INNOVATIVE INTERSECTIONS


Superstreet with Median U-Turn in Leland, NC (innovativeintersections.org)

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

Description

Intersections are crucial to a street's performance; they control the road's speed, safety, cost, and efficiency. Accommodating turns can directly affect safety and efficiency, making left turns the key design factor in intersection improvement. Traditional left-turn lanes, however, are not always feasible or able to adequately resolve congestion problems at some intersections.

A number of innovative intersection designs have been developed in recent years to provide alternative ways for accommodating left-turning vehicles.[1] Many of them incorporate elements that seem similar to interchanges, but their at-grade design saves the cost of constructing overpasses. Some designs may also deliberately reduce average vehicle speeds while serving more vehicles and shortening travel times through the intersection and along the corridor.

Target Market

Suburban Major Streets

Innovative intersection designs are typically intended for major streets in suburban and exurban areas. These roadways frequently have higher speeds and serve higher volume corridors.

How Will This Help?

Several types of innovative intersections can help divert left turns away from the main intersection and allow more green time for through traffic. Options include:

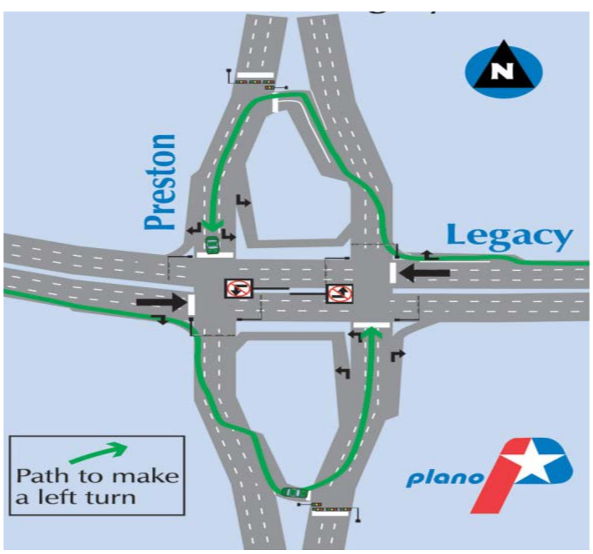
- A two-stage left-turn. Before the intersection, vehicles turn left onto a road that is parallel to their initial road; they travel toward their desired road and turn left while the traffic on the main road has a green signal.
- A right turn followed by a U-turn. These are typically for traffic from minor cross streets; all vehicles are required to turn right at the major street. Vehicles that wish to travel in the opposite direction can make a U-turn through the median approximately 500 to 1000 feet away and join the major street traveling in the desired direction.
- Use an adjacent minor roadway to handle turning movements. A separate road away from the intersection can be used to route left turning traffic and simplify the signal system.

These intersection designs can reduce the number of vehicles and/or the number of conflicting movements using the main intersection, providing for simpler and more efficient signalization, shorter cycle lengths, fewer conflict points, shorter delays, and improved traffic flow.[2, 3]

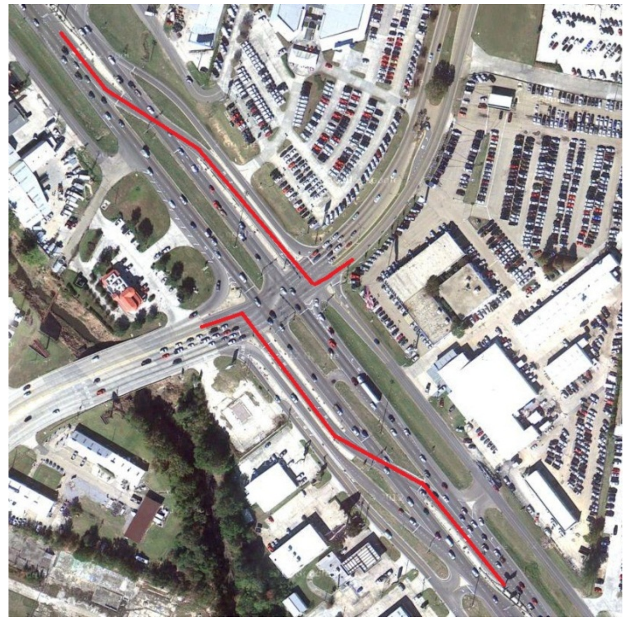
Studies of median U-turn intersections and corridors have found 20 to 50 percent increases in capacity over traditional intersections and 14 to 18 percent over dual left-turn lanes.[3]

Implementation Examples

Median U-Turn, 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. 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.



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


Continuous Flow Intersection in Baton Rouge, Louisiana.
(Google Maps)

Continuous Flow Intersection, Baton Rouge, Louisiana, US 61 (Airline Highway) and LA 3246 (Seigen Lane) in Baton Rouge: This intersection is recorded as the third Continuous Flow (or Displaced Left-Turn) Intersection in the United States, the first in the southeast, and the largest at the time of completion. The intersection is estimated to reduce evening rush-hour delay from 225 seconds per vehicle to 30 seconds, according to the Louisiana DOT and design consultants. The CFI relieves congestion at the intersection by removing the left-turn conflicts from US 61. Motorists making left-hand turns from Airline are routed to a left-turn bay, completing the turn in a two-step process:

- Motorists on Airline who want to turn left are routed into a left-turn bay several hundred feet before from the main intersection. When the Siegen cross-traffic light turns green, so does the left-turn bay light, bringing Airline motorists who were in the left-turn bay forward to a second signal.
- Then when Siegen cross-traffic stops on red and Airline through-traffic has a green signal, motorists on Airline complete the left turn onto Siegen.

Application Principles and Techniques

These innovative intersection designs improve the traffic flow through the intersection by diverting left turns away from the main intersection. These designs can help reduce intersection congestion and simplify the signal phases at the main intersection. The use of innovative intersections can simplify signal operation by reducing the number of phases and limiting the effect of left turns.

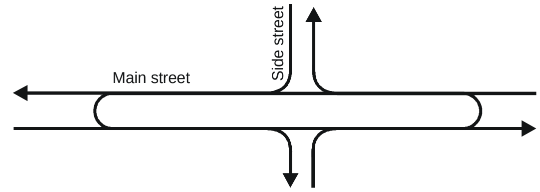
The design details are determined by a process described in a recent Federal Highway Administration report.[2] The steps involve establishing project objectives, assessing pedestrian activities and conflicts, assessing the available right-of-way, evaluating the access needs, estimating capacity and traffic volume, and conducting computerized simulation models to test viable alternatives.

Common innovative intersection designs include:

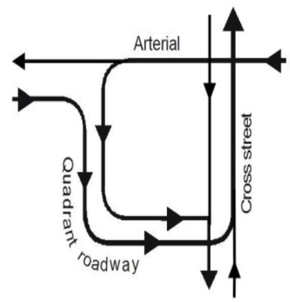
- *Restricted crossing U-turns* direct the left-turning vehicles to make a U-turn at an opening in the median after they pass through the main intersection.
- *Continuous flow intersections* separate the left turns onto a segment that is parallel to the road, but allows them to turn at the next intersection with other phases moving at the same time.
- *Quadrant intersections* direct left-turns onto a connector road before the main intersection and guide the vehicles onto the intersecting roadway.

Issues

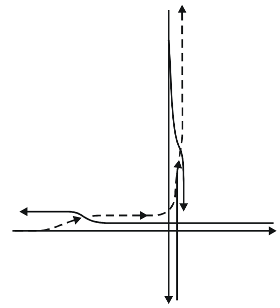
Right-of-way constraints are the primary concern for innovative intersection designs, which is why they have been typically applied in locations that are developing. Constructing an innovative intersection at an undeveloped site also helps establish access management principles before owners develop their property and set access points. Some treatments (e.g.,



Restricted Crossing U-Turn



Quadrant Intersection



Continuous Flow

median U-turn design) may be applied to urbanized arterials if the median is already present. Acquiring the right-of-way to widen the intersection could be a substantial task in fully developed areas.

In addition to right-of-way concerns, driver and pedestrian education is also critical; the new intersection signal operations may be unfamiliar to most road users. Public announcements, brochures and flyers, public meetings, and videos containing images of simulated operations (or of existing intersections at other locations) are all useful educational pieces. The Alamo Regional Mobility Authority has used these techniques on their website[5] to show the public how to navigate the new superstreet intersections on Loop 1604.

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

Innovative intersection project timelines are often lengthy, due to the need for a detailed design, public education, and construction activities. The Loop 1604 superstreet plan[5] consists of three projects, each with its own multiyear timeline to obtain environmental clearance, complete the design, and perform the construction while carrying traffic through the area. Construction activities on a recently completed superstreet project on US 281 north of San Antonio, described as an interim solution,[5] were completed in less than a year, but that construction took place without building additional travel lanes and the timeframe does not include previous design tasks. The environmental assessment for this corridor began in 2008, the superstreet concept was proposed in January 2009, and a public meeting to discuss early design concepts and operational benefits was conducted in June 2009; with a completion date in October of 2010, the overall timeframe of this project was approximately 30 months. In contrast, a continuous flow intersection project in Utah with fewer environmental assessment concerns took 18 months from the beginning of the environmental document process to the end of construction.[6]

Cost

Depending on adjacent land use and design needs, costs of innovative intersection projects can be higher due to the need for more right-of-way and more complicated construction. There are few completed projects for each type of intersection and location, but estimates from early installations are being documented. As an example, the recently opened continuous flow intersection at Bangerter Highway and 3500 South in Salt Lake City, UT, was reported to cost $7.5 million. A second example is the continuous flow intersection at US 30 and Summit Drive in Fenton, MO, which had a total construction cost of $4.5 million.[3]

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 signal timing plan, the intersection's hardware capabilities, and the system's coordination capabilities are needed as well.

Innovative Intersection 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

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

References

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4. El Esawey, M. and T. Sayed. "Comparison of Two Unconventional Intersection Schemes: Crossover Displaced Left-Turn and Upstream Signalized Crossover Intersections." In *Transportation Research Record 2023*. Transportation Research Board, Washington, DC, 2007, pp. 10-19.

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