



TRB 5th Urban Street Symposium
Raleigh, NC – May 22, 2017

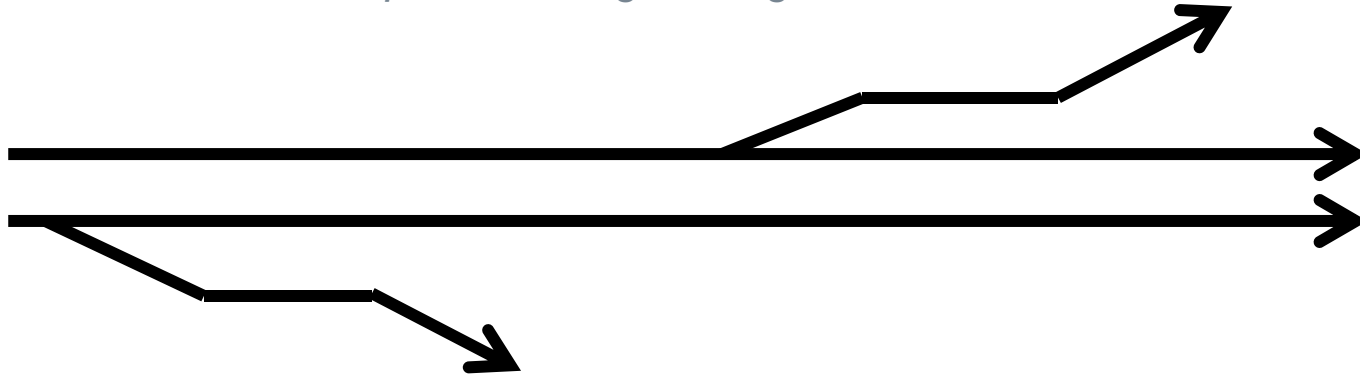
*Lane Continuity
Problems and Opportunities*

Joe Hummer, PhD, PE, Congestion Management
Reza Jafari, PhD, PE, Congestion Management



Definition

- “Drivers should not have to change lanes to follow a certain main interstate route.”
- “Helps meet driver expectations, avoid driver confusion, and ultimately eliminate collisions.”
 - *Handbook of Transportation Engineering*, 2nd ed., 2011

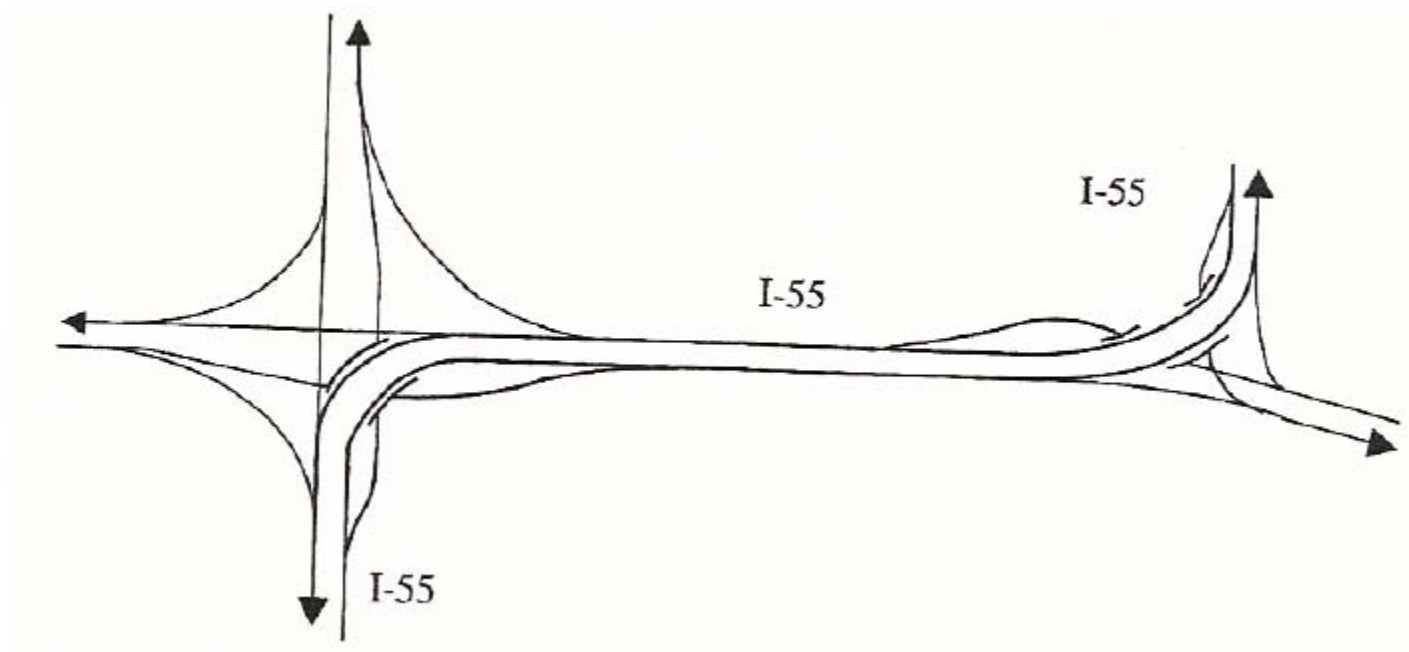


- Applies to other routes as well, although perhaps not with same intensity as interstates



Related Concepts

- Route continuity is a subset of lane continuity
 - Main route is through route at interchange regardless of orientation



- Also related to basic number of lanes and lane balance



Guidance

- AASHTO Green Book does not mention “lane continuity,” but
 - “Consistency should be maintained in the number of lanes provided along any route of arterial character.” (p. 10-72)
- ITE Traffic Engineering Handbook, p. 297: “The principles of route continuity, lane continuity, lane balance, and maintaining the basic number of lanes must be considered collectively.”
- Geometric Design Guide for Canadian Roads, 1999, page 2.1.7.1
 - Definition
 - Several paragraphs
 - Several examples



Examples

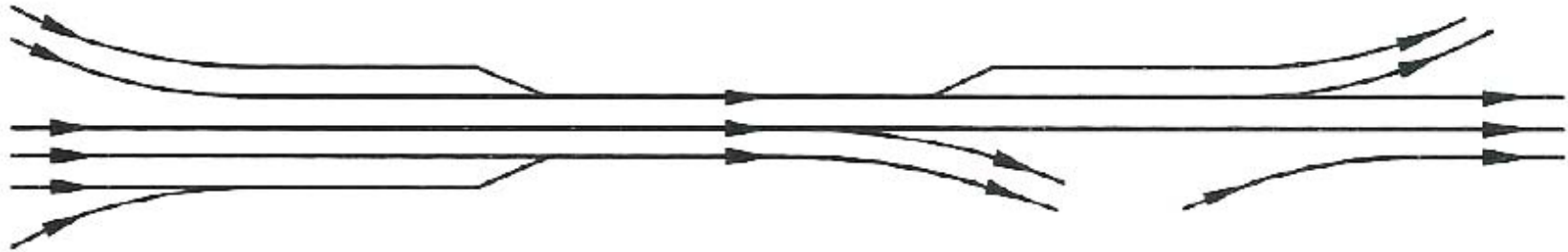


- i) three basic lanes, single lane ramps on the right
proper lane balance, lane continuity maintained

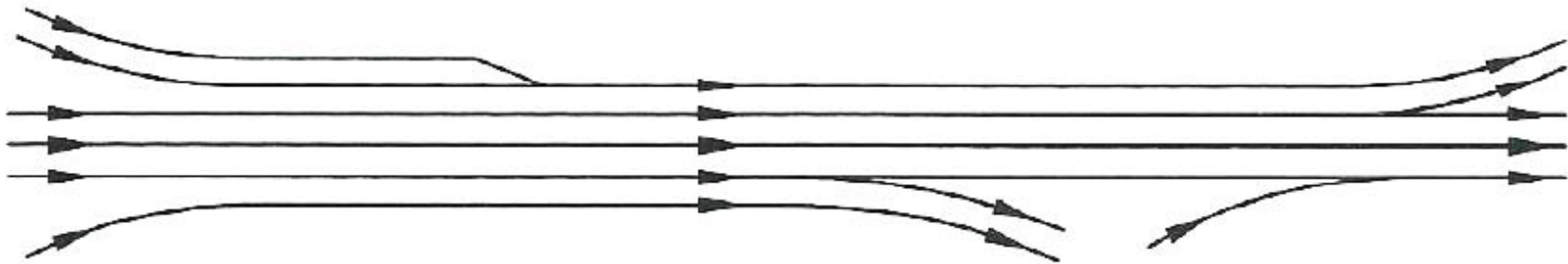


- ii) three basic lanes, two lane ramps on the right
proper lane balance, lane continuity maintained

Examples



- iii) three basic lanes, proper lane balance but only one through lane is continuous, lane continuity lost.



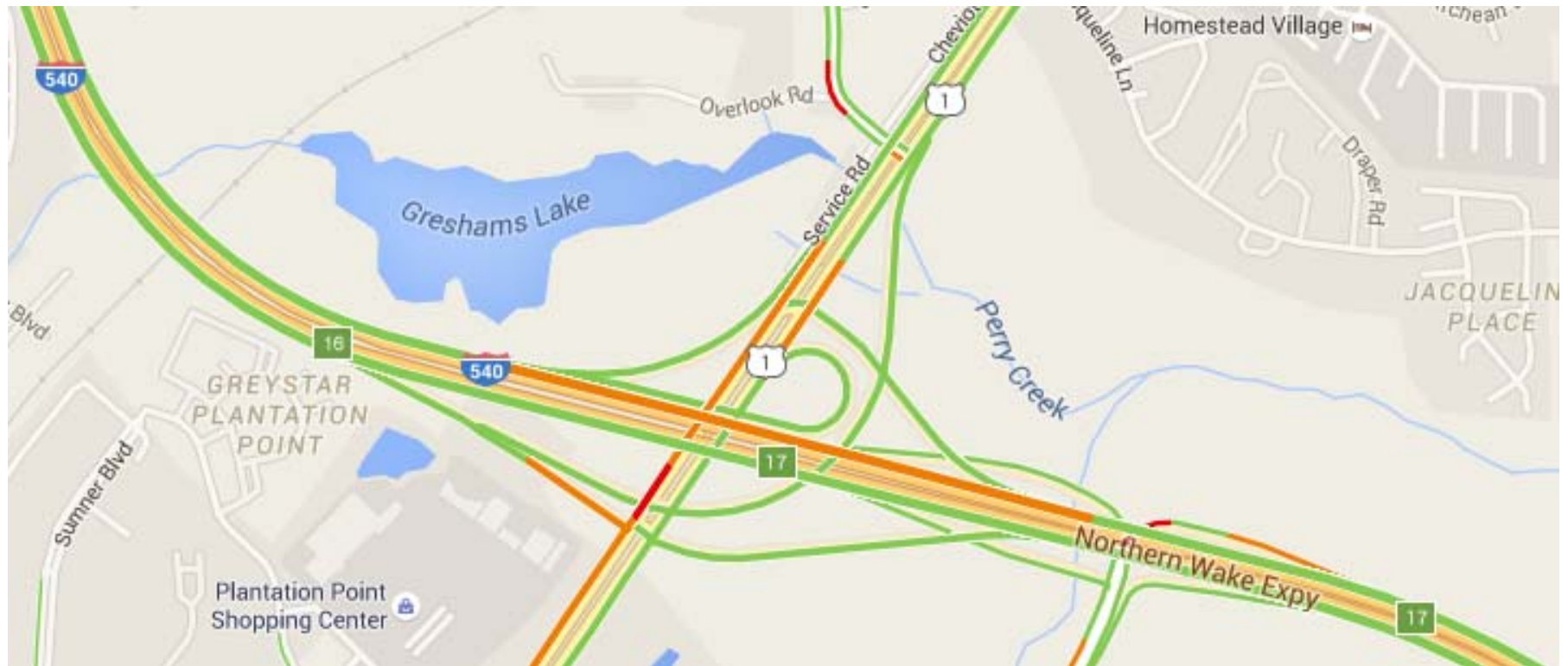
- iv) three basic lanes, proper lane balance, basic (through) lanes are continuous, lane continuity is restored

Crashes

- Lane changes lead to sideswipe crashes
- Lane change crashes are about 4% of total (200,000/yr in US)
 - 14% of those cause injuries (30,000/yr in US)
 - 0.5% of fatal crashes (200/yr in US)
 - 10% of all crash-caused delay
- Over 50% of lane change crashes on roads with speed limit of 45 mph or lower
- 26% of lane change crashes attributed to driver distraction in 2002
 - Higher now?
- Providing lane continuity at a freeway diverge reduced crashes
 - By 68% at one-lane ramp
 - By 32% at two-lane ramp
- No valid lane change crash prediction model available



Delay--Guess Where the Lane Discontinuity Is on I-540



Extent of Problem in NC

- Based on request in June to RTEs, circulated to some DTEs and design engineers
- 30 verified cases submitted
- Asheville to Wilmington
- Urban and suburban roadways
- By route:
 - 12 interstate
 - 5 US
 - 1 US Alternate
 - 3 NC
 - 9 secondary

Thank You!

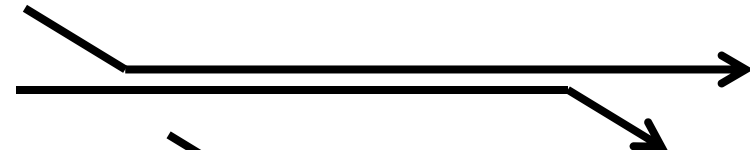


Types of Discontinuities

- 11 add right then drop left



- 7 add left then drop right



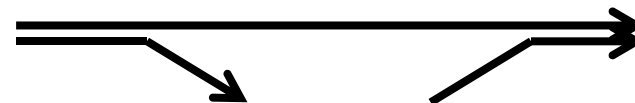
- 3 drop right then add left



- 2 drop left then add right



- 1 drop right then add right



- 5 left lane drop



- 1 multiple



Distances

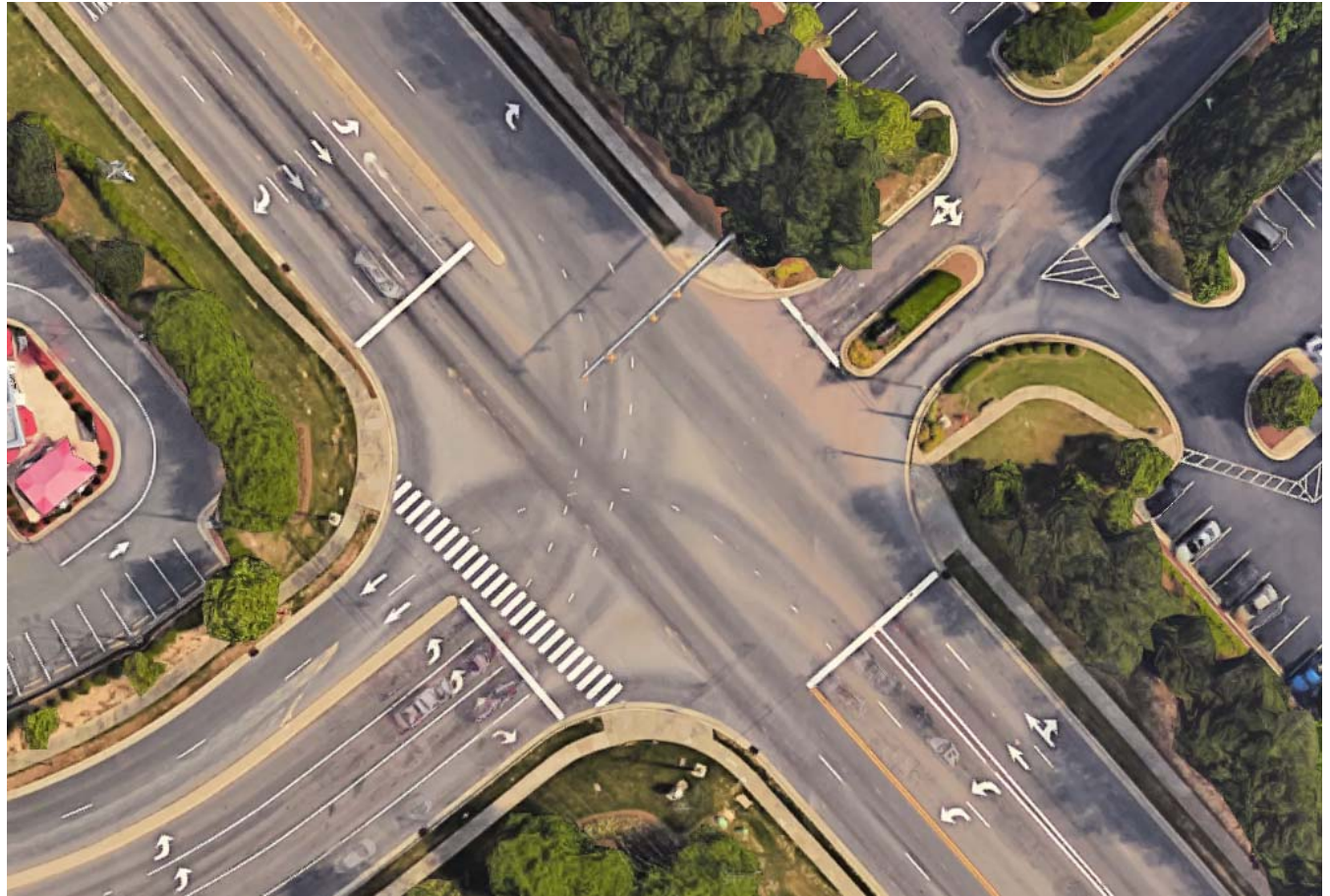
- 24 cases of add then drop or drop then add
- Averages distance = 1.86 miles
- Range 0 to 12 miles
- Shortest forced lane change is 0.08 miles (400 feet)
- 14 cases with distance under 2/3 mile



Lenoir-Rhyne Blvd., Hickory

Number of Lanes

- 10 with 1 through lane
 - Mostly SR cases, but one interstate
- 17 with 2 through lanes
- 2 with 3 through lanes
- 1 with 4 through lanes



NC-55, Apex



How Did They Happen?



How Did They Happen?

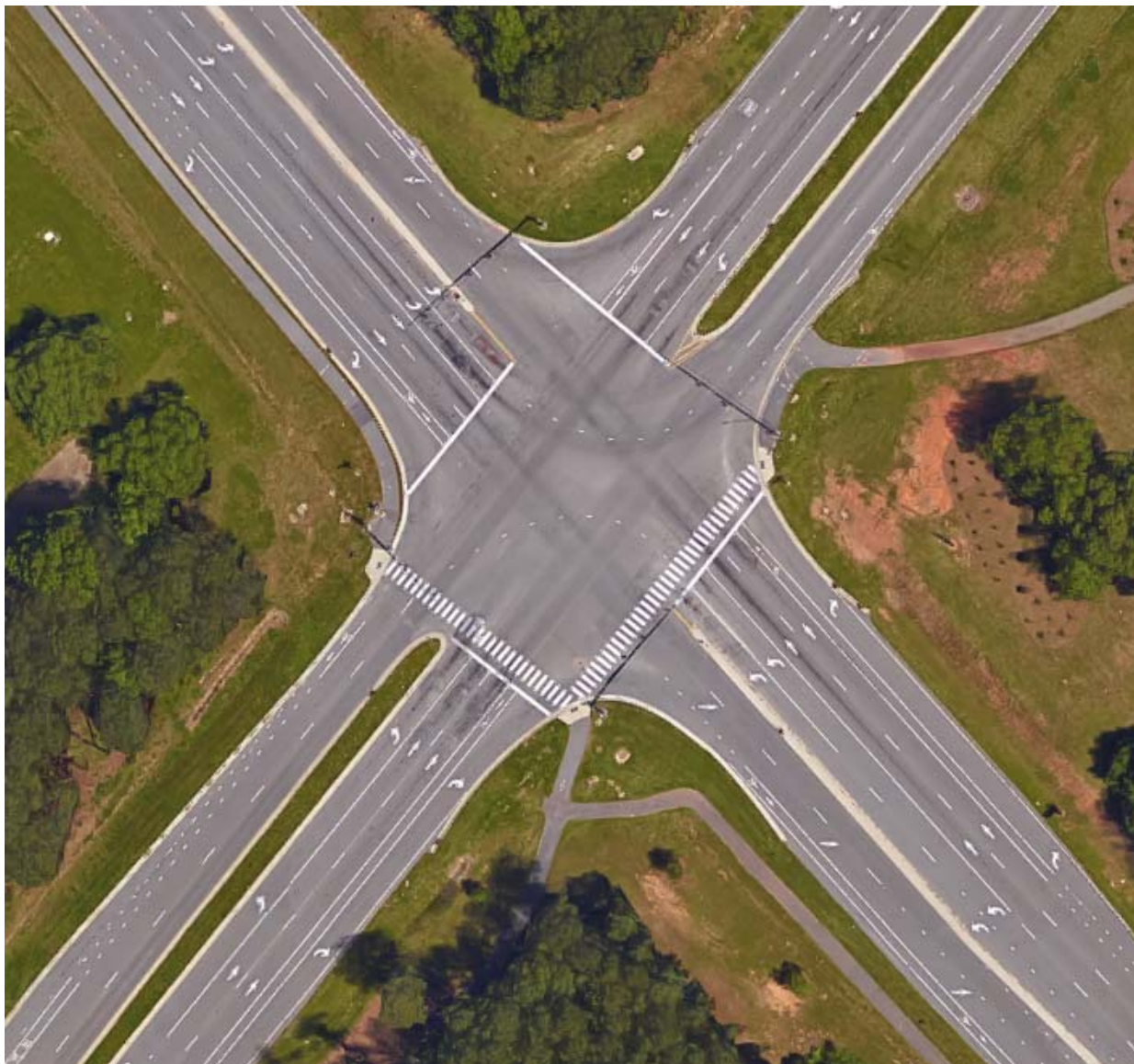
- 9 TIP projects
 - 3 fixed before opening
 - 2 fixed shortly after opening
 - 4 not yet fixed
- 6 development
- 5 new route numbering
- 4 widening expected someday
- 3 City involvement
- 3 unclear



What Can We Do

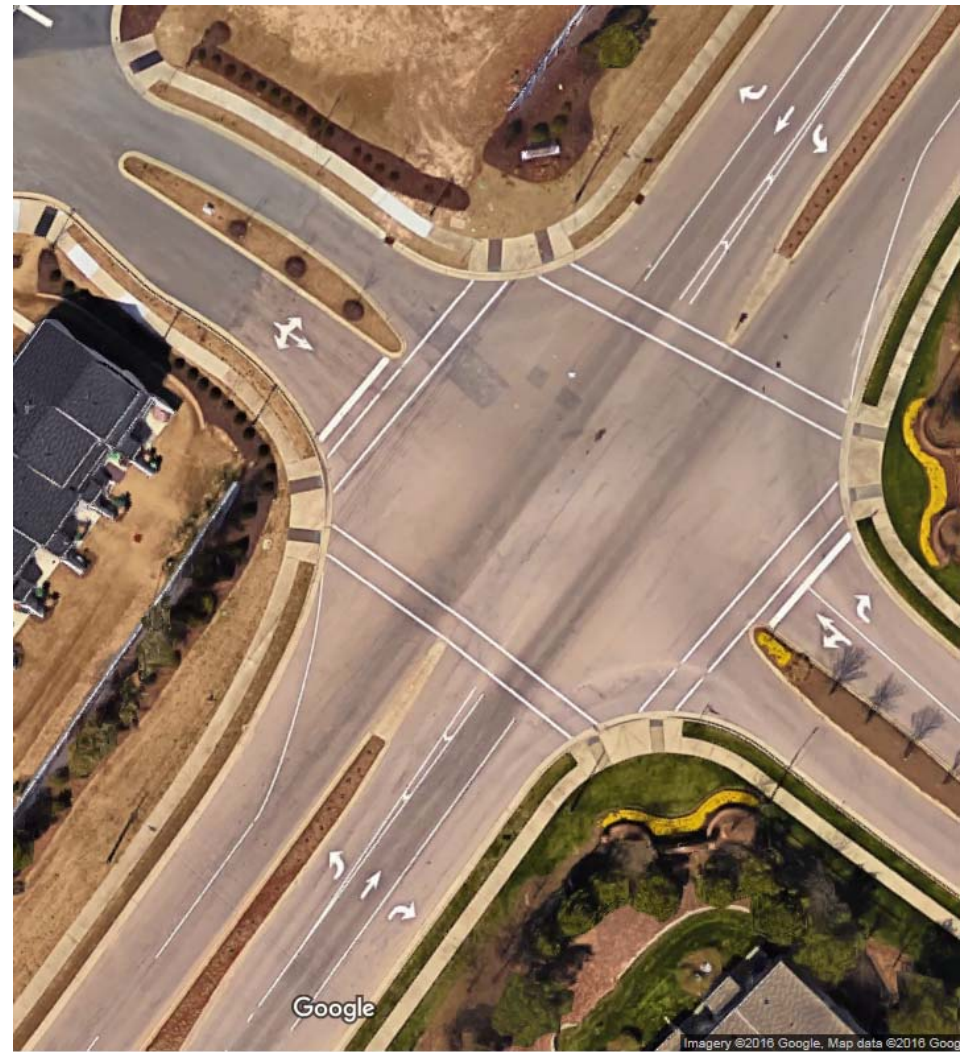
- Stay vigilant
 - DOT projects
 - City projects
 - Developers
- Don't assume next project will get done
- Be skeptical of the forecast
- Watch work zones

Cornwallis Rd., Durham



What Can We Do to Fix Existing Sites

- 25 sites not yet fixed
- 10 could be restriped with few apparent issues
- 7 could be restriped but there would be negative impacts
 - 4 lose capacity
 - 2 make entering more difficult
 - 1 narrower lanes
- 3 upcoming TIP project
- 3 need widening
- 2 no apparent solution



McCrimmon Pkwy, Morrisville



Draft Policy

- For Mobility and Safety Division
 1. Reduce existing lane discontinuities
 - Favorable funding consideration if removing one
 2. Minimize new discontinuities
 - State Traffic Engineer must approve all new ones in writing
 - Criteria:
 - Work zone or permanent
 - Any freeway left lane drop
 - Distance between lane add and lane drop 10 miles for primary interstate, 5 miles other freeway, 3 miles non-freeway US or NC route, 1 mile SR route



My Action Items

- Refine policy and get it approved
- Write paper
- Make more presentations
- Sponsor research on developing a model to predict crashes due to lane changes



Thank You!

Joe Hummer, jehummer@ncdot.gov, 919-814-5040

Reza Jafari, rrjafari@ncdot.gov, 919-814-5064

