INNOVATIVE INTERSECTIONS & INTERCHANGES

2019 ACEC-KY/FHWA/KYTC Partnering Conference

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Do you have ....

- increasing congestion?
- severe crashes?
- mobility concerns for pedestrians and bicyclists?
- limited budgets?
- inability for more right-of-way?
Intersections are planned points of conflict in the road system. People – some in motor vehicles, others walking or biking – cross paths as they travel through or turn from one route to another. Where different paths cross, join or separate - conflict points occur.

Right-angle collisions account for over 40% of fatal crashes at intersections.

Left turn crashes account for over 20% of fatal crashes at intersections.

Ped/Bike crashes account for 25% of fatal crashes at signalized intersections.
If a person commits an error (poor judgement or traffic control violation) Conflict Points may be thought of as “Collision Potential”
Reducing the number and severity of conflict points

**MUT and RCUT Can Reduce Conflict Points by 50%**

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<th>Conventional</th>
<th>MUT</th>
<th>RCUT</th>
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<td><img src="image1" alt="Conventional Diagram" /></td>
<td><img src="image2" alt="MUT Diagram" /></td>
<td><img src="image3" alt="RCUT Diagram" /></td>
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**Conflict Points**
- ● Crossing
- ● Merging
- ○ Diverging
REDUCED LEFT TURN CONFLICT INTERSECTIONS

U-Turn Based Left-Turn Movements (or “Redirected Left-Turn Movements”)

Restricted Crossing U-Turn (RCUT)

Median U-Turn (MUT)

Figure 1: Frederick County, MD RCUT Intersection
Source: Google Earth

MUT Left Turn Maneuver from a Major Road, Birmingham, MI
Source: MUT Video FHWA-SA-14-018

MUT Left Turn Maneuver from a Minor Road, Birmingham, MI
Source: MUT Video FHWA-SA-14-018
At-grade intersections with directional medians so minor road traffic must turn right and make a U-turn to cross or make the left-turn maneuver.

(Also known as J-turns, Reduced Conflict Intersections, Superstreets and Synchronized Intersections)

Typically all movements from the major road are "normal" (some variations close the median and left-turns are made via U-turn maneuvers).
Problem: Far-Side Right-Angle Collisions
RCUT DISTINGUISHING FEATURES

Minor road traffic turns right, then makes U-turn for a “Left” or “Crossing” movement

Source: Wisconsin DOT
The RCUT has fewer total conflict points, fewer crossing conflicts and eliminates far side angle collisions.
RCUT APPLICABILITY

Is the RCUT only applicable for rural divided highways?

NO !!! – They are also very applicable for signalized suburban arterials!!!
If we have a congested arterial – how do we typically “solve” the problem???

IS ADDING MORE LANES THE ANSWER?

“It’s the signals, stupid”
Basic two-phase signal operation

Adding “protected” left-turn phases is common as volumes increase.

Fewer phases (intervals) allows more green time for the major through movement and decreases intersection delays

- Fewer phases also means less “lost time”
Strategically relocating left turn movements can provide more green time to through traffic.
SIGNALIZED RCUTS

Signals on one side of arterial are independent of signals on other side.

Cross street through traffic turns right.
Cross street left turn traffic moves through.

Arterial traffic no different than conventional intersection.

Cross street traffic must turn right.

Cross street left turn and through traffic makes a U-turn in the wide median.
SR 4 Bypass at Symmes Rd
Fairfield, OH
SR 4 Bypass at Symmes Rd Fairfield, OH
BETTER SIGNAL OPERATIONS

- Signalized RCUTs with 2-phases allow more green time to the major street through
- Better signal progression
- Shorter cycle lengths than comparable conventional intersections may be possible
- Shorter cycles reduce delay for most vehicles and for pedestrians

RCUTs can even offer an ability to have different cycle lengths in the two directions of the major street
Each direction may operate independently
Directions can be progressed at different speeds and/or signal spacing
RCUT FEASIBLE DEMANDS

- Applicable to a wide range of Major Street ADTs
- At minor street demands <5,000 vpd, consider unsignalized RCUTs
- For minor street demands of more than 25,000 vpd, consider other alternative intersections (such as a MUT or DLT) that would generally serve the minor street more efficiently

Source: FHWA Restricted Crossing U-Turn Informational Guide
RCUT Intersection
8 conflict points

Conventional Intersection
24 conflict points
Pedestrian crosswalk pathways at a signalized RCUT.
PEDESTRIAN “Z” CROSSING
This variation should be strongly considered in developing areas where the minor street or driveway locations have not yet been established.

Wayfinding signs for pedestrians should be used to direct pedestrians to the proper crossing location.
MID-BLOCK PED CROSSING OPTION

Adding pedestrian signal will not interfere with signal progression!!!
Accommodating Truck Movements
LOONS & U-TURN ACCELERATION LANES

Could begin right turn lane
MUT – Median U-Turn

(aka Michigan Left)

- At-grade intersections with *indirect* left turns using a U-turn movement in a wide median and/or loon
- The MUT eliminates direct left turns on both intersecting streets, reducing the number of signal phases and conflict points at the main intersection
Vehicles on the major street (or the street with the median) that want to turn left are directed through the main intersection to a U-turn movement at a downstream directional crossover (usually signalized), and proceed back to the main intersection to then turn right onto the minor street.
Vehicles on the minor street that wish to turn left at the major street are directed to turn right, make a U-turn movement at the same crossover, and then proceed through the main intersection.
The MUT removes left-turn phasing, which results in fewer clearance intervals in the intersection cycle and to operate well with a shorter cycle length than a comparable multi-phase cycle.
The two-phase signal at a MUT typically allows a shorter signal cycle length compared to a comparable conventional intersection, but with similar green times for pedestrians and vehicles. This benefits pedestrians by creating more pedestrian phases per hour along with less “don’t walk” time between “walk” times (i.e., less wait time between walk signals).
MUT APPLICABILITY

Is the MUT only applicable for divided highways with wide medians?

NO !!! – The strategy can also be applied on roads without wide medians!!!
THRU-TURN INTERSECTION

1. Drive THROUGH
2. Make a U-TURN
3. Then turn RIGHT

Source: https://www.youtube.com/watch?v=a11wVxLle6s
IT'S EASY –
Go through, make a U, then right at the light
Vehicles will pass through the intersection and use the Express Left™ turn to head North or South.

HOW IT WORKS

1. Drive straight through the intersection and pull into a turning lane to your left.

2. A traffic signal will stop approaching traffic to allow the vehicles in the turning lane to make a U-turn into a designated right turn lane. These traffic signals will be timed with the intersection traffic signals to limit through traffic to only one stop.

3. Return to the intersection and make a right.
“The goal of ICE is to better inform the FDOT’s decision-making to identify and select a control strategy meeting the project’s purpose and need, fitting the intersection location’s context classification, providing safe travel facilities for all road users, and reflecting the overall best best value.”

https://www.fdot.gov/traffic/TrafficServices/Intersection-Operations.shtm
ICE promotes the consideration of the wide array of intersection forms and control options including variations on typical forms.
RESOURCES

For easy access ...

safety.fhwa.dot.gov/intersection/
THANK YOU !!!

QUESTIONS???