An Update of Innovative Intersections in Georgia & GDOT’s ICE Policy

Put Your Intersection On ICE:

Christina Barry, P.E.
Daniel Trevorrow, E.I.T.
GDOT Office of Traffic Operations

Overview

- Quick Facts
- What is ICE
- GDOT’s ICE Policy
  - Background
  - ICE Policy
  - ICE Process
Georgia Quick Facts

Intersection Types

• 9,500+ Traffic Signals
• 100+ On System AWSC
• 175+ Roundabouts
Roundabouts

- Circulatory roadway around a center island
- Traffic flows counter-clockwise
- Slower speed environment
- Yield on approaches
- Mini, single-lane or multi-lane

Benefits & Applicability

- Can be significantly safer than traffic signals & stop controlled
- Can operate more efficiently than 4-way stops or traffic signals
  - Higher capacity, less delay
- Can have less impact – reduced overall footprint
- Pedestrian refuge in splitter island
- Reduces number of decisions for peds. and drivers
### Roundabouts

**Traffic Control Prior to RBT | % Reduction in Injury Crashes**

<table>
<thead>
<tr>
<th>Traffic Control</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signalized</td>
<td>78</td>
</tr>
<tr>
<td>All-Way Stop</td>
<td>46</td>
</tr>
<tr>
<td>Two-Way Stop</td>
<td>82</td>
</tr>
</tbody>
</table>

NCHRP 672, Exhibit 5-15

**Benefits & Applicability**

- Circulatory roadway around a center island
- Traffic flows counter-clockwise
- Slower speed environment
- Yield on approaches
- Mini, single-lane or multi-lane

### Chance of pedestrian death if hit by a motor vehicle

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Chance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>5%</td>
</tr>
<tr>
<td>30</td>
<td>10%</td>
</tr>
<tr>
<td>40</td>
<td>80%</td>
</tr>
<tr>
<td>50</td>
<td>100%</td>
</tr>
</tbody>
</table>

NCHRP 572, Table 28

**SR 16 @ SR 54**
**Georgia Quick Facts**

**Intersection Types**
- 9,500+ Traffic Signals
- 100+ On System AWSC
- 175+ Roundabouts
- 25+ RCUTS

**Restricted Crossing U-Turns (RCUT)**
- Restricts through + left movements from side street
- Must make right turn and U-turn instead
- Signalized; unsignalized merge, yield or stop scenarios

**Benefits & Applicability**
- Improved safety over TWSC
- Reduces queueing on minor street
- Typically minor street volume less than major
- Often easy retrofit - cheaper
Restricted Crossing U-Turns (RCUT)

- Restricts through + left movements from side street
- Must make right turn and U-turn instead
- Signalized; unsignalized merge, yield or stop scenarios

**Benefits & Applicability**

- Improved safety over TWSC
- Reduces queueing on minor street
- Typically minor street volume less than major
- Often easy retrofit - cheaper

---

**Restricted Crossing U-Turns (RCUT)**

- Restricts through + left movements from side street
- Must make right turn and U-turn instead
- Signalized; unsignalized merge, yield or stop scenarios

**Benefits & Applicability**

- Improved safety over TWSC
- Reduces queueing on minor street
- Typically minor street volume less than major
- Often easy retrofit - cheaper
Right-in Right-out (RIRO) with Downstream U-Turns

- No direct left turns or through movements from minor street
- No left turns into minor street
- Must make right turn then U-turn instead

**Benefits & Applicability**
- Eliminate all crossing maneuvers – improved safety
- Typically low volume making left turn in and out of minor street

---

Right-in Right-out (RIRO) with Downstream U-Turns

- No direct left turns or through movements from minor street
- No left turns into minor street
- Must make right turn then U-turn instead

**Benefits & Applicability**
- Eliminate all crossing maneuvers – improved safety
- Typically low volume making left turn in and out of minor street
Median U-Turn (MUT)

- No direct left turns, only throughs and right turns
- Must make right then use U-turn
- U-turns signalized/ unsignalized

**Benefits & Applicability**
- Improved safety over traffic signal & AWSC
- Reduced signal phases
- Good alternative with existing wide medians
- Easily used in corridor with other alt. intersections
  - Roundabouts
  - RCUTs
Median U-Turn (MUT)

- No direct left turns, only throughs and right turns
- Must make right then use U-turn
- U-turns signalized/unsignalized

**Benefits & Applicability**
- Improved safety over traffic signal & AWSC
- Reduced signal phases
- Good alternative with existing wide medians
- Easily used in corridor with other alt. intersections
  - Roundabouts
  - RCUTs
Georgia Quick Facts

Intersection Types
- 9,500+ Traffic Signals
- 100+ On System AWSC
- 175+ Roundabouts
- 25+ RCUTS
- 5 DDIs

Diverging Diamond Interchange (DDI)
- Vehicles shifted to left side of road
- Allows free flow lefts on to freeway

Benefits & Applicability
- Improved safety over conventional interchange
- Especially good where left turning volume high
- Reduce # signal phases
- Viable alternative to bridge widening for capacity increase
Diverging Diamond Interchange (DDI)

- Vehicles shifted to left side of road
- Allows free flow lefts on to freeway

Benefits & Applicability
- Improved safety over conventional interchange
- Especially good where left turning volume high
- Reduce # signal phases
- Viable alternative to bridge widening for capacity increase

I-285 @ Ashford Dunwoody Rd.
Georgia Quick Facts

Intersection Types
- 9,500+ Traffic Signals
- 100+ On System AWSC
- 175+ Roundabouts
- 25+ RCUTS
- 5 DDIs
- 1 CFI
Continuous Flow Intersection (CFI)

- Left turning traffic crosses opposing lanes in advance of intersection
  - Displaced Left Turn (DLT)
- Left turns at same time as through movements
- Can have varying # of displaced left turns

**Benefits & Applicability**

- Improved safety over conventional traffic signal
- Good alternative on high volume roadways
- Reduced # signal phases

---

**Continuous Flow Intersection (CFI)**

- Left turning traffic crosses opposing lanes in advance of intersection
  - Displaced Left Turn (DLT)
- Left turns at same time as through movements
- Can have varying # of displaced left turns

**Benefits & Applicability**

- Improved safety over conventional traffic signal
- Good alternative on high volume roadways
- Reduced # signal phases
Georgia Quick Facts

Intersection Types
- 9,500+ Traffic Signals
- 100+ On System AWSC
- 175+ Roundabouts
- 25+ RCUTS
- 5 DDIs
- 1 CFI
- 5+ Continuous Green T
High-T/Continuous Green-T

- “Top” through movement separated from other, operates continuously
- Channelized left turn from minor street

Benefits & Applicability

- Good alternative when high through volumes in one particular direction
- Relatively easy conversion with existing wide median
Quadrant Roadway

- No direct left turns at main intersection
- All left turns rerouted to connector, quadrant roadway
- Both junctions of connector road typically signalized
- All signals coordinated

**Benefits & Applicability**

- Good where there are heavy through volumes
- Reduces delay at severely congested intersections
- Simple two phase signal at main intersection
- More appropriate as a spot treatment

---

Figure 127. Illustration, Intersection with connector roadways in two quadrants.
FHWA AIR Chpt 5. Quadrant Roadways
Intersection Control Evaluation

WHAT IS ICE

GDOT Mission Statement

Deliver a transportation system focused on innovation, safety, sustainability and mobility.
Why ICE??

Integrate safety into our decision making process for intersection control on **ALL** projects

75% of all crashes in GA are intersection related

### Intersection Control Evaluation

- **Process to determine the ‘best’ intersection design/traffic control for a given location** - FHWA

- **Process that identifies the best intersection control through a comprehensive analysis and documentation of the technical (safety and operational), economic, and political issues of viable alternatives.** - MnDOT

- **The goal is to select the optimal control, lane configuration, and type of intersection based on an objective analysis of the existing conditions and future needs.** – WisDOT
Purpose of ICE

- The purpose of ICE is to provide **traceability**, **transparency**, **consistency**, and **accountability** when identifying and selecting an intersection control solution that both meets the project purpose and reflects the overall best value in terms of specific performance-based criteria.
- Promote an emphasis on **context sensitivity**, **key performance outcomes**, **cost-effectiveness** and **sustainability** instead of only the historical reliance on motor vehicle volume-based intersection control warrants;
- Effect a **cultural** and **paradigm shift** away from the predisposition toward wider/larger intersections and signalization;
- **Mainstream** and **sustain implementation** of proven, innovative access strategies that are underutilized, such as those promoted through the FHWA *Every Day Counts* program.

Policy or Process

ICE is a **policy** and a **process**

**Policy**

*Establishes the general applicability and future effect; sets forth a course of action, plan or procedure.*

**Process**

*Describes the framework and methodologies by which a Policy can be successfully implemented.*
Intersection Control Evaluation

THE POLICY

Intersection Policy Before ICE

• **Ch. 7 Design Policy Manual: At Grade Intersections**
  – **Intersection Design Elements**
    • Human Factors
    • Traffic Considerations
    • Physical Elements
  – **MUTCD**
    • Signal Warrant Analysis
    • Section 4B.04 Alternatives to Traffic Control Signals

• **Ch. 8 Design Policy Manual: Roundabouts**
  – **Roundabouts Policy**
  – **Policy requires consideration (not from safety perspective)**
  – **Roundabout Validation**
    “When considering a roundabout, a variety of alternatives should be evaluated to determine whether or not a roundabout is the most appropriate alternative. The alternatives evaluated should include all appropriate conventional intersection forms, which may include two-way stop control, all-way stop control, and/or signal control.”
ICE Policy Timeline

- **June 2013**: GDOT approached FHWA about ICE
- **September 2015**: Meeting with Chief Engineer
- **June 2016**: Attended Peer Exchange in Matteson Illinois
- **January 2015**: ICE Peer Exchange Webinar
- **December 2015**: Formed Working Group and Advisory Group
- **May 2017**: Meeting with Commissioner and Chief Engineer
- **June 2017**: Chief Engineer Signs Memo Announcing ICE Policy
- **July 2017**: Ice Policy effective date

Ice Policies in the United States

- **2013**: Existing ICE Policies
- **2014**: Developing ICE Policies
- **2015**: Interest in ICE Policies
- **2016**: Existing ICE Policies
- **2017**: Developing ICE Policies
- **2018**: Interest in ICE Policies
Location and format

http://www.dot.ga.gov/

Home -> Business & Government -> Design Manuals -> Manuals & Guides

Requirements & Waiver

<table>
<thead>
<tr>
<th>Not Required</th>
<th>Required</th>
<th>Waiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>No changes to intersection footprint or control</td>
<td>Project is on State route/NHS and/or uses State or Federal money</td>
<td>ICE <em>may</em> be waived based on appropriate evidence and a written request</td>
</tr>
</tbody>
</table>
Not Required

The proposed work involved:
– **Does not include** any changes to the intersection footprint

Examples include:
– A project that will not do any widening where there is no change to intersection geometry or control
  • Sidewalk/streetscapes
  • Bridge replacement
  • Resurfacing
– Routine **traffic signal timing** and equipment maintenance.

Not Required

For driveway permits where driveway is not a new leg to an existing intersection where:
- Driveway is along a divided, multilane roadway where access will be limited to a closed median with only right-in/right-out access,

OR
- Driveway is along an undivided roadway and the development will not be required to construct left and/or right turn lanes
Required

For any intersection improvements where:

The intersection includes at least one roadway designated as a State Route (State Highway System) or as part of the National Highway System;

The intersection will be designed or constructed using State or Federal funding.

Waiver Eligible

In certain circumstances where an ICE would otherwise be required, the requirement may be waived based on appropriate evidence presented with a written request.

- Proposed improvements do not substantially alter the character of the intersection, and are considered minor in nature, such as extending existing turn lane(s);

- The intersection consists of a public roadway intersecting a divided, multilane roadway where the access will be limited to a closed median with only right-in/right-out access that will operate acceptably;

- The intersection is along an undivided, two-lane roadway that will not be widened and:
  - Low risk in terms of exposure (less than 1,000 vehicles entering per day).
  - Latest 5 years of crash history is not indicative of a crash problem
  - No undesirable geometric features
  - Proposed changes will not adversely affect safety
Approvals

**Level 1: Chief Engineer (or Designee)**
- Projects going through PDP
- New or revised signal permits
- New median openings

**Level 2: District Engineer with notification to Chief Engineer**

Projects that are not level 1 where:
- Leg is added to intersection
- Intersection control is changes

**Level 3: District Engineer**
- QR, Driveway Permits, Maintenance Work that does not qualify as level 2

Responsibility

- The responsibility for conducting the ICE is with the entity initiating the intersection improvement (Ex. GDOT, local government, developer)
- Should be prepared under supervision of Professional Engineer licensed in Georgia
- Conducted the same way regardless of sponsor
Implementation

• ICE is required for all projects that do not have concept approval by July 1, 2017

• If ICE would delay the concept report submittal for any projects that have schedules set by July 1, 2017, ICE may be completed during the preliminary design phase

• Submittals during preliminary design must occur no later than 1/3 of the way through the time allotted for preliminary design
Stage 1 - Screening

• Conducted as early in the project development process as possible.
  – Completed Prior to Initial Concept Team Meeting for corridor Projects
  – For spot intersection improvements should be documented in TE Study along with Stage 2 and may be completed before project is programmed

• Screening Effort to eliminate non-competitive options and identify alternatives for further consideration
Stage 1 - Screening

Unsignalized
- Minor Stop
- All-Way Stop
- Mini Roundabout
- Single Lane Roundabout
- Multilane Roundabout
- RCUT
- RIRO w/Downstream U-Turn
- High-T (unsignalized)
- Offset-T Intersections
- Diamond Interchange (Stop)
- Diamond Interchange (RAB)
- Turn Lane/Median Improvements
- Other

Stage 1 - Screening

Signalized
- Signal
- Median U-Turn
- RCUT
- Displaced Left Turn (CFI)
- Continuous Green-T
- Jughandle
- Diamond Interchange (signal)
- Quadrant Roadway
- Diverging Diamond
- Single Point Interchange
- Turn Lane/Median Improvements
- Other
Stage 1 - Screening

1. Does alternative address the project need in a balanced manner and in scale with the project?
2. Does alternative improve safety performance in terms of reducing severe crashes?
3. Does alternative incorporate safety, convenience and accessibility for pedestrians and/or bicyclists?
4. Does alternative improve (or preserve) traffic operations (congestion, delay, reliability, etc.)?
5. Does alternative appear feasible given the site characteristics, constrains and location context?
6. Does alternative appear feasible with respect to other project factors?
7. Overall feasible alternative?
ICE Documentation

Stage 1

- Completed Stage 1 Decision Record
- Single intersection projects may proceed seamlessly to Stage 2
- For corridor projects a concurrence memo is recommended

Stage 2 – Alternative Selection

- Begins after Stage 1 is completed
  - For corridor projects begins after initial concept team meeting and conclusion is documented in concept report
  - For spot intersection improvements should be completed seamlessly with Stage 1 and documented in the TE Study
- More detailed evaluation of the alternatives identified in Stage 1 in order to support the selection of the preferred alternative that will be advanced to detailed design
Stage 2 - Alternative Selection

Shortlist of Alternatives from Stage 1

- Total Project Cost
- Traffic Operations
- Safety Analysis
- Environmental Impacts
- Stakeholder Posture

Preferred Alternative
ICE Documentation

Stage 1
• Completed Stage 1 Decision Record
• Single intersection projects may proceed seamlessly to Stage 2
• For corridor projects a concurrence memo is recommended

Stage 2
• Completed Alternative Selection Decision Record with Supporting documentation
• Included in Project Concept Report or as a stand-alone document
• Completed waiver form if the ICE recommended alternative is not selected as the preferred alternative

If only 1 alternative is deemed to be feasible from the ICE Stage 1, then a waiver may be submitted in lieu of completing ICE Stage 2.

Approval Milestones

Stage 1
• As attachment to Concept Report
  – Standalone intersection projects
  – Longitudinal projects
• Required for permit packages and new median opening requests
• District will handle approvals for other projects

Stage 2
• As attachment to Concept Report
  – Stand-Alone intersection projects
  – Encouraged for Longitudinal projects
• Stage 2 for longitudinal projects may be submitted for approval up to 1/3 of the way through the schedule for preliminary design.
• Required for permit packages
• District will handle approvals for other projects
ICE Tool

Next Steps

• Working with DP&S to revise other applicable documents and policies

• Provide training and technical assistance