Moving Together 25

Intersection Control Evaluation

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MassDOT

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U.S. Department of Transportation Federal Highway Administration

Intersection Control Evaluation

- 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.**

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Evolution of Intersection Control Evaluation

- 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 Directive E-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

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MassDOT ICE Timeline

Bi-Weekly ICE Improvement Meetings

2021

ICE Roll-Out & Innovation Conference

ICE is included in the Pre-25% Engineering Directive E-21-002

New procedure noted at Pre-PRC meetings

ICE Presentation

Safety Alternatives Analysis Guide

2022

MAITE/NEITE Annual Meeting

ICE & Safety Alternatives Analysis Presentation

Submissions:
Stage 1: 8
Stage 2: 1
Stage 3: 1

2023

Initial Improvements

Piloted On-Call for Stage 1

Applicability Form developed and rolled into MaPIT process

Training Modules Started

Procedure Updates

Submissions:
Stage 1: 80
Stage 2: 38
Stage 3: 1

2024

PM, ACEC, SNEITE Presentations

Procedure Updates

Abbreviated Stage 2

Training Modules Completed

Submissions:
Stage 1: 56
Stage 2: 45

2025

Continued Improvements

Applicability Form Updates

Framework for Systems Analysis

Framework for Qualitative Safety Analysis

Submissions (10 months):
Stage 1: 25
Stage 2: 30

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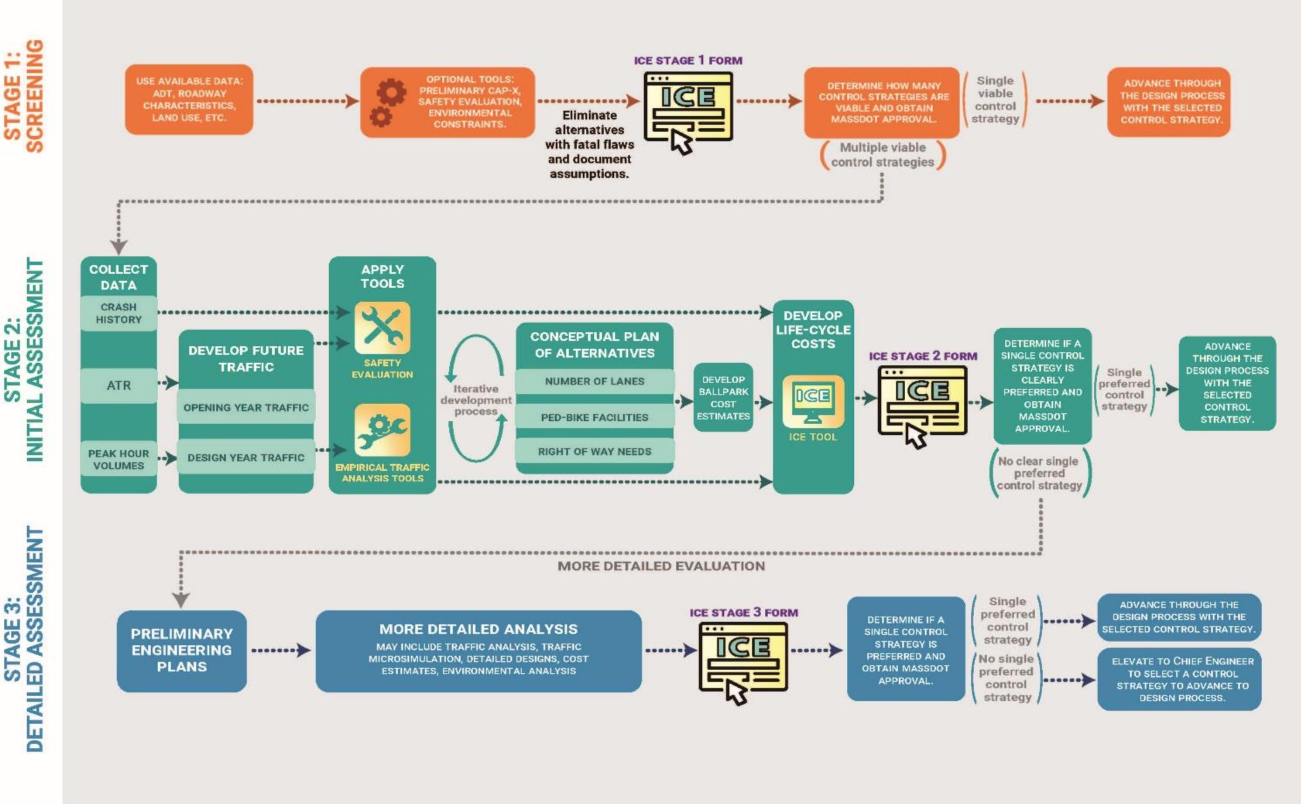
MassDOT Intersection Control Evaluation Process

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



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Applicability for Projects

- Advertising Program
- Development projects requiring MEPA review specifically scoped for ICE
- Exemptions for:
  - Municipally led on local roads, not using FHWA funds or being designed or advertised by MassDOT
  - Funded through Chapter 90 or MassDOT grant program on local roads
  - Waiver from STE
  - MEPA Projects with Section 61 Findings
  - Permit Projects

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Applicability for Intersections

- Creating a new intersection
- Adding a leg to an existing intersection
- Adding left, through, channelized or bypass lanes
- Changing traffic control
- Identifying as a high crash location

- Exemptions for minor road ADT less than 1000 vpd or waiver from STE

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Applicability Form

MassDOT Intersection Control Evaluation (ICE) Applicability Checklist

Project Name	
MassDOT District	
Project No. (if known)	
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 drop-down provided for each question.

Did the project receive a written waiver from the State Traffic Engineer?	No
Has the project been reviewed through the MEPA process and has a Section 61 Finding with specific mitigation requirements?	No
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 consultants under contract with MassDOT?	Yes
Will the project be advertised by MassDOT?	Yes
Is the project fully funded through Chapter 90 or a MassDOT grant program?	No

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*	Is the combined AADT of all minor intersection legs 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 leg(s) being added to the intersection?	Are any through, left-turn, channelized turn, or bypass lanes being added to the intersection (adding lanes does not include reallocation of existing pavement/travel lanes)?	Is the traffic control at part or all of the intersection changing (e.g., adding or removing signal, stop, or yield control)?	Is the intersection a high-crash location (except when the scope of work is limited to maintenance or resurfacing)?**	Is ICE required?
1	Main St at First St	No	No	No	No	No	Yes	No	YES
2	Main St at Second St	No	No	No	Yes	No	No	No	YES
3	Main St at Third St	No	No	No	No	Yes	No	No	YES
4	Main St at Fourth St	No	No	No	No	No	No	Yes	YES
5	Main St at New Driveway	No	No	Yes	No	No	No	No	YES
6	Main St at Fifth St	No	No	No	No	Maybe	No	No	MAYBE
7	Main St at Sixth St	Yes							NO
8	Main St at Seventh St	No	Yes						NO
9	Main St at Eighth St	No	No	No	Yes	No	Maybe	No	YES

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Stage 1: Screening

- Consider wide range of control strategies
- Eliminate fatally flawed alternatives

Result

- Single viable control: ICE complete
- Multiple viable controls: → Stage 2

Link to intersection location

COULD THE CONTROL STRATEGY:

Control Strategy	... address the project need in a balanced manner and in scale with the project?	... improve safety performance in terms of reducing severe crashes?	... incorporate safety, convenience, and accessibility for pedestrians and/or cyclists?	... improve (or preserve) traffic operations (congestion, delay, reliability, etc.)?	... appear viable given the site constraints & location context (e.g., ROW, cultural impacts)?	... appear viable with respect to other project factors (e.g., environmental, utility impacts)?	VIABLE CONTROL STRATEGY?	Decision Justification
Two-Way Stop Control (TWSC)	Yes	No	No	No	Yes	Yes	No	TWSC operation with major/minor streets oriented in either direction not feasible due to inadequate capacity & failing operations in future-year peak hours (see CAP-X analysis), and the existing signal meeting MUTCD signal warrants 1-3 (see warrants worksheet)
All-Way Stop Control (AWSC)	Yes	No	Yes	No	Yes	Yes	No	AWSC operation not feasible due to inadequate capacity & failing operations in the future-year peak hours (see CAP-X analysis), and the existing signal meeting MUTCD signal warrants 1-3 (see warrants worksheet)
Signalized Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Existing signal-control & lane geometry provides adequate capacity in future-year peak hours (see CAP-X & Synchro analyses), and reconfigured turning lane assignments can improve vehicle safety performance; multimodal accommodations can also be added without parking/building impacts.
Roundabout	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Roundabouts address project need of enabling safe access along Great Road for all users. Adequate future-year capacity would be nearly achieved with 1x1 configuration (see CAP-X analysis), but reliably so with 2x1 E/W configuration; 2x1 configuration building/parking impacts should be reviewed.
Median U-Turn (MUT)	No	Yes	Yes	Yes	Yes	No	No	MUT configuration is not feasible due to substantial costs to widen Great Road exceeding the scale of the project scope, as well as impacts to DEP-Approved Wellhead Protection Areas (Zone II) on both sides of Great Road east & west of the intersection.
Partial Median U-Turn (PMUT)	No	Yes	Yes	Yes	Yes	No	No	PMUT configuration is not feasible due to substantial costs to widen Great Road exceeding the scale of the project scope, as well as impacts to DEP-Approved Wellhead Protection Areas (Zone II) on both sides of Great Road east & west of the intersection.
Restricted Crossing U-Turn (RCUT) Signalized	No	Yes	No	No	Yes	No	No	RCUT configurations are not feasible due to parking area impacts along the western leg of Great Road, and overall poor fit given the relatively even balance of entering traffic from both cross-streets (55%-45% from Great Road & Main Street, respectively.
Restricted Crossing U-Turn (RCUT) Unsignalized	No	No	No	No	Yes	No	No	Unsignalized RCUT not feasible due to the existing signal meeting MUTCD signal warrants 1-3 (see warrants worksheet).
Jughandle	No	No	No	Yes	No	No	No	Jughandle configurations with added connectors from Great Road (EB or WB approaches) are not warranted given the relatively low EB/WB peak hour left-turning volumes; also would require additional crossings for pedestrians & bicyclists at the added junctions.
Displaced Left-Turn (DLT)	No	No	No	Yes	Yes	Yes	No	DLT configurations (full or partial) are not warranted given the relatively low peak-hour left-turn movement volumes at the Great Road (EB/WB) approaches.
Continuous Green Tee	No	No	No	No	No	No	No	Continuous Green-T configurations are only applicable to 3-leg intersections.
Quadrant Roadway	No	No	No	Yes	Yes	No	No	Quadrant Roadway configurations with added connectors in the east or west quadrants are not feasibe due to impacts to DEP-Approved Wellhead Protection Areas (Zone II) on both sides of Great Road.

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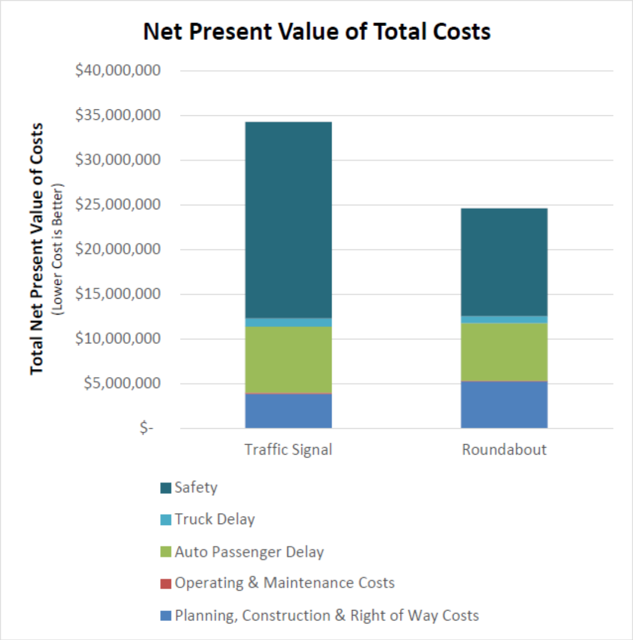
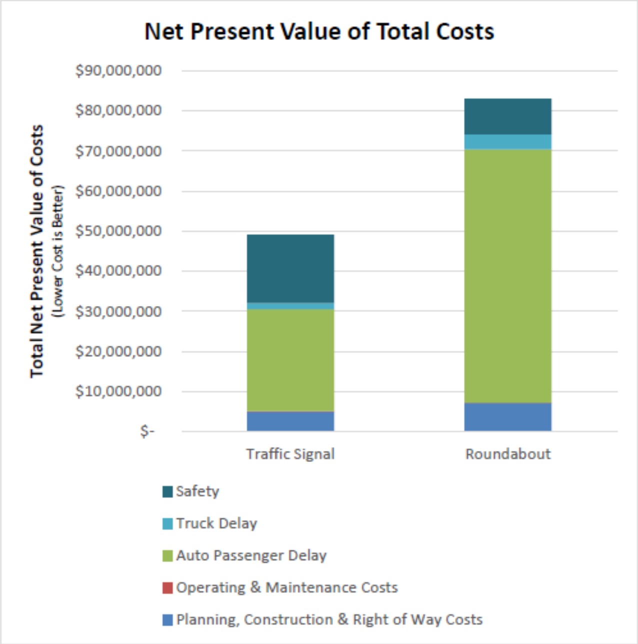
Stage 2: Initial Assessment

- Quantitative assessment to determine long-term best value (Net Present Value) includes:
  - Traffic Operations Costs
  - Safety Costs
  - Capital Costs
  - Operating/Maintenance Costs
- Abbreviated process if fatal flaw identified after Stage 1

Result

- Single viable control: ICE complete
- Multiple viable controls: → Stage 3





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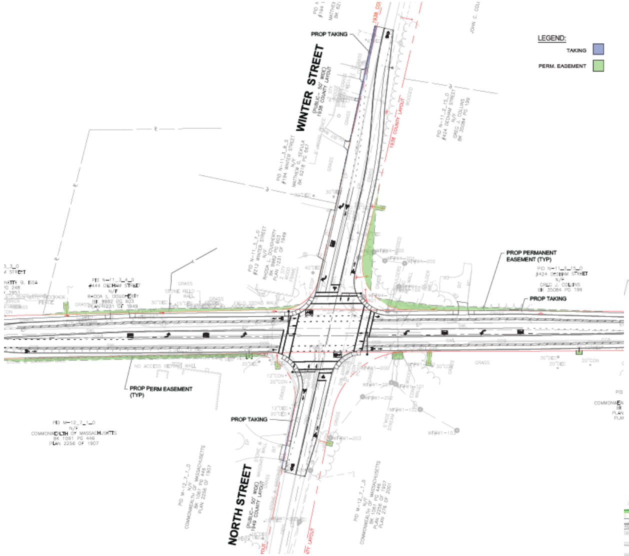
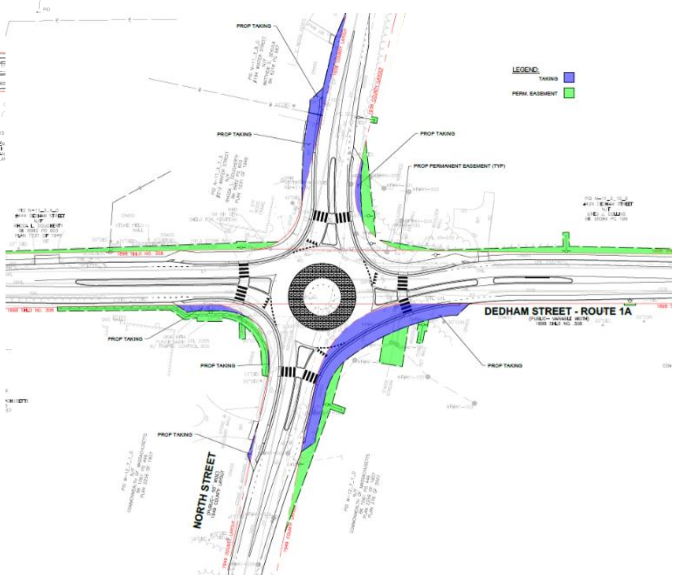
Stage 3: Detailed Assessment

- Conducted if no single preferred control strategy after Stage 2
- Only required if all initial assessment methods are exhausted
- Detailed assessment of viable controls
  - High level design to model impacts
  - Detailed analysis (traffic analysis/microsimulation)
  - Cost estimates
  - Environmental impacts

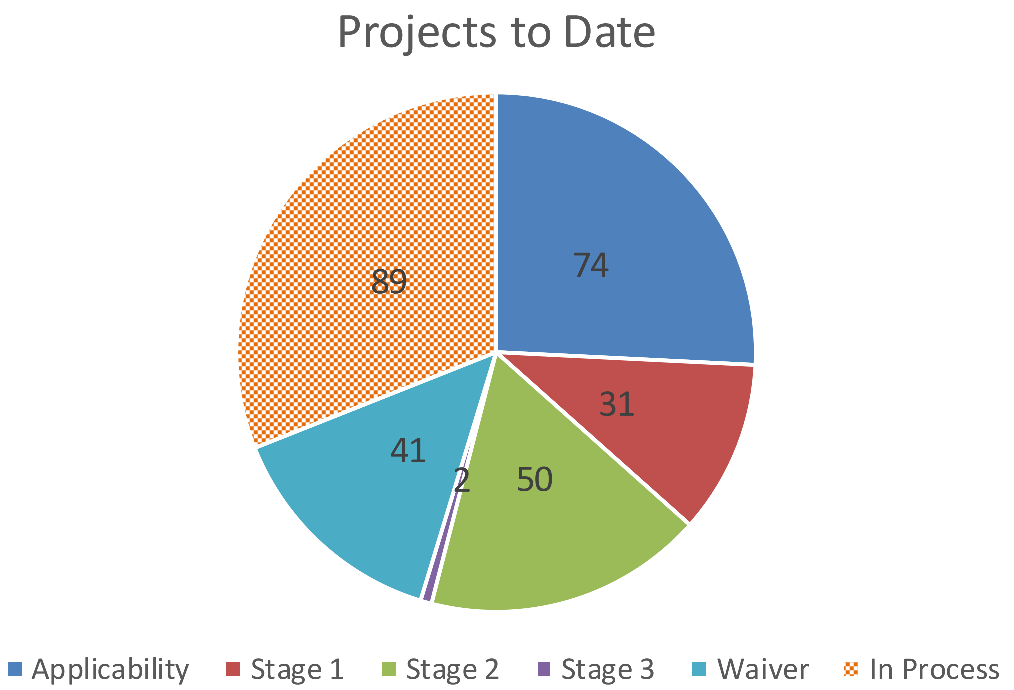




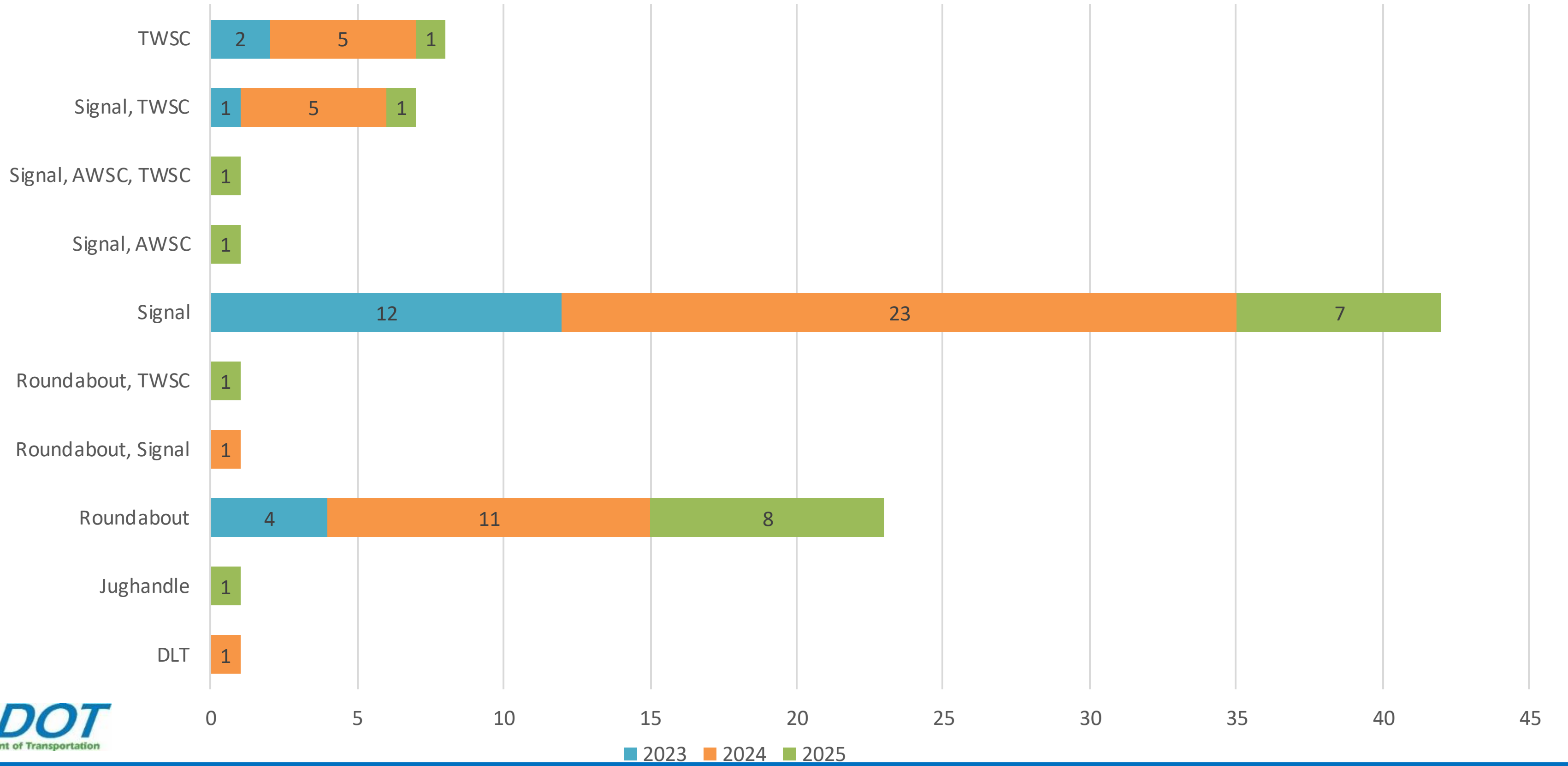
Result

- Single viable control: ICE complete

ICE by the Numbers



Intersection Control Outcomes (by Project)



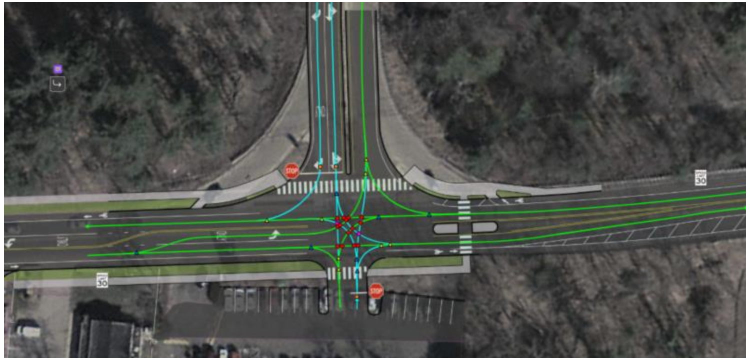
Training Online

- Module 1 – Nov. 2023
  - Stage 1 Overview
- Module 2 – March 2024
  - Stage 1 Case Studies
- Module 3 – July 2024
  - Stage 2 Overview
- Module 4 – Sept. 2024
  - Stage 2 Case Studies
- Module 5 – Nov. 2024
  - Stage 3 Overview

MassDOT Intersection Control Evaluation (ICE) Stage 1 Overview

Additional Updates Coming

- Qualitative Safety Analysis Framework



- Systems Analysis Framework

Analysis Summary

Cost Categories	Net Present Value of Costs					
	Alternative A		Alternative B		Alternative C	
	Bridge Street / North Street Ramp	Bridge Street / MBTA Driveway	Bridge Street / North Street Ramp	Bridge Street / MBTA Driveway	Bridge Street / North Street Ramp	Bridge Street / MBTA Driveway
Construction Costs	$ 4,100,000		$ 4,500,000		$ 4,700,000	
Post-Opening Costs	$ 48,239	$ 11,809	$ 48,239	$ 106,363	$ 106,363	$ 106,363
Auto Passenger Delay	$ 3,298,417	$ 1,261,402	$ 3,298,417	$ 1,623,151	$ 5,110,892	$ 2,523,522
Truck Delay	$ 277,051	$ 105,569	$ 277,051	$ 135,845	$ 429,080	$ 211,206
Safety	$ 1,670,563	$ 1,182,777	$ 1,670,563	$ 659,009	$ 2,568,824	$ 645,053
Sub-Total cost (Excluding Construction Cost)	**$5,294,270**	**$2,561,557**	**$5,294,270**	**$2,524,368**	**$8,215,159**	**$3,486,144**
Total cost	**$11,955,827**		**$12,318,638**		**$16,401,303**	

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Intersection Control Evaluation Resources

- MassDOT ICE Webpage:

https://www.mass.gov/info-details/massdot-intersection-control-evaluation-ice

- Email for Questions:

TrafficSafetyAnalysis@dot.state.ma.us

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