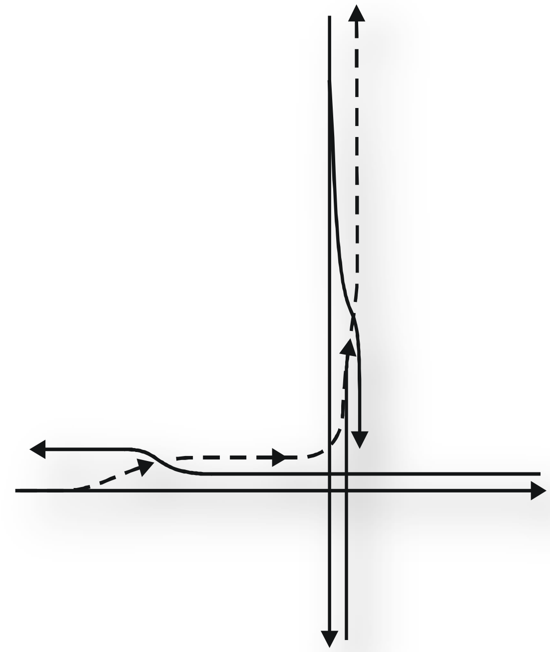
CONTINUOUS FLOW INTERSECTIONS



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

Description

Accommodating turns directly affects 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 were therefore developed to handle turning vehicles in a manner that disrupts the through traffic as little as possible.

A continuous flow intersection (CFI), or displaced left-turn (DLT) intersection, removes the left-turning vehicles from the main intersection and directs them to a separate roadway running parallel to the main lanes. This design allows more green time for the major traffic flows.

Target Market

Intersections with Large Left Turn Movements
Major intersection conflicts and congestion can be caused by left-turning vehicles, especially if the queue spills into the main traffic lanes. Guiding the left-turning traffic onto a separated road segment allows more green time and fewer phases at the main intersection for the through traffic. The left-turns are accommodated in a simpler intersection away from the primary location.

Intersections with Available Right-of-Way
Continuous flow intersections require larger amounts of right-of-way to widen the road for the left-turn roadway segments. CFI intersections can improve the traffic flow through the intersection if the area is not overly developed or if more funding can be obtained to acquire the land needed.

How Will This Help?

Continuous flow intersections can help maximize capacity and decrease delay by allowing smoother traffic flow through the intersection. This design alters the intersection to separate left-turns and through traffic. Multiple traffic streams (turning and through) can proceed at the same time, reducing congestion when compared to traditional intersections.

Implementation Examples

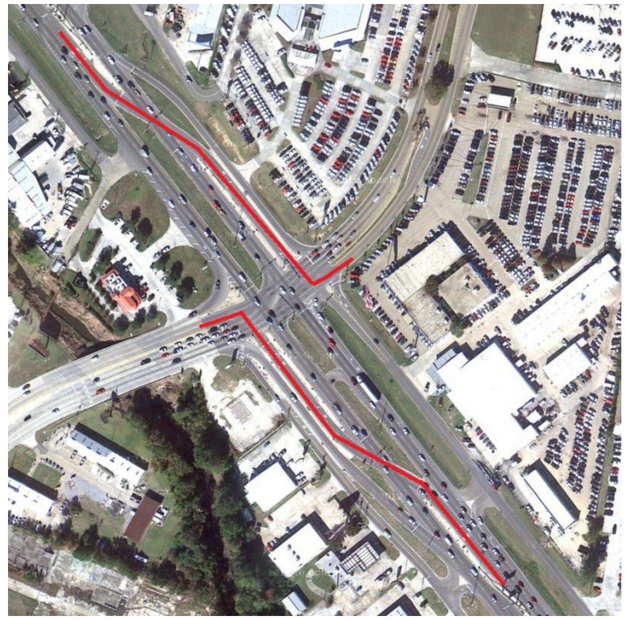
IH 35, San Marcos, Texas: TxDOT recently opened the first continuous flow intersection in the state in San Marcos on Loop 82 (Aquarena Springs Drive) at IH 35 and a second following shortly after on SH 80 (Hopkins Street). TxDOT built both to alleviate congestion from the nearby Texas State University and improve auto and pedestrian safety. Both locations had high left-turn volumes and other restrictions that made other options less attractive. The combined cost for both intersections was estimated to be $4.7 million.

Oak Hill Parkway, Austin, Texas: The city of Austin is getting its first set of continuous flow intersection along US 290 to serve as a stop-gap measure addressing mobility concerns until funding for the Oak Hill Express (a 6-lane tolled expressway) can be obtained. Three CFIs, at a cost of $6.5 million, will be used at SH 71, William Cannon, and Joe Tanner. Preliminary models estimate the intersections will improve travel times in the area by 30 to 50 percent.

Salt Lake City, Utah: An ongoing Utah DOT project is upgrading a section of Bangerter Highway (SR 154); the approximately 12.5-mile corridor will have five continuous flow intersections when complete. This corridor project, collectively called "Bangerter 2.0," is nearing completion on several specific improvements; CFI improvements included additional left turns, bicycle lanes, updated sidewalks, and road widening. Two other CFIs were already reported to be in place on the corridor, at 4700 South and 5400 South.

Baton Rouge, Louisiana, US 61 (Airline Highway) and LA 3246 (Seigen Lane): This intersection is recorded as the third CFI in the United States, the first in the southeast, and the largest at the time of completion. The intersection in the figure below 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.



Continuous Flow Intersection in Baton Rouge, Louisiana (AlternativeIntersections.org)

Fenton, Missouri, Gravois Road (Missouri Route 30) and Summit Road: This intersection in southern St. Louis County is the first CFI in Missouri. It is in close proximity to the SH 30 and SH 141 intersection, meaning the Missouri DOT needed to make sure they reduced how much time vehicles were stopped at this intersection. Projections show that the new design should reduce delays at this intersection from an average of 25 seconds per vehicle to a little more than 17 seconds per vehicle. Assuming a 25 percent increase in the number of vehicles after 20 years, this type of intersection should reduce delays from almost two minutes to about 30 seconds.

Application Principles and Techniques

Continuous flow intersections are applied in areas that require handling large traffic volumes, especially left-turns and through movements. The CFI design is best for roadways that reach or exceed capacity and have access management plans. The design is also recommended for areas that have sufficient right-of-way for expanding the footprint of the intersection.

Issues

Continuous flow intersection designs can be costly because additional right-of-way is needed for the project. CFI intersections can also be challenging for pedestrians to cross due to the additional crossing distance and unique traffic flows. Certain crossing maneuvers may not be completed within one signal cycle, but median islands provide refuge for pedestrians to wait for subsequent walk intervals.

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 of a CFI/DLT intersection depends on the current intersection conditions and the amount of expansion required. An intersection that is not in a developed area and has adequate room to expand will have a shorter timeframe than one in a heavily used area. Depending on construction phasing and whether an intersection can be closed during construction, a typical CFI intersection can take between 12 and 24 months to implement.

Cost

The cost of a CFI/DLT intersection design depends on the available right-of-way and other geometric considerations. The cost can increase if buildings and parking lots are acquired in the additional right-of-way. Redesigning the access management plan and signalization in the area can greatly increase the financial requirements of the project. Based on bids for existing installations and a case study example provided in FHWA's *Alternative Intersections/Interchanges Informational Report*, continuous flow intersections typically cost between $4 million and $7.5 million to implement.

Data Needs

The adjacent development and access needs, the available right-of-way, segment lengths and widths, intersection geometry data, intersection 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 intersection's hardware capabilities, and the system's coordination capabilities are needed as well.

Continuous Flow 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

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

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

Brewer, M.A. *Recent Roadway Geometric Design Research for Improved Safety and Operations*. NCHRP Synthesis 20-05/Topic 42-04. Draft Final Report. Transportation Research Board, Washington, DC. October 2011.

Continuous Flow Intersections. Metro Analytics, http://www.continuousflowintersections.org/intersections/show/IntersectionCategoryId:1/IntersectionTypeId:7, Accessed: October 27, 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.

Louisiana Department of Transportation and Development, press release on CFI opening. http://www.dotd.la.gov/pressreleases/Release.aspx?key=627, accessed November 30, 2011.

Missouri Department of Transportation, CFI information page. http://www.modot.org/stlouis/links/ContinuousFlowIntersections2.htm, accessed November 30, 2011.

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

Utah Department of Transportation, Bangerter Highway Upgrade information page. http://www.udot.utah.gov/bangerter2.0/Bangerter2-0.aspx, accessed November 29, 2011.