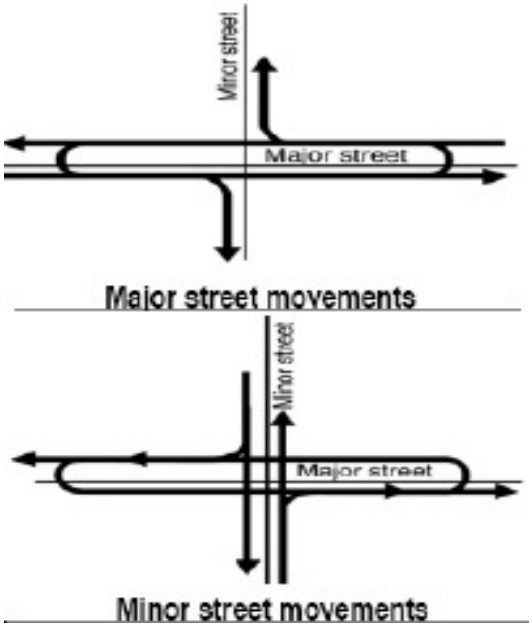
MEDIAN U-TURN INTERSECTIONS

Description

Turning movements directly affect intersection safety and efficiency, making left turns the key design factor in intersection improvement and design. Traditional left-turn lanes are not always feasible or able to adequately resolve congestion problems at some intersections. Innovative intersections have been developed to handle turning vehicles in a manner that disrupts the through traffic as little as possible.

The Median U-Turn (MUT) intersection design, also called a "ThrUTurn," guides all traffic, except right-turning vehicles, through the main intersection. The traffic desiring to turn left does so through U-turn openings in the median beyond the main intersection. Eliminating the left turn at the main intersection simplifies signal timings and provides more green time and less congestion to the major direction.



FHWA

Cost:	●●●●○
Time:	**Moderate**
Impact:	**Spot**
Who:	**City/State**
Hurdles:	**Right-of-Way**

Target Market

Signalized intersections with heavy congestion for through traffic

The MUT intersection is meant to alleviate congestion and delays on the through traffic caused by left turns and other signal phase problems. If through traffic is provided with more time to traverse the intersection, the queues may be shorter and more traffic can cross the intersection during the green time.

Moderate left-turn volumes

Too many left turns at the downstream U-turn location can cause congestion at that location by creating long queues even though the MUT design can help alleviate congestion at the main intersection.

How Will This Help?

- The MUT intersection design is typically cheaper than other innovative intersection designs. The cost for development and implementation may be lower due to fewer infrastructure changes or additional right-of-way, depending on the development of the adjacent land.
- Median U-Turn intersections can decrease signal complexity. The signal operation becomes simpler and allows more time for through-moving vehicles by eliminating the need to incorporate left turns in the signal timing.

Implementation Examples

Bloomfield Hills, Michigan, Telegraph Road (US 24) and 14-Mile Road: Michigan corridors with MUT designs typically have medians widths ranging from 60 to 100 feet to separate opposing directions of traffic and to provide an adequate median width for landscaping and beautification. The wide rights-of-way were originally established for "super highways," as they were called in the 1920s. By the early 1960s, many of these highways had capacity problems, generally because of interlocking left turns at the conventional intersections. In addition, a wide median on the major road increases the pedestrian crossing distance. Larger clearance intervals are required for the side street signal phase with an increased possibility of vehicles and pedestrians getting stranded in the median space.

The intersection shown in Figure 1 is near the northern end of a corridor containing numerous MUT intersections; every at-grade intersection on a 30-mile corridor of US 24, running from IH 75 in Taylor north to Orchard Lake Rd in Sylvan Lake, has been converted to a Median U-Turn configuration. At this intersection, northbound drivers on US-24 travel through the intersection with 14-Mile Road and make a U-turn at the crossover provided about 625 feet north, near the top of the figure. After making the U-turn, the now-southbound driver makes a right turn onto westbound 14-Mile Road. The process is the same for drivers wishing to make a left-turn onto eastbound 14-Mile Road. Drivers on 14-Mile Road still make direct left turns onto US 24 at the intersection.

Plano, Texas, Preston Road (SH 289) and Legacy Drive: The City of Plano recently installed a variation of a Median U-Turn design on their local street network, the first of three planned installations. The Plano City Council previously decided to not construct overpasses at those locations. Whenever traffic congestion levels rise to unacceptable levels at these locations, the City of Plano Transportation Division will consider incorporating other designs, such as what is locally named the Median Left-Turn design. The city reports that the new design provides 20 to 50 percent greater capacity than direct left-turns. This concept reduces the average delay for left-turning vehicles and through traffic. The primary difference between a Median U-Turn design originating in Michigan and a Median Left-Turn design in Plano is the width of the median at the intersection, shown in Figure 2. Because the alignment of Preston Road was originally planned for freeway expansion, it has an especially wide median at the intersection with Legacy Drive. This wide median changes the configuration of the U-turn crossovers.

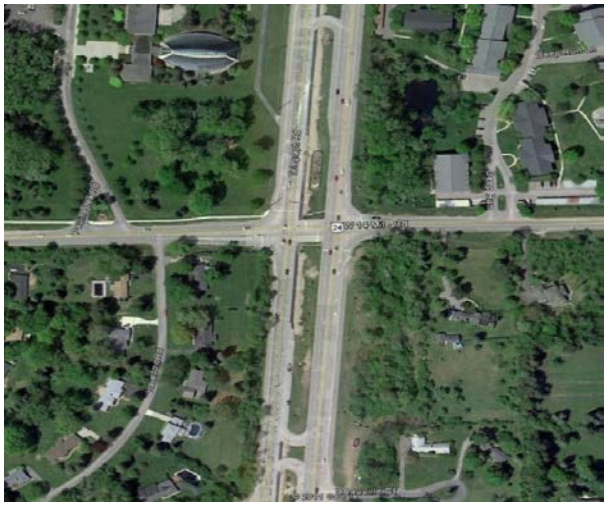


Figure 1. Median U-Turn Intersection in Bloomfield Hills, Michigan (Google Earth)

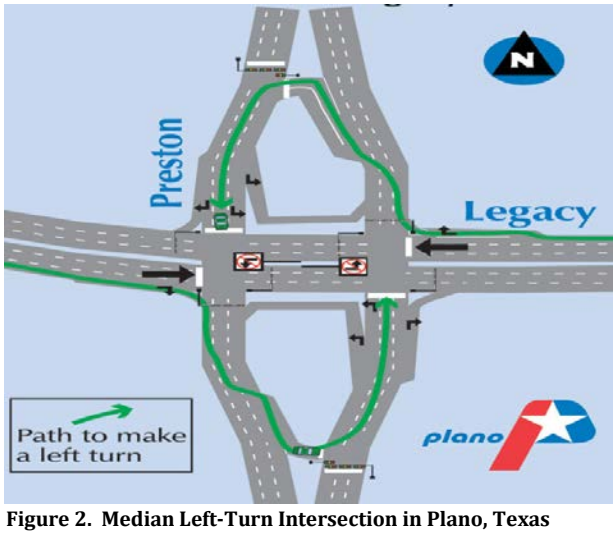


Figure 2. Median Left-Turn Intersection in Plano, Texas (City of Plano)

For more information, please refer to: http://mobility.tamu.edu/mip/strategies.php.

Application Principles and Techniques

The purpose of the MUT design is to improve traffic flow at intersection locations, especially for through traffic. This type of intersection design is typically used as a corridor improvement for high-speed and median-separated roadways with moderate levels of left-turns on both the major and minor roadway. An MUT intersection works best to replace typical intersections that have high through volumes and moderate left-turn counts. Intersections that are heavily congested due to signal timing delays caused by left turns are also good candidates for this treatment.

Issues

Median U-Turn intersection designs can result in situations in which there are too many right turns and a large amount of weaving from the right-side to the left-side of the road, disrupting the overall traffic flow. The MUT design can also cause vehicles to traverse the same intersection more than once, creating potential confusion and unnecessary trips over the same road. The MUT design requires more right-of-way to accommodate the turning radii of large vehicles.

Who is Responsible?

The local TxDOT office will typically be the responsible agency for most innovative intersection locations; these designs are often located on major state highways. Local governments may also wish to consider such treatments on new city roads.

Project Timeframe

The timeframe for constructing an MUT intersection depends on the existing intersection conditions. The implementation involves constructing a crossover through the median and shifting lanes to act as a left turn access. The MUT design is constructed in different stages depending on if the existing roadway is a two-lane highway or if the project is a conversion of a multilane divided highway. A typical MUT intersection can take between six months (conversion from typical multilane arterial) and 24 months (conversion from typical two-lane arterial) to construct.

Cost

The cost of a Median U-Turn intersection depends on whether a roadway expansion is required. The MUT design has a higher cost than a typical intersection due to the additional right-of-way required to accommodate the U-turns. Costs can be reduced, however, if the current median is already wide enough for the vehicle turns. Construction of an MUT intersection has greater initial costs compared to a conventional signalized intersection in most cases. Items for mobilization, overhead lighting, pavement markings, and drainage are similar for an MUT intersection as compared to a conventional intersection. There is more signing at an MUT intersection than at a conventional intersection. Turn prohibitions and directional signing for the traffic using the crossover for left-turn movements is a major part of that additional cost. If the median openings for the U-turns require signal control, additional signals and mast arms are required at each crossover. The signalization costs at an MUT intersection are higher compared to a conventional intersection, again raising the overall costs compared to a traditional intersection. Median U-Turn intersections can cost less than $100,000 to simply construct the U-turn roadways and add signing, or they can cost over $1 million to add signals, widen the roadway, and move utilities.

Data Needs

The adjacent development and access needs, the available right-of-way, segment lengths and widths, intersection/interchange geometry data, intersection/interchange spacing, traffic volumes (including peak hour volumes), turn counts, pedestrian and bicycle counts, and the typical speeds on the intersection approaches should be identified.

The necessary information also includes the crash history (type and frequency) corresponding to the intersection, the typical delay experienced, the existing roadway and median width, the available financial support for the project, and the optimized signal timing plans. Data regarding the current signal timing plan, the hardware capabilities, and the system's coordination capabilities are needed as well.

Median U-Turn Intersections Best Practice

- Type of Location: High-volume major streets, particularly at intersections with substantial left-turn volumes.
- Agency Practices: Coordination between planning, design, safety, and operations.
- Frequency of Reanalysis: After substantial land use changes or development; as travel increases or trips change in the area; at time of roadway widening or reconstruction.
- Supporting Policies or Actions Needed: Capability to fund improvements; multi-agency agreements and policies where roadways cross jurisdictional boundaries; driver education campaign.
- Complementary Strategies: Intersection pedestrian treatments, access management.

For More Information

Alternative Intersections/Interchanges: Informational Report (AIIR). Report No. FHWA-HRT-09-060. Federal Highway Administration, McLean, VA. 2010.

City of Plano, Median Left Turns information page. http://www.plano.gov/Pages/turn.aspx, accessed November 29, 2011.

Crawford, J. A. et al. *A Michigan Toolbox for Mitigating Traffic Congestion*. Texas Transportation Institute, Texas A&M University, College Station, TX, 2011.

Innovative Intersections: Overview and Implementation Guidelines. Wilbur Smith Associates, Columbia, SC, April 2008.

Jagannathan, R. *Synthesis of the Median U-Turn Intersection Treatment: TechBrief*. Report No. FHWA-HRT-07-033. Federal Highway Administration, McLean, VA. 2007.

Mobility Improvement Checklist: Adding Capacity, Vol. 3. Texas Transportation Institute, College Station, TX, 2004.

A Policy on Geometric Design of Highways and Streets. American Association of State Highway and Transportation Officials, Washington, D.C., 2004.

Utah Department of Transportation, ThrUTurn Intersection information page. http://www.udot.utah.gov/thruturn/, accessed November 29, 2011.