

Dynamic Left Turn intersections: Reducing tradeoffs and creating opportunities

Joe Milazzo II, PE
– RTA (Regional Transportation Alliance)

NC Section ITE
Annual Meeting
November 9, 2023

Use of a Dynamic Left Turn intersection (DLTi) when you have Dual left turn lanes



Protected left turns at signalized intersections

Benefits of protected left turns

- No conflicts
- Clear direction to motorist
- Can be more efficient phase operation / platooning during peak

Protected left turns at signalized intersections

Operational impacts of protected-only left turns

- Requires dedicated phase for even a single left turning vehicle
- Other movements must wait while protected phase is served
- Some left turning travelers have 1-2 min delay vs. permitted
- Cycle lengths go up, making coordination more challenging
- Potential maintenance issue – displaying dedicated phase to no one

Dynamic Left Turn intersection (DLTi)

Operational objective:

Creates a dynamic, permitted phase opportunity for movements with two available left turn lanes at signalized intersections



DLTi vs. Dual Left Flashing Yellow Arrow

Both DLTi and Dual Left FYA have same objective:

Create dynamic, permitted phase opportunity for movements with two available left turn lanes at signalized intersections

But they realize this objective in slightly different ways.

Dynamic Left Turn intersection (DLTi)

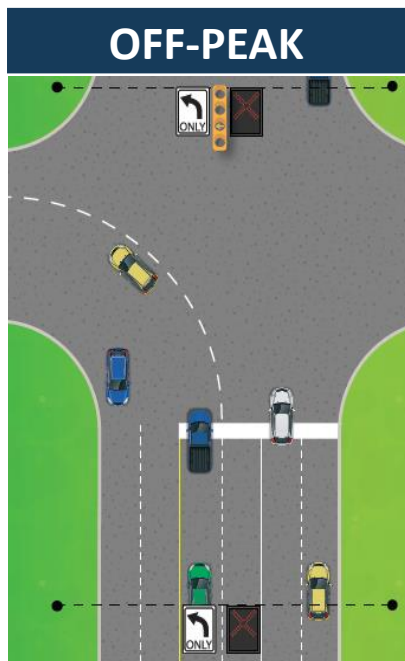
Typical implementation:

Close outer (right-most) left turn lane during off-peak times of day when “permitted” flashing yellow arrow (FYA) phase can be displayed



DLTi goal: Save drivers time majority of day

- Peak: Both left turn lanes available; must wait for green arrow to turn (“protected only”)
- Off-peak: Only inner (left-most) turn lane open; can turn on green or flashing yellow (P/P)



Example use cases (DLTi vs. dual left FYA):

DLTi

- Adequate sight distance for at least left-most left turn lane
- Desire to simplify permitted left turning operation for driver by only having a single left turn lane
- Concerns about adjacent turning vehicles encroaching on each other while executing permitted dual left turns



Example use cases (DLTi vs. dual left FYA):

Dual Left FYA use case conditions

- Adequate sight distance for both left turn lanes
- No significant concerns about executing dual lefts under permitted operation, at least during off-peak periods
- No significant concerns about adjacent turning vehicles encroaching on each other while executing permitted dual lefts, at least during off-peak

Time of day variation (DLTi vs. dual left FYA):

- Peak: Both left turn lanes open; protected-only operation
(i.e., Dual Left FYA and DLTi are identical during peak periods)
- Off-peak: DLTi: Left-most left turn lane open Protected-permitted
- Off-peak: Dual Left FYA: Both left turn lanes open Protected-permitted

NOTES:

- During peak periods, there is no difference between protected-only dual lefts, DLTi, and Dual Left FYI – all operate as protected only dual lefts
- During off-peak periods, both DLTi and Dual Left FYI allow protected-permitted operation
- The only difference between DLTi and Dual Left FYI is the number of open left turn lanes during off-peak

Dynamic Left Turn intersection (DLTi)

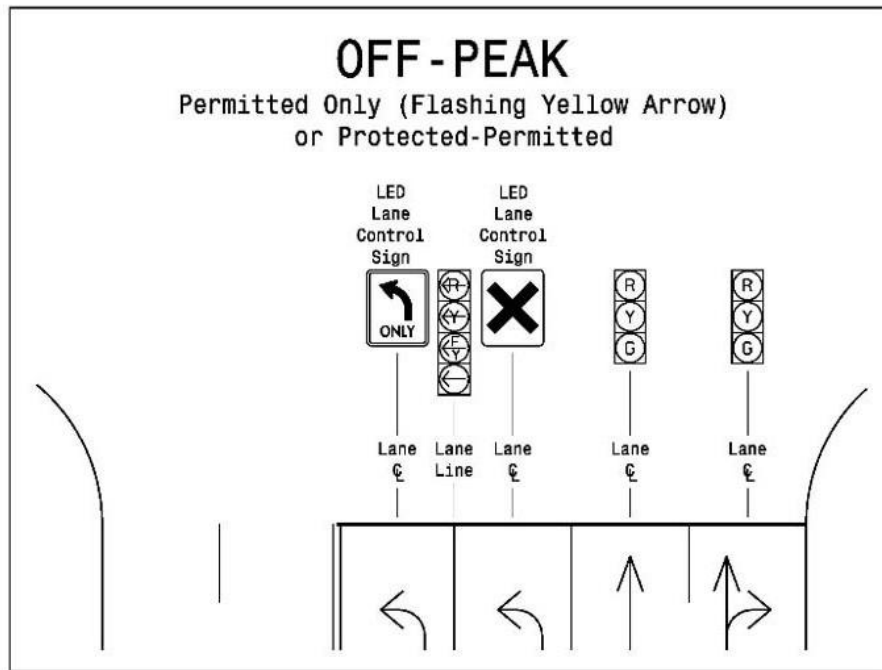
DLTi - Example use case (vs. single left)

- Situation: Dual lefts desired during peak periods for capacity reasons, but concern about adverse operational impacts during lower volume periods under typical protected-only phasing for dual lefts.
- DLTi use case: Minimize operational risk of installing a second left turn lane with either limited off-peak turning volumes and/or potentially unbalanced left turn lane utilization

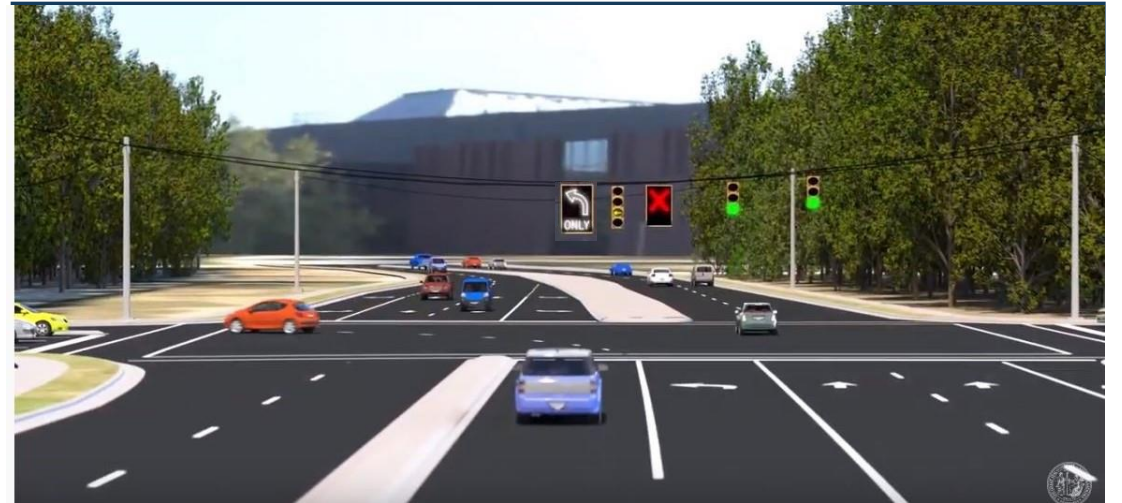
Dynamic Left Turn intersection (DLTi)

Implementation:

- Single 4-section left turn signal head, mounted above lane line between 2 turn lanes
- Lane use control signals for both left turn lanes, at and in advance of intersection



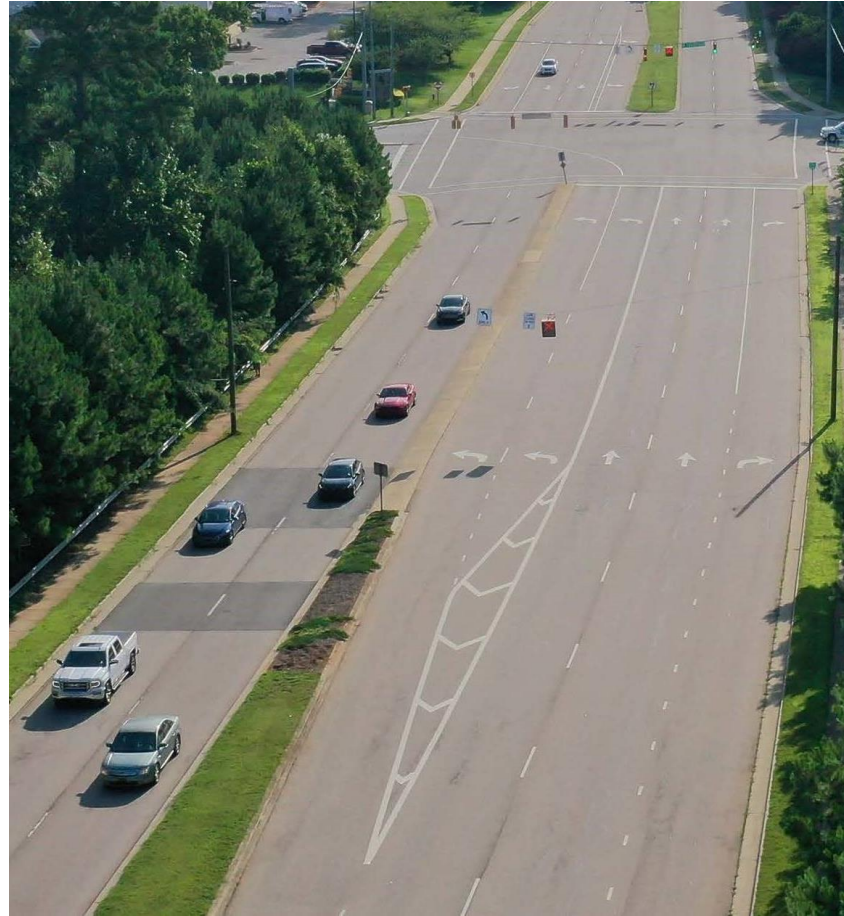
Dynamic Left Turn intersection (DLTi)



DLTi pilot

- **Site selection criteria for initial pilot, and future pilots**
 - Sufficient volume during peak periods across two left turn lanes
 - Sufficient variation in left turning volume during day
 - Adequate sight distance for both left turn lanes
 - Receptive partners
- **First pilot site implemented: EB Tryon at Cary Pkwy., Cary**
 - Installed February 14, 2020 – *about one month prior to pandemic impacts*
 - Initial peak periods 7:15 - 9 AM and 3:45 - 6:45 PM
 - 24/7 off-peak phasing during pandemic (i.e., “100% DLTi”)
 - Peak periods 7:15 AM – 6:45 PM since February 23, 2023

Dynamic Left Turn intersection (DLTi)



Dynamic Left Turn intersection (DLTi)



Dynamic Left Turn intersection (DLTi) pilot

- Open in Town of Cary for more than 3.5 years
- Some drivers saved up to 2 minutes of travel time each cycle
- Based on estimated time savings and typical assumed value of time, DLTi paid for itself within 6 months of opening
- Operational framework has varied as pandemic, travel, experience has evolved
- Some crash types elevated, so P/P hours reduced to 13 per day in early 2023



DLTi – Compliance, Lessons Learned

- Prior to pilot: most (65%) of turning vehicles used right-most left turn lane
- DLTi active: ~85% using left-most left turn lane (when only open lane)
- *This is a change from 65% to 15% usage of right-most turn lane*
- LED lane controls signals not yet installed in left-most left turn lanes as of Oct '23

Pilot site note:
Heavy demand
on right side
just after DLTi



DLTi, Dual Left FYA costs

Both DLTi and Dual FYA are inexpensive solutions

- DLTi is \$20k - \$40k, including advance span wire and multiple lane control signals
- Dual FYA installation is even lower cost and does not require advance signals
- Either option would typically make a competitive Spot Mobility project submittal
- *Can install as DLTi and operate as DLTi, Dual Left FYA, or Dual Left protected-only, since permitted phase hours and lane activation/closure can be adjusted as need be*

DLTi – other guidance

Treatment not appropriate:

- Three or more opposing through lanes
- Inadequate sight distance all day for both left turn lanes

DLTi - Current status

- NCDOT Mobility and Safety considers the Cary Parkway / Tryon Road site a successful, ongoing pilot
- Final analysis report shared with NCDOT division/regional traffic engs
- Updating pilot location with additional LEDs (vs. static signs) in left-most left turn lane
- NCDOT examining other potential sites for 3-5 additional pilots
- DLTi treatment is eligible for consideration at other locations in N.C.

Dynamic Left Turn intersections: Reducing tradeoffs and creating opportunities

Joe Milazzo II, PE

– RTA (Regional Transportation Alliance)

joe@letsgetmoving.org
m 919.389.9285