

# Intersection Control Evaluation Overview and Updates

Presented to: ACEC/MA

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# Agenda

- What is ICE
- Evolution of ICE
- ICE Process
- Challenges Encountered
- Timeline of MassDOT ICE Improvements
- Applicability
- State-Led Project Process
- Training, Guidelines & More
- More Updates Coming
- Feedback Needed

# What is ICE?

- Intersection Control Evaluation (ICE) is a data-driven, performance-based framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection.
- The ICE process provides an opportunity for safety to be integrated into intersection control decisions, leading to the implementation of **safer, more balanced cost-effective solutions**.
- The goal of ICE is to objectively select a control strategy that meets the project's **purpose and need** and fits the intersection's location context and roadway classification, while achieving the **overall long-term best value**.

# Evolution of ICE

- September 2015: the National Cooperative Highway Research Program completed the report: Estimating the Life-Cycle Cost of Intersection Designs
- December 2017: MassDOT starts Task with Kittleson to develop MassDOT Intersection Control Evaluation (ICE) procedures
- 2019: 10 States have ICE Policy
- March 2021: MassDOT releases the ED-21-002 Pre-25% Design Scoping Procedure which includes ICE
- 2022: 15 States have ICE Policy, including Massachusetts
- February 2024: NCHRP Research Report 1087 Guide for Intersection Control Evaluation

# ICE Process

- Applicability
- Stage 1
- Stage 2, if needed
- Stage 3, if needed (rare occasions)
  
- Waiver available

# Challenges Encountered

- ICE Process not integrated into Project Development process
- Application of ICE to projects where it didn't meet purpose & need or severely impacted project schedule/delivery
- ICE Stage 1 taking many revisions
- Timing of ICE Stage 1 and Design NTP
- Different interpretations of Stage 1 fatal flaws
- ICE roll-out and training delays
- Complexities of systems analysis and qualitative safety analysis in ICE

# ICE Improvements Timeline

March 2021

## ICE Implementation

- Engineering Directive E-21-002
- Process identified at PRC

February – April 2023

## Process Improvements

- Applicability Form
- On-Call Pilot

June 2023

## MaPIT

- Applicability Form rolled into MaPIT
- Weekly ICE Meetings

December 2023 +

## Procedure Improvements

- Stage 1 Training on-line
- Guidelines updated
- Interim SOP for PMs
- Weekly Meetings w/PMs
- Sasha Wood hired to facilitate ICE

# Applicability in Guidelines

## 2. Applicability

The ICE procedure is the same whether it involves new intersections or modifications to existing intersections. ICE is **required** for each project intersection that (a) is located on State Highway, (b) requires issuance of a Category II or III Access Permit (including those projects that require MEPA review before applying for an Access Permit from MassDOT), and/or (c) receives MassDOT or Federal Highway Administration funding; and meets any of the following criteria:

- Creating a new intersection
- Adding an approach or departure leg to an existing intersection
- Adding one or more through lanes, left-turn lanes, channelized turn lanes, or bypass lanes to an existing intersection approach
- Changing the traffic control at an existing intersection. Examples include:
  - Adding or removing a traffic signal
  - Adding or removing a Stop or Yield sign to control an intersection movement on a leg
- Full-depth pavement reconstruction of an existing intersection on any NHS roadway
- High crash locations (except when the scope of work is limited to maintenance or resurfacing)

At highway interchanges it is recommended that all ramp junctions be considered and evaluated through the ICE procedure and considered as a system.

MassDOT encourages municipalities to perform an ICE for intersection projects they lead on locally maintained roadways, but ultimately it is the choice of the municipality.

A project intersection is **exempt** from the ICE procedure if any of the following apply:

- The project is municipally-led on locally-maintained roadways, and no state or federal funds are used for its design or construction
- The minor street is a low-volume roadway with an AADT less than 1,000 vehicles per day
- The intersection receives a written exemption from the State Traffic Engineer

Interpretations of Applicability using the written guidelines led to confusion and disagreement of where ICE should be applied, and to which intersections.



# Applicability: Original Form

**MassDOT Intersection Control Evaluation (ICE) Applicability Checklist**

**Step 1) Check if the project is exempt from ICE by answering the questions below. Select Yes/No in the gray drop-down box provided for each question.**

Project Name		Is the project municipally-led?	No
MassDOT District	District 2	Is the project entirely on locally-maintained roadways?	No
City/Town		Are Federal Highway Administration (FHWA) funds used?	Yes
Submitted By		Is the project being designed by MassDOT or MassDOT consultants?	Yes
Agency/Company		Will the project be advertised by MassDOT?	Yes
Email		Is the project fully funded through Chapter 90 or a MassDOT grant program?	No
Date		Did the project receive a written waiver from the State Traffic Engineer?	No
		Is the project included in a Category II or III Access Permit?	No

Is ICE required? **Yes** Proceed to Step 2.

**Step 2) Answer the questions below to check each project intersection for ICE applicability. Select the appropriate answer in the gray drop-down box provided for each question.**

Intersection #	Intersection*	Do all minor street approaches to the intersection have an AADT less than 1,000 vehicles per day?	Did the intersection receive a written waiver from the State Traffic Engineer?	Is this a new intersection being created?	Are any approach or departure legs being created?	Are any through, left-turn, channelized turn, or bypass lanes being added to the intersection?	Is the traffic control of at least one of the intersection legs being changed (e.g., adding or removing signal, stop, or yield control)?	Does the intersection include a full-depth pavement reconstruction on a National Highway System roadway?	Is the intersection a high-crash location (except when the scope of work is limited to maintenance or resurfacing)?**	Is ICE required?
1	Fake Street at Fake Road	No	No	No	Yes	No	No	No		YES
2										

Is ICE applicable to the project based on ownership and funding?

If yes, to which intersections is it applicable to based on volumes, intended scope, and crash history?

# Applicability: Revised Form

**MassDOT Intersection Control Evaluation (ICE) Applicability Checklist**

Project Name: \_\_\_\_\_  
 MassDOT District: District 2  
 City/Town: \_\_\_\_\_  
 Submitted By: \_\_\_\_\_  
 Agency/Company: \_\_\_\_\_  
 Email: \_\_\_\_\_  
 Date: \_\_\_\_\_

**Step 1) Check if the project is exempt from ICE by answering the questions below. Select Yes/No in the gray drop-down box provided for each question.**

Is the project municipally-led?	No
Is the project entirely on locally-maintained roadways?	No
Are Federal Highway Administration (FHWA) funds used?	Yes
Is the project being designed by MassDOT or MassDOT consultants?	Yes
Will the project be advertised by MassDOT?	Yes
Is the project fully funded through Chapter 90 or a MassDOT grant program?	No
Did the project receive a written waiver from the State Traffic Engineer?	No
Is the project included in a Category II or III Access Permit?	No

Is ICE required? **Yes** Proceed to Step 2.

Answer the questions below to check each project intersection for ICE applicability. Select the appropriate answer in the gray drop-down box provided for each question.



Intersection #	Intersection*	Do all minor street approaches to the intersection have an AADT less than 1,000 vehicles per day?	Did the intersection receive a written waiver from the State Traffic Engineer?	Is this a new intersection being created?	Are any approach or departure leg(s) being added to the intersection?	Is the traffic control at part or all of the intersection being changed (e.g., signalized, roundabout, etc.)?	Does the intersection in divide full-depth pavement reconstruction on a National Highway System roadway?	Is the project being added to the maintenance of resurfacing work?	Is ICE required?
1	Fake Street at Fake Road	No	No	No	Yes	No	No	No	YES
2									

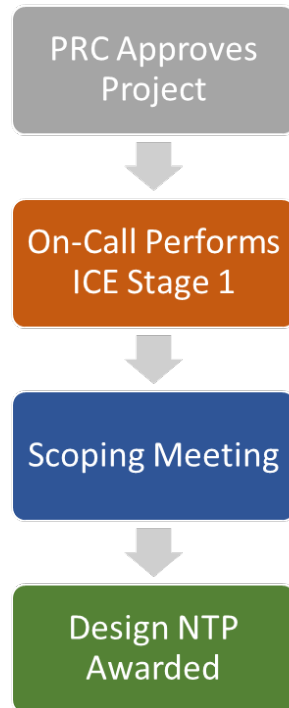
Access permits removed from applicability, MEPA clarified

Applicability Threshold related to full-depth reconstruction on an NHS roadway removed Winter 2023

# State-led Projects: Stage 1 On-Call Consultant

## Preferred Process for MassDOT-designed projects

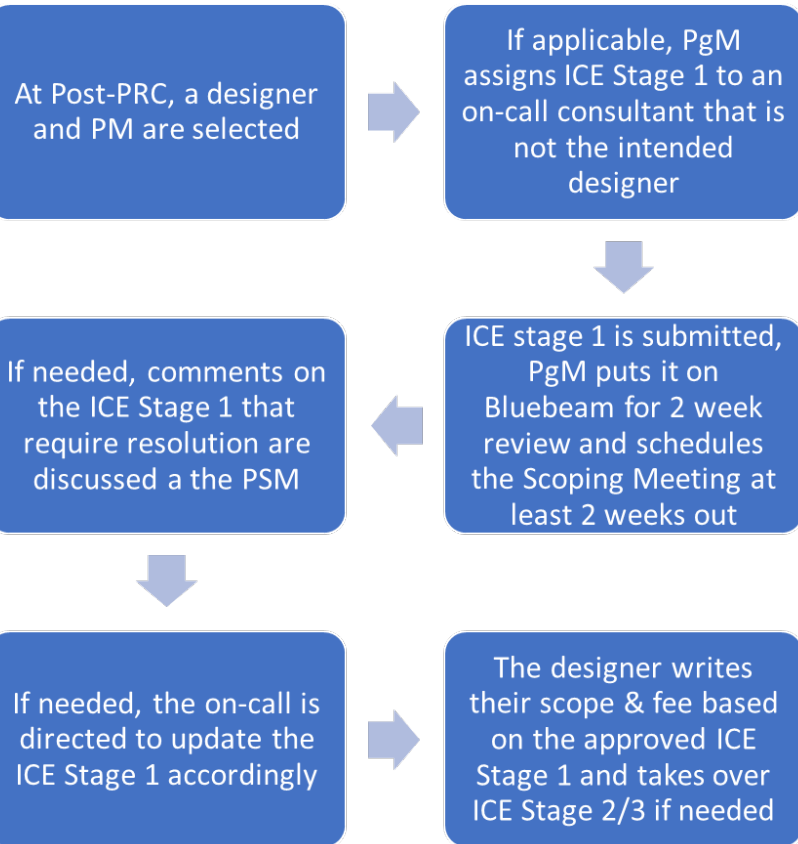
-  Consultants getting paid to do ICE Stage 1
-  Scope & fee can be developed with less unknowns and PSM discussion more informed



## Goals of the ICE Stage 1 On-call:

- Set a standard fee range for future On-Calls
  - *Consultants had been quoting 60+ hours and assuming 2-3 rounds of revisions and CRMs based on experience*
- Set up a streamlined process to reduce # revisions of Stage 1
  - *Kick-off meeting as helpful to identify fatal flaws up front*
  - *Utilize PSM as ICE CRM*

# State-led Projects: Scoping Process



**MASSDOT PROJECT SCOPING CHECKLIST**

Project File No.: 612975 Date: 01/26/24

**X. DATA, STUDIES, ANALYSIS & REPORTS**

**A. Intersection Control Evaluation (ICE) Requirements**

- ICE is applicable only due to "unknown" design - to be revisited after design more known
- ICE is applicable for project intersection(s), list intersections below

ICE is applicable for the Top 200 clusters but not the Turnpike/138 intersection. Reviewed during Pre-PRC.

- ICE Stage 1 submitted 2 weeks prior to PSM [ICE Forms](#)

Comments - discuss potential fatal flaws and identify what MassDOT Sections should be involved in ICE discussions if there is need for a follow-up:

*Potential 106 Historic Review. Consider in fatal flaw discussion.*

Turnpike @ Purchase - moving forward with AWSC, signal, roundabout. (TWSC to be removed per District comment).

138 @ Purchase - Stage 1 showed AWSC, signal, roundabout, jughandle. D5 commented to add quadrant roadway since Turnpike St could be used for this.

ICE Stage 1 to be re-submitted, then a follow-up meeting will be held to determine Nitsch's scope. Network vs ICE to also be determined - it was discussed today that alternatives analysis may be better off outside of ICE tool. If ICE is to progress, there should be a potential revisit to ICE Stage 1 after counts have been taken to see if any controls should be removed. Turnpike may become applicable to ICE if there are changes required to address the crash clusters.

- Alternatives analysis should proceed without ICE due to tool limitations, to be approved by MassDOT (i.e. qualitative safety analysis, complex systems, etc.)

# Training On-Line

- Module 1 – Nov. 2023  
    Stage 1 Overview
- Module 2 – March 2024  
    Stage 1 Case Studies
- Module 3 – Coming Soon  
    Stage 2 Overview



## MassDOT Intersection Control Evaluation (ICE) Stage 1 Overview



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This training is one of five modules for ICE procedure. More information: <https://www.mass.gov/info-details/mas...> ...more

# Guidelines Updated

- Updated applicability criteria, including removal of Permits and full-depth reconstruction
  - Clarification for lane reallocation
  - Definition of high crash

## Intersection Criteria

- Creating a new intersection
- Adding a leg to an existing intersection
- Adding one or more through lanes, left-turn lanes, channelized turn lanes, or bypass lanes to an existing intersection approach (Note: this does not include reallocating existing travel lanes. For example, changing the lane use on an approach from a through lane to a left-turn lane does not constitute adding a lane.)
- Changing the traffic control at an existing intersection. Examples include:
  - Adding or removing a traffic signal
  - Adding or removing a Stop or Yield sign to control an intersection movement on an approach
- High-crash location, except when the scope of work is limited to maintenance or resurfacing. For the purpose of the ICE Procedure, a high-crash location is defined as an intersection within a cluster (to include vehicle, pedestrian, or bicycle) for the most recent period shown on the MassDOT Interactive Crash Cluster Map (<https://gis.massdot.state.ma.us/topcrashlocations/>).  
Note that a high-crash location is defined differently for purposes of Road Safety Audits.
  - Ramp terminals, roundabouts, and rotary intersections are not included on MassDOT's Interactive Crash Cluster Map. If a subject location is one of these intersection types, MassDOT Traffic Safety should be contacted ([TrafficSafetyAnalysis@dot.state.ma.us](mailto:TrafficSafetyAnalysis@dot.state.ma.us)) to determine whether the location is a high crash location or not. This determination should be formally documented with MassDOT HQ and District Traffic sections copied.

# Guidelines Updated

- Added waiver procedure including **specific reasons** why a waiver may be requested

## 2a. Waiver Procedure

If a written waiver from the State Traffic Engineer is being requested, an email containing the below information shall be sent to James Danila, P.E., State Traffic Engineer ([James.Danila@dot.state.ma.us](mailto:James.Danila@dot.state.ma.us)) with the Traffic Safety Analysis group ([TrafficSafetyAnalysis@dot.state.ma.us](mailto:TrafficSafetyAnalysis@dot.state.ma.us)) copied.

- Project information summary (including MassDOT project number, if known)
- Whether the waiver is being requested for the entire project or individual intersection(s) within the project
  - If the waiver is for the entire project, project limits shall be specified
  - If the waiver is for individual intersections, the intersections shall be specified
- Narrative describing reasons for the waiver
- Any supporting analysis, such as traffic volumes, if available

A waiver should be requested prior to project scoping, but also can be requested at any time during the ICE process if the Proponent feels there is a valid reason for the request. Examples of reasons why waivers may be considered include, but are not limited to:

- Alternatives analysis was conducted prior to project initiation
- Short-term project at the same location as a proposed long-term project where the intersection control will be evaluated as part of the long-term project
- Implementation of only low to medium cost countermeasures from a road safety audit
- Intersection outside of project limits and proposed improvements limited to minor changes (signal phasing, signage, pavement markings only) to mitigate project-related queues
- No viable control options other than existing control

# Guidelines Updated

- Provided examples of ICE Stage 1 **fatal flaws**, to allow for certain ROW and environmental factors, MUTCD warrants, or alternatives that do not fit the project needs, objectives, and scope to rule out control

**Stage 1: Screening** – considers a wide range of control strategies. Stage 1 includes the ICE Form and the following optional items: count data, preliminary capacity analysis (CAP-X), warrants analysis, safety analysis, high level sketch of alternatives, or any other analysis prepared as part of Stage 1. Eliminates fatally-flawed alternatives. Fatal flaws include but are not limited to:

- Alternatives that do not fit with the project needs, objectives, and scope
- Alternatives that trigger Article 97, when other alternatives exist that do not require Article 97 takings
- Right-of-way (ROW) for municipal projects: municipality does not support the ROW acquisition process
- Impacts that require a lengthy ROW acquisition or permitting process that may push the project schedule beyond the programmed timeline
- Traffic control strategy not in conformance with MUTCD, including MA Amendments
- Relocation of power transmission lines
- Removal of five or more shade trees within an Environmental Justice community



# Guidelines Updated

- Modified language for closely spaced intersections (systems analysis)
- Mentioned qualitative safety analysis

At closely spaced intersections including highway interchanges with multiple ramp junctions, MassDOT may request that the intersections be considered and evaluated through the ICE Procedure as a system. In some cases, a quantitative safety analysis may not be possible, and a qualitative safety analysis will be required. Consult with MassDOT Traffic and Safety group on how to proceed in these cases.

## X. DATA, STUDIES, ANALYSIS & REPORTS

### A. Intersection Control Evaluation (ICE) Requirements

- ICE is applicable only due to "unknown" design - to be revisited after design more known
- ICE is applicable for project intersection(s), list intersections below

- ICE Stage 1 submitted 2 weeks prior to PSM [ICE Forms](#)

Comments - discuss potential fatal flaws and identify what MassDOT Sections should be involved in ICE discussions if there is need for a follow-up:

- Alternatives analysis should proceed without ICE due to tool limitations, to be approved by MassDOT (i.e. qualitative safety analysis, complex systems, etc.)

# Guidelines Updated

- Added submission requirements section to outline the deliverables at each stage so designers know what to submit
  - **Stage 2: Initial Assessment**
    - Required
      - ICE Stage 2 Form in PDF (one per intersection)
      - ICE Tool in PDF (one per intersection). Excel to be submitted as back up.
      - Safety Analysis Spreadsheet or qualitative analysis (one per intersection, multiple years can be combined into a single PDF). Excel files to be submitted as back up.
      - Concept sketches in PDF (one per intersection)
      - All supporting analysis, combined into a single PDF with a table of contents
        - Capacity analysis
        - Crash data
        - Traffic Signal Warrants Analysis, if applicable
        - Count data
        - Planning level cost estimates
        - Any other supporting documentation prepared for Stage 2

# Interim SOP for MassDOT PMs

- Project Info Organization
- Applicability Form Policy and Procedure
- Waiver Policy and Procedure
- Stage 1, 2, and 3 Procedure
  - Includes **review timelines**

For projects initiated prior to June 1, 2023

## ICE Project Info Organization

MassDOT Project Managers (PM) shall create a folder called ICE within the Pre-25% Folder in ProjectInfo. Separate folders shall be created within that folder for each stage. All documents, Bluebeam batch summaries, marked-up documents, responses to comments, meeting minutes, and meeting sign-in sheets pertaining to ICE shall be saved to these folders. Refer to the ICE Procedure Requirements for additional information on waivers.

## ICE Applicability Form

### POLICY:

The Applicability Form is not required but may be filled out by the Designer prior to commencing ICE Stage 1 if applicability is uncertain or that it's believed that ICE does not apply. The preparation of the form is not needed if ICE is being evaluated at all intersections and major driveways within project limits. The form can be prepared and submitted for review at any time during the ICE process to confirm that ICE is applicable.

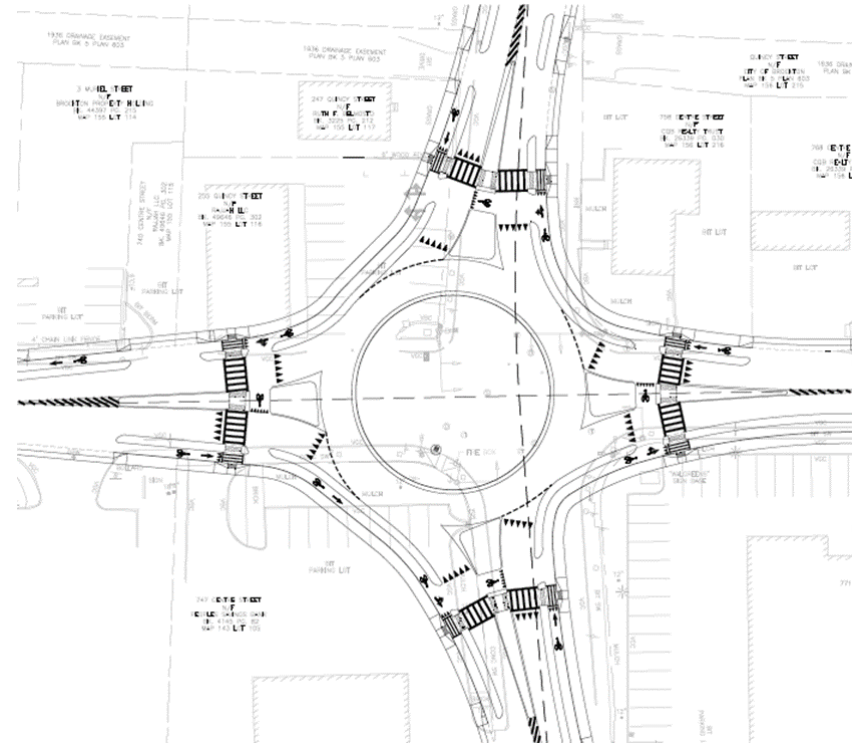
Since the criteria for ICE Applicability changed on December 6, 2023, there are occasions where ICE may no longer be required for some locations. If the PM or Designer has a question about whether ICE is required for a particular intersection during the ICE process, the PM can encourage the Designer to revisit the ICE Applicability Form. If the new Applicability Form indicates that ICE is not required for certain intersections where ICE is already in process, the PM shall follow the procedure in Step 1 below for review. If the new Applicability Form indicates that ICE is still required for all locations where ICE is in process, there is no need to submit the Applicability Form for review, however, the Form should be attached (for record purposes) with next ICE submittal.

### PROCEDURE:

1. The PM shall upload the Applicability Form to Bluebeam with a 7-day review timeframe for review by the MassDOT HQ and District staff as identified in the ICE Column of [SOP775\\_Attachment\\_C\\_Distribution Lists2.xlsm](#)
2. If the designer and PM believe that ICE is not the best option to evaluate intersection control (due to closely spaced intersections or other project factors), the PM should consult with HQ and District Traffic sections to determine if a different form of alternatives analysis may be a better fit for the project. See Waiver process below.

# Stage 2 Updates

- Revised Stage 2 Form for fatal flaws identified after Stage 1
  - ROW takings (sketch required)
  - MUTCD warrants
  - Article 97 impacts
- Involving Program Managers in discussion for appetite for ROW takings with respect to project purpose and need



## More Updates Coming...

- PDDG Chapter 2 – includes ICE
- SOPs for Scoping/ICE/Pre-25%, as needed
- Stage 2 Training Module w/Case Studies
- Guidance for Systems Analysis
- Guidance for Qualitative Safety Analysis
- Tracking of ICE within Project Schedule

Share your experience  
using ICE with us!



Have you used the  
MassDOT Intersection  
Control Evaluation  
procedure...

ANONYMOUS



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