The Intersection Control Evaluation (ICE) v2.14 Tool is an open-source Excel workbook that includes eight worksheets which each contain information and data inputs to complete an ICE. Please note that the ICE analysis requires input on multiple worksheets that continually update analysis results; therefore, no results should be considered final until all worksheets are fully complete.

The Frequently Asked Questions (FAQ) worksheet provides information on ICE updates and answers to common questions analysts have. The Intersections worksheet provides illustrations and descriptions for each intersection type, as well as links to national publications that describe each intersection type in greater detail.

**GDOT ICE Tool: Introduction Worksheet**

Both full ICE studies and Waiver requests begin by filling out the information on the Introduction worksheet. Figure 1 illustrates the blank worksheet requesting project info and traffic data. The project data info, illustrated for the example project in Figure 2, requires the following:

- Project number and responsible person/agency
- Drop down box of the County where the project is located (GDOT District Office auto-populates)
- Major/Minor Road names & speed limits (drop down)
- Major Street direction and area type (rural, suburban/transition, or urban) -- both drop down menus
- Existing intersection control
- Name of preparing firm and analyst
- Date, internal project ID, and brief project description

Figure 3 illustrates the project example traffic data entry. The first entries (upper left) are existing and project Opening and Design years, reflecting the year improvements are expected to be complete (open to traffic) and expected design life of the improvements (typically Opening Year + 20 years).

Next, input existing AM and PM peak hour volumes for each movement, truck percentages and peak hour pedestrian crossings for each approach (if available) using the tables to the right (outside the worksheet print border). This data is automatically copied into the data entry graphic. Other inputs include the annual growth rate (historical or model based) and the daily K-factor (upper right).

Based on these inputs, the worksheet will auto-calculate daily intersection entry volumes, approach volumes and Average Daily Traffic (ADT) volumes for existing, opening-year and design-year scenarios. If Opening and Design year traffic volumes and/or ADT volumes are known from other sources, the calculated volumes can be overwritten using the tables to the right (outside worksheet print border).
**GDOT ICE Tool: Stage 1 Worksheet**

Stage 1 serves as a screening effort meant to eliminate non-competitive options and to identify which alternatives merit further considerations in Stage 2 based on their practical feasibility. Figure 4 illustrates the blank Stage 1 worksheet where intersection screening evaluations and justifications are made.

The top left portion of the worksheet includes project information data carried forward from the Introduction worksheet. It also notes that the alternative analysis requires consideration of at least two alternatives and a maximum of five alternative to be carried into the Stage 2 evaluation.

There are drop down boxes on the left side that allow the selection of alternatives consisting of one or more right and/or left turn lanes, and it is also possible to “write in” an intersection improvement type not contained in the defined list of alternatives. Write-in alternatives require additional work to calculate crash-modification factors and cost estimates described in later worksheets.

Analysts should use good engineering judgement in responding to the following six evaluation questions (listed in Figure 5) by selecting “Yes” or “No” in the drop-down boxes:

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?

The response to question 7, by a Yes or No response, is the determinant question for which alternatives are to be carried forward for Stage 2 analysis. Selected alternatives are highlighted in blue and the minimum 2 to maximum 5 selected alternatives are automatically carried forward into the Stage 2 worksheet. Figure 6 illustrates the responses and justifications for a project case study.

Alternatives should not be summarily rejected without due consideration, and reasons for eliminating or advancing an alternative should be documented in the "Screening Decision Justification" column. As illustrated for the example case in Figure 6, there is not a pre-determined number of positive responses to questions 1 to 6 that automatically determines a “Yes” response to question 7. Questions 1 through 6 are only a guide to best determine alternative feasibility for any number of justifiable reasons.
**GDOT ICE Tool: Stage 2 Worksheet**

Figure 7 illustrates the top of the **Stage 2 worksheet** contains pre-populated project info data and drop-downs for entries of both the existing traffic control and study type (safety funded project or conventional, non-safety funded project). Below are drop downs to indicate if the current intersection volumes meet signal warrants and whether operational analysis will be performed using traditional delay and volume-to-capacity (v/c) measures produced in most standard static traffic analysis models or using network delay information produced in most microscopic (simulation) traffic analysis models. Both approaches require analysis using traffic analysis tools outside of the Stage 2 worksheet.

Next, input the AM and PM peak hour delay and V/C operational results for both Opening and Design Year no-build conditions (including growth in traffic without intersection improvements). To the right, check boxes if any complete street warrants are met. Furthest right, enter the number of intersection crashes (by type) occurring at the intersection using the most recent five years of available crash data.

Figure 8 illustrates the input of cost data for each of the selected alternatives (alternative names auto-populated along the top row). If cost estimates are independently generated for one or all of the selected alternatives, construction, ROW, environmental mitigation, utility and design/contingency costs can be directly entered using the table to right. If/when these costs are not readily available, analysts can use the **CostEst worksheet** to determine planning level costs (described later in greater detail).

Figure 9 illustrates data inputs for operational analysis of the Build Conditions for each of the alternatives (including growth in the traffic volume with the intersection improvements). The AM and PM peak hour operational results are generated using traffic analysis tools outside the Stage 2 worksheet.

Alternative safety analysis results are generated from Crash Modification Factors (CMF’s) found in FHWA’s CMF clearinghouse (http://www.cmfclearinghouse.org). Most safety CMFs from known to-and-from intersection types (i.e. improvement from 2-way stop-controlled intersection to a single lane roundabout) are auto-populated from the clearinghouse data (sources are listed); however, when no clearinghouse data exist, or the analyst feels different clearinghouse data is more appropriate, analysts can use the fields below each alternative type to input CMFs for PDO and injury/fatal crash types and the source of the data.

Figure 10 illustrates inputs of potential environmental impacts for each alternative (none, minimal & significant). If there are potential impacts, the Environmental score is decreased AND a mitigation cost is added (depending on the impact type and potential severity). Stakeholder support of alternatives (both local community and GDOT support) should be determined and entered using drop-downs (strong, positive, neutral, negative, opposition or unknown).

The final ICE Stage 2 scores and rankings are provided at the bottom of the worksheet. Make sure all worksheet data has been completed (including the COST ESTIMATE worksheet) before relying on any results. Use the data field at the bottom to provide comments or explain unique data entries.
GDOT ICE Tool: Cost Estimating Tool

The Cost Estimating (CostEst) worksheet can be used to generate planning-level cost estimates when no independent cost estimates are available. The process begins by selecting “yes” in the drop down “Cost Estimate Tool Used?” on the right side of the worksheet. This will insert the tool-generated cost estimates into the Stage 2 worksheet. Figure 11 illustrates a blank template for the required inputs to identify existing intersection footprint, including number of lanes, turn bays and length, median width, and ROW.

Figure 12 illustrates the table used to identify specific elements for each alternative. Most of the input data can be determined from a mapping program image or GIS data and by using engineering judgement. The last row is used to identify any cost (in dollars) for ROW and structural impacts above and beyond the general ROW impacts of each alternative, which is automatically calculated by existing ROW inputs and expected alternative footprint.

Figure 13 illustrates the inputs of site context and cost multipliers for the example intersection. Begin with topography, maintenance of traffic and project size (all drop-box choices). These responses change overall factors in the cost estimates in the table below. Analysts enter preliminary engineering and contingency costs as a percentage. Intersection control choices include type of signal poles and design vehicle and the analyst can input anticipated diameters for each roundabout type (or leave the default parameters). The ROW cost is auto-populated based on county-generated cost data and drop-down land use type.

Figure 14 illustrates the table (located at the bottom of the CostEst worksheet) where assumptions for each alternative are entered to refine costs. The grey drop-down and blue data fields will only appear for the selected alternative. Analysts can make choices in the drop-down boxes and override fields if the default values for ROW, sqft of pavement and/or project limits (calculated based on a generic alternative concept) are significantly different from analyst calculated values (calculated or estimated based on a more refined concept).

The table illustrated in Figure 15 will appear on the one-page printout of the CostEst worksheet. The quantities and costs cannot be changed; analysts can only review individual cost components of the cost estimates carried into the Stage 2 worksheet. If the worksheet-generated cost estimates do not seem reasonable, costs can be modified in Stage 2 by either a) overriding costs data as described earlier or b) applying a percent multiplier to the overall costs. If a cost adjustment is made, a note will appear indicating the variance, and a reason for the variance should be included at the bottom of the Stage 2 worksheet. The cost estimate worksheet is intended to generate a planning-level cost for comparative purposes and the ranking of selected ICE alternatives; a more detailed cost estimate should be prepared for the preferred alternative in the later project concept phase.
**GDOT ICE Tool: Environmental Worksheet**

The last two worksheets are optional. Figure 16 illustrates the Environmental (ENV) worksheet, which is used to document any potentially significant environmental impacts in any given alternative (indicated in red as “significant” in the drop-down box in Stage 2). The goal here is to document that reasonable mitigation (or avoidance) can be achieved (that would otherwise disqualify this alternative) before that alternative is selected a preferred solution.

**GDOT ICE Tool: Waiver Worksheet**

Figure 17 illustrates the Waiver worksheet, to be used when the analyst feels that a full ICE study is not warranted. Circumstance for a waiver are outlined in the top portion of the worksheet (and presented in the full ICE policy document). The top portion of the Waiver worksheet requires a Waiver Request Type (selected from a drop-down list), which identifies the level of waiver request and signature authority. In the remainder of the form, requests for crash data, ADT and operations data for Existing and Design Year No-Build conditions are made, determined the same way as data for the Introduction and Stage 2 tabs.

The Waiver Worksheet tab can not only be used as a waiver request from conducting a full ICE study but can also be used to waiver the highest ICE result and choose to recommend a different (lower scoring) alternative. The data entry box at the bottom is used to describe the waiver request circumstances, and the worksheet requires submittal and signature of acceptance as described in the ICE policy.

**GDOT ICE Tool: Multi-File ICE Summary**

A separate file, Multi-File ICE Summary.xls is provided to allow the summary of multiple individual ICE results, that can be useful to see alternatives and recommendations for a corridor analysis of multiple intersections. Place the summary.xls file into a folder with all ICE case studies desired to summarize, select the “Clear data and update information” box, and the program will read and display the final score for each alternative in each ICE file. The highest recommended alternative is highlighted in green.

On a separate page in the same worksheet, users can input multiple locations where two-way stop control (TWSC) waivers are being requested and can be approved as a group. Here, additional information is requested including geometry, ADT, operations and safety data, to better understand the circumstances under which the warrant is requested. Locations that do not meet waiver requirements are highlighted in bold RED text, and a full ICE process is recommended for these intersections.