Overview of Informational Report

OPPORTUNITIES FOR OPERATION AND DESIGN OF SIGNALIZED INTERSECTION APPROACHES WITH TWO POTENTIAL LEFT TURN LANES

Prepared by the Regional Transportation Alliance for the Congestion Management Section, NCDOT

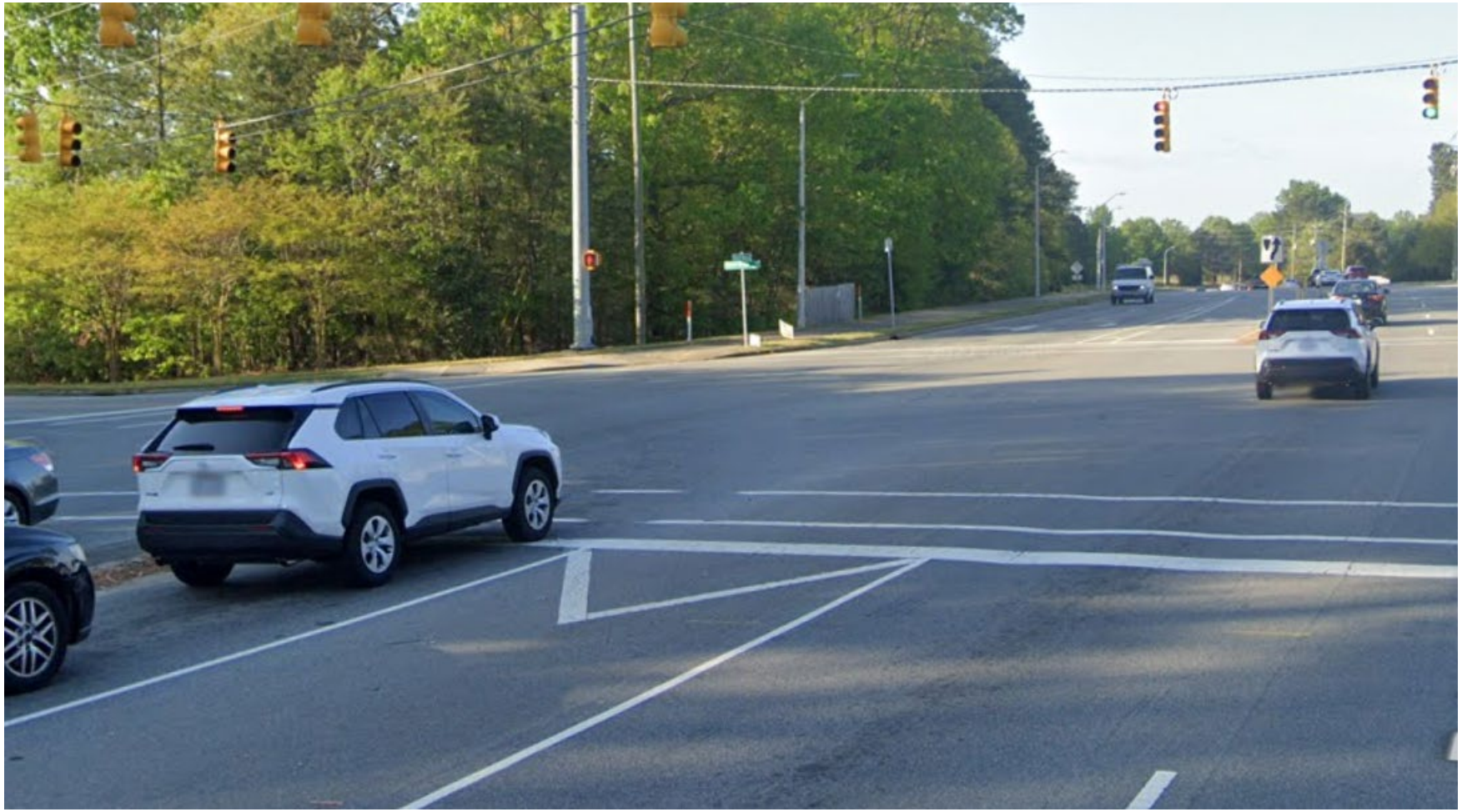
Posted October 2022

Summary of Opportunities / Use Cases With 2 potential left turn lanes

- **Single, positive offset, permitted-only** left turn lane
- **Single, positive offset, protected-permitted** left turn lane
- **Dual, protected-permitted** left turn lanes
- **Dynamic left turn intersection (DLTi)** approach
- **Dual, protected-only** left turn lanes

Single, positive offset, permitted-only left turn lane

Single, positive offset, protected-permitted left turn lane



Dual, protected-permitted left turn lanes

Dynamic left turn intersection (DLTi) approach

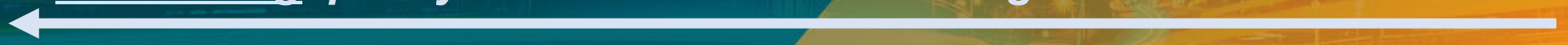
Dual, protected-only left turn lanes

General comparison

***Increasing* left turn volumes or cross products**

Single **Positive offset** **Permitted-only** Left turn lane	**Single** **Ideally positive offset** **Protected-permitted** Left turn lane	**Dual** **Protected-permitted** Left turn lanes	**DLTi** ***(off-peak)* Single, positive offset Protected-permitted** Left turn lane ***(peak)* Dual Protected-only** Left turn lanes	**Dual** **Protected-only** Left turn lanes

***Decreasing* quality or level of intersection sight distance**



(e.g., excellent, to reasonable, to reasonable for one left turn lane, to low)

Left turn phasing types

- **Protected-only operation**
- **Permissive left turn operation**
- **Protected-permissive** *(or lagging, permissive-protected)*

Phasing type depends on particular movement or approach

Protected-only operation

- **Reduces motorist uncertainty**
- **Lessens likelihood of conflicts, crashes** *(low left turn CMF)*
- **Capacity benefits under higher volume conditions**
- **Suboptimal, inefficient operations with lower volumes**

Permissive left turn operation

- Allows redistribution of green time
- Reduces delay for subject movement
- Some reduction of delay for overall intersection

Protected-permissive left turn operation

- **Protected-permissive** seeks to provide capacity, conflict reduction benefits of protected phase with operational efficiency and flexibility of permitted phase
- **Via flashing yellow arrow (FYA) for all new installs in N.C.**

Two *potential* left turn lanes

- **We don’t have to install or activate both left turn lanes – at least not right away – even if we have room to do it**
- Several design and operational possibilities

Two *potential* left turn lanes

Decision of what to install/activate should be based on:

- Operational analysis (e.g., cross product)
- Safety analysis (e.g., intersection sight distance, crash history)
- Traffic progression, pedestrian flows, adjacent land uses, etc.

Typical left turn peak hour volume thresholds

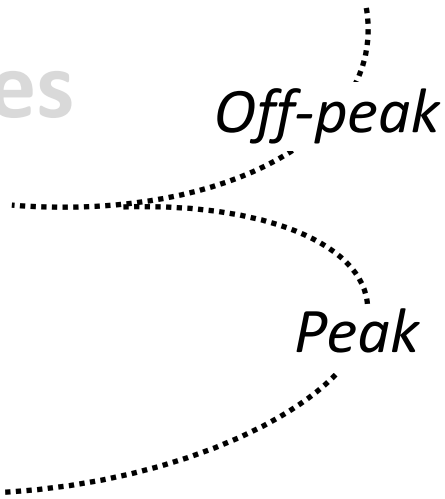
- **Below 250 vph –** look to single left turn lane
- **Below 350 vph –** single left turn lane, protected-permissive phase
- **Above 350 vph –** dual lefts with protected-permitted, DLTi, or protected-only dual lefts
- **Above 500 vph –** consider protected-permitted dual lefts for added capacity

Where does Dynamic Left Turn intersection (DLTi) fit ?

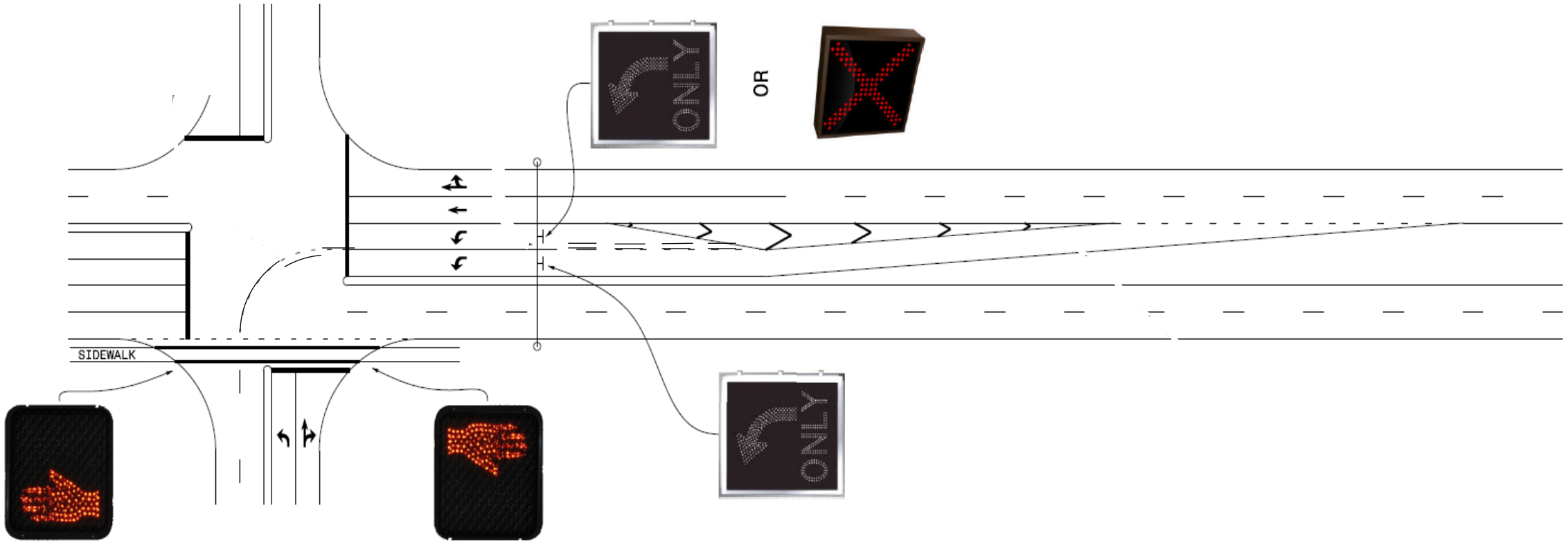
- Single, positive offset, permitted-only left turn lane
- Single, positive offset, protected-permitted left turn lane
- Dual, protected-permitted left turn lanes
- Dynamic left turn intersection (DLTi)
- Dual, protected-only left turn lanes

Where does Dynamic Left Turn intersection (DLTi) fit ?

- Single, positive offset, permitted-only left turn lane
- **Single, positive offset, protected-permitted left turn lane**
- Dual, protected-permitted left turn lanes
- **Dynamic left turn intersection (DLTi)**
- **Dual, protected-only left turn lanes**



Dynamic left turn intersection (DLTi) approaches: Example design elements



Typical DLTi installation scenarios

- **Above 350 vph in peak hour …**
  - Reasonable sight distance for both left turn lanes, low/moderate volumes:
    Dual, protected-permissive left turn lanes
  - Sufficient sight distance for one left turn lane for permitted operation:
    DLTi approach
  - Sight distance concerns for both left turn lanes:
    Dual, protected-only left turn lanes

Reminders

- Volume thresholds are based on analysis of a “typical” intersection
- Consider the thresholds as general levels not absolute cutoffs
- Question or confirm assumptions about lane balance / utilization
- Compare peak performance, off-peak benefits, inefficiencies, tradeoffs
- Improving sight distance, through restriping and other means, should always be considered
- Use the “Capacity Analysis Guidelines” posted on the Congestion Management Section website in all operational analyses for NCDOT

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