Using the ICE 2.0
to Conduct Intersection Control Evaluations

Training Workshop
August 2017

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ARCADIS

Purpose of ICE Tool

• Tool goal: provide a **simplified and consistent way** of using data to assess and quantify intersection control benefits
  – Traffic
  – Safety
  – Cost
  – Environmental Impact
  – Stakeholder Posture

• Support ICE policy to provide **traceability, transparency, consistency and accountability** when identifying and selecting intersection control

• Reduce time required to analyze and compare multiple intersection alternatives

• Select alternative that **reflects the overall best value** in terms of specific performance-based criteria.
What the ICE Tool is NOT

- Not viable for 100% of alternative studies due to extent of control possibilities and geometric variabilities
- A determinate of final project cost for the preferred alternative
- A replacement for good engineering judgment in evaluating alternatives

**NOTE:** Before you get started, make sure that Calculation Options (under FORMULAS tab) is set to Automatic calculations

Case Study: SR 22 @ Fulton Mill Road

- Rural intersection in Bibb County, GA
- Minor stop, skewed intersection with high-crash history (1 fatality)
- SR 22 is four-lane median-divided highway; narrows to two lanes west of Fulton Mill Intersection
- Not exact representation - liberties taken to illustrate tool functions
ICE 2.0 TOOL – INTRODUCTION

SAMPLE BLANK INTRODUCTION WORKSHEET

Always fill out the INTRODUCTION tab first, whether completing a full ICE analysis (Stage 1 and Stage 2) or the WAIVER form.
INTRODUCTION tab has fields to fill in project info including project numbers, date, road names, analyst and purpose.

General note: BLUE fields indicate data entry required; GREY fields contain drop-down lists.

Selecting County (drop down menu) auto-populates GDOT District.
Introduction

In 2005, SAFETEA-LU established the Highway Safety Improvement Program (HSIP) and mandated that each State prepare a Strategic Highway Safety Plan (SHSP) by which to prioritize safety funding investments. Intersections quickly became a common component of a majority of States' SHSP emphasis areas and HSIP project lists, including Georgia's SHSP. Intersection...
Selecting correct area type is important as it impacts analysis and cost estimates.
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Introduction

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ICE 2.0 TOOL – INSTRUCTIONS & INTERSECTIONS
INSTRUCTIONS TO FILL OUT INTRODUCTION, STAGE 1 & 2 WORKSHEETS

INSTRUCTIONS TO FILL OUT COST ESTIMATE WORKSHEETS
Intersection Control Types

**Unsignalized**
- Minor Stop
- All-Way Stop
- Mini Roundabout
- Single Lane Roundabout
- Multilane Roundabout
- RCUT
- RIRO w/downstream U-Turn
- High-T
- Offset-Tee Pair
- Other

**Signalized**
- Signal w/turn lanes mainline
- Median U-Turn
- Superstreet
- Displaced Left Turn (CFI)
- Continuous Green-Tee
- Jughandle
- Quadrant Roadway
- Diverging Diamond
- Single Point Interchange
- Other

Click on image to link to design publications
Intersection Control Evaluation

ICE 2.0 TOOL – STAGE 1
## SAMPLE BLANK FULL STAGE 2 WORKSHEET

All project data carried into Stage 1 worksheet.
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 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?
Provide rationale for eliminating or carrying forward each control type.
**GDOT ICE STAGE 1: SCREENING DECISION RECORD**

**Problem: Based on first 6 questions, choose if alternative should be further analyzed.**

<table>
<thead>
<tr>
<th>Innovation Alternative (use “Innovations” tab for a detailed description of each innovation type)</th>
<th>Decision Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional (After Step)</td>
<td>Yes</td>
</tr>
<tr>
<td>Conventional (Off-Ramp Map)</td>
<td>No</td>
</tr>
<tr>
<td>Mix Roundabout</td>
<td>Yes</td>
</tr>
<tr>
<td>Single Lane Roundabout</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*“Yes” selects alternative for evaluation in Stage 2 and highlights row green.”*
## Screening Decision Record

### GDOT Ice Stage 1: Screening Decision Record

**GDOT P#** 02222  
**Project Location** 592 @ Fuller Mill Road  
**Prepared by** Jacobs  
**Analyst** J. Reid  
**Date** 1/7/2017

**Screening Decision Justification:**

<table>
<thead>
<tr>
<th>Innovation Alternative (use “Innovations” tab for a detailed description of each Innovation type)</th>
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<th>Stage2</th>
<th>Waiver</th>
<th>Environmental</th>
<th>Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional (After Step)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Conventional (All Way)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Mixed Roundabout</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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### Summary

- **Innovation Alternative:** Yes
- **Stage1:** Yes
- **Stage2:** Yes
- **Waiver:** No
- **Environmental:** Yes
- **Cost Estimate:** Yes

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**Critical Evaluation:** Yes

**Recommended Solution:** Yes

**Potential Solution to evaluate:** Yes
Add alternative description for "non-standard" control type / geometric changes
### GDOT ICE STAGE 1: SCREENING DECISION RECORD

**Project Location:** I-75 @ Fuller Rd/Red<br>**Prepared by:** Arcade<br>**Prepared by:** J. Reed<br>**Date:** 1/10/2017

**Purpose:**
- **Yes** or **No**: Briefly explain why this is a yes or no question. Ensure responses are consistent with the project objectives and criteria.<br>**Decision:** By who and when the decision was made.<br>**Schedule:** Percent complete and due date.

**Evaluation:**
- **Yes** or **No**: Briefly explain why this is a yes or no question. Ensure responses are consistent with the project objectives and criteria.<br>**Decision:** By who and when the decision was made.<br>**Schedule:** Percent complete and due date.

**Innovation Alternatives (see "Description")**: List all viable or desirable project improvements.<br>**Description:** Provide a brief description of each innovation type.<br>**Decision:** By who and when the decision was made.<br>**Schedule:** Percent complete and due date.

**Traffic Signal**
- **Yes** or **No**: Briefly explain why this is a yes or no question. Ensure responses are consistent with the project objectives and criteria.<br>**Decision:** By who and when the decision was made.<br>**Schedule:** Percent complete and due date.

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**Stage 1**

**Stage 2**

**Waiver**

**Environmental**

**Cost Estimate**
Choose existing intersection control; important determinant for several factors

Five alternatives auto-populate

Determine if safety-funded or non-safety funded project
Determine if BASE condition meets signal and/or AWS warrants

Choose what software was used to develop BASE conditions
Input “worse case” operational analysis results for BASE (external operational analysis required; “Worse Case” = delay and V/C during worst one-hour operational period (typically AM or PM peak))

Input “worse case” operational analysis results for FORECAST no-build conditions (external operational analysis required)
Input number, type and severity of crashes for most recent FIVE year period

Cost development aid using “CostEstimate” worksheet
Intersection Control Evaluation

ICE 2.0 TOOL – COST WORKSHEET

Select direction of Major Street
Enter existing number and width of lanes, turn bays and lengths, median widths (if present) and ROW for each approach.

Enter median widths (if any) and right-of-way.
Select general intersection topography (level, rolling or steep grade)

Select construction traffic control plan (most applicable to roundabouts)
Select level of expected utility impacts

Select type of signal pole
Select if unsignalized intersections will include flashing beacons

Select design vehicle
Select diameter and circulating lane width for roundabout types

Input PE and Contingency %
Input rural / urban ROW costs (in future versions, will be provided based on county)

Select proposed type of pavement construction for each alternative (full-depth, mill & overlay or none)
**Input number of driveways impacted**

**Input number signal & lighting poles**
Input # signalized ped crossings

Inputs for LF of sidewalk, cross-drains, retaining walls, guardrail, sqft of bridge specific to each alternative
Additional ROW, easement or demolition costs

Use table(s) to input non-standard alternative geometric changes

Add geometry change for addition of LT lanes on SR 22
Understand pavement area assumptions to determine if proposed and default pavement areas are vastly different.

User overrides for pavement area and Major/Minor street CST limits.

Table on costing spreadsheet showing pay items and how alternative costs are calculated; user cannot edit but there is opportunity to adjust or replace costs in Stage 2 worksheet.
Final costs from costing worksheet are auto-populated in Stage 2 worksheet

STAGE 2: OPERATIONS & SAFETY
Input "worse case" design year operational analysis (delay and V/C) results for each alternative and software analysis tool used

Select analysis tool used for each alternative evaluation
Safety Determination Using CMFs

- Safety benefit by change of intersection control determined using FHWA’s CMF Clearinghouse (www.cmfclearinghouse.org)
  - CMFs (Crash Modification Factor) used to compute the expected number of crashes after implementing a given improvement
  - CRFs (Crash Reduction Factors) estimates % reduction in crashes
- Many CMFs predefined based on existing/proposed control; others users may have to find or develop (and document)

Known CMF values auto-populate; if shown as zero (no safety benefit, user can best define using FHWA clearinghouse or other known studies (include justification)
Intersection Control Evaluation

**ICE 2.0 TOOL – ENVIRONMENTAL / POLITICAL DATA**

Historic, Archeology Resource & Graveyard impacts are quantified as “None”, “Minimal” or “Adverse”
Any "Adverse" impacts are highlighted red, & justification that this impact will not make project infeasible is required (use form on ENV tab)

Adverse impacts must be documented in "Environmental" worksheet

Add explanation of impact for each Adverse impact for each alternative (if any)
Stream impacts are quantified as “None” “Perpendicular” or “Longitudinal”.

Other environmental impact are quantified by their presence or not (Y/N).

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Political support for a project alternative is rated by both local jurisdiction and GDOT as support being "Strong", "Supportive", "Neutral", "Negative" or "Opposition"
## FINAL COSTS INCLUDING ALL FACTORS

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**Estimate 10% lower than expectations**
**User replaces with better cost estimate (once edits made formulas are lost)**

**Add cost of constructing left turn lanes to Traffic Signal alternative**
### Final ICE Score

The final ICE score recommends a roundabout for this location.

#### What if signal warrants are not met?

Score is not given for signalized alternative not meeting warrants.
In certain circumstances the ICE requirement *may* be waived based on appropriate evidence presented with written request:

- Proposed improvements don’t substantially alter intersection character
- Considered minor in nature
- Intersection is along a divided, multilane roadway and will be limited to a closed median with right-in/right-out access only
- 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
Select waiver request category; determines waiver request level (1 thru 3) and signature authority

Add major / minor street ADTs
Add Existing / Build operational results

Describe justification for Waiver request
Now What?

• After July 1, 2017 Official ICE Policy approval and guidance:
  – Always start with most recent tool version on website
  – Workshop presentation and video tutorial will be posted
  – Submit: **Introduction, Stage 1** and **Stage 2** one-page summaries with TE’s and/or CR’s (total of 3 pages plus Environmental form if used); OR one-page waver request

• Check website for version updates (ver2.1 Fall 2017)
  – More predetermined CMF’s and costing tool updates
  – More control types (diamond interchange)
  – Predictive safety factors for new intersections

• Provide Feedback on the Tool – Please!
  – Provide feedback from use of Tool on projects of differing intersection control, geometry etc. to incorporate needed changes in future versions

Questions
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