Why Not A Raised Median?

by **Robert Reish** and **Nazir Lalani**

The Public Works staff of the City of Lakewood, Colorado, was assigned to design a project to widen sections of Wadsworth Boulevard, an important north-south major arterial in the city. Wadsworth Boulevard was originally designed as a four-lane facility with two through lanes in each direction and with center left-turn lanes. Additional acceleration/deceleration lanes, typically less than one block in length, had been provided at certain high-volume driveways serving adjacent commercial and office developments.

As the city continued to develop, the afternoon peak hour volumes on Wadsworth Boulevard rose to over 4,100 vehicles per hour (the total volume in both directions). Such volumes are normally associated with major or arterial streets designed as six-lane facilities with three lanes in each direction. Twenty-year traffic projections indicated that volumes on Wadsworth Boulevard would continue to rise significantly.

As part of the design process, the city conducted workshop meetings with property owners and business property tenants on land adjacent to Wadsworth Boulevard. The most important issue discussed at these workshops concerned the selection of one of the following three design alternatives:

1. Control of left turns through the use of raised medians.
2. Provision of dedicated left-turn lanes. Because of the number of access points and local street intersections, the lanes would be back-to-back.
3. Provision of continuous two-way left-turn lanes.

The city staff members considered the decision on which alternative to select to be of utmost importance for several reasons:

1. Wadsworth Boulevard's important role in meeting the future transportation needs of the city.
2. The enormous expense of widening Wadsworth Boulevard to six through lanes, three in each direction.
3. The need to address the concerns of property owners and business property tenants on land adjacent to Wadsworth Boulevard.

To provide decision makers with current and comprehensive information on which a sound technical decision could be based, the city conducted a review of published literature and a survey of transportation and traffic engineers throughout the United States working for state departments of transportation or city governments.

Survey Objectives

The objectives of the survey were to obtain data on the following:

1. Statistical research comparing accident characteristics on roadways with various median treatments.
2. Current practice on the use of raised medians or two-way left-turn lanes.
3. Techniques being used to control U-turns at intersections or along roadways with medians as well as the safety aspects of U-turn maneuvers.
4. Evidence of loss of business or business failures along a roadway that had substantial commercial development and upon which a raised median had been installed, restricting left turns into the business development.

Literature Review

A literature review was conducted to examine the reported safety and operational impacts of raised and traversable medians. The review was aimed at identifying methods used to select median treatments for specific geometric and traffic flow conditions.

In a study by the City of Overland Park, Kansas, it was stated that installation of raised medians caused no known business failure in the city, although raised medians were unpopular with adjacent businesses.[1]

In a 1970 study of public safety systems, landscaped medians were recommended for major business-oriented streets as a means of providing improved aesthetics and an atmosphere more conducive to pedestrian activity.[2] Businesses were found to be enhanced by the installation of raised medians.

In a 1962 article in the Los Angeles *Evening Outlook*, the then deputy chief of the Los Angeles Fire Department stated, "In normal response to a fire, the apparatus must thread its way through traffic, shifting from one side of the street to the other."[3] The construction of a built-up center divide "forces fire equipment

to stop behind traffic at red lights since an apparatus is unable to detour to the other side of the street."

A 1967 report by the chief engineer and general manager at the Board of Fire Commissioners, city of Los Angeles, listed three reasons for their opposition to raised channelization.[4]

- Raised medians slow down emergency response, to a high degree.
- In built-up areas, the islands make it difficult, if not impossible, to operate in the vicinity of large and extensive fires.
- The above two factors create the need to raise insurance rates to businesses.

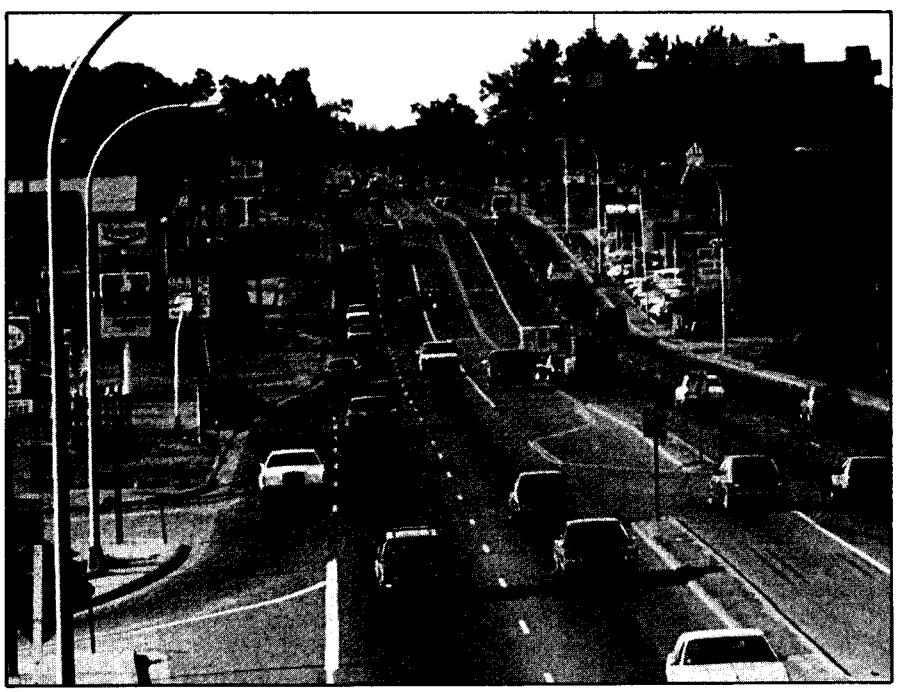
Data provided by the Georgia Department of Transportation indicated that the accident rate for a six-through-lane roadway where the three through lanes in each direction were separated by a grass or depressed median was 4.4 accidents per million vehicle miles lower than a similar facility where the three through lanes in each direction were separated by a two-way left-turn lane.[5]

In a study by the City of Arlington, Texas, a 66% reduction in accidents was reported due to the use of raised medians on four-lane roadways.[6]

In a study by the New York State Department of Transportation, the accident rate for undivided highways with three through lanes in each direction was 11.28 accidents per million vehicle miles of travel; for divided highways, the rate was 7.43 accidents per million vehicle miles of travel, a difference of 34%.[7]

In a 1982 study by the Federal Highway Administration (FHWA), the results at a number of roadway improvements showed that accident rates were reduced significantly wherever medians were implemented.[8] Reductions in accident rates varied from 5% to 80%. The report listed the following advantages of raised medians and intersection channelizations:

- Increase in capacity and safety.
- Enhancement of the smoothness of traffic flow.
- Decrease in conflicts resulting from a physical separation of opposing lanes of traffic.
- Better regulation of traffic through the elimination of certain movements.
- Provision of a more positive indication to drivers of the proper use of travel lanes at intersections.
- Provision of opportunities to favor a predominant movement.
- Provision of a protected area for the location of traffic control devices.
- Better control of the speed of turning vehicles through an intersection.
- Provision of pedestrian refuge areas.



Wadsworth Blvd. showing typical frequency of driveways and uncontrolled left turns onto and from the roadway.

In a memorandum from the director of the FHWA Office of Traffic Operations to regional FHWA administrators, two-way left-turn lanes were considered an appropriate design option for roadways expected to have average daily volumes of 10,000 to 25,000 vehicles per day; at volumes greater than 25,000 vehicles per day, raised medians to provide physical separation were desirable.[9]

In Circular letter 66-108, dated 1966, the State of California reported that a curbed street with curbed medians is considered the highest type of conventional two-way road available to an urban area; continuous curbed medians should be avoided where the resultant one-way roadway would become too narrow for U-turns.[10]

The report "Arterial Street Design—Two Way Left Turn Lanes or Raised Medians," prepared for the Des Moines Urbanized Area Transportation Technical Committee, noted the following advantages of raised medians[11]:

- Reduced mid-block conflicts and left-turn conflicts both onto and off a major or arterial facility.
- Provision of pedestrian refuge areas.
- Encouragement of the development of alternative access roads, driveways and parallel streets.

The report also noted the disadvantages of raised medians—namely, increased U-turns and travel on local streets. The Des Moines study also indicated that:

- Two-way left-turn lanes had been successfully used on streets and highways with traffic volumes carrying 8,000 to 31,000 vehicles per day.
- Studies cited in the Des Moines report indicated that two-way left-turn lanes should not be used on facilities with over 25,000 vehicles per day.
- Based upon the findings of a study by Springfield, Missouri, the frequency of mid-block accidents could become alarmingly high on higher volume streets and highways with two-way left-turn lane facilities.

Survey Results

There were 85 responses to the survey questionnaires—27 from state departments of transportation and 58 from city governments. The responses are summarized in Table 1.

In addition to the information con-

tained in Table 1, the majority of the survey responses also indicated:

- A large majority of agencies prefer medians for a six-lane arterial.
- U-turns were considered safe and appropriate to supplement the street circulation system and to provide for directional turn movements.
- Design decisions should be made on site specific conditions.

Conclusions

Safety improvements as a result of the implementation or construction of continuous two-way left-turn lanes were generally based on comparisons of situations where there were no left-turn lanes and no medians in the before situation.

Although construction of raised medians is believed by some engineers to increase intersection accidents, no documentation or statistics could be found to substantiate that belief.

Data found in the literature indicate that reductions in accidents due to the construction of raised medians ranged from as little as 5% to as much as 80%.

Fire departments claim that raised medians increase emergency travel times in congested areas and medians in heavily built-up areas hamper fire-fighting operations.

Continuous two-way left-turn lanes should be used on streets with either one or two through lanes in each direction when average daily volumes range between 10,000 and 25,000 vehicles per day and when there is a strong need to provide for left-turn movements at all locations. When volumes exceed 25,000 vehicles per day, raised medians should be considered.

Most engineers view U-turns as safe and effective in general terms, but indicated that the decision to permit U-turns should be based on site-specific conditions.

U-turns are typically recommended with raised median implementation. U-turns should only be permitted

Table 1. Summary of Survey Responses

Question	State (%) Yes	State (%) No	City (%) Yes	City (%) No
Do you restrict left turns on urban major or arterial streets?	70	30	76	24
Do you use continuous two-way left-turn lanes on major or arterial streets?	20	80	20	80
Do you use specific measures to control left-turn movements?	70[a]	30	76[a]	24
Are U-turns restricted on major or arterial streets?	15	85	20	80

NOTE: Questions have been paraphrased for brevity.
[a]Fifty-two percent of the respondents cited medians as a specific measure.

at intersections when there is sufficient street width to allow for vehicles to make U-turns in one continuous movement and, in the case of signalized intersections, when there is a protected left turn.

Most engineers recommend the consolidation of traffic accessing adjacent land uses to selected intersections by the provision of a secondary circulation system between adjacent developments.

No documentation was found to substantiate the claim that raised medians cause businesses to fail, other than if a business was oriented to drive-up-type facilities.

Recommendations

Based on the conclusions drawn from the literature search and questionnaire survey, the City of Lakewood staff recommended the following for Wadsworth Boulevard:

- Raised medians be implemented throughout the length of the project.
- Adequate street widths and left-turn signal phasing be provided to allow for U-turns at signalized intersections.
- A secondary circulation system be constructed wherever possible to enable traffic accessing adjacent lane uses to utilize selected intersections or access points to execute left-turn maneuvers.

The recommendations were based on several factors. Volumes on Wadsworth Boulevard were well in excess of 25,000 vehicles per day, the maximum volume recommended for the continuous two-way left-turn lane alternative. Accident rates along most sections of Wadsworth Boulevard indicated a strong need for better access control and reduced accident rates provided by raised medians at mid-block locations. U-turns could be accommodated at both unsignalized and signalized intersections by the provision of adequate turning geometrics and the presence of protected left-turn phasing at signalized intersections.

In addition, raised medians would improve the design aesthetics.

A final factor was the lack of documentation indicating that businesses would fail as a result of the construction of raised medians.

Acknowledgments

The authors wish to acknowledge Marshall Elizer and Robert Kochevar for their contributions to this study.

References

1. Department of Transportation, City of Overland Park, Kansas. *Alternate Types of Design—Raised vs. Painted Medians.* November 1976.
2. Box, Paul C. "Medians for Main Business Streets." *Public Safety Systems*, May/June 1970.
3. "Fire Department Against Wilshire Planters." *Evening Outlook*, Wednesday, January 31, 1962.
4. Hill, Raymond M. "Raised Traffic Channelization." Board of Fire Commissioners, City of Los Angeles, California, April 10, 1967.
5. Office of Traffic Safety, Georgia Department of Transportation. Untitled traffic accident data. January 1985.
6. Traffic and Transportation Department, City of Arlington, Texas. Untitled traffic accident data. August 16, 1983.
7. Traffic and Safety, New York State Department of Transportation. *Mean Accident Rates on State Highways.* December 17, 1984.
8. Stover, Vergil, et al. *Synthesis of Safety Research Related to Traffic Control and Roadway Elements,* Volume 1. Office of Research, Development and Technology, Federal Highway Administration, U.S. Department of Transportation, December 1982.
9. Eicher, John P. *Paper on Two-Way Left Turn Lanes.* Office of Traffic Operations, Federal Highway Administration, U.S. Department of Transportation, September 7, 1984.
10. *Policy on Medians for Conventional Highways in Developed Areas.* Division of Highways Circular Letter #66-108, Department of Public Works, State of California, June 9, 1966.
11. Parker, Martin R. *Design Guidelines for Raised and Traversable Medians in Urban Areas.* Virginia Highway and Transportation Research Council, Virginia Department of Transportation, December 1983. ■

Robert D. Reish is transportation department manager for CRS Sirrine Inc. in Denver, which is involved in providing transportation planning and engineering services to highway, transit, and air service clients. Formerly, Reish had been a staff consultant to the City of Lakewood's Traffic Engineering Department. In addition, Reish had been vice-president of the URS Inc. Reish has also served as senior transportation planner for the Denver Regional Council of Governments and as highway engineer for the Federal Highway Administration. He received a BS from Michigan State University (1968) and an MS from the University of Colorado (1972).

Nazir Lalani is senior transportation and development engineer with Santa Barbara County, California. Previously, he was principal traffic engineer with the City of Lakewood, Colorado, and traffic engineer with the City of Santa Rosa, California. He has held local government traffic engineering positions with Jefferson County, Colorado; the City of Phoenix, Arizona; and the City of London, England. He was also employed as a consultant with Centennial Engineering. Lalani graduated from the University of Exeter in England in 1971 with a BS in chemical engineering. He also graduated from Arizona State University in 1981 with an MS in civil engineering. Lalani is a licensed professional engineer in the states of California and Colorado.