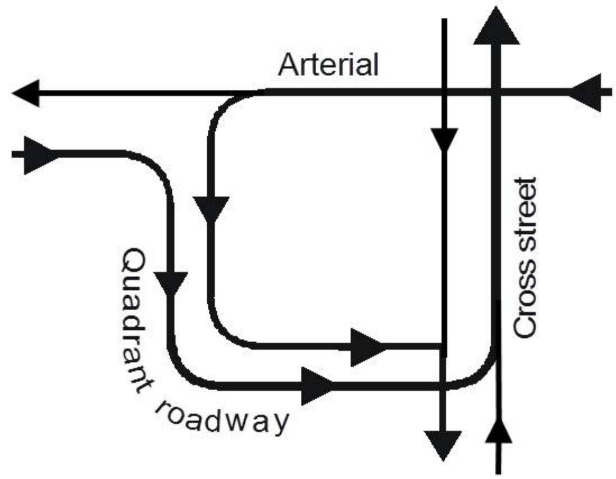
QUADRANT ROADWAY

Description

Accommodating turning movements directly affects intersection safety and efficiency, making left turns the key 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 major street through traffic as little as possible.

The Quadrant Roadway intersection design alleviates congestion at a four-approach intersection. One (Single-Quadrant) or all (Multiple-Quadrant) left-turn movements are guided onto connector roads in different quadrants away from the intersection, eliminating these maneuvers from the main intersection.



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

Target Market

- *Intersections with large through volumes*
  The quadrant intersection separates turning vehicles from through-moving vehicles at a separate location away from the main intersection. The lack of turning vehicles, especially left-turning, allows the other cars to move more freely through the intersection.
- *One approach with high left-turn movements*
  Single-Quadrant Roadway intersections handle low to moderate turn volumes best. If only one intersection approach has a large turn count, this intersection type guides the vehicles through the intersection to help alleviate congestion at that spot.
- *Intersections with available right-of-way*
  The quadrant intersections require large amounts of right-of-way to construct the connector(s) used for left-turn movements. The expanded intersection allows traffic to travel through a previously unused surrounding area.

How Will This Help?

Quadrant Roadway intersections are <u>less intimidating and easier to navigate</u> for pedestrians than other innovative designs or typical intersections. The lack of turning vehicles at the main intersection and the overall traffic environment provides an area that is also accessible for pedestrians and transit riders.

A Multiple-Quadrant Roadway intersection can <u>eliminate left-turn movements from the main intersection</u>. The added connector road for each of the intersection approaches removes the left-turning vehicles, and it eliminates the conflict points caused by these vehicles as well as the signal time needed to accommodate the left-turn movements.

Implementation Examples

Charlotte, North Carolina, Sam Furr Road (NC 73) and Statesville Road (US 21): This intersection improvement is part of a larger project to widen NC 73 from two lanes to four lanes with center turn lanes from west of US 21 to east of NC 115. Eastbound NC 73 traffic turning left onto US 21 will continue straight through the intersection, turn right onto Holly Point Drive, and then right onto US 21. Westbound NC 73 traffic wanting to turn left onto US 21 will now turn left on Holly Point Drive and then left onto US 21. Motorists wanting to turn right on US 21 from NC 73 westbound can either turn right at the intersection with US 21, or turn left onto Holly Point Drive and right onto US 21.

This project is a design-build project. Design-build allows NCDOT to contract a team that consists of both designers and a contractor to simultaneously design and construct the project. The estimated completion date for this project was originally November of 2012, but by using the design-build approach, the project is estimated to be completed by April of 2012.

Saratoga Springs, Utah, W. Main Street/W. Cedar Fort Road (SR 73) and N. Redwood Road/N. 10800 Street W. (SR 68): The intersection shown in Figure 2 is near the west edge of the developed area of Saratoga Springs, northwest of Orem. The design of this intersection has been developed such that the quadrant configuration does not have to be implemented immediately, but the infrastructure is available so that the operational changes can be made after the area has been more fully developed. This will save time and money in the implementation project, because neither the city nor Utah DOT will have to acquire extensive right-of-way or build new alignment. In this configuration, three of the quadrant roadways are already built and function as local streets until the conversion to quadrant operations is necessary. The fourth roadway in the southwest quadrant can be built as needed, but the right-of-way can be acquired while the land is undeveloped.

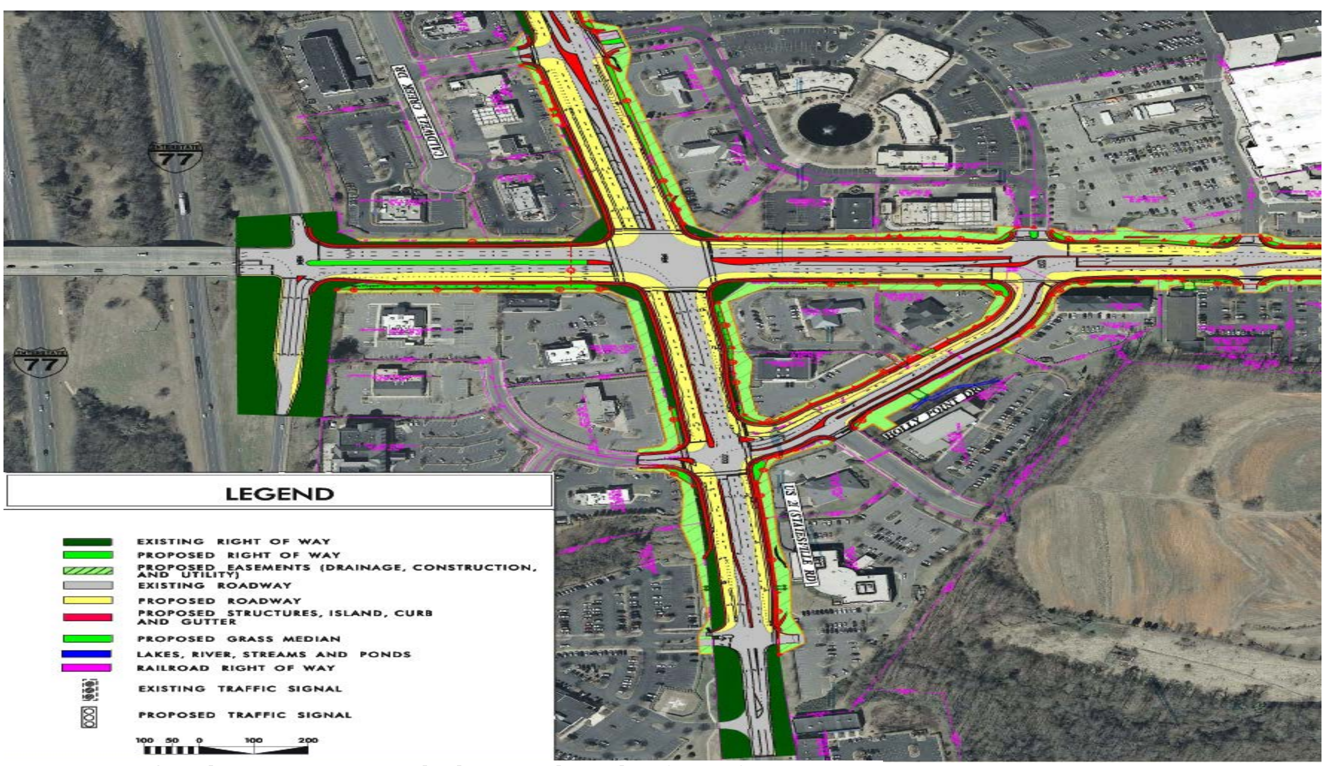


Figure 1. Site of Quadrant Intersection in Charlotte, North Carolina (NCDOT)

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

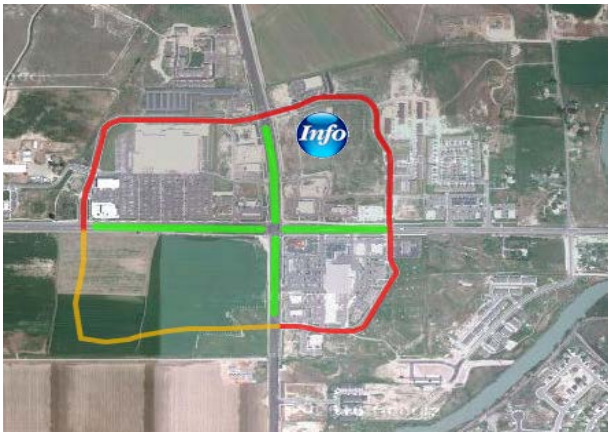


Figure 2. Proposed Quadrant Intersection in Saratoga Springs, Utah (AlternativeIntersections.org)

Bend, Oregon, Bend Pkwy (US 97) at Powers Road: This intersection in Bend, Oregon (Figure 3) is a third example of a quadrant intersection. Quadrant intersections typically have larger footprints, where the area inside the quadrant roadways is developed and access is provided from those quadrant roadways. This alignment eliminates left turns on US 97, requiring left-turning drivers to travel through the intersection and then make a right turn on the quadrant roadway downstream of the intersection, followed by another right turn onto Powers Rd. Eastbound and westbound drivers on Powers Rd. may make a left turn onto US 97, but right-turning drivers can avoid the intersection by using the quadrant roadway. A raised median throughout the footprint of the intersection physically restricts left-turns on US 97.

Application Principles and Techniques

The purpose of Quadrant Roadway intersections is to reduce intersection congestion and limit the travel time required to traverse the location. This design alleviates congestion at intersections that have large through volumes and a low to moderate turn count. If more than one approach fulfills this requirement and the quadrant design is deemed best, each approach should have a connector to limit the traffic volume on each connector. The surrounding area should be developed to handle the new connector and traffic volumes common with this design.

Issues

Quadrant Roadway intersection designs can be costly because additional right-of-way is needed for the project. A second common issue is that the multiple quadrants create T-intersections, resulting in more signals and timing complexity for the road network.

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 Quadrant Roadway intersection depends on the existing intersection conditions and the amount of expansion required. If an existing road is a viable candidate to serve as the required connector, the overall timeframe will be reduced. A typical Quadrant Roadway intersection could take between two and 12 months to construct.

Cost

The cost of a quadrant intersection will typically be higher than that of a standard intersection due to the extra land and additional signals needed. The price of implementing this intersection design depends on the extra amount

Figure 3. Quadrant Intersection in Bend, Oregon (Google Earth Mapping Service)

of land needed (one quadrant or multiple) and the current use of the land. The financial requirement will increase if a new roadway is needed to serve as the connector, rather than using an existing roadway. A Quadrant Roadway intersection could cost less than $100,000 if the only requirement is fine-tuning existing infrastructure, or it could cost well over $2,500,000 to acquire at least 4.5 acres of right-of-way, build four quadrant roadways, and install additional traffic signals.

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.

Quadrant 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 improvements – 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.

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

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