewer project has been advertised for construction. There should have been an advisory committee. Without an Advisory Committee, Public Works simply holds the meetings and decides what it wants to do, with the July 1 court deadline as the driving force to move the decision along.

For the actual design of the road, the key controversy remains the median. The second issue is the loss of parking. Another controversial issue is the bike lanes and the extent to which modern aggressive bicyclists tend to find themselves in conflict with cars and pedestrians.

At the early meetings on the sewer project last year, I supported the concept of bikelanes, better crosswalks, landscaping and the removal of the median, since many of these features are inherent in good traffic calming

design. However, during the process I realized that there were two factors which severely question the wisdom of removing the median -- one safety-related and the other relating to land use.

My letter to Steve White of January 22, 1998 (attached) laid out the safety concerns. I apologize for the level of engineering detail involved, but I enclose this letter for the record to indicate the extent of legitimate safety concerns about the designs for Mass Avenue. I never received a response to my letter.

The safety data and logic available suggests that the removal of the median would create major safety problems for traffic turning left into driveways and turning left out of driveways along North Mass Avenue. Moreover, drivers of these turning vehicles would be primarily concerned about other traffic and thus could represent a safety hazard to both cyclists in the bike lane and pedestrians on the sidewalk.

In the literature I have seen, highway design professionals are debating between having medians or having left turn lanes -- not an uncontrolled road with no median and no turn lanes. The debates are centered around roads carrying 25,000 to 50,000 cars a day. The current Mass Avenue design would have between 30,000 to 40,000 cars a day -- but neither a median nor a left turn lane. Turning cars would be stopping in the left lane of Mass Avenue at unexpected points.

The other difficult move is the left turn out of a driveway, across the center line and into the opposing lanes of traffic. This turn is even worse than the turn into the driveway. The best way to understand and test this left turn problem is to try to make a left turn out of existing Cogswell Avenue or Creighton Street -- where today there is a break in the median. It's not an easy move at all.

The safety justification for deleting the median must come explicitly from City officials -- if they seek to create a busy 4-lane road with many driveways and with no median or turning lanes.

Furthermore, if there is no median, abutting land owners may be encouraged to develop their land for auto-related activities or otherwise increase driveway activity -- making the problem worse. The city's design for the new roadway did recognize some of these concerns when the designers reinserted back into the plans many of these median sections they had earlier planned for removal. This land use problem has been variously described within the community as the creation of another "Automile" or "Jiffy-Lube Heaven."

Finally, I am worried that if the reconstruction of North Mass Avenue is presented as a traffic calming proposal and if it has adverse safety impacts or triggers new auto-related development, these controversies will be employed as general criticism of efforts to implement traffic calming within the City of Cambridge. Such a backlash could result in a return to the "bad old days" of road design which is so woefully evident around Kendall Square.

PROPOSAL


The best solution would be to retain the median -- unless we know exactly in safety terms that it would be safe to delete the median. A new, narrow median would be inserted into the plans by shifting space from other uses in the corridor. By taking 6 inches from each travel lane and 1 foot from each bike lane, we would achieve enough room for the median. This new median would be 2-foot wide with a pair of one-foot painted edgelines on either side, for a total of four feet. The median would be added to the plan wherever a median exists today but is not shown on the design plans.

The loss of parking spaces could be addressed by looking at the numerous excessively wide commercial driveways along Mass Avenue and determining whether they could be reduced in width in order to produce more parking spaces. Such a design adjustment would provide a benefit for pedestrians as well.

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This proposal should be adaptable to the current design plans, without any major change in drainage or utilities. It would retain the key design features of more crosswalks and bike lanes, with some reduction in vehicle speeds, while avoiding introducing new hazards from uncontrolled left turns at driveways.

Sincerely,



Stephen H. Kaiser
Traffic and Transportation Engineer

cc. DPW
CDD
CTPT

January 22, 1998

Stephen H. Kaiser
191 Hamilton Street
Cambridge, Mass. 02139

To : Steve White, Cambridge Public Works

From : Stephen Kaiser

SUBJECT: Concerns regarding Median Designs for North Massachusetts Avenue

I am aware that the City's schedule for setting curblines on the North Mass Avenue sewer project was passed a month ago, and I would have hoped that since the process started last April there would have been time for a full discussion and analysis of the proposed design changes, especially the median. While I began as a traffic-calming advocate who supported removing the existing median where possible, I came to doubt the wisdom of unrestricted left turns because of its implications for triggering new auto-related development along Mass Avenue and upsetting the existing balance of older commercial and residential uses. Now I am concerned that given existing traffic volumes and land uses there may be problems in deleting the median.

The traffic problem is for a roadway with volumes in the 30,000 to 40,000 ADT range, with through volumes conflicting with turning movements. If there is additional congestion and delay, vehicles may tend to shift over to other local streets, such as Rindge Avenue. If the conflicts result in collisions, there is an obvious safety problem.

I am concerned that there is already a trend towards auto-related development along Mass Avenue -- some citizens have made references to the "AutoMile" or to "JiffyLube Heaven." If this trend continues, there will be increased strains on the ability of Mass Avenue in North Cambridge to provide safe and adequate traffic service.

Clearly, if Mass Avenue had only a thousand cars a day and almost no driveways, it would work fine without a median. But if it had 60,000 cars a day and a driveway every 50 feet, the road would be in terrible trouble. What we have is a roadway which is in the middle -- about 30,000 to 40,000 cars a day and driveway densities which vary along the roadway. The recently circulated design plans do not show any of the existing or proposed driveways, so there is no easy way to calculate the driveway densities, but we may be able to gain from the experience of others who have tried to deal with the issue of median vs. no median.

I have sought to determine the consequences of removing medians in areas of dense driveway development, and found three ITE Journal articles on the subject, all dealing with the issue of a median vs. a two-way left turn lane. On Massachusetts Avenue the issue is a median vs. no turning lane. I could find no literature which dealt with removing a median without providing turning lanes (or U-turns) as is now proposed for

various sections of North Mass Avenue.

The July 1993 ITE article provides general survey data, and reports on four studies which came to somewhat different conclusions. The general conclusion is that the lower the travel speed, the less likely a removal of the median will create a safety problem. Generally, the system begins to break down when a certain level of business activity is placed adjacent to a combination of speed and dense traffic flow on the main thoroughfare. The problems can occur with left turns out of adjacent parcels, as well as left turns in. The activity level is a combination of frequency of driveways and the amount of traffic at each driveway.

The December 1994 article goes into more specific detail, about problems on Jimmy Carter Boulevard in Georgia, where a 4-lane road with a center turn lane was converted into a road with a fixed median, because the corridor "was experiencing many traffic accidents and was perceived to be a hazardous place to drive." There is a fairly complete listing of the pros and cons of medians and turn lanes, and the accident results are again mixed, but the Georgia experience is that two-way left turns do not work well for traffic volumes higher than 24,000 cars a day. Carter Boulevard was perceived as having severe problems with volumes of 40,000 to 50,000 a day. Mass Avenue has volumes of 30,000 to 40,000 a day, but in the future will have no median and no turn lane in many sections.

Another Georgia project referenced in the December 1994 article was State Route 10, Memorial Drive which had a center turn lane and a daily volume of 43,000, and the median resulted in a 37% drop in total accidents, 42% reduction in injuries and a 100% drop in fatalities -- from about 2 a year to zero. These results give me reason to wonder about the safety consequences of removing the median on Mass Avenue. If there were assurances of fewer future driveways and less auto-related development there would be more reason to be sanguine about median deletions, which I believe are highly desirable for traffic calming. While I am hopeful that the proposed new design will tend to reduce speeds, there is a legitimate question whether we have the zoning and governmental protections in place to prevent north Mass Avenue from becoming a lower speed road which still has 40,000 cars a day and too many driveways.

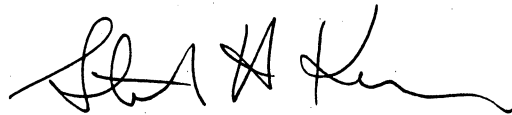
The only evidence I have of undivided 4-lane roads vs. medians occurred when I was employed for the state MEPA office in the 1980s. Intensive development was occurring along Route 1 through Norwood, Sharon and Walpole, as an older 4-lane undivided road was becoming overwhelmed by adjacent development and its turning traffic. Part of this road in Norwood is called the Auto-Mile. The solution imposed by the state highway officials was to install a median, with associated turn lanes and jughandles in order to provide for more orderly and safer access.

The last item I found was a rather sad letter from a traffic engineer a dozen years ago, who was seeking help from ITE engineers because he felt the removal of a median to be replaced by a center turn lane would "exceed the limits of usefulness" of the turn lane concept. His example was described as having high driveway density, 100% commercial strip development and high traffic volumes, but he reported that his efforts to have an experienced outside consultant review the concept was "dismissed as unnecessary." He stated that "I must remain anonymous at this time for obvious reasons."

January 22, 1998

I understand that the Cambridge Public Works Department has primary experience and interest in sewers and their construction, which will be an awesome task in itself. However, on the issue of roadway design there should have been more technical assistance offered to you in order to deal with the complex issues of median and driveway design and the public safety implications. One suspects that it will not be easy for you or any other engineer or planner in the City of Cambridge to make these decisions, given the intensive developer interest in various parcels along Mass Avenue.

Sincerely,



Stephen H. Kaiser
Traffic and Transportation Engineer

Choosing Between a Median and a TWLTL for Suburban Arterials

BY DIBYENDU MUKHERJEE, ARUN CHATTERJEE AND RICHARD MARGIOTTA

Highway engineers often have to upgrade existing two-lane or four-lane, non-freeway arterial roads in urban and suburban areas. A common issue encountered in these cases involves left-turning traffic and the design feature for accommodating these movements. A few alternative designs exist. An arterial road can have a non-traversable, raised or depressed median that eliminates left turns to and from driveways except at median openings. Another alternative is to provide unlimited access to and from driveways by providing a lane at the center for left turns only. This lane is known as a continuous, two-way, left-turn lane (TWLTL). A third alternative is to use a traversable median, which is sometimes referred to as a "flush-painted" median; however, this design is not very common in urban/suburban areas.

The purpose of this article is to examine the existing state of the art with regard to the choice between the two alternative treatments—a non-traversable median and a TWLTL. The scope of the article is limited to roads with two through lanes in each direction.

Existing Guidelines

The widely used book *A Policy on Geometric Design of Highways and Streets*, published by the American Association of State Highway and Transportation Officials (AASHTO),¹ does not present a comparative analysis of medians and TWLTLs. It does, how-

ever, make a few specific comments about the use of a TWLTL, which include: "[TWLTL] works well where the speed on the arterial highway is relatively low (25 miles per hour to 45 mph) and there are no heavy concentrations of left-turn traffic," and "[TWLTL] should be used only in an urban setting . . . where there are no more than two through lanes in each direction."

In a report prepared for the Federal Highway Administration (FHWA), Azzeh et al. presented the results of a comparative analysis on the safety aspects of a raised median and a TWLTL.² The authors analyzed accident data and found that when driveway density was high (more than 60 driveways a mile), a raised median was safer than a TWLTL. In other situations with low to medium driveway densities, a TWLTL was found to have fewer accidents than a raised median.

Among other comparative studies of the two alternative design features, three are particularly noteworthy since they include procedures for estimating quantitative information on two important aspects of these alternatives—delay and accidents. These studies were performed by Parker,³ Squires and Parsonson,⁴ and Harwood.⁵

Conversion Factors		
To convert from	to	multiply by
ft	m	0.3048
mph	km/h	1.609
mi	m	1609

Parker used data collected in Virginia to develop equations for estimating accidents and left-turn delay for roads with a TWLTL and a nontraversable median, respectively. His equations are as follows:

$$\begin{aligned} \text{Accidents/Mile/Year for Raised Median} &= 8.040 \text{ Signals/Mile} + 0.00155 \\ \text{Average Daily Traffic (ADT)} &- 0.0228 \\ \text{Driveways/Mile} &- 0.00000926 \\ \text{Population} &- 12.718 \end{aligned} \quad [1]$$

$$\begin{aligned} \text{Accidents/Mile/Year for Traversable Median (mostly TWLTL)} &= 5.432 \\ \text{Signals/Mile} &+ 0.00173 \text{ ADT} + 2.157 \\ \text{Streets/Mile} &+ 0.0000058 \text{ Population} - \\ &28.797 \end{aligned} \quad [2]$$

$$\begin{aligned} \text{Mid-Block Left-Turn Delay (Seconds) per Vehicle for Raised Median} &= -1.362 \text{ Signals/Mile} + 0.0184 \\ \text{DHV} &- 0.205 \text{ Median Openings/Mile} - \\ &0.0000332 \text{ Population} + 2.937 \end{aligned} \quad [3]$$

$$\begin{aligned} \text{Mid-Block Left-Turn Delay (Seconds) per Vehicle for Traversable Median (mostly TWLTL)} &= -0.525 \\ \text{Signals/Mile} &+ 0.0198 \text{ DHV} - 0.0676 \\ \text{Driveways/Mile} &- 0.0000214 \\ \text{Population} &+ 0.920 \end{aligned} \quad [4]$$

Squires and Parsonson used data from urban areas in Georgia to develop equations for estimating accidents for roads with a raised median and a TWLTL, respectively. They did not analyze delay. Their equations for accidents are as follows:

$$\begin{aligned} \text{Accidents/Mile/Year for Raised Median} &= 0.0019168 \text{ ADT} + 16.13910 \\ \text{Signals/Mile} &- 14.79288 \end{aligned} \quad [1]$$

Accidents/Mile/Year for TWLTL =
0.0038777ADT + 22.68622
Signals/Mile - 8.85380
Approaches/Mile - 21.86862 [2]

Parsonson⁶ performed further analysis of accident data from Georgia, and he arrived at the conclusion that a raised median is safer than a TWLTL under all traffic conditions when used with either four-lane or six-lane roads. Harwood used accident data from California and Michigan to develop a procedure for estimating accidents for roads with different design features, which included a TWLTL and a raised median. For the estimation of delay he used a simulation model. Harwood's procedures utilize tabular data and graphs.

A comparative analysis of the mathematical models and procedures developed by Parker, Squires and Parsonson, and Harwood was performed by applying their procedures to several scenarios built with realistic data. The results were conflicting. One probable explanation of the differences in the results is that these models were developed using data from different sources. In any case, it is clear that these models and procedures are not applicable to all cases and locations. An attempt was made to develop more information on this subject by contacting highway design engineers of various state departments of transportation, and the findings of this effort are described in the following sections.

Survey of State Design Engineers

In order to learn how state highway engineers make decisions with regard to the use of a median or a TWLTL, a questionnaire survey was implemented. The questionnaire was sent to all states except Alaska, Hawaii and Tennessee. Two extra questionnaires were sent to the South Carolina State Department of Transportation to be completed by different groups within the same agency. Thus a total of 49 questionnaires were sent out and 31 completed questionnaires were received—three from South Carolina and 28 from other states. There were 14 questions and three case study scenarios in the questionnaire. Among the 14 questions, seven were directly related to the use of a median

and a TWLTL. The results of these seven questions are discussed below.

Formal Guidelines

Does your state have formal guidelines on when to use median and TWLTL designs?

About 25 percent of the states indicated that they had some kind of guidelines for the selection process, and a few provided manuals that they commonly use for designing cross sections in their states. However, the material received was not directly helpful in choosing between a median and a TWLTL.

Effect of a Median and a TWLTL

We have identified factors that are influenced by median treatments: traffic/volume capacity, accidents, surrounding land use and signal operation. Using your state's experience, please compare the effects that median vs. TWLTL designs have on these factors.

Regarding how traffic volume/capacity would be affected by the installation of a median or a TWLTL, 35.48 percent thought that a TWLTL was better for higher capacity while 25.8 percent favored a median. The remaining 38.72 percent did not have any preference. The largest proportion (32.26 percent) of the responses regarding accidents was in favor of the TWLTL treatment. Only 16.13 percent of the responses preferred the median design for safety, and some (9.68 percent) thought there was no difference in accident rates for the two alternatives.

Most of the respondents thought that the TWLTL could encourage surrounding land use. More than 60 percent of the responses were of the opinion that TWLTL was the best solution where strip commercial development is expected or where such a development already exists.

With respect to signal operation, the responses were not overwhelmingly in support of any particular treatment. According to 16.13 percent, the median was a better alternative, while about 25.80 percent thought that a TWLTL design would be effective for smooth signal operation.

Changing a TWLTL/Median

Have you ever changed a TWLTL to a median design or vice versa? Why?

About 42 percent of the states had at

least one case where they actually changed a road section with a median to one with a TWLTL. By contrast only 19 percent of the states had transformed a roadway with TWLTL into a roadway with a median.

A few officials responded as to why they had made a change, and the reasons given varied. Some of the responses include:

- A TWLTL to a median to reduce the number of left-turn related accidents occurring at driveways for a particular high-density development.
- A median to a TWLTL design to accommodate higher traffic volume.
- A seven-lane section with a TWLTL to a boulevard with a 60-foot median to reduce exposure of pedestrians, to provide storage space for turning vehicles and to control traffic.
- Medians to TWLTLs to increase capacity and reduce accidents.
- Medians to TWLTLs to allow more turn movements and to improve safety by eliminating curbed medians.

In one state the public and business community prevented attempts by the state to convert TWLTLs to raised medians. One department of transportation referred to a case where a TWLTL was replaced with a median because of accidents. After the change, the accident rate declined and the traffic volume increased. Officials of one state reported changes of several medians (about 20 feet wide) to TWLTLs because of problems with U-turns at intersections.

It is obvious from the above responses that the experiences of different agencies with medians and TWLTLs vary widely, and that there is no consensus.

Before-and-After Effects

Have you ever conducted a before-and-after study of changing design from a TWLTL to a median or vice versa, or have you ever conducted a comparative analysis of the two cross-sections?

More than two-thirds of the state officials said they never conducted a before-and-after study. Only a few states indicated that they had performed such a study. However, follow-up inquiries revealed that these studies were involve with changes from an undivided section to a TWLTL or a median.

Median Width

What is your practice/experience with the following issues relating to medians: typical and desired median widths.

Responses to this question were so varied that it is difficult to group them into specific categories and ranges. The range of values provided by the engineers was from 4 ft to 84 ft for a raised median, while that for a grass median was between 12 ft to 100 ft. While the average typical width of a raised median was 19 ft, the average desired width was 26 ft. The average typical and desired widths of a grass/earth median were 43 ft and 54 ft, respectively. The most frequently mentioned typical width for a raised median was 16 ft and that for a grass median was 40 ft.

U-Turns

If you have experienced problems with U-turns at signalized intersections on median sections, how have you addressed them?

In response to this question 32.26 percent of the engineers replied that there was no problem with U-turns. Nearly 13 percent did not respond to this question, while 54.84 percent replied that they did experience problems with U-turns at signalized intersections on median sections. Among those responding to how they solved this problem, 64.7 percent preferred the restriction or prohibition of U-turns with regulatory signs along with adequate enforcement. Other alternatives mentioned included a wider median (11.77 percent), a TWLTL (5.88 percent) and the construction of jug handles (5.88 percent).

TWLTLs with Speeds of 45 mph

Have you ever used a TWLTL cross section on a highway where current travel speeds are 45 mph or higher? What has been your experience with these sections with accidents, traffic flow and adjacent land access?

Responding to this question, 41.94 percent replied that they installed a TWLTL on roadways with travel speeds greater than or equal to 45 mph, and they had no problem with the parameters mentioned in the question. On the other hand, 12.9 percent of the engineers mentioned that they experienced a variety of problems, which include an increase in rear-end accidents, numer-

Table 1. Case Study 1: Practitioners' Choice

Alternative Treatments	Percent Choosing an Alternative
Nontraversable Median	45.16%
TWLTL	25.81%
Traversable Median	6.45%
Other	3.22%
No Response	19.36%
	100%

ous turning conflicts, the misuse of the TWLTL as a passing lane, and so forth. A large percentage (32.26 percent) indicated they never used a TWLTL on a road with such high speeds.

Case Studies in Questionnaire Survey

The questionnaire included three hypothetical cases, which were developed in such a way as to have close resemblance to real-life conditions at a few locations in Tennessee. In each case the respondents were asked to select a cross-section feature related to median treatments.

Case Study 1: Rural Area Expected to Become Suburban

This case deals with a two-lane highway in a rural area that is expected to develop into a suburban area. The future pattern of development along the two-lane section is not known. The exact description of Case Study 1 as sent to the state officials is presented below:

Existing conditions: A state highway changes from a four-lane section into a two-lane section as it extends beyond a suburban area into what is now a rural area with little development along the roadside. The two-lane section is to be upgraded from that point for a length of five miles, and the existing four-lane section will be redesigned if necessary so its cross section will match the one chosen for the existing two-lane section. The existing four-lane section has strip commercial development along both sides. However, it is not known how the land along the existing two-lane section will develop after it is upgraded.

Current/design year average daily traffic: 14,000/22,000 (on two-lane section).

Speed limit: Existing speed limit in the four-lane section is 45 mph and on the two-lane section is 55 mph.

Existing right of way: 90 ft to 100 ft.

Cross streets: There is one signalized intersection and 12 unsignalized intersections.

Driveways: 50 minor driveways exist along the five-mile stretch of two-lane road.

An analysis of the responses (Table 1) revealed that 45.16 percent of the respondents favored the median (raised or depressed) treatment, while 25.81 percent favored the TWLTL treatment. Only 6.45 percent of the respondents favored a traversable median, which is also referred to as the flush painted median. Nearly 3.22 percent desired a treatment other than a median or a TWLTL, and 19.36 percent abstained from making any comments on the case. Thus the treatment most favored by practitioners for Case 1 is the median.

The traffic and geometric characteristics of Case 1 were fed into Parker's and Harwood's models predicting accident rates. (Squires and Parsonson's model was not applicable to this rural scenario). The results of these calculations, which are presented in Table 2, reveal that the two prediction models are in favor of a TWLTL treatment from the safety standpoint, although the difference is not very large.

The amount of delay to left-turning vehicles according to Parker's model is slightly more in the case of the TWLTL than in the case of a raised median treatment, the difference in delay being 2.98 seconds per vehicle. According to Harwood's tables, the delay to left-turning vehicles in a four-lane divided section is about 55 seconds per vehicle more than that in a road section with a TWLTL at the center. Thus it appears that the models do not agree in their

predictions of delay to left-turning vehicles. Harwood's model provides a clear choice of a treatment in favor of a TWLTL. The accident rate according to Parker's model favors a TWLTL, while delay to left-turning vehicles according to his model favors a raised median treatment. However, according to Parker's model, the difference in the delay for the two treatments is small. The model results are presented in Table 3.

A comparison of the practitioners' choices with those of the models is interesting. While the models seem to favor a TWLTL, the majority of the state highway engineers favor a median treatment for this case.

Case Study 2: Existing Suburban Area

This case is concerned primarily with a four-lane undivided highway in an existing suburban area that needs upgrading because of accident and delay problems. The absence of mid-block turn lanes have created an unsafe situation. The exact description of Case Study 2 as sent to the state officials is presented below:

Existing conditions: A four-lane undivided highway (no median or mid-block turn lanes) runs for two miles through an area that has developed rapidly into strip commercial land use. Numerous rear-end accidents have occurred from vehicles trying to make mid-block left turns into businesses. These left turns are also causing delay problems.

Current/design year average daily traffic: 25,000/30,000.

Speed limit: 40 mph.

Existing right of way: 85 ft to 90 ft.

Cross streets: Five signalized intersections are present in the two-mile section. In addition, there are 10 unsignalized intersections.

Driveways: Driveways for businesses are uncontrolled—about 150 exist along the section.

An analysis of these responses revealed that 45.17 percent of the respondents favored the TWLTL treatment while 25.81 percent favored the median (raised or depressed) treatment (Table 4). Only 3.22 percent expressed their desire to provide a traversable (or flush-painted) median. Several states did not respond to the case.

Table 2. Case Study 1: Model Predicted Accident Rates

Model	Treatment	
	Nontraversable Median	TWLTL
Parker	29.10	25.97
Harwood	67.3	52.4

Note: Accident rates are expressed as accidents per mile per year.

The three models for predicting accident rates were used with the data from Case Study 2. As shown in Table 5, the models produced inconsistent results. While the Squires and Parsonson model, and the Harwood procedure supported the choice of a TWLTL treatment, the Parker model showed a higher accident rate for TWLTL.

As far as delay to left-turning vehicles is concerned, Parker's model produced slightly less delay with a raised median treatment than with a TWLTL. The delay with a TWLTL was predicted to be 1.14 seconds more per left-turning vehicle. Harwood showed that the delay would be less by 209.5 seconds per left-turning vehicle with the installation of a TWLTL than with a median.

The different model results (Table 6) are somewhat conflicting. While Parker's model favors a raised median treatment, the model of Squires and Parsonson and the procedure of Harwood agree with the majority of practitioners who favor a TWLTL.

Case Study 3: Existing Suburban Residential Area

This hypothetical case deals with a road section passing through a low-density, high-income residential area. The exact description of Case Study 3 as sent to state departments of transportation is presented below:

Existing conditions: A four-lane urban arterial changes into a two-lane section as it extends beyond the city limit. The two-lane section runs through a low-density, high-income residential area for about four miles, after which development becomes very sparse. Current and projected traffic volumes dictate that the two-lane section be upgraded. The cross section of the existing four-lane section might also be upgraded to match the design chosen for the two-lane stretch.

Table 3. Results from Models for Case 1

Criterion	Treatments Favored by Models	
	Parker	Harwood
Accident Rates	TWLTL	TWLTL
Delay	Median	TWLTL

Current/design year average daily traffic: 13,000/18,000.

Speed limit: 40 mph.

Existing right of way: 60 ft to 80 ft.

Cross streets: There are two signalized intersections and six unsignalized intersections along the four-mile stretch of two-lane road.

Driveways: There are about 80 driveways serving the residential properties.

The percentage of engineers choosing a median (raised or depressed) was 19.36, while the percentage of those choosing a TWLTL was 22.58. As high as 32.25 percent of the officials did not respond to this particular case. A small portion (6.45 percent) of the responses was in favor of a traversable median (or flush-painted median), and the remaining 19.36 percent of the responses were in favor of treatments other than a TWLTL or a median of any type. These proportions are presented in Table 7.

To compare the responses of practitioners with the predictions of mathematical models, the hypothetical traffic and geometric data of Case Study 3 were fed into the three models. For accident rates, two of the three prediction models were in favor of a TWLTL treatment (Table 8). The amount of delay to left-turning vehicles according to Parker's model is more with a TWLTL treatment than with a raised median by about 1.33 seconds per vehicle. According to Harwood, the left-

turn delay for a section with a raised median is more than that with a TWLTL, the difference being 54.7 seconds per vehicle. Thus Harwood's procedure favors a TWLTL section from both delay and accident rate considerations. A summary of model results is presented in Table 9.

Conclusions and Comments

An analysis of a few existing models and procedures dealing with accidents and delay to left-turning vehicles on arterial highways with nontraversable medians and TWLTLs showed that these empirical models based on different data sets yielded different results. The survey of state highway engineers also revealed that they differed in their assessment of medians and TWLTLs. Evidently the choice between a median and a TWLTL is not clear cut. This will continue to be a controversial issue until more information is generated.

The choice made by most of the highway engineers for each of the three hypothetical cases provides interesting information, and some inferences can be made regarding the rationale for these choices.

The first case dealt with an undeveloped area, and the choice of most of the engineers was a nontraversable median. A probable reason for this choice might be the notion that a nontraversable median would discourage strip commercial development in the currently undeveloped area. It should be pointed out that it has not been proved whether there is a causal relationship between land development patterns and roadway geometrics. There are many factors involved with land development other than roadway geometrics. However, the initial use of a median before the development of adjacent land would be a prudent policy to pursue, because it would provide the opportunity to manage driveways and land access in a more orderly fashion. Further, a change to a TWLTL can be made later since sufficient right of way already would exist.

The second case dealt with a situation where strip commercial development already exists, and most of the highway engineers chose a TWLTL. This choice can be justified based on the consideration that a TWLTL would

Table 4. Case Study 2: Practitioners' Choice

<i>Alternative Treatments</i>	<i>Percent Choosing An Alternative</i>
Nontraversable Median	25.81%
TWLTL	45.17%
Traversable Median	3.22%
Other	3.22%
No response	22.58%
	100%

Table 5. Case Study 2 — Model Predicted Accident Rates

<i>Model</i>	<i>Treatment</i>	
	<i>Nontraversable Median</i>	<i>TWLTL</i>
Parker	51.94	69.18
Squires & Parsonson	83.06	62.64
Harwood	106.2	91.2

Note: Accidents rates are expressed as accidents per mile per year.

Table 6. Results from Models for Case 2

<i>Criterion</i>	<i>Treatments Favored by Models</i>		
	<i>Parker</i>	<i>Squires and Parsonson</i>	<i>Harwood</i>
Accident Rates	Median	TWLTL	TWLTL
Delay	Median	—	TWLTL

Table 7. Case Study 3: Practitioners' Choice

<i>Alternative Treatments</i>	<i>Percent Choosing an Alternative</i>
Nontraversable Median	19.36%
TWLTL	22.58%
Traversable Median	6.45%
Other	19.36%
No Response	32.25%
	100%

be better for accommodating left turns into and out of adjacent driveways. Another rationale used by some highway engineers is that a TWLTL requires less right of way in an already built-up area. It should be pointed out that the specified existing ADT of 25,000 vehicles was fairly high. Some highway engineers believe that as traffic volume increases beyond certain levels, left turns become increasingly difficult and unsafe. It also should be noted that when traffic volume is high enough to warrant three through lanes in each

direction, the situation would be significantly different. The case of a seven-lane cross section with the center lane being a TWLTL has not been studied much, and this article is not applicable to such a case.

The third case dealt with residential land use, and it brings in a few additional considerations. Residential areas are more sensitive to environmental factors such as traffic noise than commercial areas. Residential areas also do not generate as much traffic as commercial areas. It is interesting to note that high-

way engineers did not show any clear consensus in this case. Nearly one-third of the engineers did not even respond to this case, and the remaining engineers were nearly evenly split among a median, a TWLTL and other alternatives, such as an undivided four-lane section. This situation deserves more research.

The authors would like to add that in addition to the questionnaire survey, they interviewed in person several highway engineers from the North Carolina Department of Transportation, City of Charlotte's Department of Transportation and Georgia Department of Transportation. These interviews also revealed differences in opinion and practice with regard to the use of a median and a TWLTL. Clearly, a choice between a median and a TWLTL involves trade-offs among safety, delay and land development considerations. In each individual case these trade-offs should be identified clearly before a choice is made.

Acknowledgment

The authors wish to acknowledge the assistance and support of the Tennessee Department of Transportation in performing the study. The contribution of all highway engineers who participated in the personal interviews and the questionnaire survey also is gratefully acknowledged. This study was a part of a larger research project funded through the Southeastern Council of University Transportation Centers.

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Table 8. Case Study: Model Predicted Accident Rates

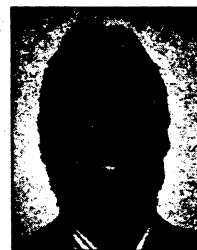
Model	Treatment	
	Nontraversable Median	TWLTL
Parker	18.65	13.75
Squires & Parsonson	27.78	32.71
Harwood	37.0	31.5

Table 9. Comparison of Results from Models for Case 5

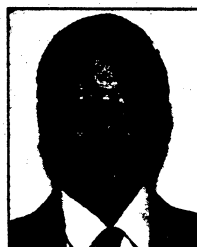
Criterion	Treatments Favored by Models		
	Parker	Squires and Parsonson	Harwood
Accident Rates	TWLTL	Median	TWLTL
Delay	Median	—	TWLTL

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Are Raised Medians Safer Than Two-Way Left-Turn Lanes?

BY W. MARTIN BRETHERTON JR.

Jimmy Carter Boulevard is a major east-west arterial in Gwinnett County. The county road system has many north-south principal and major arterials. These include Peachtree Industrial Boulevard, Buford Highway, Interstate I-85, U.S. 29, Five Forks Trickum Road and U.S. 78. The problem with the road system is the lack of major arterials that operate east-west. These east-west arterials are Jimmy Carter Boulevard/Rockbridge Road, Indian Trail-Lilburn Road/Killian Hill Road, Beaver Ruin Road/Arcado Road, Pleasant Hill Road/Lester Road and the planned Ronald Reagan Parkway. The capacity of the north-south arterial roads are much greater than the east-west arterial.

Jimmy Carter Boulevard, before April 1987, was a five-lane roadway with four thru lanes and a two-way left-turn lane (TWLTL). The area of greatest traffic congestion occurs between Buford Highway on the West end and Singleton Road on the east end. I-85 bisects this section of roadway forming a "barrier" between land uses. The east side from Singleton Road to I-85 is mostly retail businesses while the west side from Buford Highway to I-85 is mostly industrial and commercial businesses with some retail. This corridor was experiencing many traffic accidents and was perceived to be a hazardous place to drive. The main reason was because average daily traffic volumes were averaging between 39,000 vehicles/day on the Buford Highway side to more than 50,000 vehicles/day on the Singleton Road side. The roadway is maintained by the Georgia Department of Transportation on the north as State Route 140, while the south end, from I-85 to Singleton Road is maintained by Gwinnett County. Figure 1 shows the project location and limits.

The Existing Operation of the Two-Way Left-Turn Lanes

The operation of a two-way left-turn lane allows vehicles to make seven conflicting movements (See Figure 2). The conflicts involve 1) motorists trying to cross Jimmy Carter Boulevard from a driveway to a driveway or street to street; 2) making a left turn off Jimmy Carter Boulevard to a drive-

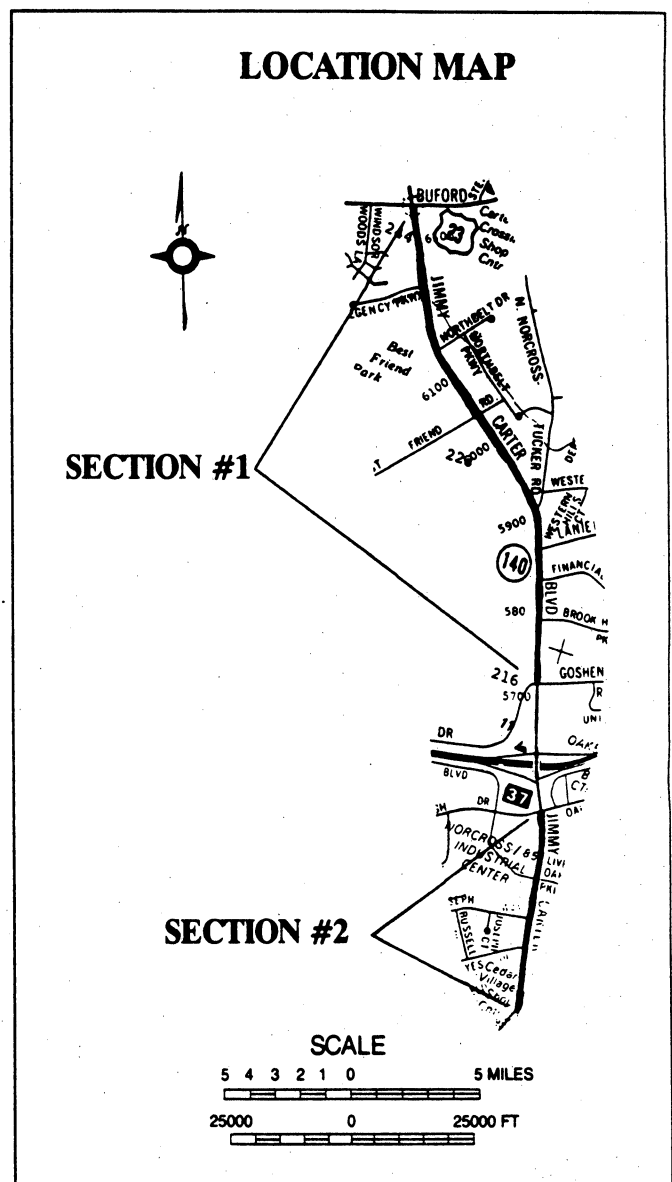


Figure 1. Location Map

way or side street; 3) using the left-turn lane to pass stopped vehicles in the main thru lanes; 4) allowing uncontrolled U-turns across two thru lanes; 5) making a left turn from a side street or driveway onto Jimmy Carter Boulevard; 6) accelerating in TWLTL to merge right; and 7) head-on accidents in the TWLTL. All of these conflicts are potential traffic accidents. These conflicts are highlighted by the very high traffic volumes on Jimmy Carter Boulevard, which minimize natural gaps in traffic. Another operational problem is the potential safety hazard of pedestrians trying to cross the street, as there is no refuge area in a five-lane roadway. The final problem on Jimmy Carter Boulevard was the lack of capacity for the corridor. All the turning movement conflicts, closely spaced traffic signals and near misses were causing very low operating speeds, which severely limited the capacity of the roadway.

It was decided by the Gwinnett County Board of Commissioners, under the recommendation of the Gwinnett

County Department of Transportation and the Georgia Department of Transportation, to install a raised median in place of the two-way left-turn lane. The new roadway would be six thru lanes with a 10 foot (ft) concrete median (4 ft wide) dividing the three thru lanes in each direction.

The county and state expected the conflict accidents involving the usage of the two-way left-turn lanes to be reduced. The expected reductions included mid-block angle intersection type accidents, side swipe opposite accidents, head-on type accidents and possibly some rear-end accidents. The county expected an increase in struck object accidents and angle intersection accidents at intersections. The theory for the reductions and increases was based on how a two-way left-turn lane and raised median section operate. To get a better understanding of these operational services and their effects on safety, the county looked at the operational advantages and disadvantages of two-way left-turn lanes and raised medians.

Operational Effects of Two-Way Left-Turn Lanes

Listed below are the advantages and disadvantages of designing and operating a median with a two-way left-turn lane.¹

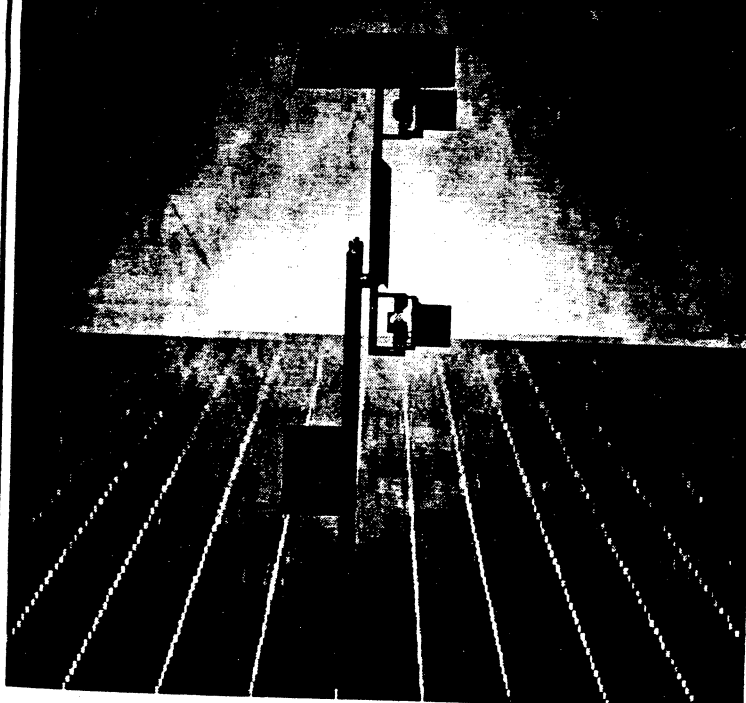
Advantages

1. Remove left-turning vehicles from thru traffic while still providing maximum left-turn access to side streets and driveways.
2. Encourage new strip development.
3. Reduce delay for left-turning vehicles.
4. Enhance operational flexibility for emergency vehicles and others.
5. Operate safer when less than 60 commercial driveways per mile are permitted to be constructed.
6. Are operationally safer than roadways with no turn lanes in the median.

Disadvantages

1. Conflicting vehicle maneuvers at driveways.
2. Poor operation of roadway if stopping sight distance is less than the AASHTO minimum design.
3. No refuge area for pedestrians.

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4. Operate poorly under high volume of thru traffic.
5. Should not be used when access is required on only one side of the street.
6. Visibility problems with painted median, especially with snow and rain or when pavement markings begin to outlive their design life.
7. A safety problem when they are used as a passing lane.
8. High maintenance cost of keeping the striping and raised pavement markers in proper operating condition.
9. Must continually instruct public of proper use and operation.

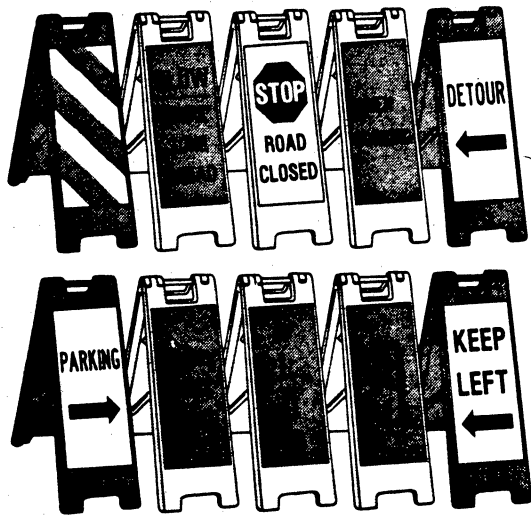
Operational Effects of Raised Medians

Listed below are the advantages and disadvantages of designing and operating a median with a raised median design.¹

Advantages:

1. Discourage new strip development.
2. Allow better control of land use by local government.
3. Reduce number of conflicting vehicle maneuvers at driveways.
4. Safer on major arterials with high (greater than 60) number of driveways per mile.
5. Increase traffic flow.
6. Desirable for large pedestrian volumes, provide refuge area.
7. Permit circuitous flow of traffic in a grid pattern.
8. Allow greater operating speeds on through roads.

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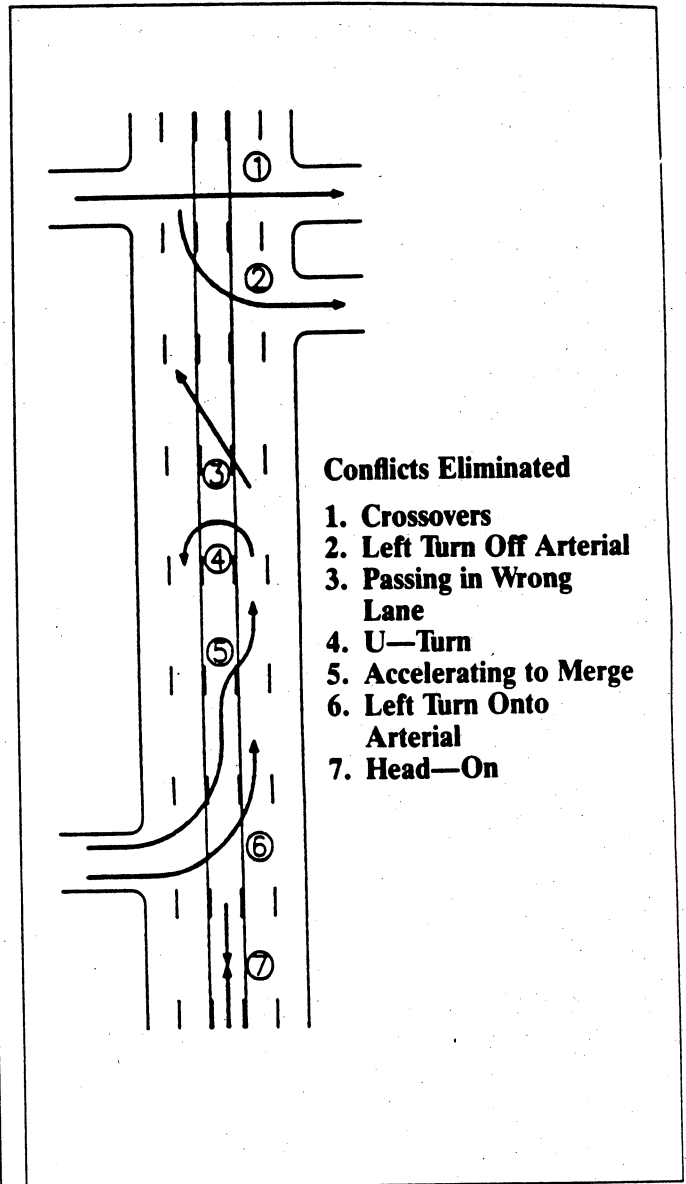


Figure 2. Midblock conflicts eliminated by raised medians

9. Safer than TWLTLs in four-lane sections.
10. Safer than TWLTLs in six-lane sections, but depends on number of signals per mile, driveways per mile, average daily traffic, and street approaches per mile.
11. Encourages access roads and parallel street development.
12. Reduce accidents in mid-block areas (See Figure 1).
13. Reduces total driveway maneuvers on the major roadway.
14. Low maintenance cost of raised median, depending on final design.

Disadvantages:

1. Reduce operational flexibility for emergency vehicles and others.
2. Increase left-turn volume at major intersections and median openings.
3. Increase travel time for vehicles desiring to turn left where median openings not provided.
4. May reduce capacity at signalized intersections.
5. Possible increase of accidents at intersections and median openings.
6. Possible increase in object struck type accidents.

Safety Effects of Raised Median Project

Description of Project

The operational review of installing a raised median on Jimmy Carter Boulevard involved looking at two variables: land use and type of raised median.

The first part of the analysis looked at land use by section of roadway. The heavy retail business area is on Jimmy Carter Boulevard from I-85 to Singleton Road (east end). The other section of Jimmy Carter, from I-85 to Buford Highway (west end), has a mixture of commercial and industrial development, with some retail.

The second part of the analysis reviewed the type of raised median. The project built two different types of medians because of the planned staging for the construction of the median. On the first day of construction in April 1987, the contractor installed a 3-ft high temporary New Jersey type barrier, the length of the two projects. The final raised median was 10 inches (in) high, with the first 5 in having a vertical face and the second 5 in being slanted at 45 degrees. The raised median was 4 ft wide, except at intersections where it narrowed to 2 ft adjacent to left-turn lanes.

This study reviews the effect of different heights for medians. The first accident analysis compared the pre-construction period of the TWLTL operation to the temporary construction period with a 3-ft high raised median section (New Jersey barrier). The study then compared the pre-construction period of the TWLTL operation to the 10-in high permanent raised median sections.

Construction began on Jimmy Carter Boulevard (SR-140) from I-85 to Buford Highway on April 17, 1987, and the project was completed on Aug. 21, 1988. This section of the project took 16 months to complete and had a project length of 1.63 miles.

Description of Accident Analysis Procedures

The intersections at Buford Highway and Singleton Road and all accidents at the two I-85 interchange ramps were not included in the analysis to prevent a biased analysis. The

computer database could not differentiate the approaches to the end intersections; since the end intersections had approaches not affected by the raised median project, these end intersections were not analyzed. The analysis only used complete months of accident data in the before and after conditions, thus skipping all transitional accidents. Figure 1 shows the project limits for each section of analysis.

All accident frequency and rate changes were analyzed for statistical significance. The Poisson Distribution and Comparison of Means Test was used to test for statistical significant change at 95 percent level of confidence. This gave three statistical answers: yes, significant at level of confidence of 95 percent for both Poisson tests; no, not significant at level of 95 percent for both Poisson tests; or uncertain at 95 percent level of confidence (yes, for Poisson Distribution, but no for Poisson's Comparison Mean Test).

The analysis of the 3-ft high New Jersey barrier section is called the "during" construction analysis. Only

the results of the "during" study will be provided in this report.

Because of space limitations, detailed analysis is only available from the author. The permanent 10-in high raised median is called the "after" construction analysis. The computerized accident database started on Jan. 1, 1986, and was complete through Dec. 31, 1993. This limits the before and after periods for analysis, because of the short "before" period.

Fatal accidents along these corridors were not analyzed. The county only experienced one fatal accident before the project and one occurred after the project. This is not statistically significant data to analyze. This project's inception was motivated more by the number of accidents and traffic congestion than fatal accidents.

Review of Raised Median Project

The accident data shows that retrofitting a two-way left-turn lane with a 10-in concrete raised median is benefi-

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cial. However, the benefits are not as wide sweeping as the 3-ft high temporary New Jersey raised median. Both projects, regardless of land use, showed accident rate reductions with this project. Both projects had increases in the total number of injuries along Jimmy Carter Boulevard, though the increases are not statistically significant. However, the injury rate in Section 1 had a small decrease.

When analyzing these two projects, the significance of the rate analysis is quite different. The median project from Singleton Road to Oakbrook Parkway (Section 2) had statistically significant accident reductions for angle-type and total accidents (Table 1). This supports one of the reasons for building this project: making the road safer. Considering traffic is moving along this section of road at a higher average speed (less congestion) and the road is operating as a safer arterial, this supports the decision to build this project.

The safety benefits of the median project from Buford Highway to Crescent Drive are not nearly as beneficial from an accident reduction perspective. The only significant reduction was with rear-end accidents, and this was not an anticipated benefit of the project (Table 1). The biggest surprise was the relatively small reduction in angle-type accidents. This section of road experiences much greater demand for U-turns than the Singleton project (Section 2). The project along this section of road did reduce accidents by 9 percent, though this is not statistically significant.

Most of the accident reductions by type of accident behaved as theorized. The angle-type accident rates had a reduction of 13 percent and 45 percent. The side swipe-opposite and head-on accidents also decreased as expected. The road had an increase in "object struck accidents," as expected. The biggest surprise was in the very large (25 percent and 39 percent) and significant reduction in rear-end accidents rates. The study had projected a small accident opportunity for thru motorists to be cut off by turning vehicles from and to Jimmy Carter Boulevard. This category analysis proposes the theory that there was a very serious rear-end accident problem with the two-way left-turn lane opera-

Table 1. Section 1: Buford Hwy to Crescent Dr., Section 2: Singleton Rd to Oakbrook Pkwy

Permanent Raised Median (10") Installation						
Accident Frequency Analysis						
Type of Accident	Section 1			Section 2		
	Before	After	%Change	Before	After	%Change
Angle	71	72	+1, N	106	65	-39, Y
Rear End	105	93	-11, N	104	70	-33, Y
Side Swipe-Same	13	25	+92, Y	23	26	+13, Y
Side Swipe-Opposite	3	1	-67, N	3	1	-67, N
Head-On	5	2	-60, N	2	1	-50, N
Object	0	19	+00, Y	0	8	+00, Y
Other	1	1	0, N	1	1	0, N
Total Accidents	198	213	+8, N	239	172	-28, Y
Total Injuries	68	73	+16, N	37	50	+35, U

Accident Rate Analysis						
Type of Accident	Section 1			Section 2		
	Before	After	%Change	Before	After	%Change
Angle	2.45	2.12	+13, N	4.61	2.55	-45, Y
Rear End	3.62	2.73	-25, Y	4.52	2.75	-39, Y
Side Swipe-Same	0.45	0.73	+62, U	1.00	1.02	-2, Y
Side Swipe-Opposite	0.10	0.03	-70, N	0.13	0.04	-69, N
Head-On	0.17	0.06	-65, N	0.09	0.04	-56, N
Object	0.00	0.56	+00, Y	0.00	0.04	+00, Y
Other	0.03	0.03	0, N	0.04	0.04	0, N
Total Accidents	6.82	6.26	-9, N	10.39	6.75	-35, Y
Total Injuries	2.34	2.32	-1, N	1.61	1.97	+22, N

*%Change Statistically Significant at 95% Level of Confidence Using Poissons Distribution and Comparison of Means Test: Yes, No or Uncertain

**Note: Accident and Injury Rates are Per One Million Annual Vehicle Miles

tion. This must have involved many vehicles using the lane as a thru lane or cutting off thru vehicles as they tried to merge back into traffic. As expected, the object and side swipe-same type accidents increased for both projects.

Conclusions and Recommendations

The conclusion of this study is that retrofitting the raised median barrier reduces accidents. As was documented in another paper on medians,¹ two-way left-turn lanes do not function safely or efficiently when traffic volume exceeds 24,000 vehicles per day. Jimmy Carter Boulevard had more than 40,000 vehicles a day along the analyzed corridor.

Should additional projects for retrofitting the TWLTLs be considered, it is the conclusion of this analysis to recommend retrofitting a raised median, based on operating the road more safely and more efficiently. Consideration

should be given to looking at alternative raised median designs to minimize object struck type accidents, while minimizing the opportunity to illegally cross the median. It is very interesting that the before/during analysis found that utilizing the temporary 3-ft New Jersey barrier reduced accidents by 32 percent for both sections of road. The 10-in median only reduced accidents in both sections by 12 percent. The results suggest that land use type, traffic volume and median designs are significant variables in the optimum design. However, better consideration should be given to the crossing ability of emergency vehicles, while still eliminating motorists' opportunity to illegally cross the raised median.

Limitations with Analysis and Data

There was a problem with traffic volume (ADT) counts from the

Georgia DOT along Jimmy Carter Boulevard from I-85 to Buford Highway for the years 1986 to 1989. We had to use our turning movement counts to adjust their traffic volume counts because of the Georgia Department of Transportation's mechanical and statistical problems with their two-count stations on this section of road. This may have caused the rate analysis to be biased against the benefits of the median. Traffic on Jimmy Carter Boulevard has risen dramatically since the project completion.

The annual vehicle mileage for Section 1 (Buford Highway to Crescent Drive) had a 17 percent increase in traffic volume, and Section 2 (Singleton Road to Oakbrook Parkway) had a 10 percent increase in traffic volume. Both these increases seem very low when the study considers that vehicle registrations in Gwinnett County have increased from 262,000 vehicles in 1986 to about 311,000 vehicles in 1989, the time period of analysis for this project. The increase (19 percent) in traffic along a major arterial should be at least this high. The 1994 traffic volume on Jimmy Carter Boulevard is more than 69,000 vehicles a day for Section 1 and 76,000 vehicles a day in Section 2. These are very dramatic traffic volume increases since 1986.

The most important limitation of this analysis is lack of data detailing traffic volume approaching Jimmy Carter Boulevard from side streets and driveways. As the number of conflicts increase, the potential for accidents increase, and although there is no data to support the claim, potential traffic conflicts increased dramatically. However, the median prevented many of these left-turn conflicts or they were handled more safely at controlled intersections.

Another problem involves the comparison of the permanent raised median installation with the existing five-lane section. The permanent improvement has six thru lanes compared to the four thru lanes for the existing roadway. A partial consideration to this limitation involves the analysis of the temporary raised median (3 ft). During most of this construction period, there were only four thru lanes. This project had the greater reduction

in accidents compared to the permanent raised median, even though the "before" and "during" period had an equivalent number of thru lanes.

Other Retrofit Project in Georgia

The Georgia Department of Transportation sent Gwinnett a copy of the study results from a similar project on Memorial Drive (SR-10) in DeKalb County. Memorial Drive was a seven-lane roadway with similar problems to Jimmy Carter Boulevard: accidents, congestion and motorist's perceptions as a "dangerous" corridor.

The Department of Transportation installed a median in place of the TWLTL based on the Jimmy Carter Boulevard safety results. The results of the project were better than the Jimmy Carter Boulevard project. The concrete median was 10 ft wide with a 6-in (mountable) raised median. Accidents were reduced by 37 percent and injuries by 42 percent. The "before" traffic volume was 43,000, and the "after" traffic volume was 50,400. The biggest benefit of this project was the fatality analysis. From Jan 1, 1979, to July 27, 1987, this road experienced 15 fatalities, many involved MARTA buses and pedestrians. Two years after this project, there has not been a fatality on this 4.3 mile section. Georgia DOT estimates that in the past two years since the median was installed, they have saved 600 accidents and 300 injuries.

Other Opinions

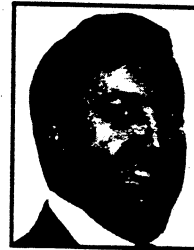
Medians are not liked by many practicing traffic engineers across the country.³ After much discussion with many traffic engineers, there is a good hypothesis regarding why some states prefer raised medians while others to prefer two-way left-turn lanes.

The major difference between states seems to be the way traffic operates in the TWLTL. Some states educate and enforce the proper use of the TWLTL. Thus, traffic does not use the lane as an accel and decel lane. States such as Georgia that allow this operation find TWLTLs do not work well when traffic gets heavier than 24,000 vehicles a day. States such as Arizona and Michigan are reported to have

good operation in TWLTL, and not surprisingly are strong supporters of TWLTLs.

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TO THE EDITOR

The Right-Turn-on-Red

You recall that the RTOR was the hero in the energy-saving hysteria of the 1970's, when turning down the thermostat was nearly as patriotic as rising for the national anthem. It promised to save gasoline and time costs in preventing traffic tie-ups. But studies like the report in ITE Journal/May 1981 gave the facts. The Insurance Institute for Highway Safety (IIHS) reported accident statistics from six states relating to right-turns-on-red accidents, before and after adoption of RTOR: 20% increase in number of crashes; 57% increase in pedestrian injuries; 30% increase in children injuries; 100% increase in adult injuries; 110% increase in accidents for the elderly; 70% increase in pedestrian accidents in urban areas; 25% increase in urban area accidents. ONLY .2-1.3 gallons of gasoline savings per vehicle per year. ONLY .3-1.7 hours savings per vehicle per year.

I know from bitter experience in November, 1980, the danger of RTOR when I was struck away from my legal "WALK" by a driver failing to stop in his greedy rush on a RTOR. I suffered damage to my brain's visual cortex for lasting visual impairment. Damage to my liver for endocrine disturbance. Torn knee ligament and deep bruises.

There is growing awareness of the danger in RTOR, an ineffective, brutal law which encourages macho contempt for the traditional respect for any red light. But generally the public objects mainly when personally affected. Or when someone like a TV idol with a gorilla sex-change implant is killed by a RTOR!

The problem of the drinking driver is serious across North America. It appears to me that our retention of this law seriously and unnecessarily increases the problem. Every day here in Victoria, pedestrians are forced to wait to allow greedy drivers not stopping for the red light to barge past our legal "WALK". This dangerous law creates highly unsocial behavior in even the sober drivers.

Now, put the drunk-on-liquor driver behind the wheel. In his confused mind, red can mean "GO" on the RTOR; or a dash across the red light-barred intersection.

Have any surveys considered the psychological effect of the RTOR on the drinking driver? Would they prove that this dangerous law confronts the drinking driver with a negative force as potent as the chemical blast of the final drink which tripped him into intoxication? The brewing industry supplies the alcohol. We, the people, and our lawmakers, in accepting this useless, dangerous RTOR, have the heavy responsibility for setting the stage for traffic tragedies due to drunk drivers.

Are we the "chief executioners" of citizens killed by the RTOR, which has the ugly force of something like permissive pre-meditated manslaughter?

Do the heads of departments concerned with traffic accidents visit hospital emergency rooms to see the RTOR's victims: the D.O.A.'s; the dying; the cases with terrible injuries leading to wheelchair suicides, and shock for mental wandering; and all the associated grief and suffering and despair?

Dear Editor, might your Journal make a survey to discover the proportion of drunk-driver infractions caused by RTOR violations and running red lights across intersections?

Thank you for your attention.

Sincerely yours,

(Mrs. A. V.) Carol M. Turner
Victoria, British Columbia, Canada

Editor's Note—The Institute continues to monitor experiences with Right-Turn-On-Red-After-Stop. We would welcome the submission of any additional up-to-date data on the safety impacts of RTOR, including information on alcohol related accidents.

City Traffic Engineer Needs Help!

The Situation:

An existing suburban 4-lane arterial-at-grade having a 30' median, within a usable right-of-way averaging 175 feet, serving an A.D.T. in the high 40,000's, and having an average commercial driveway density of 83 per mile is being seriously considered for (improvement?)

to a 7-lane undivided section having a continuous two-way left-turn lane (2WLTL).

Assuming that sufficient capacity and satisfactory geometrics can be obtained at the major signalized intersections by the provision of separate double left turn lanes and separate right turn lanes, this traffic engineer has a "gut feeling" that between the major intersections, the combination of high traffic volumes, 3-thru lanes in each direction, the high driveway density, and the total 100% strip commercial development with its inherent high turning movement volumes will exceed the limits of the usefulness of the 2WLTL design concept, which under most conditions I feel is indeed a highly desirable design concept.

My superiors, not unreasonably, are demanding more information than my intuitive belief that the proposed 7-lane 2WLTL concept is an inadequate design under the conditions as described.

Unfortunately, Federal aid participation may not be sought which would remove my opportunity for an FHWA design review, and my requests to have this concept reviewed by an outside consulting firm experienced in urban arterial design are dismissed as unnecessary.

Any traffic engineer in government service, or serving as a consultant who has had experience in designing, operating, or evaluating the operation of a 7-lane 2WLTL having conditions anywhere near similar to the above is asked to respond to my plea for information, both supportive and/or nonsupportive, of this concept, and any comments you would care to forward concerning this particular design will be so gratefully appreciated.

I must remain anonymous at this time for obvious reasons. Please send your response to the attention of Mr. Mark Norman, at the address stated below, who will forward your information to me. I really need your help!

Mark R. Norman
Institute of Transportation Engineers
525 School Street S.W.
Suite 410
Washington, D.C. 20024
Phone (202) 554-8050

Consent Communication #13 S-265

A communication was received
from Stephen H. Kaiser, transmitting
a letter regarding the design
and process of North Massachusetts
Avenue.

In City Council April 13, 1998

Referred to

~~7:00 pm Hearing~~