Advancing Roundabouts with Intersection Control Evaluation

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Roundabouts historically have either been overlooked or not seen as a viable alternative by some agencies during the project development process. The adoption of a performance based policy like Intersection Control Evaluation (ICE) has created a transparent approach for agencies to consider intersection alternatives based on performance metrics, such as safety, operations, cost, environment, and footprint/right of way impacts and document the decisions. ICE is a data driven, performance-based framework and approach established to identify the optimal investment and solution for highway access issues and needs considering all users. ICE has allowed consideration and implementation of innovative intersection designs such as roundabouts, RCUTs (Median U-turn) , DDIs, and DLTs—all encouraged under FHWA Every Day Counts safety initiative—by comparing key performance metrics.

Source: GettyImages.com

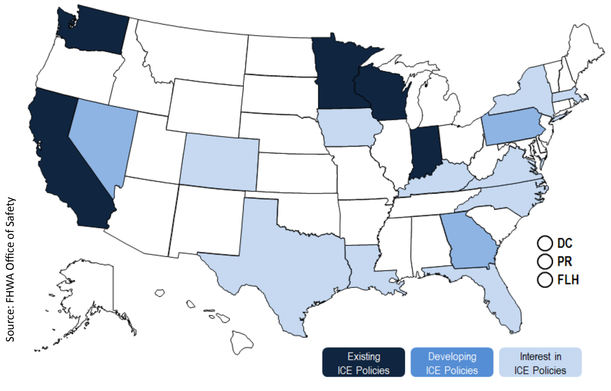
ICE is typically a two-stage/phase process where

- •Stage 1 is a high-level assessment that considers all possibilities but filters down to short list, and
- •Stage 2 is a more rigorous assessment of key performance criteria for the short-listed alternatives (typically w/ prelim engineering).

The ICE process involves screening all possible alternatives for an intersection project, which is important because it stresses to all designers and decision makers to look beyond the traditional designs and control for every project; consider short term, interim and long term goals; and construction costs and life cycle cost consideration.

Furthermore, ICE policies and procedures can help states achieve safety performance management targets across the entire highway program by selecting intersection designs that reduce the number and rate of fatal and injury crashes.

Five states have ICE policies, including MN, WI, CA, IN, and WA, and three states are working on ICE polices, and at least 10 other states are considering ICE policies, as shown on the map below. Both Minnesota and Wisconsin DOT's updated their original ICE policies in 2017.



Source: FHWA Office of Safety

Lessons learned from states who have implemented ICE policies include a need to:

- Enhance the importance of multimodal criteria to consider for pedestrians, bicyclists, transit, freight;
- Include community desires, context, values as a consideration along with the quantitate performance metrics;
- Provide clear purpose to two-phased approach and requirements;
- Expand innovative intersection designs options explicitly in the ICE;
- Include provisions for phased improvements/interim layout for roundabouts if additional lanes are not needed beyond 10-15 years;
- Discount perception that ICE creates more paperwork when it really streamlines the intersection alternative analyses process;
- Include safety performance resources and methodology for consistent use across alternatives; and
- Include analysis tools to compare alternatives, for example
  - FHWA CAP-X
    https://www.fhwa.dot.gov/software/research/operations/cap-x/
  - NCHRP 03-110 Estimating the Life-Cycle Cost of Intersection Designs
    http://www.trb.org/Main/Blurbs/173928.aspx
  - CMF clearinghouse
    http://www.cmfclearinghouse.org/
  - Highway Safety Manual
    http://www.highwaysafetymanual.org/Pages/default.aspx
  - KY IDAT tool
    http://www.ktc.uky.edu/projects/improving-intersection-design-practices/
  - FHWA resource links page
    https://safety.fhwa.dot.gov/intersection/innovative/others/#other

State DOT ICE web links:

MN (update 2017) - http://www.dot.state.mn.us/trafficeng/safety/ice/

WI (update 2017) - http://wisconsindot.gov/rdwy/fdm/fd-11-25.pdf#fd11-25-3

WA (2015) - http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1300.pdf

IN (2014) - https://secure.in.gov/indot/files/ROP_IntersectionDecisionGuide.pdf

CA (2013) - http://dot.ca.gov/trafficops/ice.html

California Department of Transportation ICE Directive

Caltrans implemented an ICE policy (Traffic Operations Policy Directive 13-02) in 2013. When this policy was implemented Caltrans had approximately 20 roundabouts on the state highway system. They now have over 30 roundabouts constructed and over 50 in the planning and design phase. ICE was instrumental in accelerating the implementation of roundabouts being considered on projects and it also brought awareness of other innovative intersections that reduce conflicts like DDIs.

The first roundabout on the state system in District 12 (Southern CA) was also one of the first projects to use the ICE process after the Directive was in place. The intersection of Valle Rd/ LaNovia Ave/ I-5 NB hook ramps was complex and new development was planned for this area. This offset stop control intersection had operational issues and the City and a developers team desired to improve the intersection. Several signal alternatives were considered along with a roundabout. The City, developer team, Caltrans and FHWA worked as a team to vet the alternatives using the ICE process.

Caltrans San Juan Capistrano Project Details

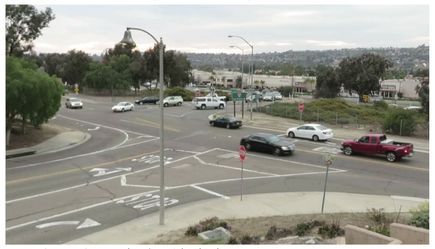

Source: Gary Warkentin, Michael Baker

Table 1 – Intersection Control Evaluation

Feature	Alternative 2 Signalize Existing off-set Intersection	Alternative 3 Realign La Novia Signalize Intersection	Alternative 4 Roundabout Intersection
1. Existing AM/PM Average Delay (seconds per vehicle)*	29.6/29.1	28.6/28.7	7.9/9.6
2. Existing AM/PM Volumes Level of Service (LOS)	C/C	C/C	A/A
3. 2035 AM/PM Average Delay (seconds per vehicle)	44.9/46.8	35.7/35.5	24.2/24.4
4. 2035 AM/PM Volumes Level of Service (LOS)	D/D	D/D	C/C
5. Longest Vehicle Queue (2035 pm)	25 cars	17 cars	18 cars
6. Right-of-Way Requirement	None	3,500 ft²	40 ft²
7. Construction Traffic Control	$39,100	$108,400	$69,800
8. Retaining Wall	No	Yes	No
9. Project Cost	$940,000	$2,891,000	$1,682,000
10. Benefit/Cost Ratio	2.61	0.70	6.18
11. Environmental Document	Mitigated Negative Declaration	Mitigated Negative Declaration	Mitigated Negative Declaration
12. Projected Savings for Life of Project	$2,026,000	$1,170,000	$9,537,000
13. Safety Performance B/C Ratio	2.16	0.4	5.68

* For reference, the existing average delay (sec/veh) based on 2012 traffic volumes is 23.4 AM and 59.0 PM


Source: Brad Orien, MUROW|CM

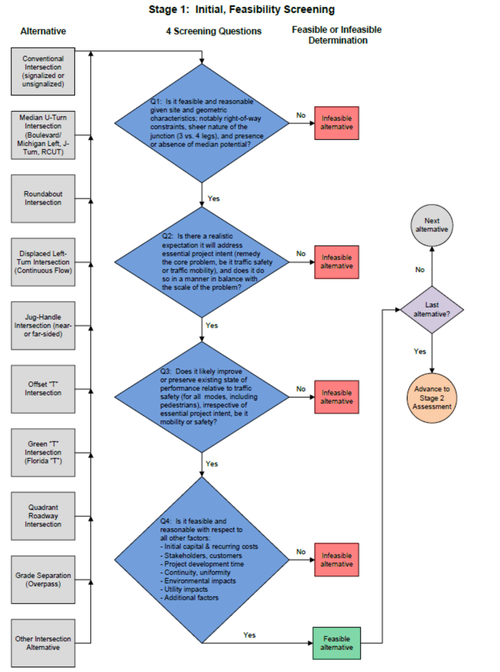

Source: Gary Warkentin, Michael Baker

Caltrans Template for Documentation of ICE Findings

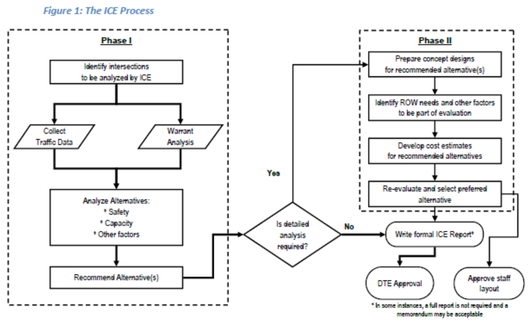
Control Option or other Strategy	Estimated Cost To implement ($)	Estimated Service Life (no. of years)	Estimated DELAY (peak periods)	Estimated COLLISION Cost or Savings ($)	Benefit vs. Cost Index (optional)
Stop Only on Minor Legs (baseline)					
Multi-Way Stop					
Signal					
Yield (RIRT)					
Alt Strategy #1 (optional)					
Alt Strategy #2 (optional)					

Example of State DOT ICE Policy Process Diagrams

Indiana DOT—Intersection Decision Guide (Stage 1 Screening)



Minnesota DOT—Intersection Control Evaluation Process



Wisconsin DOT—Intersection Control Evaluation Project Triggers

- » New traffic control
- » A change in traffic control
- » A new or alternative type of intersection or interchange
- » Introduction of access/median restrictions on the State Truck Network
- » Off-setting intersections