Traffic Signal Design Specifics

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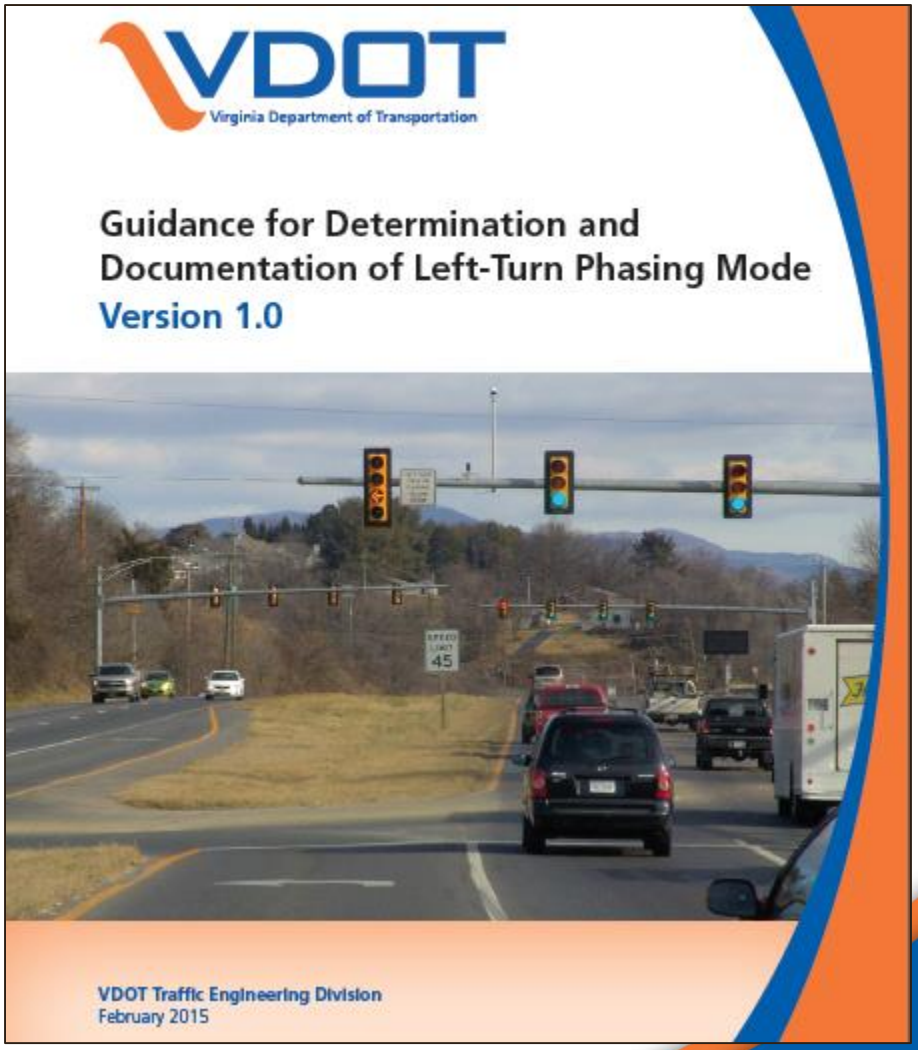
NRO Traffic Signals Workshop| July 20, 2015 | Fairfax

Agenda

- Recent New Policy & Guidelines
  - Left Turn Phase Determination Guidance
  - TE-379 Overhead Street Name Signs
- Upcoming Guidelines
  - Supporting Documents for TE-306.1 Clearance/Change Interval Calculations
  - Flashing Yellow Arrow Guidelines
- NRO Signal Design Specifics
- Questions & Answers

Left Turn Signal Phasing | *Guidance*

- Released February 2015
- Guidance, intentionally not prescriptive
- A framework for evaluating factors that influence left-turn mode selection
- Not a threshold-based or purely quantitative evaluation



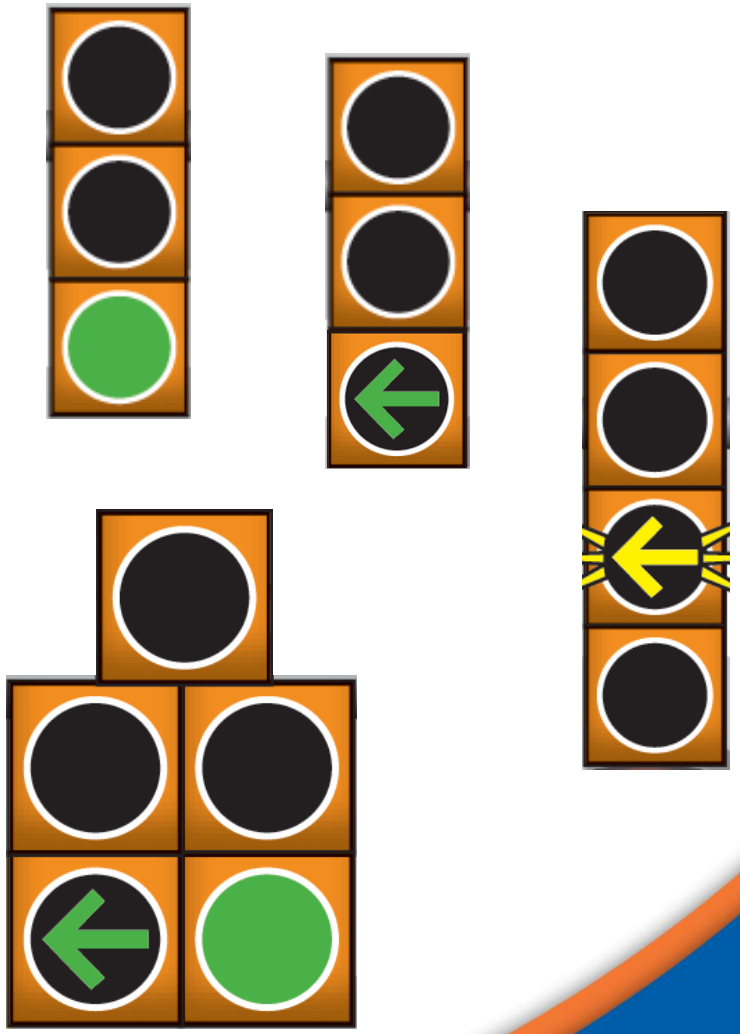
Left Turn Signal Phasing | *Guidance*

- Left turns – most challenging movement in terms of safety and operations
- Need for consistency in decision-making
- Documentation and permanent record of decisions is needed

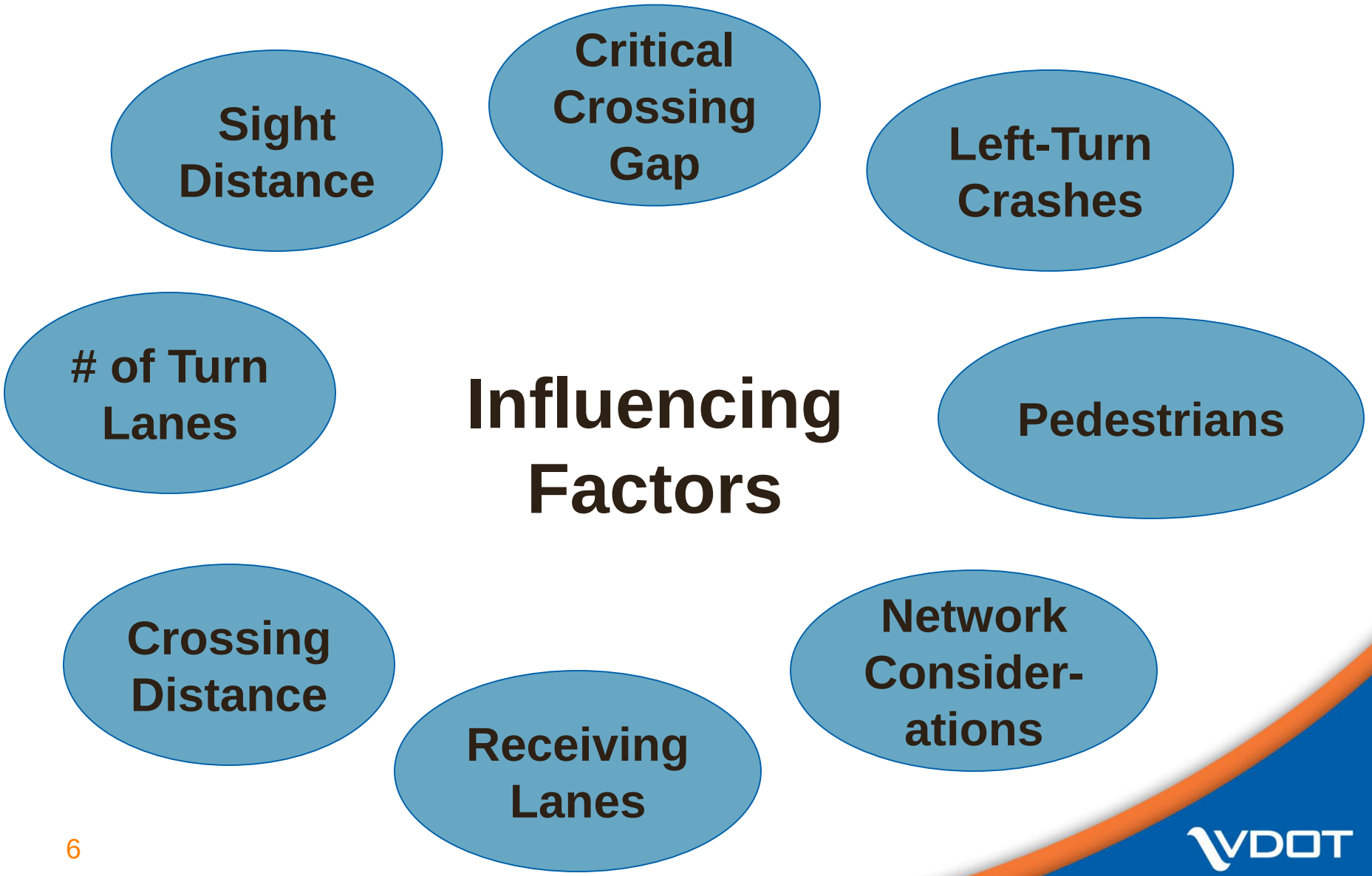
Left Turn Signal Phasing | *Guidance*

At the core of determining left turn phasing mode:

- From a safety perspective, can permissive left-turn movements be allowed on an approach?
- Should some level of left-turn protection be provided for efficiency reasons?

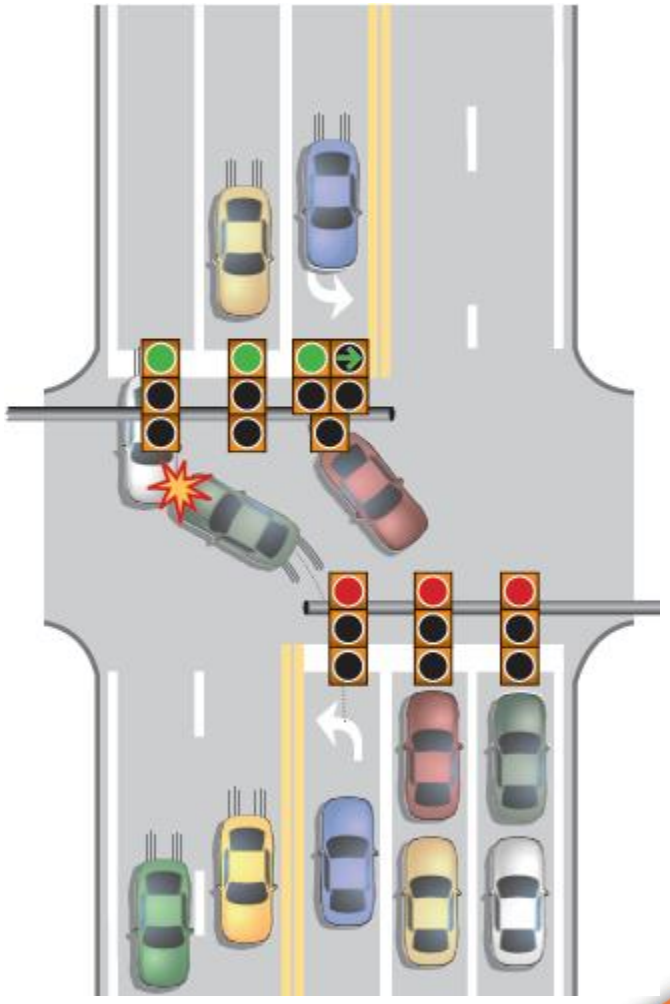


Left Turn Signal Phasing | *Guidance*



Left Turn Signal Phasing | *Guidance*

- Factors evaluated individually and collectively
- Engineering judgment is critical
- Phasing mode may be different in opposing directions
- Documentation requirement is formal VDOT policy – now fully in effect



Left Turn Signal Phasing | *TE-362.1*

- TE-362.1 clarification issued February 2015
- Requires signed & sealed engineering assessment with documentation for:
  - New left turn signal phasing
  - Changes to left turn signal phasing
- Requirement for left turn phasing decisions only. Not applicable to:
  - Right turn phasing
  - Pedestrian phasing
  - Sequencing

Left Turn Signal Phasing | *Documentation*

- Engineering Assessment Workbook available on VDOT's website

VDOT Virginia Department of Transportation

Traffic Engineering

LEFT-TURN PHASE SELECTION ENGINEERING ASSESSMENT WORKBOOK

TE-362.1

VDOT Office or Firm Name
City, State
Technical Discipline

Intersection Information

Intersection: Click here to enter text.	
Operations Region: Choose an item.	Locality:
Intersection Node:	Reference #:
Prepared by:	Date: Click here to enter a date.
Reviewed by:	Date: Click here to enter a date.
Assessment Origin: ☐ New Signal ☐Rebuild – Modification ☐Operations – Timing Study ☐Other:	

Left Turn Signal Phasing | *Guidelines*

WORKSHEET 2 - SB Approach Evaluation

Place "X" for Factors	*When making left-turn phasing decisions, the engineer should document their consideration of the factors in boxes 1-7 that most influence left-turn phase selection. Additional factors may be considered and documentation of those factors can be included in box 8. It is not necessary to consider all items if one (or more) items clearly support a specific left-turn phasing decision. Refer to VDOT's "Guidance for Determination and Documentation of Left-Turn Phasing" when completing this worksheet.*
☐	***1) Turn Lanes & Intersection Geometry*** a. Number of Left-Turn Lanes: Exclusive - XX Shared - XX b. Concurrent opposing left-turn movements possible within intersection? Choose an item. c. Intersection geometry commentary: Click here to enter text.
☐	***2) Sight Distance*** a. Measured sight distance at stop line: Click here to enter text. b. Sight distance speed evaluated: Click here to enter text. c. AASHTO sight distance requirement: Click here to enter text. d. AASHTO sight distance met at stop line? Choose an item. e. Sight distance commentary: Click here to enter text.
☐	***3) Correctable Left-Turn Crashes*** a. Total approach left-turn crashes or crash rate(s): Click here to enter text. b. Time period evaluated and source of information: Click here to enter text. c. Left turn crash commentary: Click here to enter text.

Overhead Street Name Signs| *TE-379*

- Released April 2015
- Provides guidance for the design of overhead mast arm street name signs (D3-V1 series)
  - Larger street name signs can yield excessive loading or be impractical size for placement
  - Policy provides flexibility and guidance for designers
  - Modifies Section 2D.43 of the Virginia Supplement to the MUTCD

Overhead Street Name Signs| *TE-379*

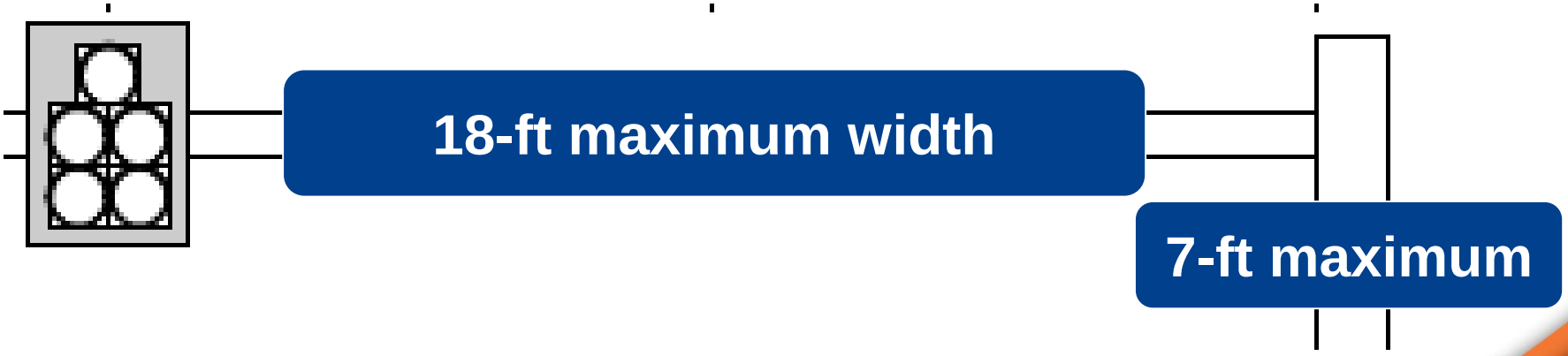
- Recommended and minimum text heights:

Sign	Intersection Speed Limit *(a)*	Recommended Text Height *(b)*	Minimum Text Height
D3-V1 	≥ 50 mph	12”	8”
	40 – 45 mph	10”	8”
	≤ 35 mph	8”	6”
D3-V1a *(c)* 	≥ 50 mph	8”	8”
	40 – 45 mph		8”
	≤ 35 mph		6”
D3-V1b *(c)* 	≥ 50 mph	12” (street name) 7” (block numbers)	8” (street name) 6” (block numbers)
	40 – 45 mph	10” (street name) 7” (block numbers)	8” (street name) 6” (block numbers)
	≤ 35 mph	8” (street name) 6” (block numbers)	6” (street name) 5” (block numbers)
D3-V1c 	≥ 50 mph	12” (street name) 20” (shield)	8” (street name) 14” (shield)
	40 – 45 mph	10” (street name) 20” (shield)	8” (street name) 14” (shield)
	≤ 35 mph	8” (street name) 14” (shield)	6” (street name) 10” (shield)

Overhead Street Name Signs| *TE-379*

- 8” maximum letter height for two-line signs

- Maximum sign width:



Overhead Street Name Signs| *TE-379*

- Guidance on constraints that may necessitate reduction in size and how to reduce:
  - Lateral width restrictions
  - Exceeding existing loading on existing mast arms
  - Maximum sign width limitations

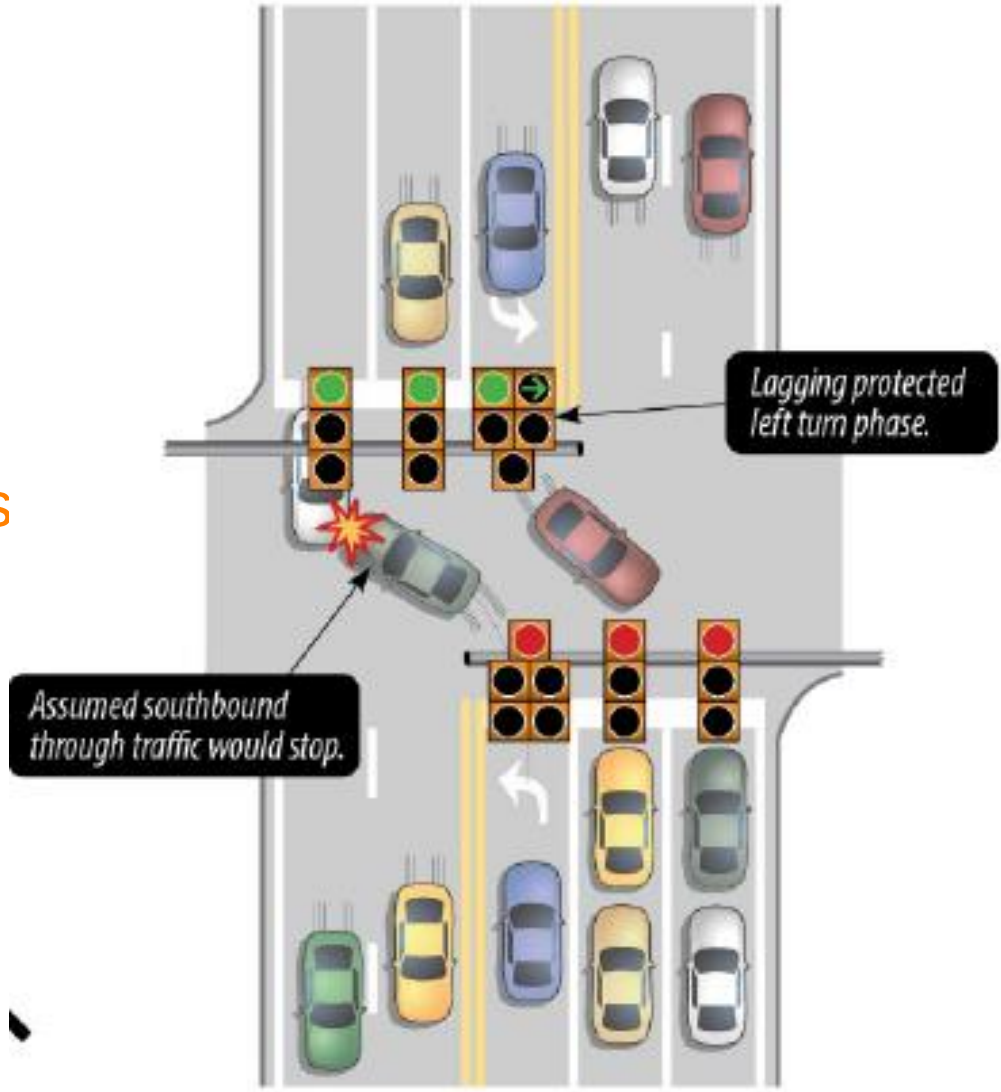
- Signs with route shields (D3-V1) should be used on Corridors of Statewide Significance

Overhead Street Name Signs| *TE-379*

- Effective dates as of release:
  - Future contracts: Shall be effective when Ad Date on or after November 1, 2015
  - Existing contracts: May be applied for existing contracts if approved by Project Engineer
  - Land development and private projects: Shall be effective for cases where a signal design plan has not yet been submitted to VDOT.
  - Design-Build or PPTA: Shall be effective for projects in which the design criteria package has not been completed for advertisement as of November 1, 2015
  - Existing signs: May remain through the end of their useful service life.

Upcoming Guidelines| *Flashing Yellow Arrow*

- National research finds FYA more readily understood for permissive conditions
- Yields safety benefits:
  - Notable reduction in crashes at pilot locations in Virginia
  - Effective method for eliminating yellow trap
- Increases operational flexibility



Upcoming Guidelines| *Flashing Yellow Arrow*

- Upcoming guidelines – under VDOT internal review
- Current draft recommends FYA for protected-permissive left turn movements when dedicated turn lane is present
- Allows use of FYA for permissive-only left turn movements when dedicated lane is present

Figure 4 - Type 1 Transition

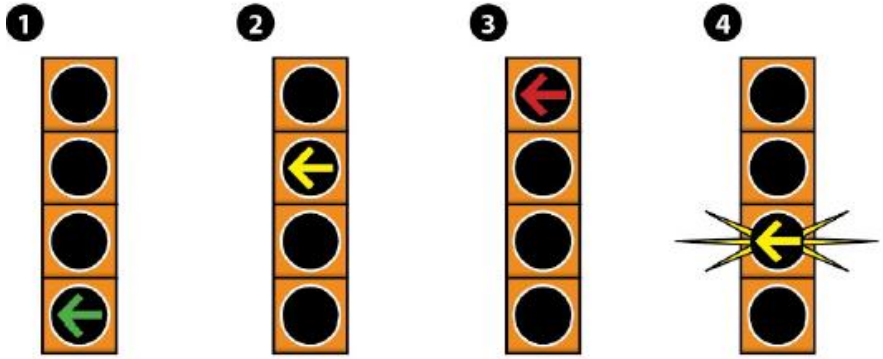
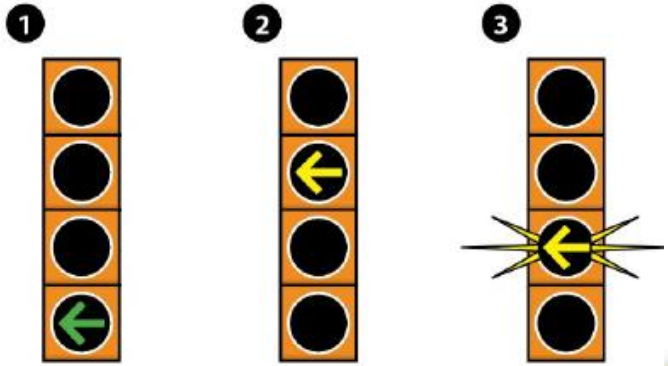
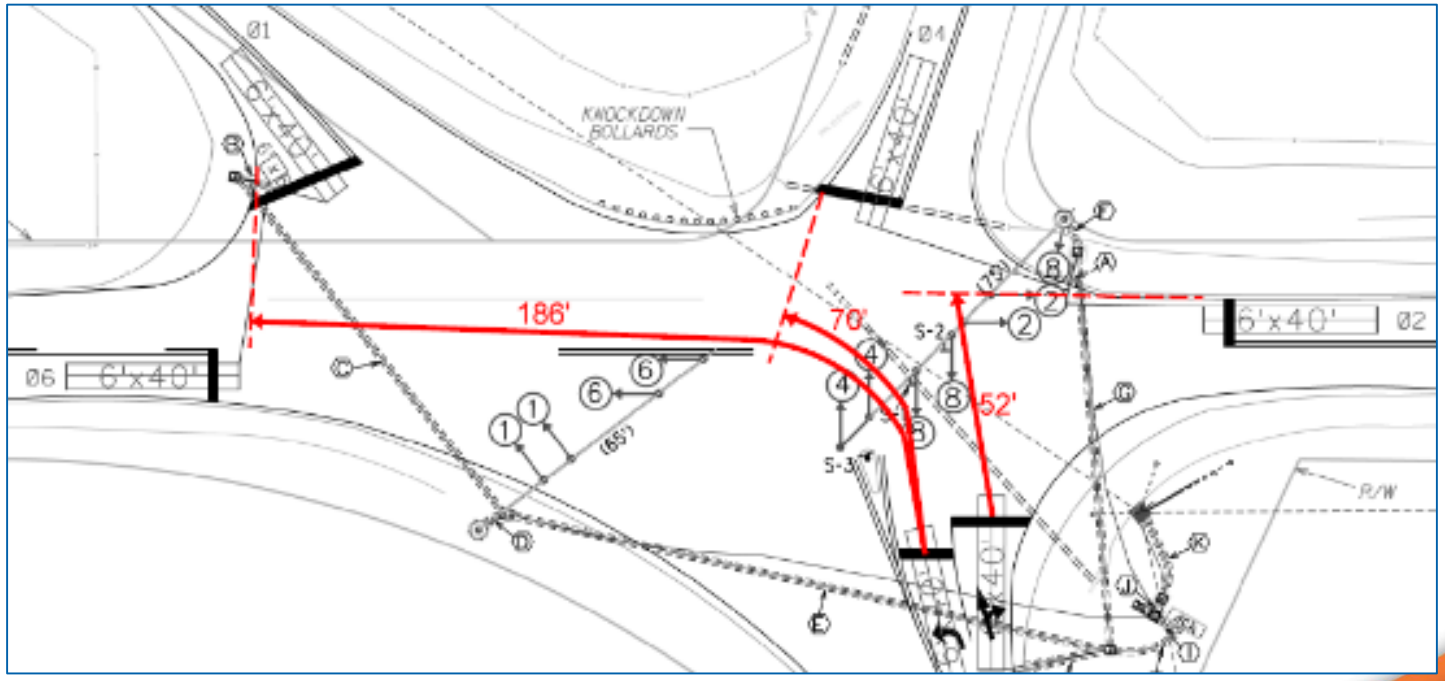


Figure 5 - Type 2 Transition



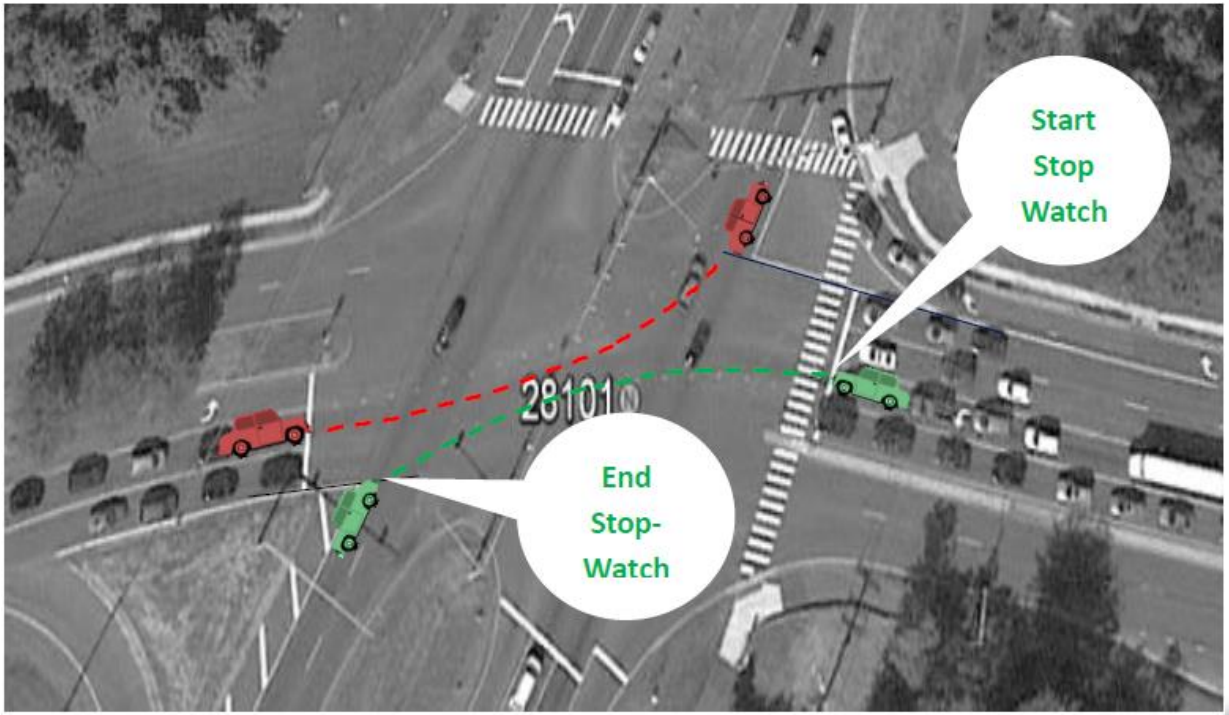
Upcoming Guidelines| *TE-306.1 FAQs*

- Currently under internal VDOT review.
- Will provide additional support for engineering judgment and answers to common questions: Grade, Intersection width, Level of documentation



Upcoming Guidelines| *TE-306.1 FAQs*

- Will include special field methodology for determining all-red interval for large intersections with wide left turns (developed by NRO)



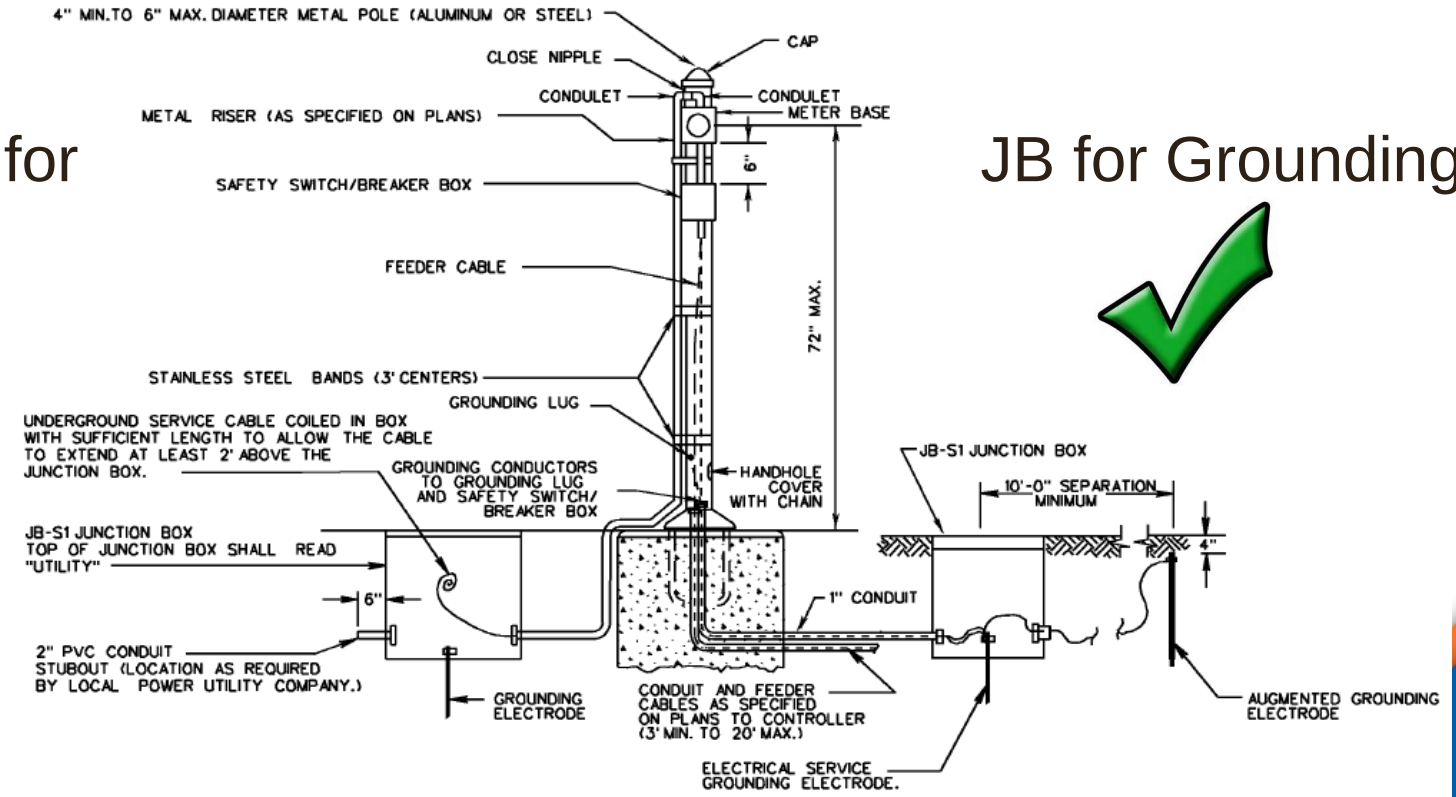
NRO Signal Design Specifics | *Elec. Service*

- Underground electrical service connections are preferred
  - Overhead electrical service should be the last resort
  - Overhead lines are more vulnerable during poor weather conditions
- SE-5 is NRO's preferred electrical service

NRO Signal Design Specifics | *Elec. Service*

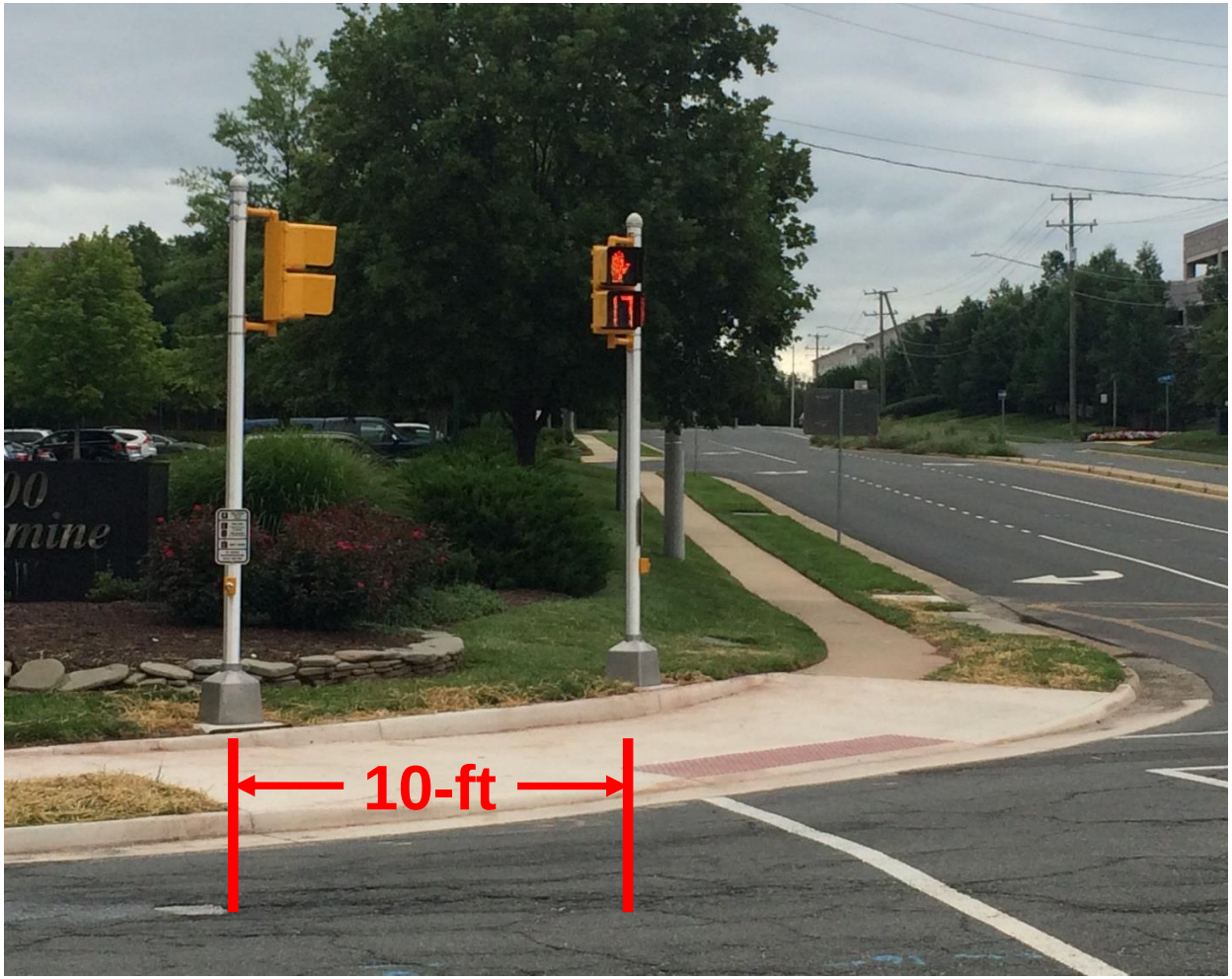
- Both electrical service providers run source cable directly to meter/switch, no service cable JB needed

JB & Cable for Service Connection



JB for Grounding

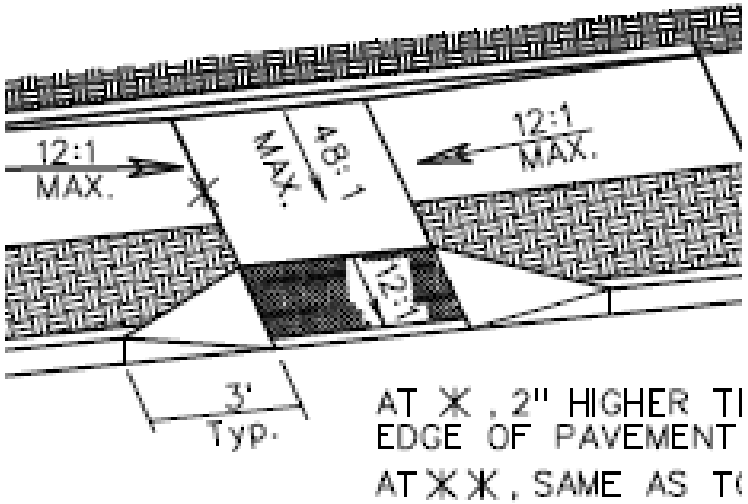
NRO Signal Design | *Ped Signal Placement*

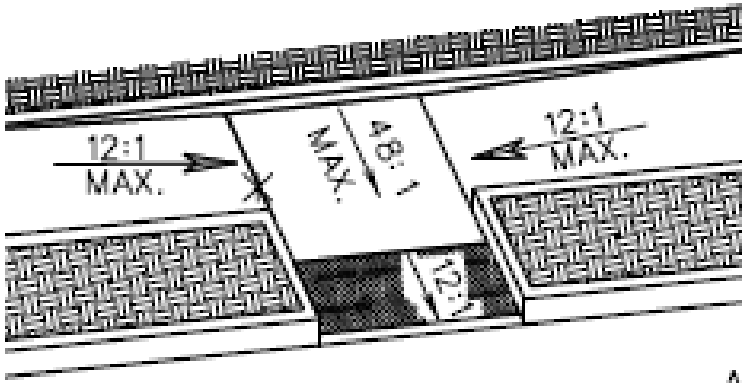


- Separate poles preferred
- 10-ft separation for potential future APS

NRO Signal Design Specifics | *Curb Ramps*

- Avoid the use of vertical curbs adjacent to detectable warning surfaces
- Challenging for snow removal
- Not ideal for cyclists





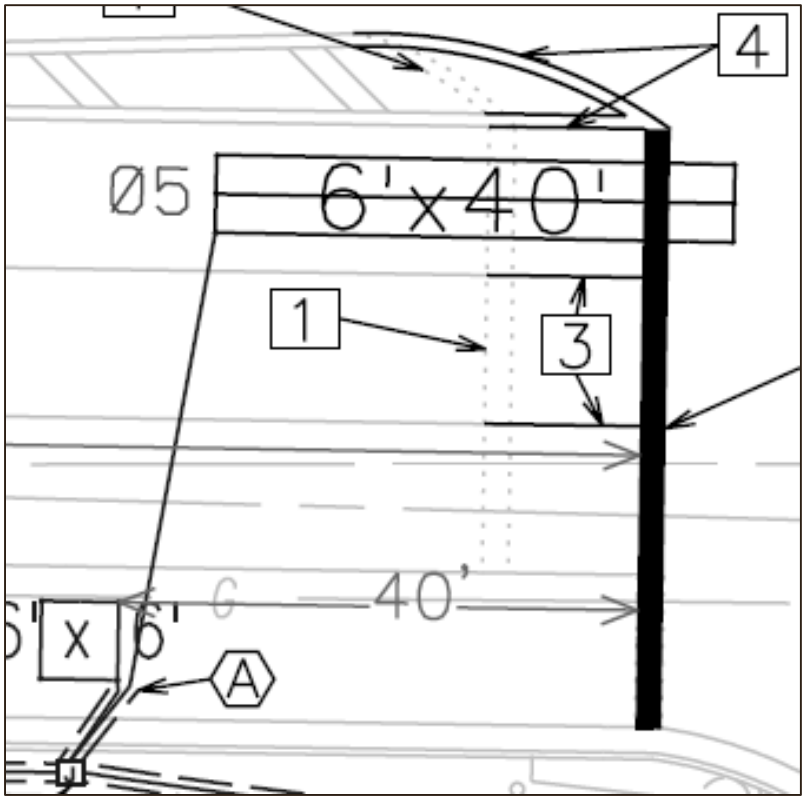
NRO TEP 301.1 | *Pavement Markings*

VDOT Northern Region Traffic Engineering Practice	No. 301.1
Pavement Marking at Intersections	July 20, 2012

- Staggered Stop Bars in Right-Turn Lanes
- Longitudinal Turn Bay Markings
- Pavement Arrows and ONLY Word Markings
- Longitudinal Crosswalk Markings

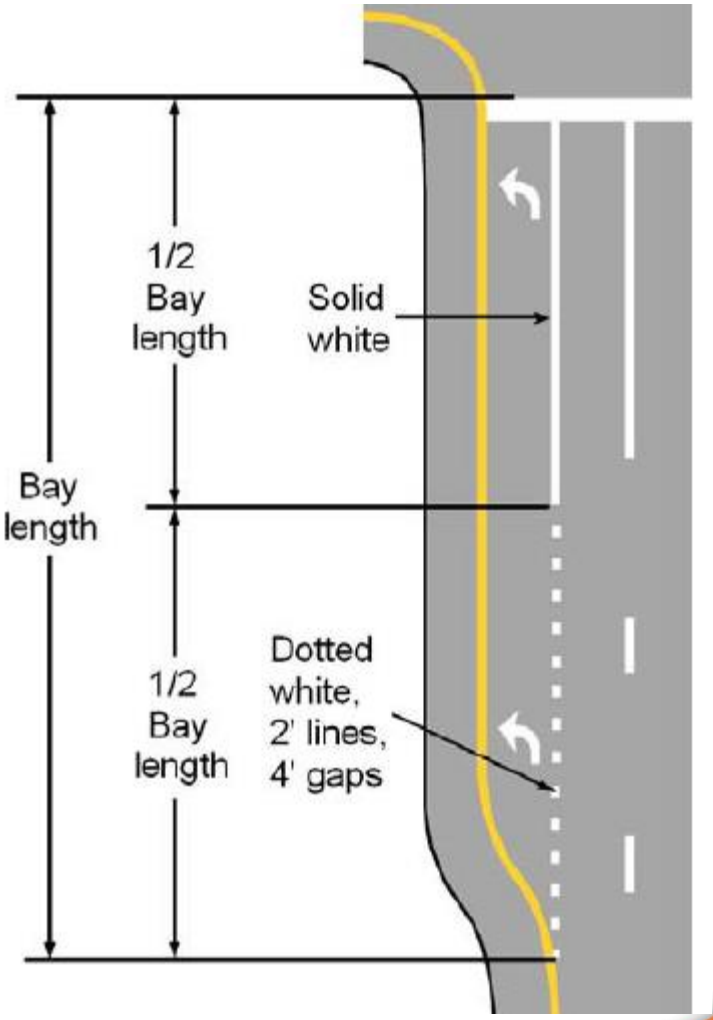
NRO TEP 301.1 | *Pavement Markings*

- Staggered stop bars in right-turn lanes
  - *Should* be staggered 10-ft only where sight distance benefit for drivers turning on red
  - *Should* not be staggered for certain conditions (e.g., when right turns on red prohibited, not exclusive turn lane, others).
  - **Shall not be staggered when right turns are permissible from more than one lane.**



NRO TEP 301.1 | *Pavement Markings*

- Longitudinal markings for turn bays
- Key difference compared to statewide guidelines:
  - Solid line and dotted line are half the length of the bay including taper



NRO TEP 301.1 | *Pavement Markings*

- Pavement arrows and ONLY word markings

Condition	***Pavement arrows***	***ONLY word markings***
Left-turn lanes where drivers are permitted to turn left from more than one lane on an approach	**Shall be used**[2]	*Should be used*[3]
Drop lanes, where a mandatory turn lane is formed from an upstream travel lane	**Shall be used**[4]	**Shall be used**[5]
Opposing offset channelized left-turn lanes	*Should be used* (to discourage wrong-way movements)[6]	*Should not be used*
Turn bays with single-lane turning movements where the end of the bay is visible to drivers from the beginning of the taper, and without complex or unusual lane configuration or roadway geometry	*Should not be used*	*Should not be used*
All other turn lanes	*Should be used*[7]	May be used[8]

NRO TEP 301.1 | *Pavement Markings*

- Crosswalk markings
  - **Where longitudinal markings are used, the markings shall be parallel to the major flow of traffic on the street being crossed.**

Questions