NORTH CAROLINA
Department of Transportation

Fifth TRB Urban Street Symposium

Raleigh, NC

May 23, 2017

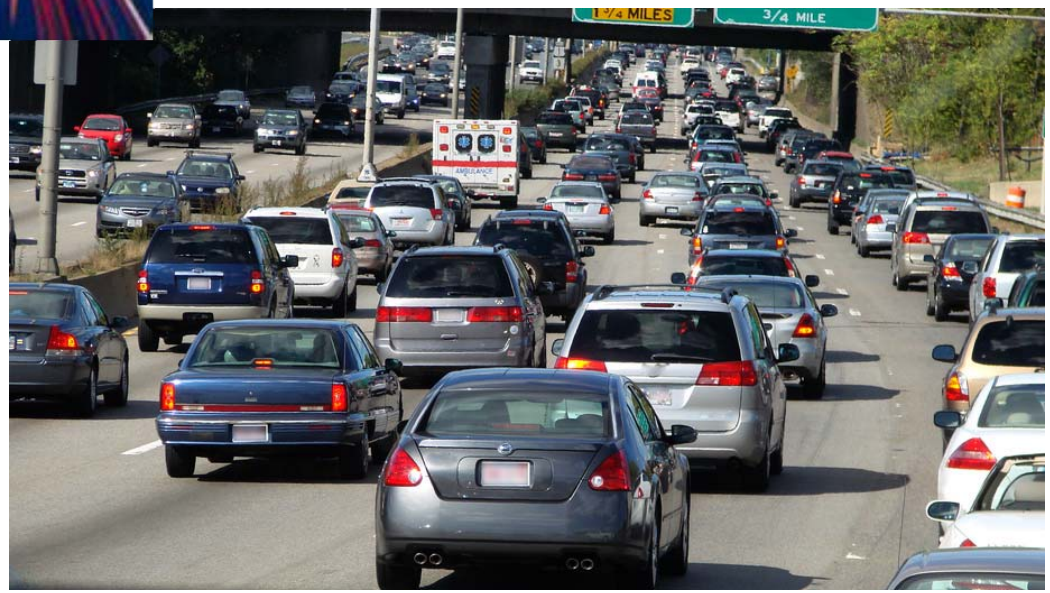
Innovative Intersections and Interchanges in North Carolina

Michael P. Reese, PE, CPM

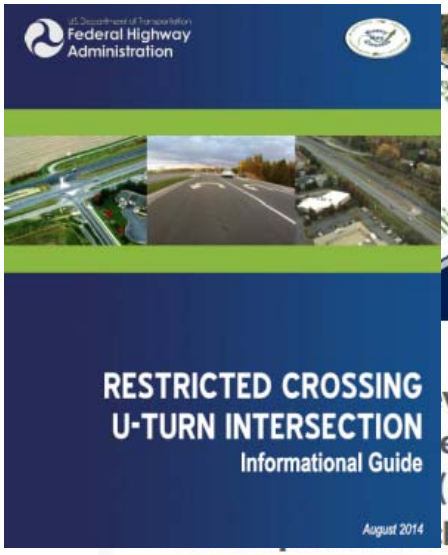
NCDOT Congestion Management Section

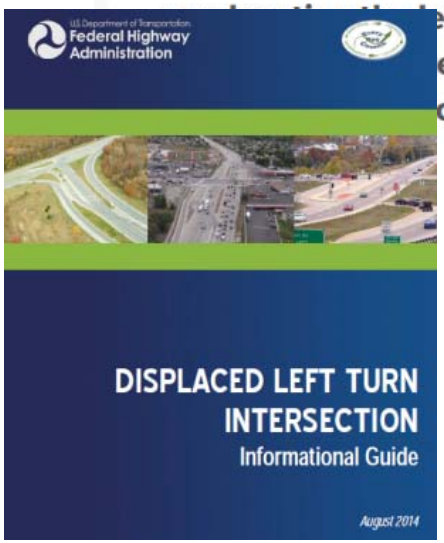
NCDOT: Mission Statement

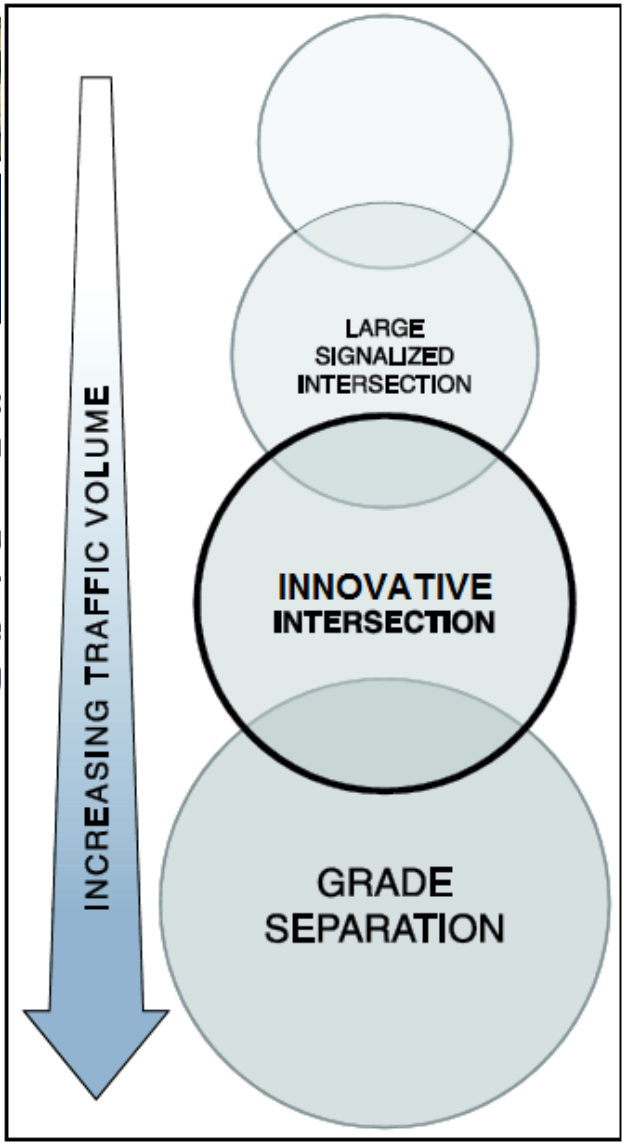
Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

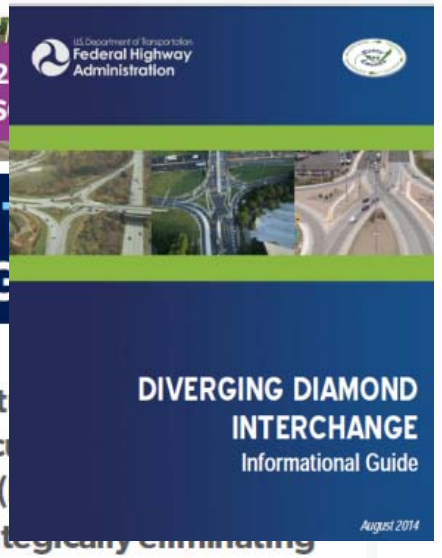


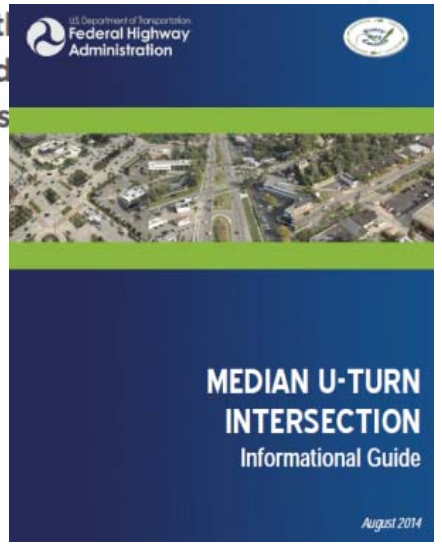
FHWA Everyday Counts Guidance











https://www.fhwa.dot.gov/everydaycounts/edctwo/2012/pdfs/edc_intersection_21.pdf

Road Junction Hierarchy

More Cost, More Complex

Stop Control | Round-about | Simple Signal | Complex Signal | Grade Separation | Interchange

At Grade Intersection

Less Cost, Simpler





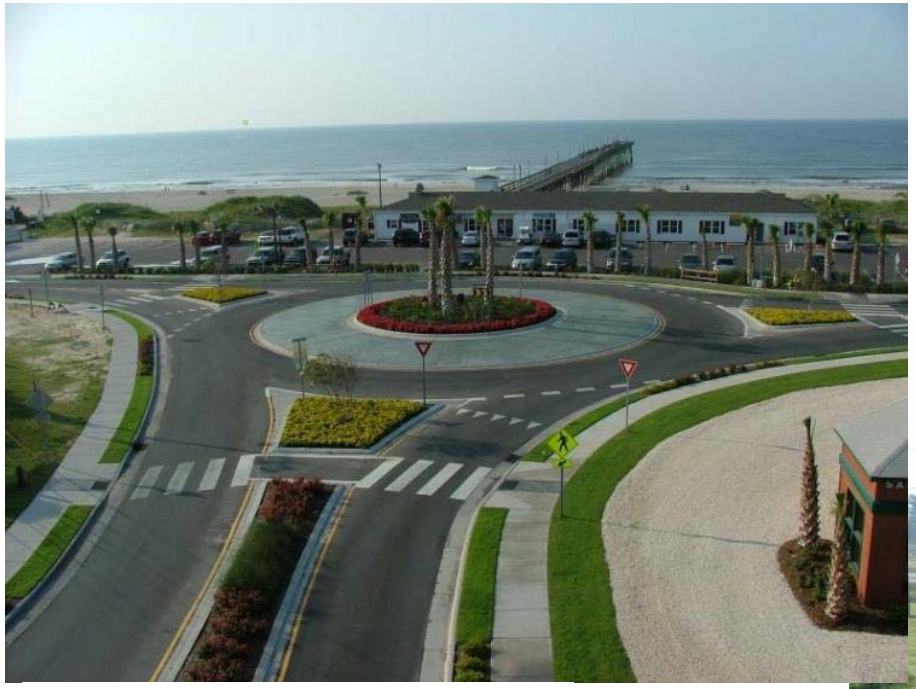
What is best for…

Safety? Operations? Cost? Public/Environment?

Innovative Intersections and Interchanges in NC

- Roundabouts
- Superstreets
- Quadrant Left Intersections
- Continuous Flow Intersections
- Diverging Diamond Interchanges
- Turbine Interchange

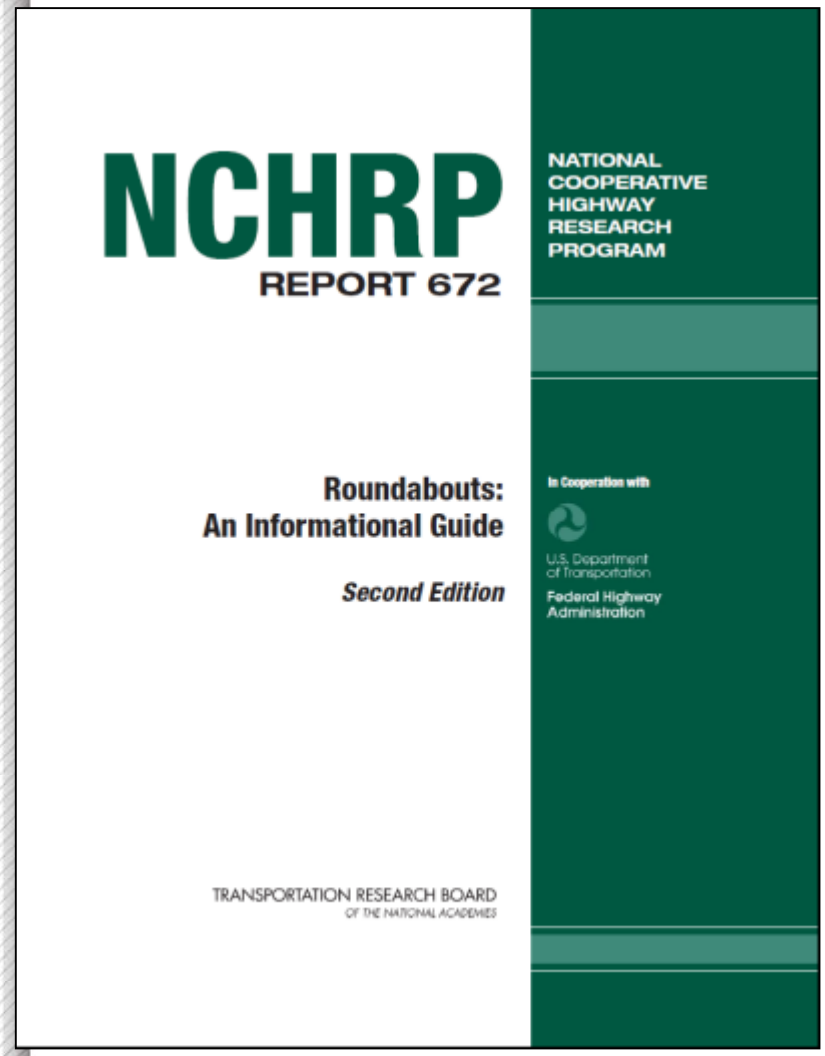
Roundabouts in NC

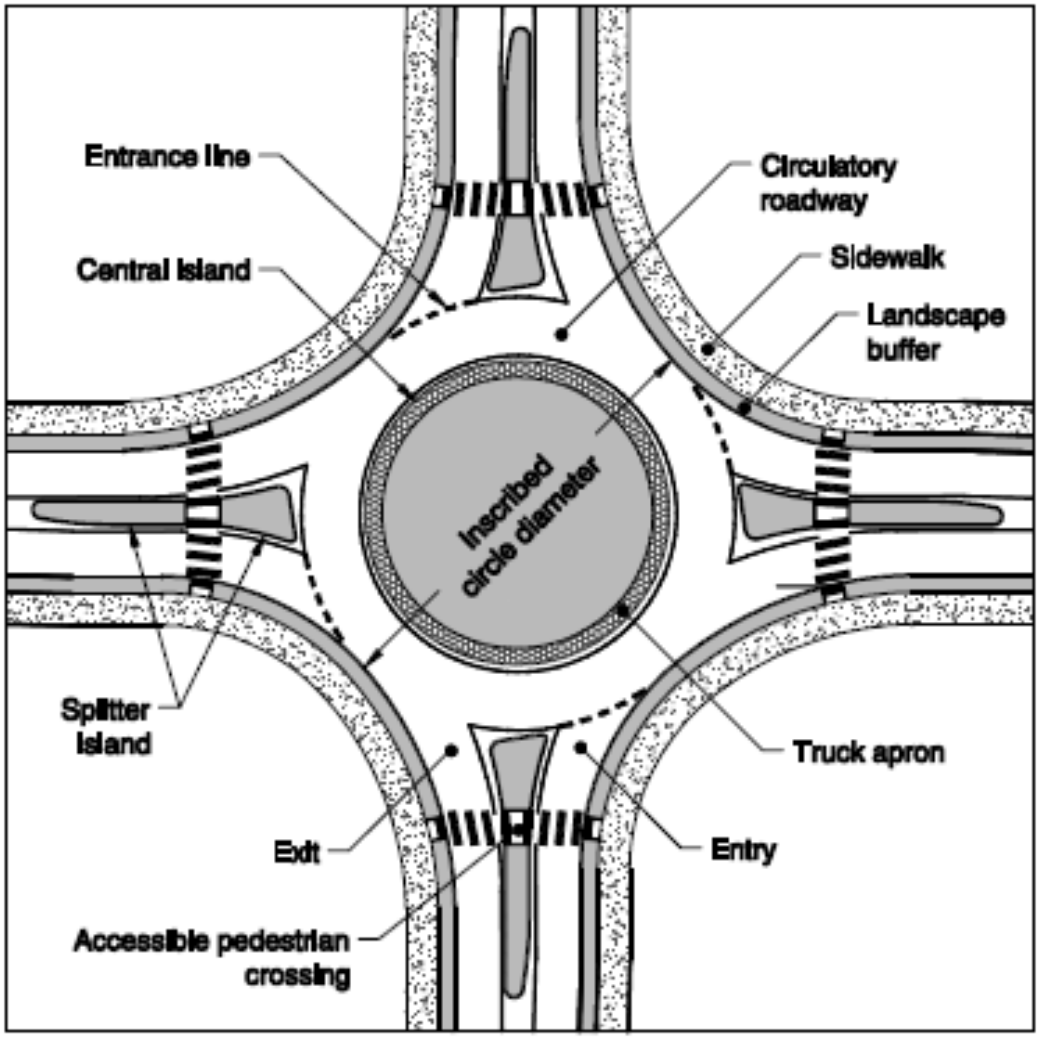


NC 904 at First St,
Ocean Isle Beach

NC 22 at Moore County Airport, Carthage

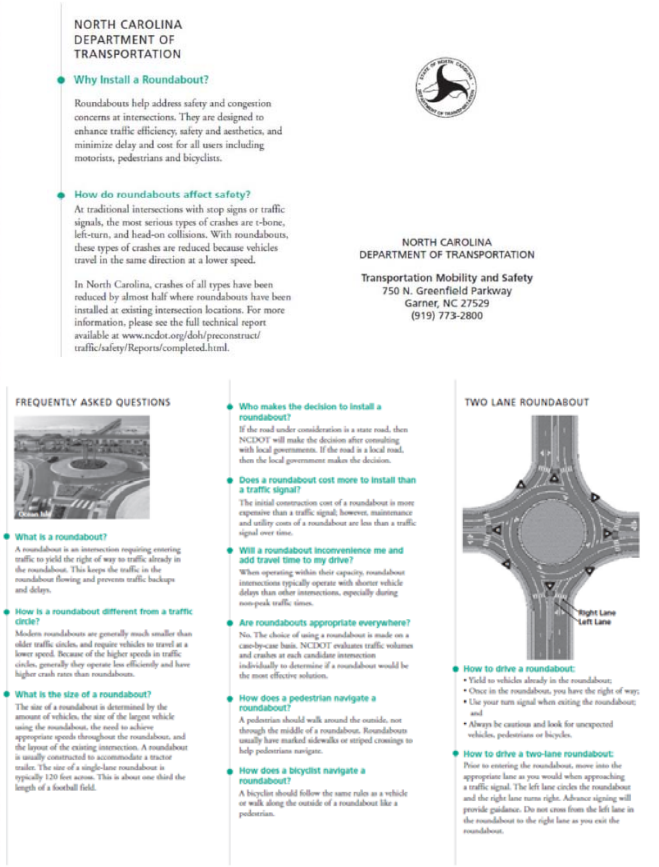
Basic Roundabout Components





http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_672.pdf

NCDOT Roundabout Public Outreach Materials



NORTH CAROLINA
DEPARTMENT OF
TRANSPORTATION

Why Install a Roundabout?

Roundabouts help address safety and congestion concerns at intersections. They are designed to enhance traffic efficiency, safety and aesthetics, and minimize delay and cost for all users including motorists, pedestrians and bicyclists.

How do roundabouts affect safety?

At traditional intersections with stop signs or traffic signals, the most serious types of crashes are t-bone, left-turn, and head-on collisions. With roundabouts, these types of crashes are reduced because vehicles travel in the same direction at a lower speed.

In North Carolina, crashes of all types have been reduced by almost half where roundabouts have been installed at existing intersection locations. For more information, please see the full technical report available at www.ncdot.org/doh/preconstruct/traffic/safety/Reports/completed.html.

NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Transportation Mobility and Safety
750 N. Greenfield Parkway
Garner, NC 27529
(919) 773-2800

FREQUENTLY ASKED QUESTIONS

What is a roundabout?

A roundabout is an intersection requiring entering traffic to yield the right of way to traffic already in the roundabout. This keeps the traffic in the roundabout flowing and prevents traffic backups and delays.

How is a roundabout different from a traffic circle?

Modern roundabouts are generally much smaller than older traffic circles, and require vehicles to travel at a lower speed. Because of the higher speeds in traffic circles, generally they operate less efficiently and have higher crash rates than roundabouts.

What is the size of a roundabout?

The size of a roundabout is determined by the amount of vehicles, the size of the largest vehicle using the roundabout, the need to achieve appropriate speeds throughout the roundabout, and the layout of the existing intersection. A roundabout is usually constructed to accommodate a tractor trailer. The size of a single-lane roundabout is typically 120 feet across. This is about one third the length of a football field.

Who makes the decision to install a roundabout?

If the road under consideration is a state road, then NCDOT will make the decision after consulting with local governments. If the road is a local road, then the local government makes the decision.

Does a roundabout cost more to install than a traffic signal?

The initial construction cost of a roundabout is more expensive than a traffic signal; however, maintenance and utility costs of a roundabout are less than a traffic signal over time.

Will a roundabout inconvenience me and add travel time to my drive?

When operating within their capacity, roundabout intersections typically operate with shorter vehicle delays than other intersections, especially during non-peak traffic times.

Are roundabouts appropriate everywhere?

No. The choice of using a roundabout is made on a case-by-case basis. NCDOT evaluates traffic volumes and crashes at each candidate intersection individually to determine if a roundabout would be the most effective solution.

How does a pedestrian navigate a roundabout?

A pedestrian should walk around the outside, not through the middle of a roundabout. Roundabouts usually have marked sidewalks or striped crossings to help pedestrians navigate.

How does a bicyclist navigate a roundabout?

A bicyclist should follow the same rules as a vehicle or walk along the outside of a roundabout like a pedestrian.

TWO LANE ROUNDABOUT

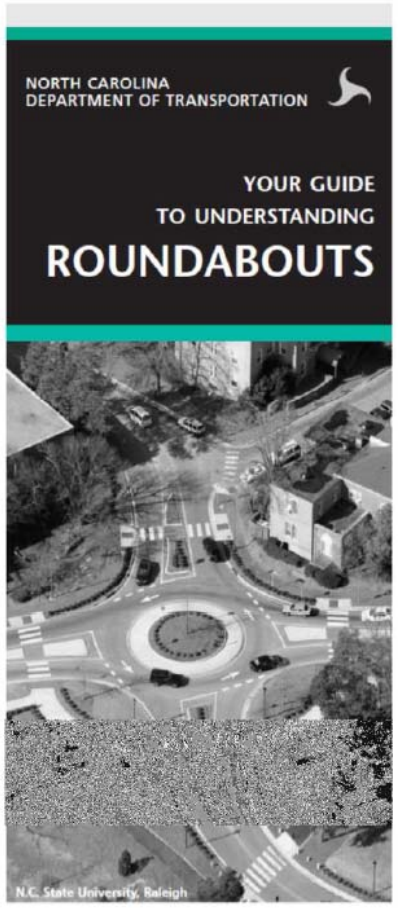
Right Lane
Left Lane

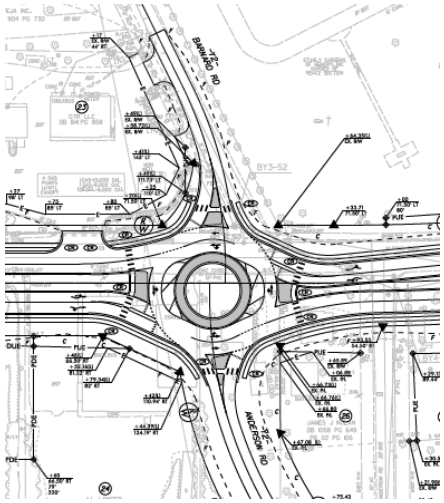
How to drive a roundabout:

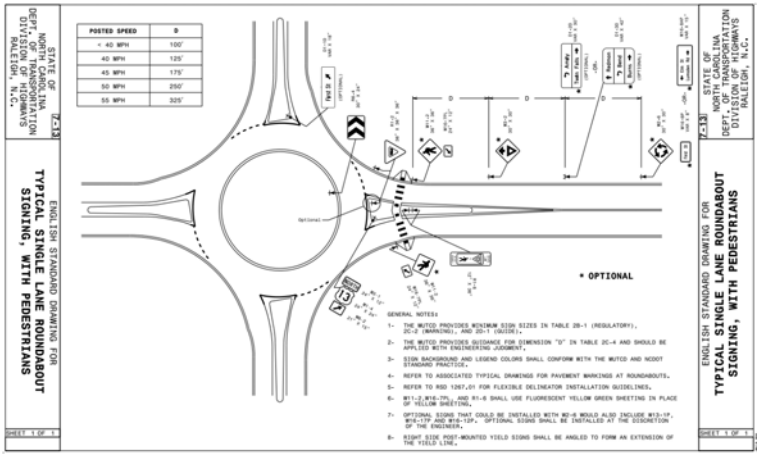
- Yield to vehicles already in the roundabout;
- Once in the roundabout, you have the right of way;
- Use your turn signal when exiting the roundabout; and
- Always be cautious and look for unexpected vehicles, pedestrians or bicycles.

How to drive a two-lane roundabout:

Prior to entering the roundabout, move into the appropriate lane as you would when approaching a traffic signal. The left lane circles the roundabout and the right lane turns right. Advance signing will provide guidance. Do not cross from the left lane in the roundabout to the right lane as you exit the roundabout.







https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/R38_br.pdf

Pullen Rd at Stinson Dr, NC State U, Raleigh

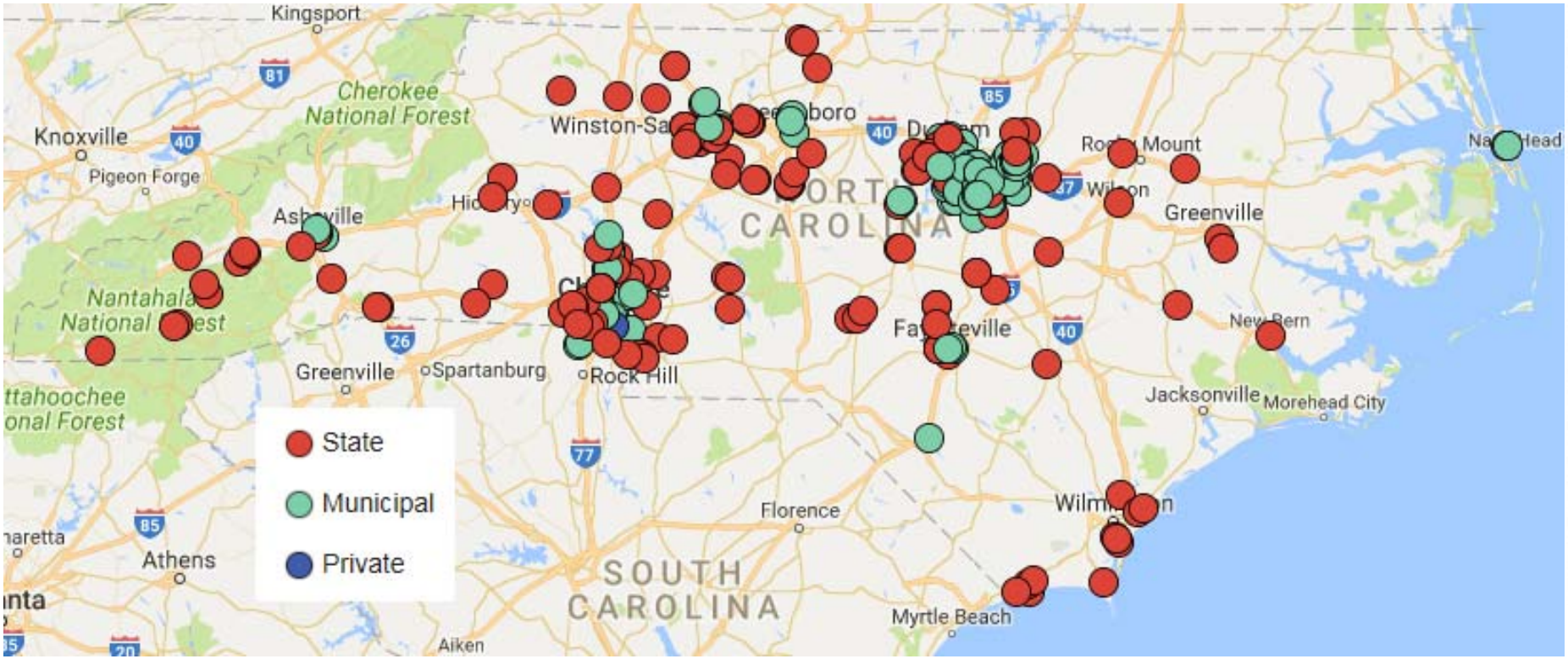
I-485 at Prosperity Church Rd, Charlotte

Griffith Street, Davidson

NC 84 at Weddington-Matthews Rd

Roundabouts in North Carolina

- 269 Roundabouts in NC Inventory (19 are multilane)
- 155 are state-maintained



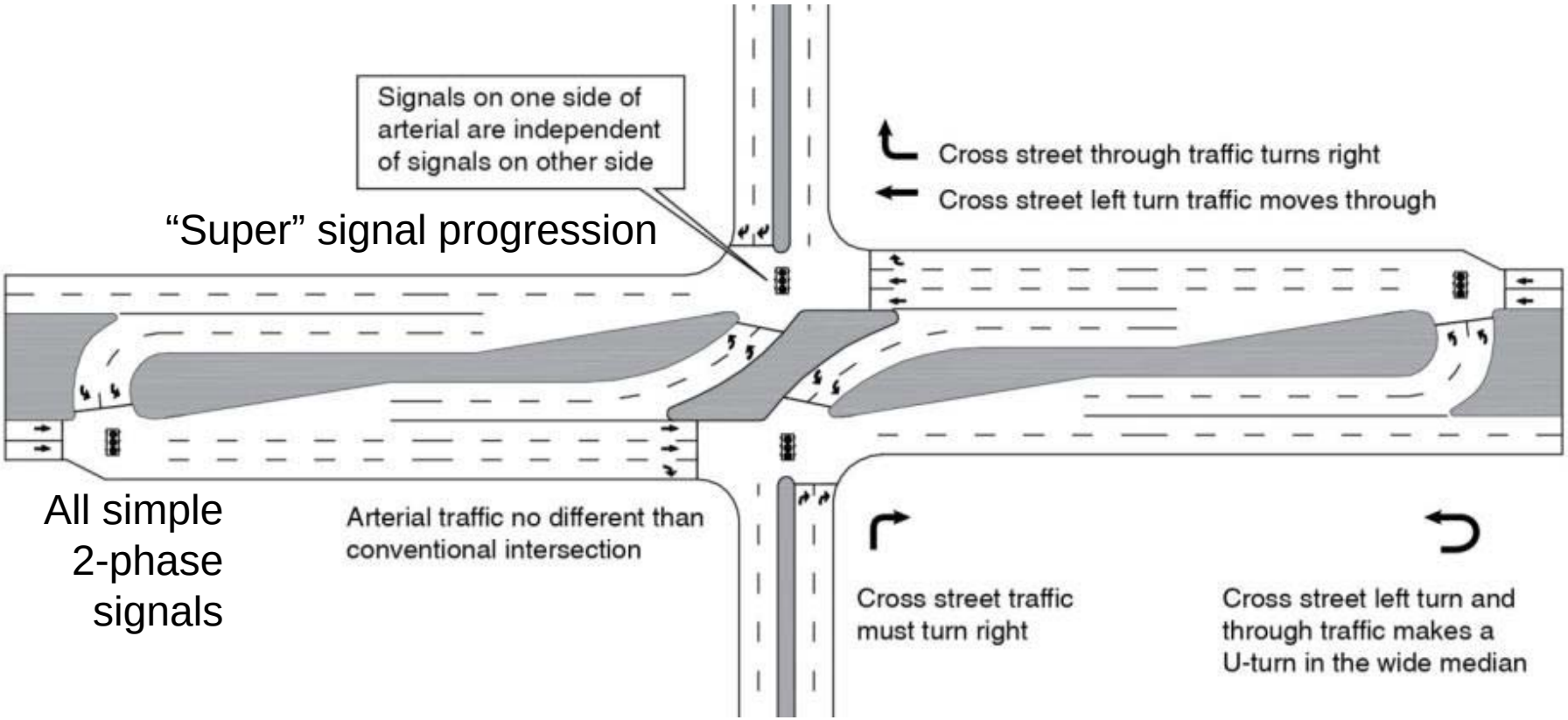
Superstreets in NC

US 23/74 at Cope Creek Rd, Sylva

US 17 at Olde Waterford Way, Leland

The Superstreet

Redirecting minor movements to improve safety and mobility



"Super" signal progression

All simple 2-phase signals

*Other configurations possible based on site specific conditions.

Left-overs with median U-turn (a.k.a. RCUT, J-Turns), No direct lefts, Michigan Left (a.k.a. MUT), "Left-out" Intersection, Offset "T" Intersections

Superstreet Reduction in Crashes

- Safety impact by collision type for unsignalized superstreets, %

Collision Type	Crash Reduction %
Total	-46
Fatal and injury	-63
Angle and right turns	-75
Rear ends	-1
Sideswipes	-13
Left turns	-59
Other	-15

Superstreet Benefits and Capacities
(NCDOT/NCSU Research Project 2009-06)

NCDOT Superstreet Public Outreach Materials

North Carolina Department of Transportation

"Connecting people and places in North Carolina - safely and efficiently, with accountability and environmental sensitivity."

SUPERSTREETS

A tool for safely and efficiently managing congestion

Conventional Intersection

The North Carolina Department of Transportation (NCDOT) is challenged to try non-traditional approaches to relieving congestion and improving safety in heavily developing areas. The superstreet is a non-traditional option the NCDOT has found beneficial. Congestion on urban and suburban arterials is an imminent consequence of developing regions of the state. Conventional intersections can create added congestion and long queues resulting in increasing delays in travel time due to the increased traffic flow.

Superstreet

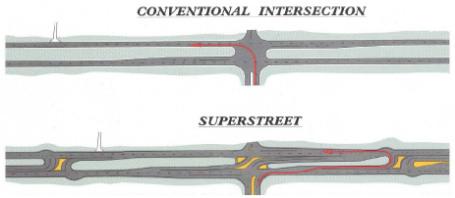
A superstreet is a type of intersection in which side-street traffic is redirected from going straight through or left at a divided highway intersection. All side-street traffic must turn right, but can then access a U-turn to proceed in the desired direction. Other configurations of superstreets are possible based on site specific conditions.

The Superstreet concept provides an effective alternative along heavily traveled regional arterials in areas with anticipated commercial and residential growth. The design concept is contingent upon a series of features that reduce potential conflict points while maintaining traffic flow, resulting in:

- Increased safety by reducing conflict points at major crossovers
- Time savings from simplified signal phasing
- Enhanced signal coordination
- Dedicated U-turn lanes for efficiency

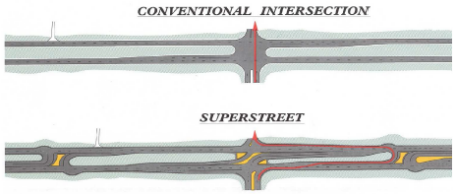
Left turn movement

The conventional intersection allows left turn movements from side streets creating numerous conflict points. The superstreet reduces conflict points therefore increasing safety.



Through movement

The conventional intersection allows through movements onto side streets, creating numerous conflicts points. The superstreet intersection prohibits through movements onto side streets forcing a right turn movement onto the arterial, then a U-turn back onto the arterial to safely



Benefits of Superstreets

- Safety
- Time savings
- Increased capacity
- Access Management
- Improved traffic flow
- Land use and corridor protection
- Alternative to interchange (Less cost)
- Smaller "footprint" than an interchange

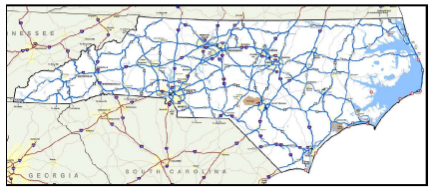
Strategic Transportation Corridors

The superstreet alternative improves mobility as a step-by-step process by bringing us one step closer to a freeway/expressway.

The North Carolina Department of Transportation (NCDOT) in collaboration with the Department of Commerce and Department of Environment and Natural Resources has established a "vision" for 5,400 miles of highway along 55 corridors throughout the state. Its primary purpose is "to provide a network of high-speed, safe, reliable highways throughout North Carolina."

https://www.ncdot.gov/download/projects/NCDOT_Synchronized_Streets_Flier.pdf

https://connect.ncdot.gov/projects/planning/TPB%20Documents/Strategic_Corridors_Fact_Sheet.pdf



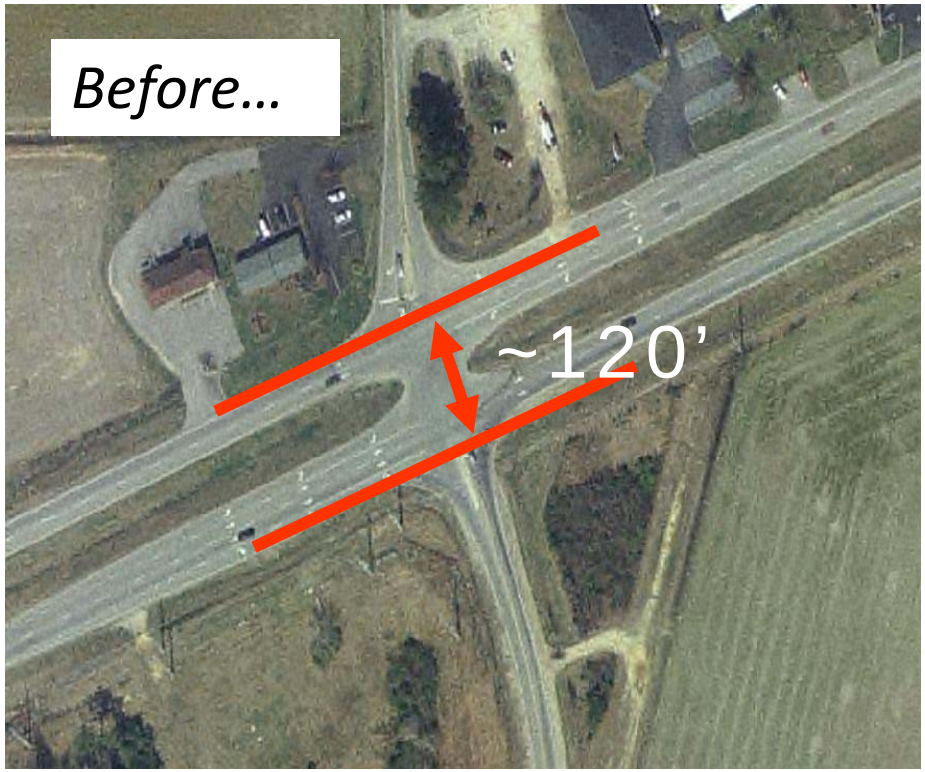
For more information, please contact:

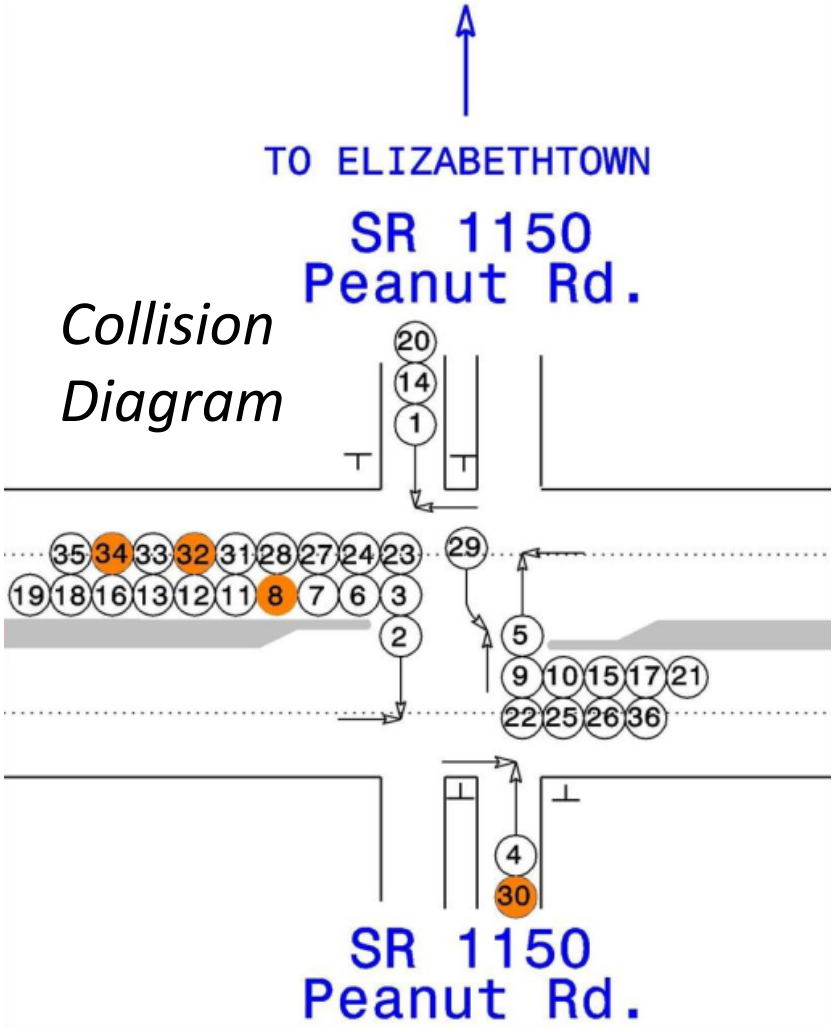
North Carolina Department of Transportation
1-800-DOT-4YOU www.ncdot.gov

https://www.ncdot.gov/download/projects/publichearings/ncdot-superstreetbrochure-2013-01.pdf

NC 87 at Peanut Plant Rd, Elizabethtown

Long distance to cross main corridor may take more time than the gap motorists are able to choose





NC 87 at Peanut Plant Rd, Elizabethtown

3 years before – 24 crashes, 21 injury crashes
3 years after – 2 crashes, zero injury crashes

US 17 Superstreet, Leland

- Four-lane divided expressway corridor
- Before: no signals, little side street traffic
- After: Large residential developments, three commercial centers
- Improvements paid for by three developments in one construction project
- 28-42% travel time savings on US 17 through movements

US 15-501 at Erwin Rd/Europa Rd, Chapel Hill

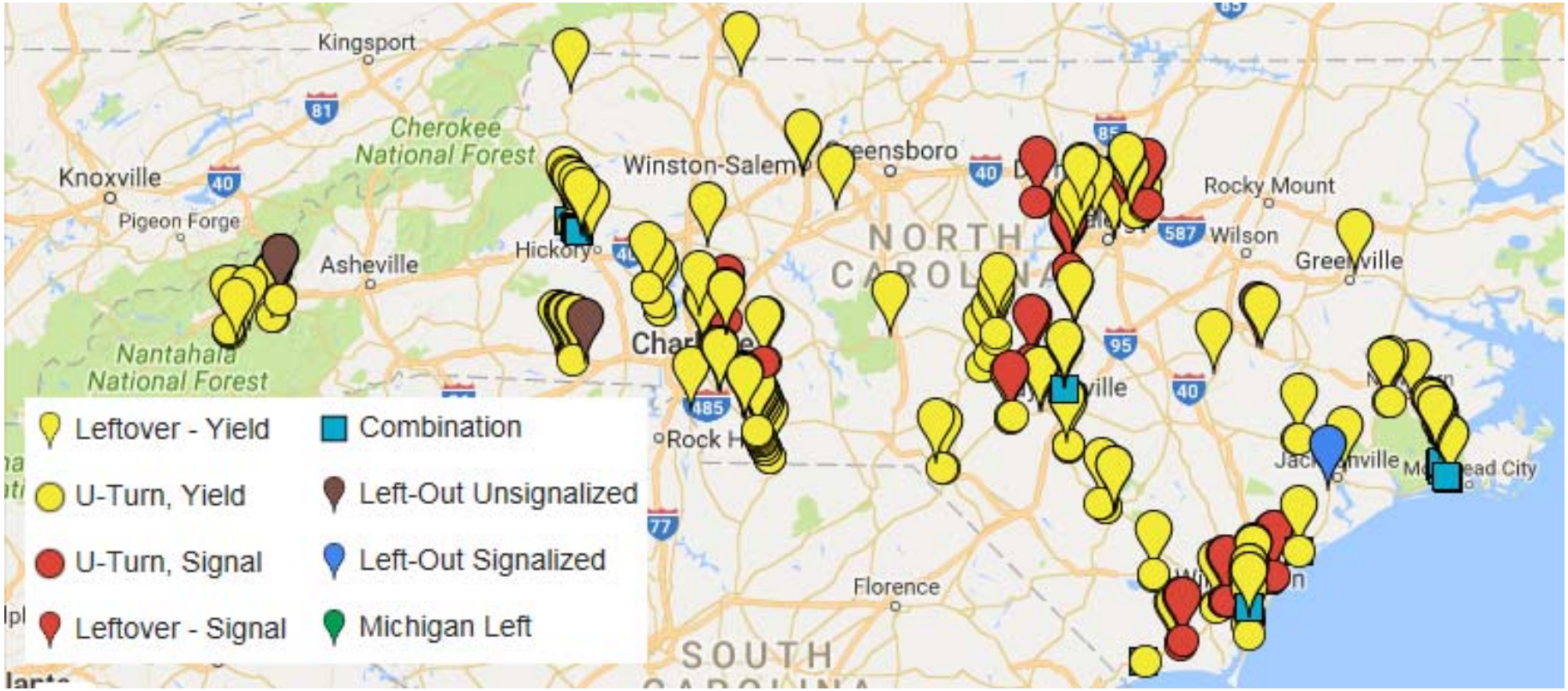
No Direct Left Superstreet

Poplar Tent Rd at Odell School Rd, Concord

Michigan Left Superstreet (MUT)

Superstreets in North Carolina

- More than 180 Superstreet Intersections in NC Inventory

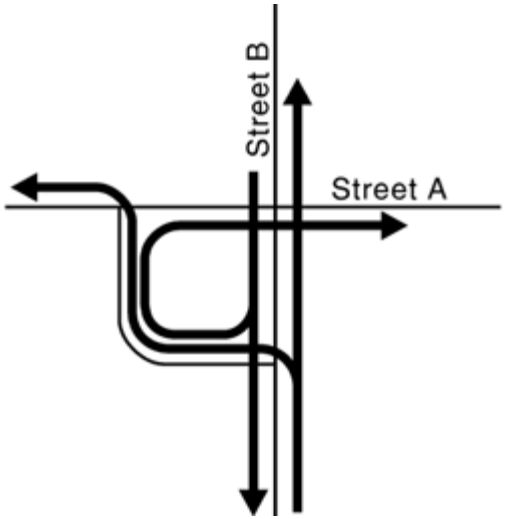


Quadrant Lefts in NC

NC 73 at US 21, Huntersville

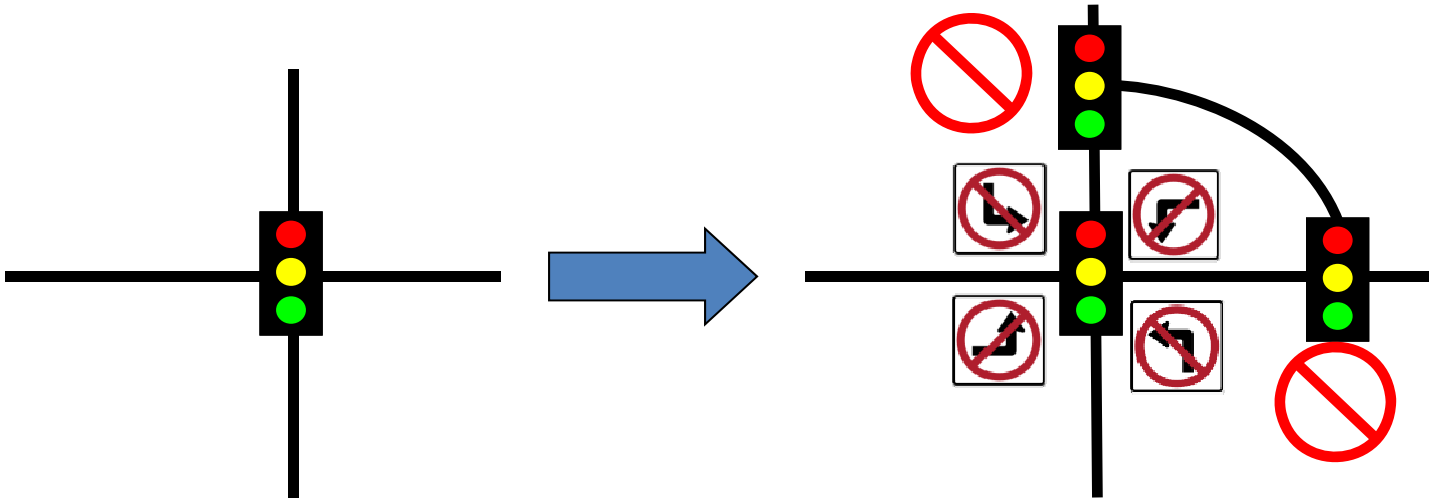
NC 73 at Ingleside Farm Rd, Lincoln Co.

Movements from Street B



Quadrant Left Intersection

- Replace **one** congested traffic signal with **three** or more **simpler**, less congested traffic signals



- **More signals** can lead to **less total delays**
- Fewer conflict points than one all-movement int.
- Can reduce road widening and can save time before an interchange is needed

NCDOT Quadrant Left Public Outreach Materials

NC 73 Quadrant Left Roadway

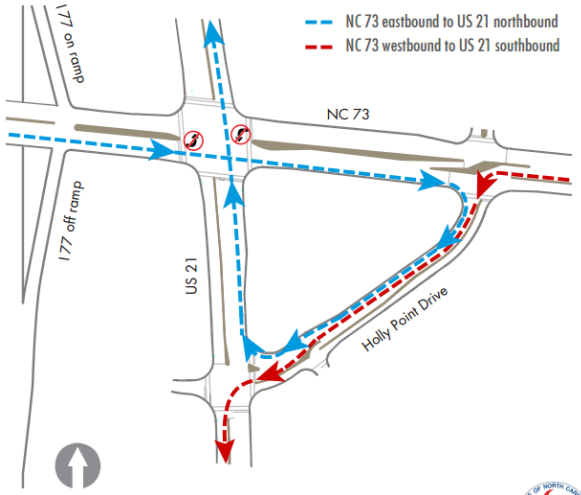
The "Quadrant Left" at the intersection of NC 73 and US 21/Statesville Road will be opened on Wednesday, March 7, 2012 at 10:00 p.m.

Eastbound NC 73 traffic wanting to turn left onto US 21 North 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 South will turn left on Holly Point Drive and then left onto US 21 South.

No left turns will be allowed from NC 73 to US 21/Statesville Road. All through movements and right turns will remain unchanged at this intersection.

See sketch and log onto www.ncdot.gov/projects/nc73widening for more information.

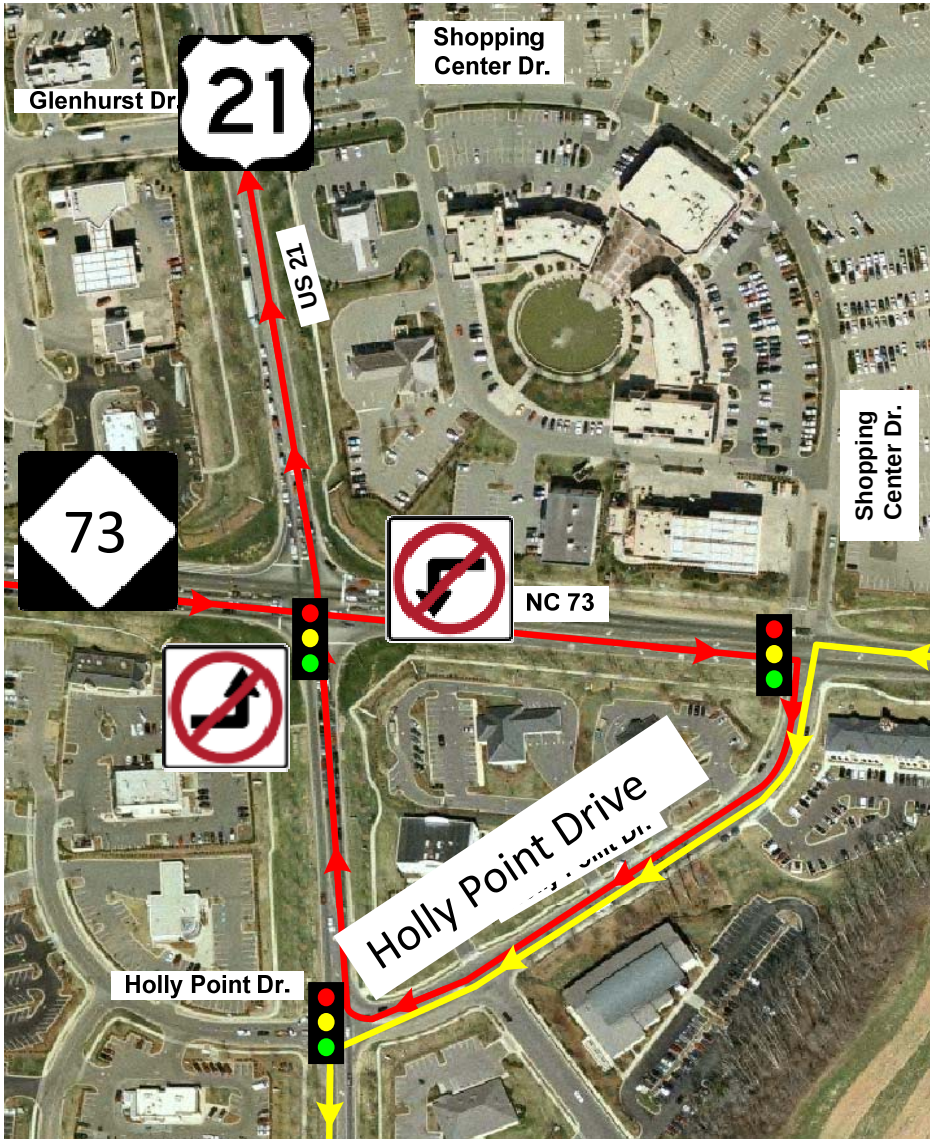


Project Contact | Jeff D'Arruda, Resident Engineer, 704-455-2958

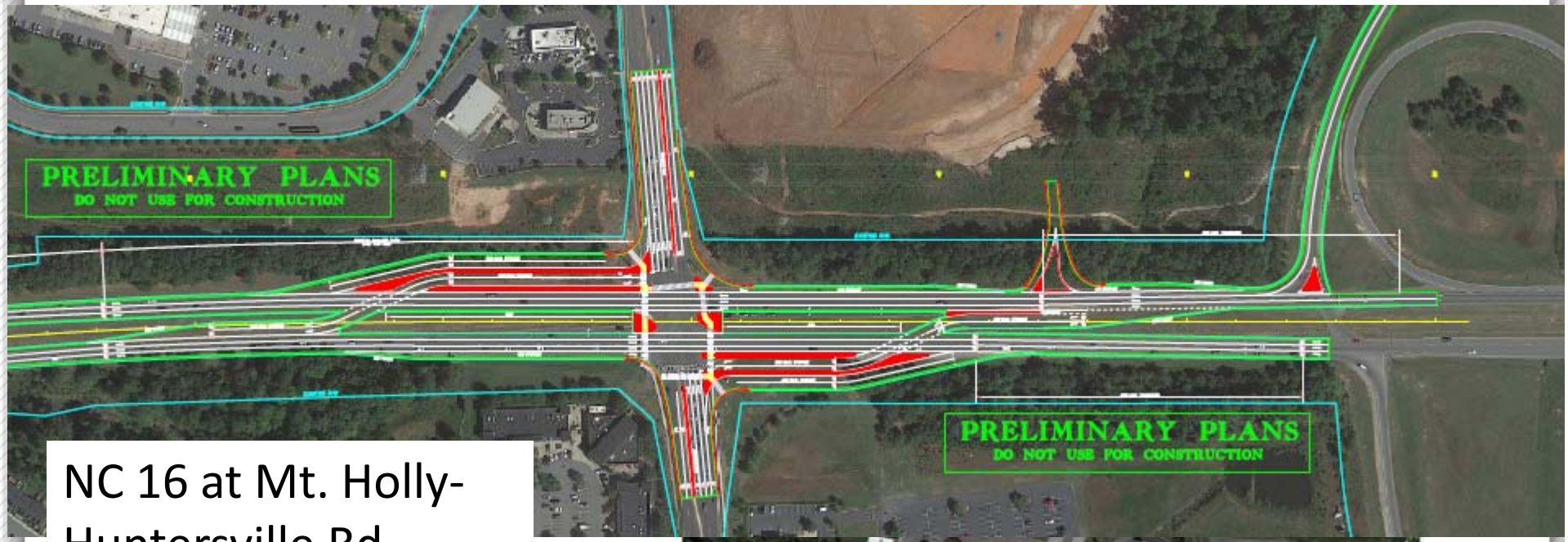
http://www.huntersville.org/Portals/0/Admin/Quad%20Left/REVISED%20Quad%20Left%20Brochure.pdf

NC 73 at US 21, Huntersville

- Restrict left turns from NC 73 to US 21
- Designate Holly Point Dr. as Quadrant Roadway
- Install simpler signals with fewer phases for Holly Point Drive intersections



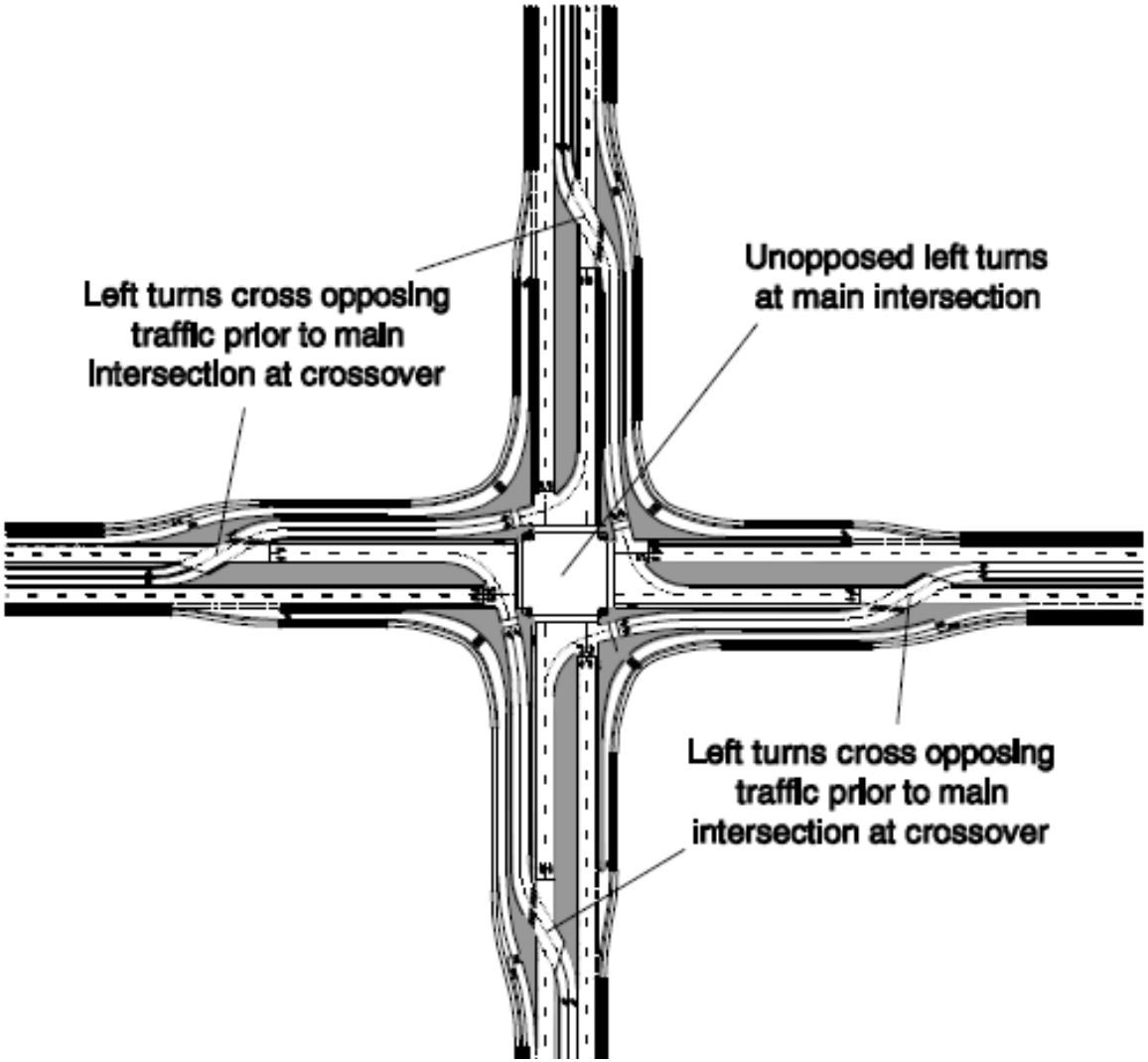
Continuous Flow Intersections in NC



NC 16 at Mt. Holly-Huntersville Rd, Charlotte *(proposed)*

NC 150 at Williamson Rd, Mooresville *(proposed)*

What is a Continuous Flow Intersection (CFI)?



NCDOT Continuous Flow Intersection Public Outreach Materials

NCDOT NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Connecting people, products, and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina.

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Home » Projects » High Profile Projects & Studies » N.C. 150 Widening Improvements

N.C. 150 Widening Improvements

Status: LONG-RANGE STUDIES | IN DEVELOPMENT | UNDER CONSTRUCTION | COMPLETE

NC 150 WIDENING IMPROVEMENTS
CATAWBA AND IREDELL COUNTIES

Project Overview and Purpose

Planning is underway on a proposed project to improve traffic capacity and reduce congestion on a 15-mile stretch of N.C. 150 – from N.C. 16 Bypass in Catawba County to just west of the U.S. 21/N.C. 150 interchange in Mooresville in Iredell County.

The N.C. Department of Transportation is also studying improvements to the I-77/N.C. 150 interchange (STIP I-5717).

Project Highlights

The Federal Highway Administration on March 8, 2016, approved and finalized the Environmental Assessment – a federally required document that details NCDOT's findings on how the proposed project would affect the environment. The approval made way for NCDOT to study and seek public input on two options to widen N.C. 150 – referred to as build alternatives – in the project area:

- **Alternative 1**, which widens N.C. 150 on the existing roadway
- **Alternative 2**, which widens N.C. 150 on the existing roadway but also incorporates a bypass around the Terrell Historic District, thereby avoiding impacts to the district (this option is being studied in pursuant to Federal Highway Administration requirements)

As required by the National Environmental Policy Act, also under review is the No-Build Alternative, in which N.C. 150 in the project area would not be widened.

Project Maps

Project Study Area Map
N.C. 150 Functional Design
Google Earth Downloadable Map

Videos

Visualization

Continuous Flow Intersection

Project Fast Facts

- **Counties:** Catawba and Iredell
- **Project Type:** Roadway Improvement (15 mile widening)

YouTube Search

Continuous Flow Intersection

NCDOTcommunications
Subscribe 1,688

2,200 views

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Published on Sep 6, 2016
An example of a continuous flow intersection.

SHOW MORE

https://www.ncdot.gov/projects/nc150/

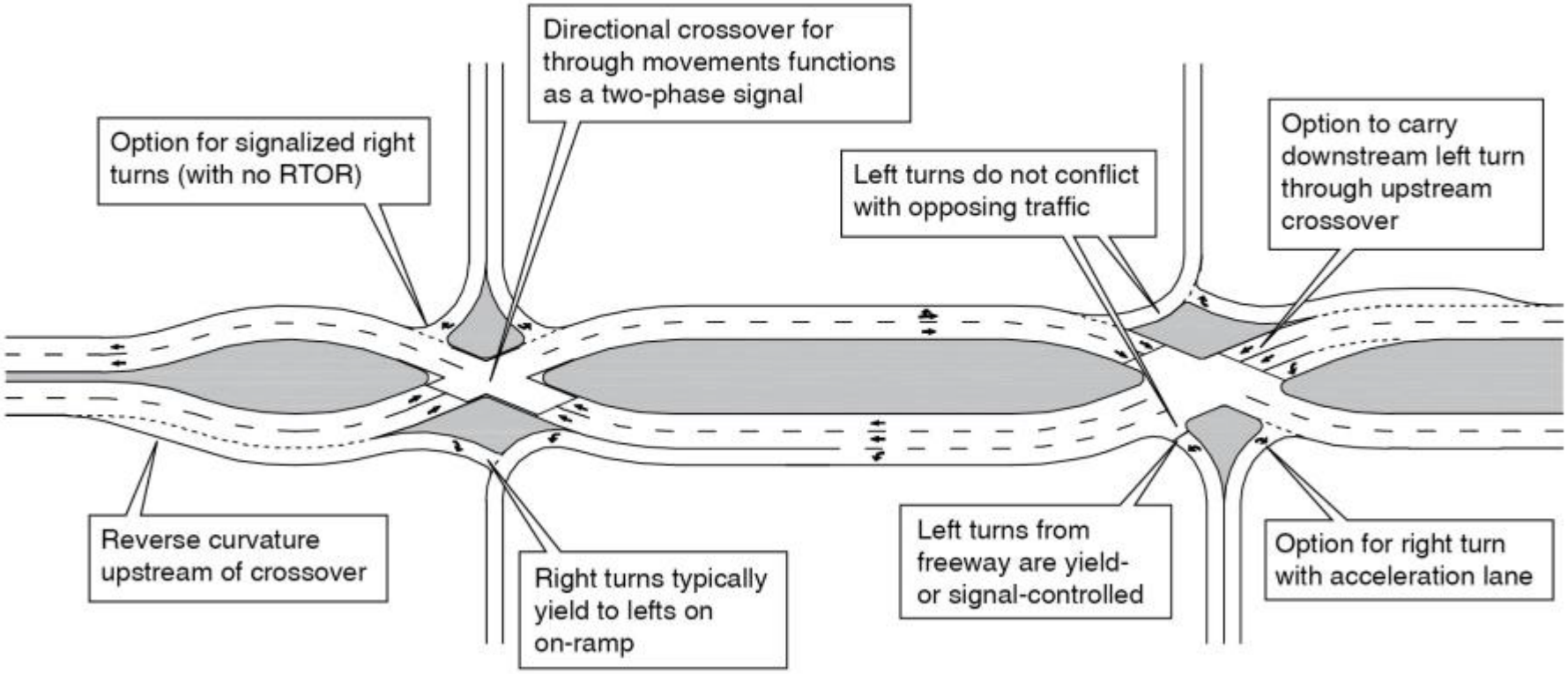
Diverging Diamond Interchanges in NC

I-485 at Mallard Creek Rd, Charlotte

I-85 at Poplar Tent Rd, Concord

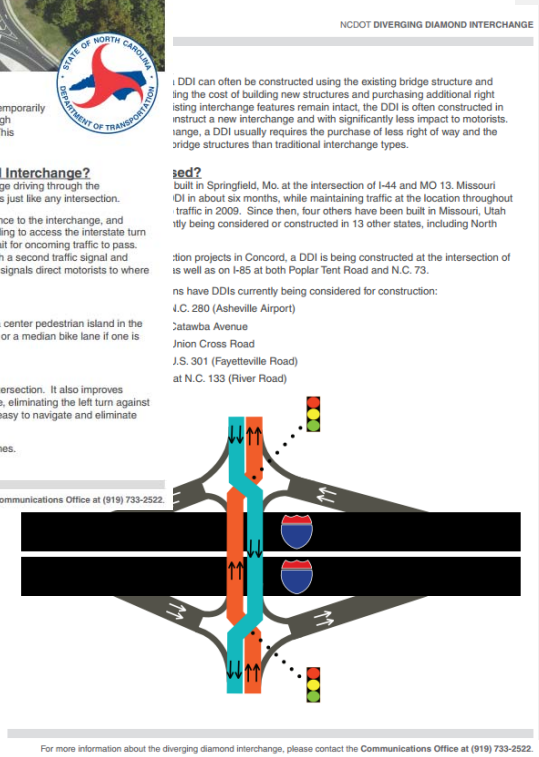
The Diverging Diamond Interchange

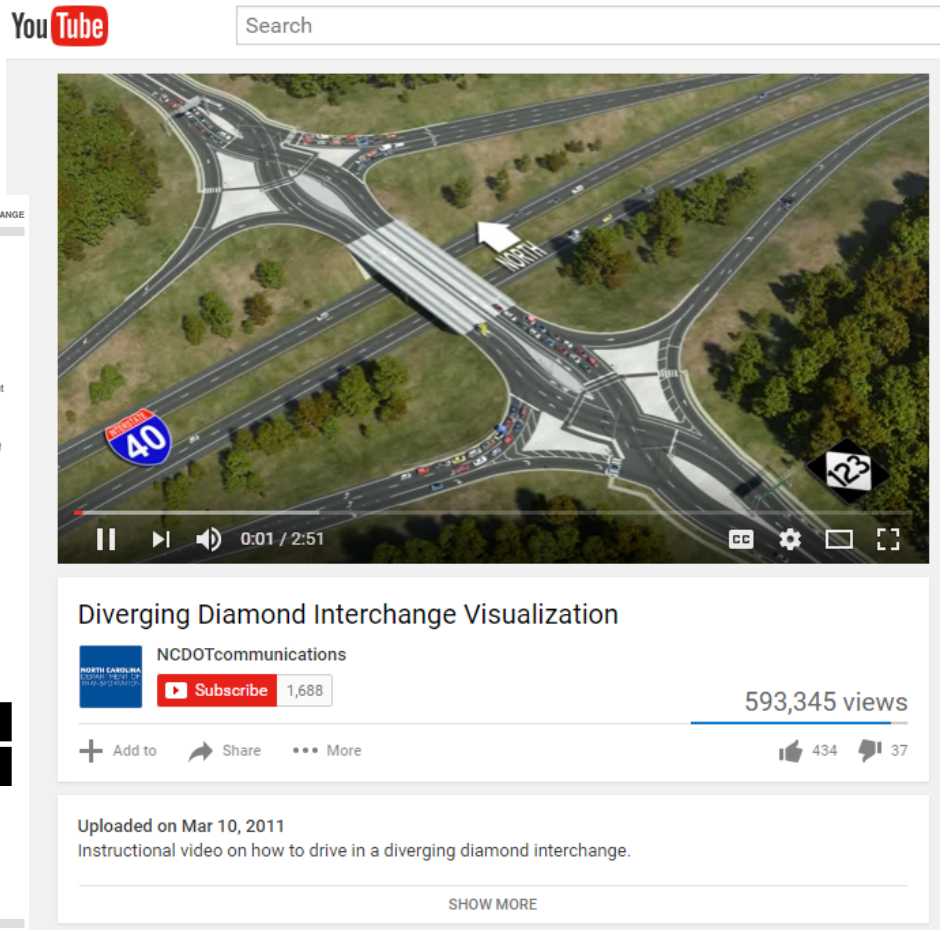
- Limits number of traffic signal phases required to move motorists through the interchange
- Movements on and off of the freeway have fewer conflict points and can be free-flowing
- Moves high volumes of traffic without increasing the number of lanes in an interchange



Graphic Courtesy of FHWA
FHWA-SA-14-067 DDI Informational Guide

NCDOT Diverging Diamond Interchange Public Outreach Materials

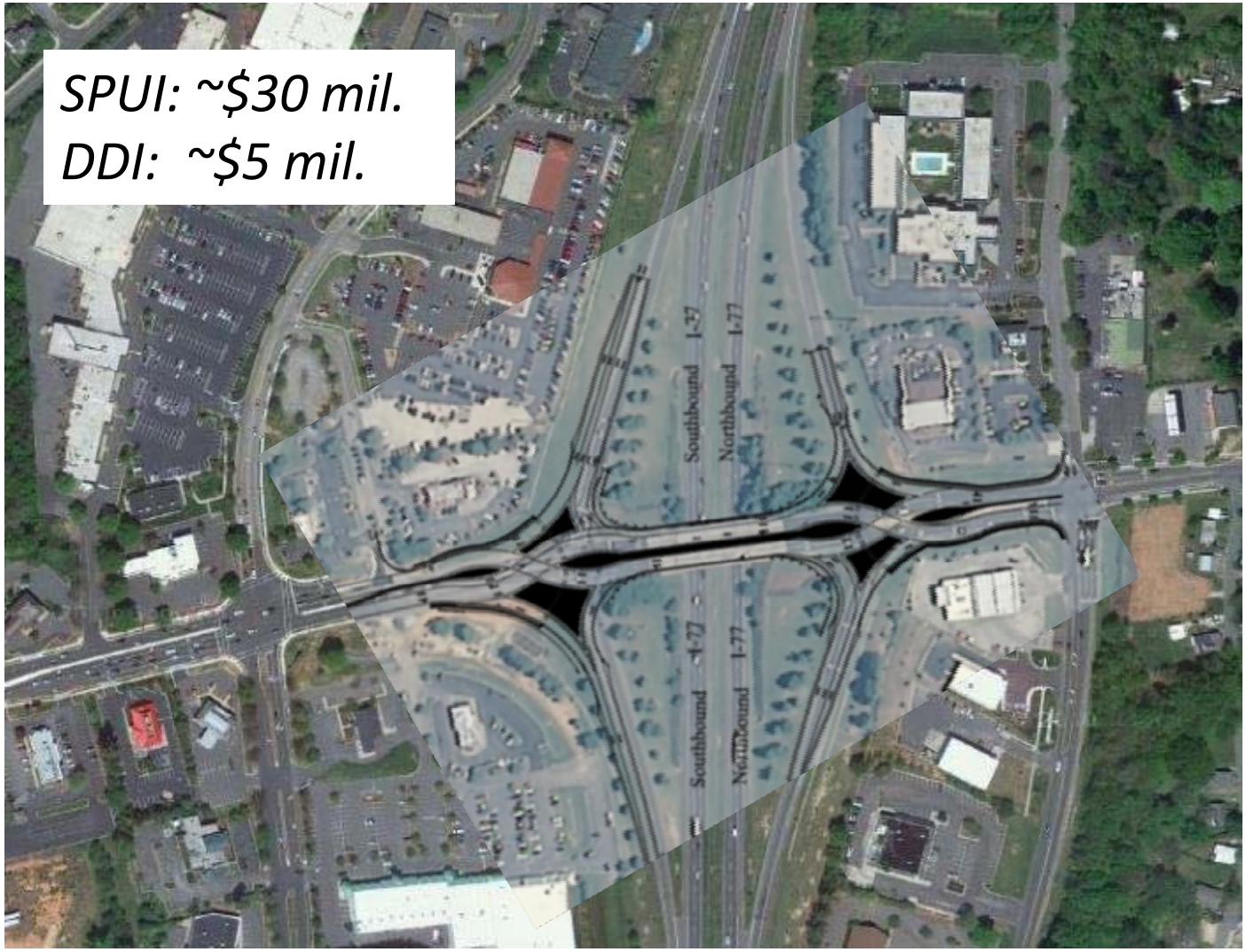




https://www.ncdot.gov/download/projects/publichearings/diverging_diamond.pdf

I-77 at Catawba Ave, Cornelius

I-77 at Catawba Ave, Cornelius



I-77 at Catawba Ave, Cornelius

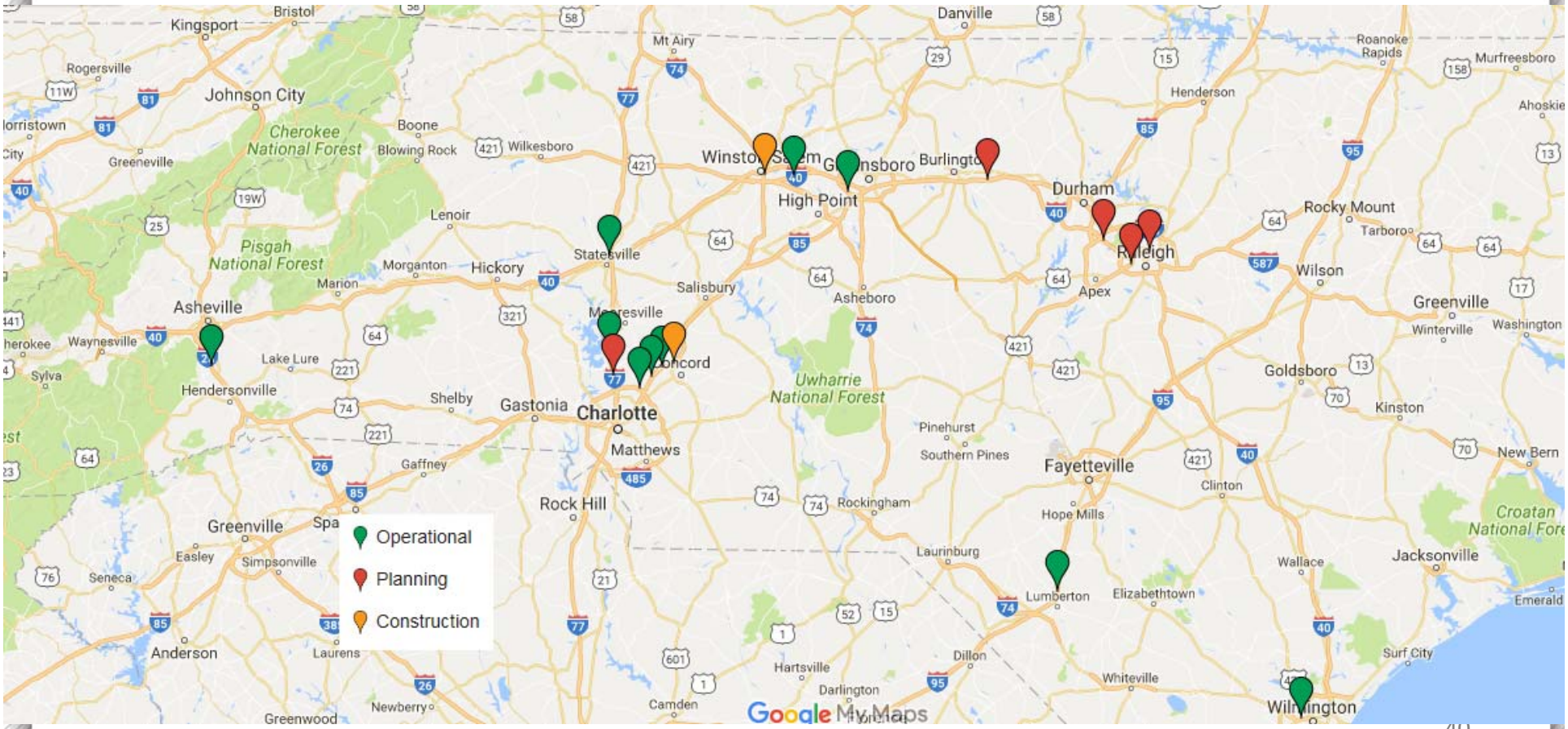
I-26 at NC 280, Fletcher

I-26 at NC 280, Fletcher

I-26 at NC 280, Fletcher

Diverging Diamonds in North Carolina

- 10 DDIs constructed in NC; 2 more to open soon
- 5 or more in planning/design stage



Turbine Interchange in NC

I-85 at I-485, Charlotte

Innovative Intersections and Interchanges in NC

- Roundabouts
- Superstreets
- Quadrant Left Intersections
- Continuous Flow Intersections
- Diverging Diamond Interchanges
- Turbine Interchange

Questions?

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