



Flashing Yellow Arrows (A different left turn option)

ASCE Meeting

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Kerry C. NeSmith, PE

Deputy State Maintenance Engineer

What IS the flashing yellow arrow???



Traditional left turn signal display



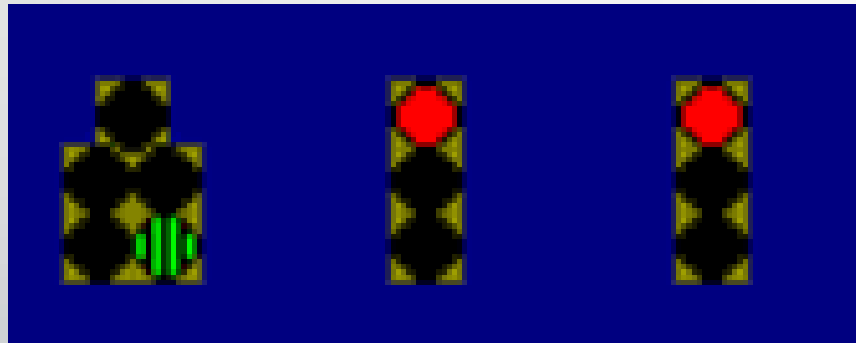
So what's the problem with this???

Different display methods for permissive lefts

- Flashing Circular Red (FCR)
- Flashing Red Arrow (FRA)
- Flashing Circular Yellow (FCY)
- Flashing Yellow Arrow (FYA)



Dallas Left turn phasing



How/when did flashing yellow arrows get started?

- NCHRP Project 3-54 in mid-1990s to evaluate various methods of permissive left turn displays
- First installations of FYA were in Montgomery County, MD, in 2000
- Other entities were soon quick to follow suit.
- During 7 year period researchers used engineering analyses, static and video-based driver comprehension studies, field implementation, video conflict studies and crash analyses.
- In 2003, completed research published as NCHRP Report 493.

How did Flashing Yellow Arrows get started?

TABLE 1 Summary of Initial FYA Implementation Sites

Agency	Implementation Date	Number of Implementation Sites
Montgomery County, Maryland	September 2000	3
City of Tucson, Arizona	May 2001	3
Jackson County, Oregon	May 2001	1
Oregon Department of Transportation	June 2001	2
City of Beaverton, Oregon	April 2002	3
Broward County, Florida	June 2002	3

National Distribution FYA Experimentation sites

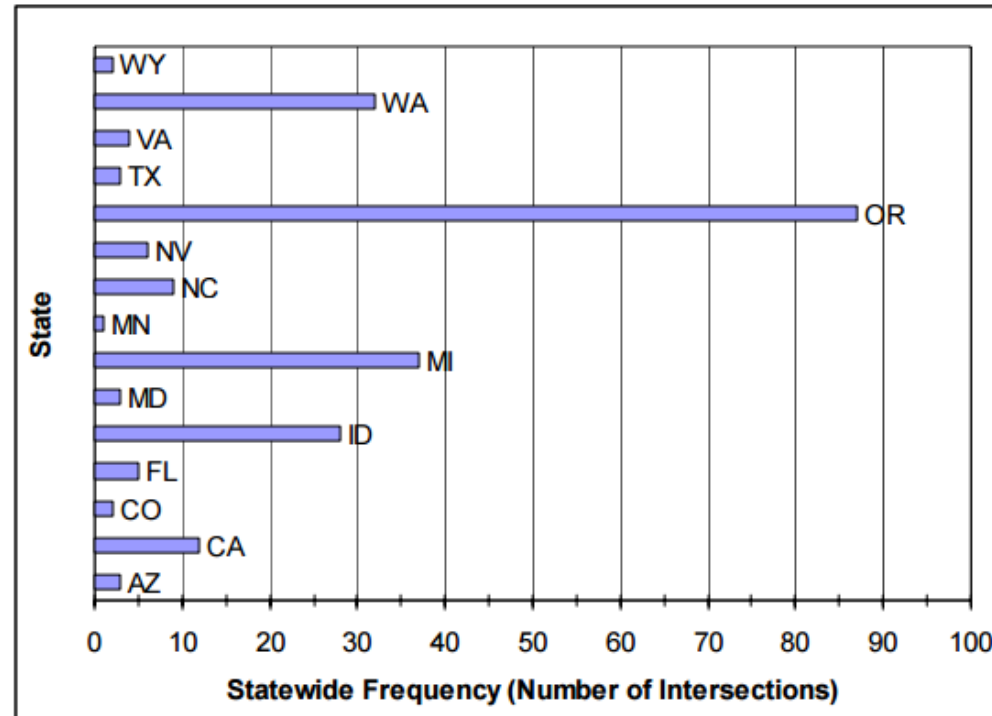
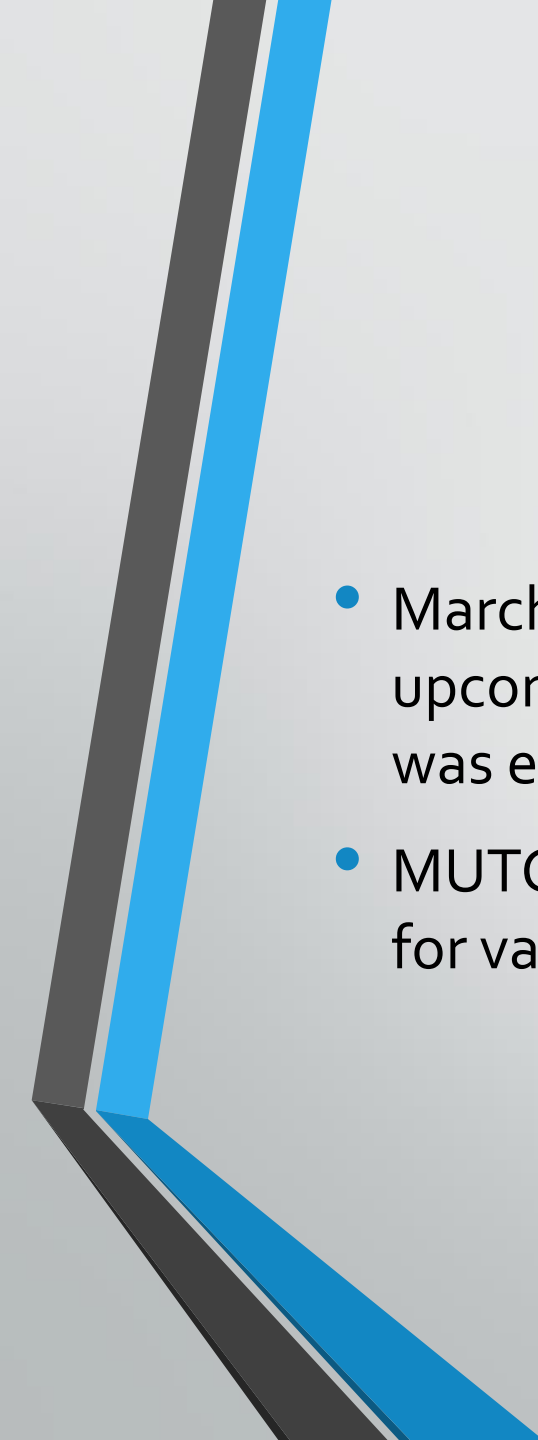


FIGURE 4 National Distribution of FHWA Flashing Yellow Arrow Experimentation Sites

Key Findings of NCHRP Report 493

- FYA was found to be the best overall alternative to the circular green as the permissive signal display for a left turn movement.
- FYA was found to have a high level of understanding and correct response by left turn drivers, and a lower fail-critical rate than circular green.*****
- The FYA display in a separate signal face for the left turn movement offers more versatility in field application. It is capable of being operated in various modes of left-turn operation by time of day and is easily programmed to avoid the “yellow trap” associated with circular green displays.



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- March 2006, FHWA granted interim approval for use of FYA while revision to upcoming edition of Manual on Uniform Traffic Control Devices (MUTCD) was evolving.
 - MUTCD 2009 contained guidelines for use of Flashing Yellow Arrow display for various modes of left turns.

Flashing Yellow Arrow display

Solid Green

Ok to turn left; oncoming traffic must stop



Solid Yellow

Prepare to stop or clear intersection before solid red arrow appears



Flashing Yellow Arrow display

Solid Red

STOP - no turn allowed



Flashing Yellow

Ok to turn left after yielding to oncoming traffic and pedestrians



Additional FYA research

- NCHRP Project 20-7, Task 222 by Traffic Operations and Safety Laboratory at University of Wisconsin at Madison.
- Findings:
 - Safety was improved at intersections that operated with Protected/Permissive (PPLT) left turns prior to using the FYA.
 - Safety was NOT improved at intersections that operated with Protected only left turns and were converted to PPLT using FYA.
 - No conclusion reached regarding use of FYA at Permissive only left turns due to not enough installations.

Comparing Protected/Permitted Left Turn Displays

Scenarios involving PPLT
combined with Lead/Lag protected
left turns

Current FYA deployment in Alabama

- Southwest Region 14 intersections
- East Central Region 1 intersection
- North Region 1 ½ intersections

Planned FYA deployment 2015/2016

- Southwest Region 1 intersection
- West Central Region 22 intersections
- North Region 14 ½ intersections
- East Central Region 3 intersections

East Central Region—Birmingham Area

- US 280 at Overton Road Installed December 2014

Southwest Region—Mobile Area

- US 98 in Daphne & Fairhope January/February 2015

North Region

- US 431 from Taylor Road – Monroe Street June 1, 2015
- AL 53 from Seminole Drive—14th Street

Flashing Yellow Arrow FAQ

- You mean I can turn left anytime I see the flashing yellow arrow???
 - Yes....but....
- Is Alabama the last state to implement flashing yellow arrows?
 - No. New Jersey and West Virginia (perhaps others) have yet to install any.
- Are the States that have implemented FYA actually experiencing any benefits??
 - Absolutely

North Carolina's experience

- First used FYA in 2005.
- 1300 intersections using FYA. Additional 634 intersections planned.
- Where 4-section heads replaced traditional 5-section heads crashes have been reduced from 22%-37%.
- Where 3-section FYA heads are used for permissive only left turn, crashes have been reduced by 50%.

Georgia's experience

- First Flashing Yellow Arrows installed in 2013.
- Crashes involving left turns have decreased at locations using FYA but data is still limited.
- FYA is now the standard design practice due to safety improvements and ability to utilize the flexibility they afford.

More Flashing Yellow Arrow FAQ

- Are they for use everywhere?
 - Probably not.
- Can/should they replace protected only left turn phasing?
 - It is not recommended to do so.
- What are ALDOT personnel saying about FYA????

Quotes from ALDOT personnel

- “People gave us ‘thumbs up’ as they drove by”—Brett Sellers, 280 Czar
- “We’ve received mostly positive feedback from the public, no crashes noticed yet. I believe the FYAs have reduced confusion previously with the green ball”---Daniel Driskell, Mobile Area Traffic Engineer
- “We do not have any in our Area, to my knowledge we do not have any planned to install until a directive is given”---Anonymous



So that's all there is to it???

- NO

Protected/Permissive with a wrinkle

H. The display shall be a four-section signal face except that a three-section signal face containing a dual-arrow signal section shall be permitted where signal head height limitations (or lateral positioning limitations for a horizontally-mounted signal face) will not permit the use of a four-section signal face. The dual-arrow signal section, where used, shall display a GREEN ARROW for the protected left-turn movement and a flashing YELLOW ARROW for the permissive left-turn movement.

FYA additional considerations

- In August 2014, FHWA granted another interim approval for FYA use in 3-section signal displays for PPLT.
- NCHRP Project 20-7, Task 283 by UW-Madison along with UMASS-Amherst evaluated use of 3-section display with the steady yellow arrow AND FYA both in the middle section.
- Research results indicated this was a safe and efficient operation for road users; similar to FYA with the green arrow section.
- Recommendation was made that next edition of MUTCD include use of both yellow modes in middle section. It was approved at June 2014 meeting of National Committee on Uniform Traffic Control Devices.

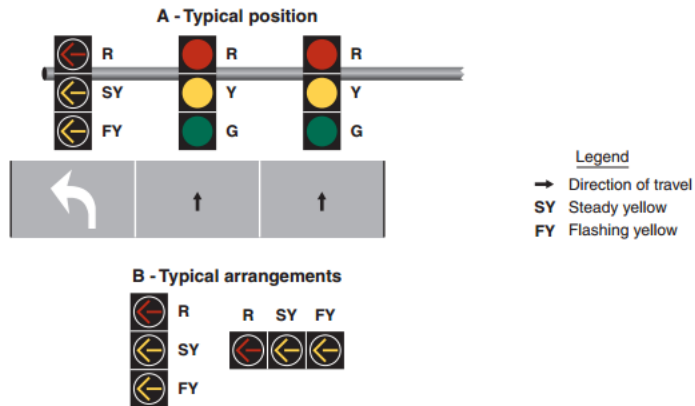
Permissive only mode

Using Flashing Yellow Arrow
(Note: no green indication)

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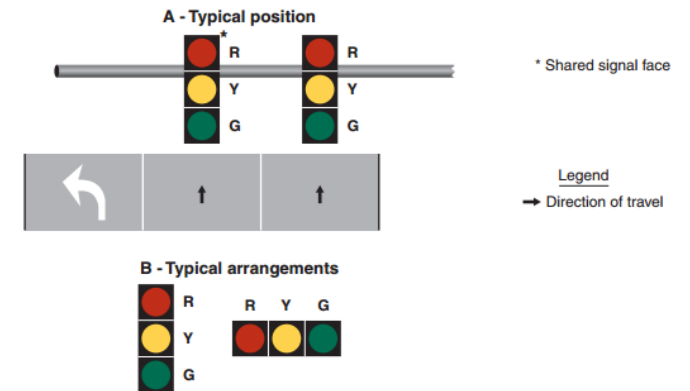
2009 Edition

Figure 4D-7. Typical Position and Arrangements of Separate Signal Faces with Flashing Yellow Arrow for Permissive Only Mode Left Turns



Using traditional circular indications

Figure 4D-6. Typical Position and Arrangements of Shared Signal Faces for Permissive Only Mode Left Turns



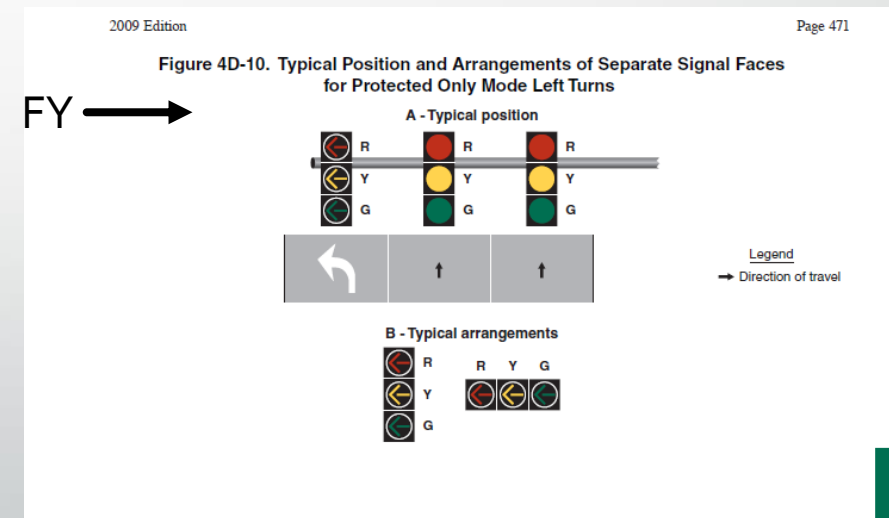
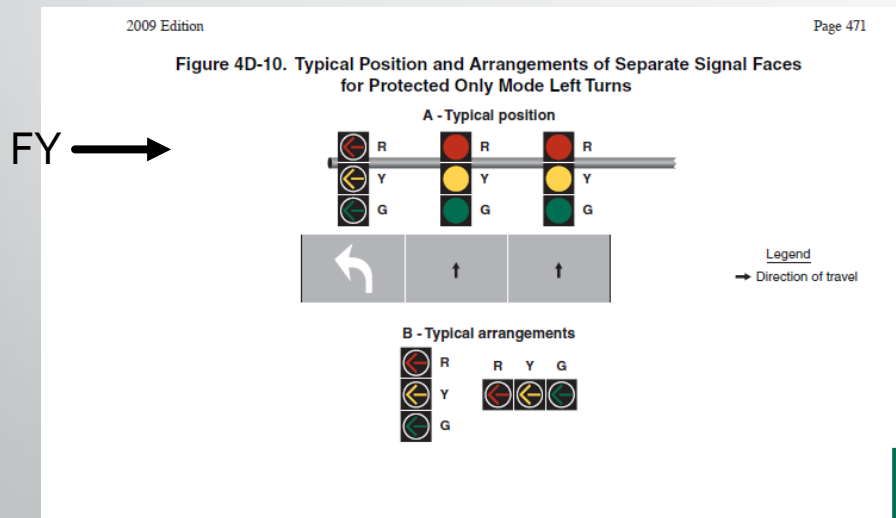
December 2009

Sect. 4D.17 to 4D.18

FYA with 3-section signal heads

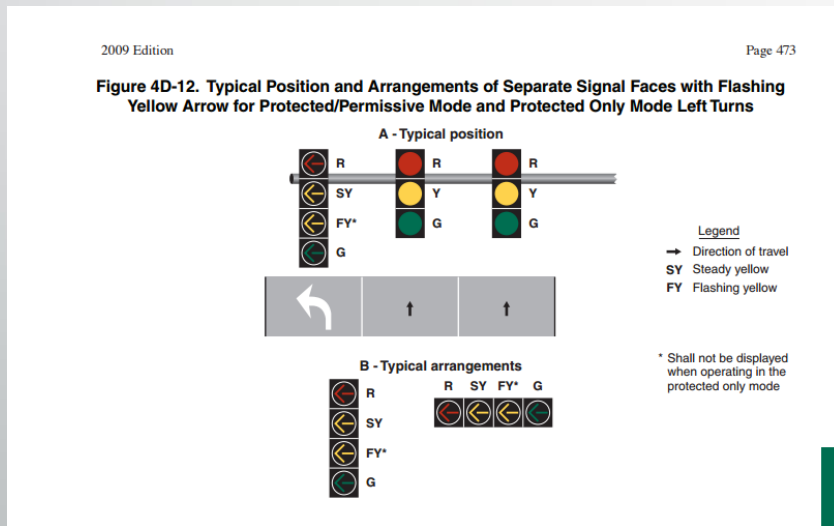
Permissible in 2009 MUTCD

Permissible via Interim Approval IA-17
August 12, 2014

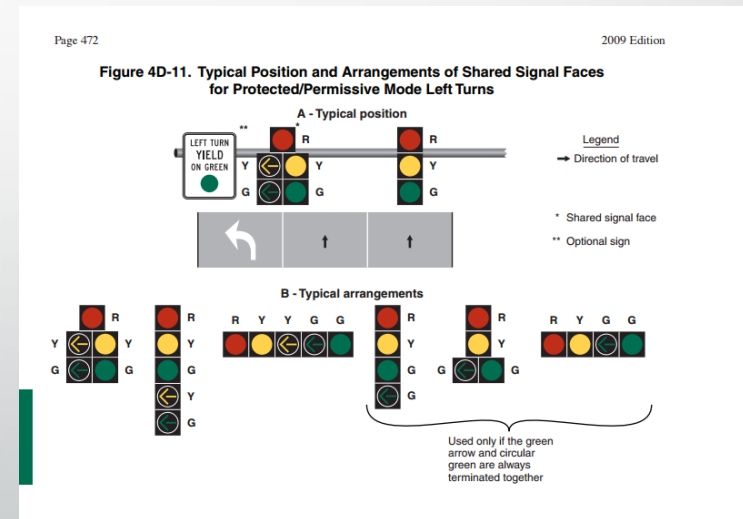


Protected/Permissive mode

Using Flashing Yellow Arrow



Using Traditional 5-section "dog house"

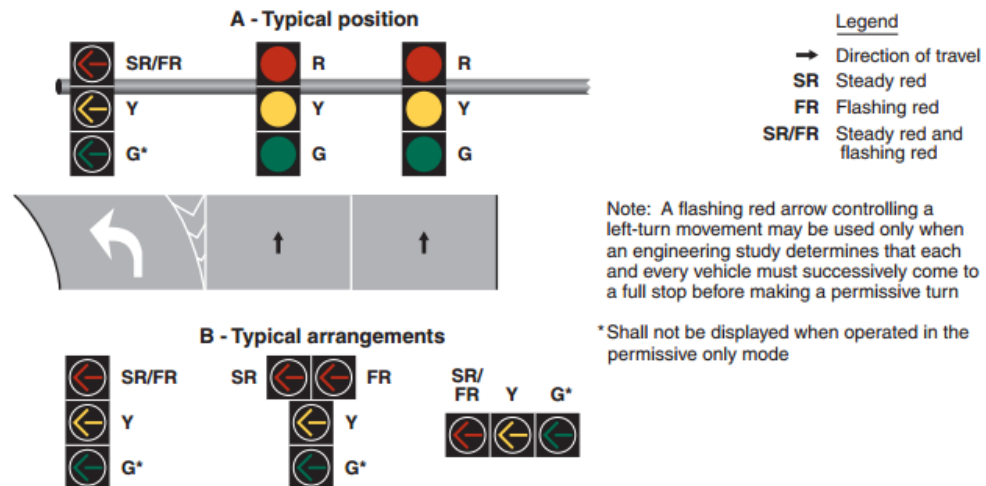


Flashing **RED** (used in Maryland)

2009 Edition

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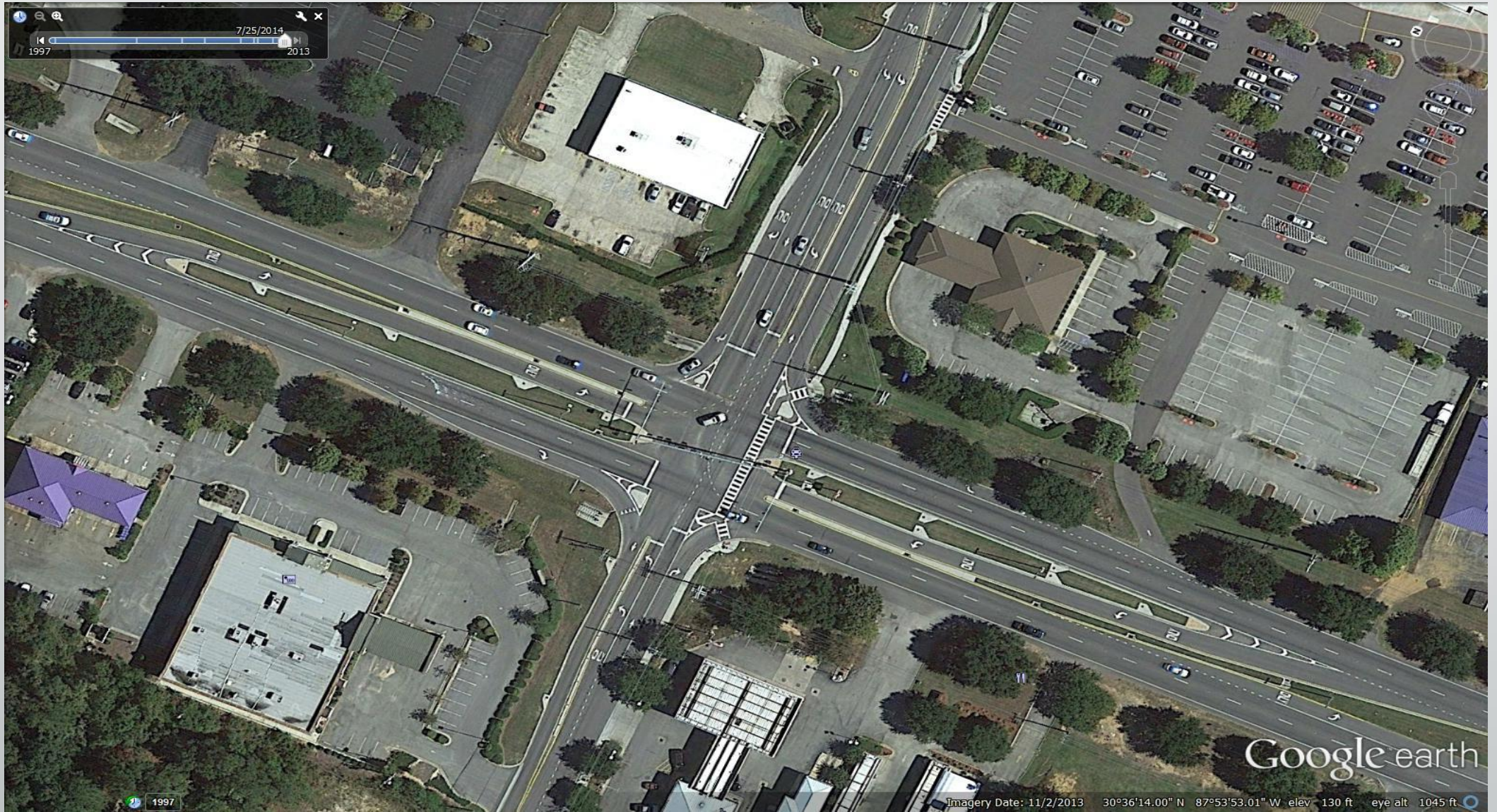
Figure 4D-8. Typical Position and Arrangements of Separate Signal Faces with Flashing Red Arrow for Permissive Only Mode and Protected/Permissive Mode Left Turns



Flashing yellow arrows in action



https://www.youtube.com/watch?v=IHeLE_6tshQ



Separated Left Turns

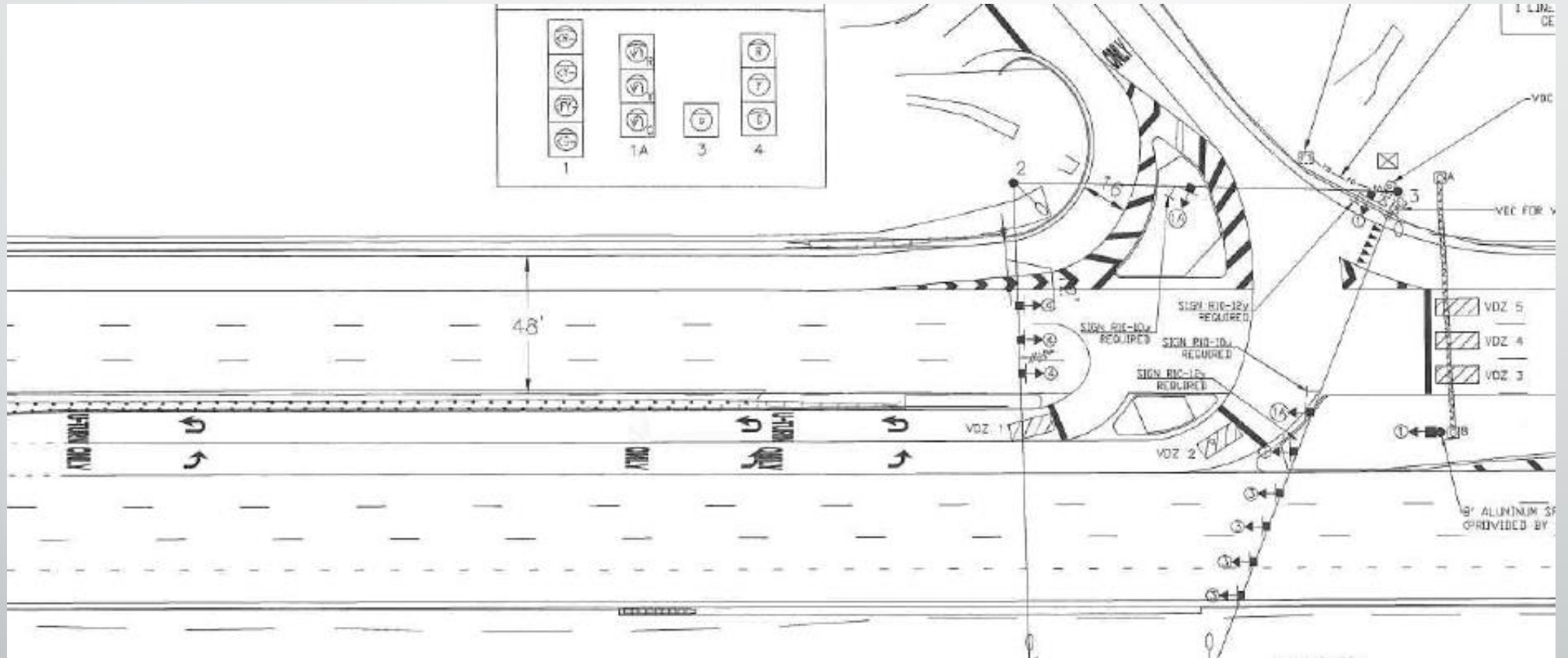












US-280 / Overton Road Intersection



US-280 / Overton Road Intersection

Flashing Yellow Arrows—Simple, right???



