Virginia Department of Transportation

Yellow Change and Red Clearance Interval & Pedestrian Signal Timing
Northern Region Operations

Nhan Vu

Traffic Signal Timing Documents

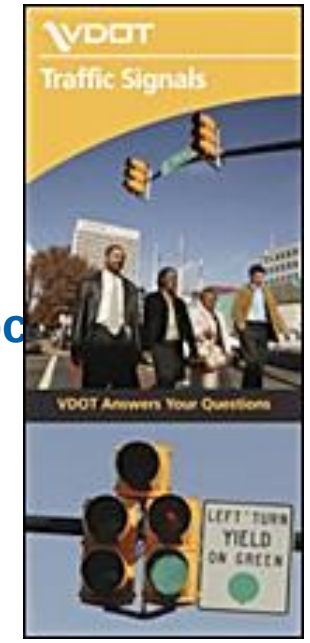
1. **VDOT TE Memorandum - Yellow Change Intervals and Red Clearance Intervals**
   - TE-306.1 (Jan. 7, 2013)

2. **NRO TEP – Yellow Change and Red Clearance Intervals**
   - NO. 406.1 (Feb. 28, 2013)

3. **NRO Clearance and Change Interval Data Collection & Proc Practices**
   - Traffic Signal Operations Section (Release Aug. 11, 2014)

4. **NRO TEP – Pedestrian Timing at Traffic Signals**
   - No. 401.1 (Dec. 8, 2011)

5. **NRO TEP – Pedestrian Accommodations at Traffic Signals**
   - No. 403.1 (Aug. 7, 2014)



Yellow Change and Red Clearance Interval

- **Calculation for Yellow change and All-Red clearance intervals based on TE 306.1, NRO TEP 406.1, and NRO Best Practices documents.**

YELLOW CHANGE INTERVAL
(Equation 1)

$$Y = t + \frac{1.47 * V}{2a + 64.4g}$$

where:

Y =	yellow change interval, in seconds (s)
t =	perception-reaction time, in seconds (s)
V =	vehicle approach speed, in miles per hour (mph)
a =	deceleration rate, in feet per second squared (ft/s^2)
g =	approach grade, in percent divided by 100 to the nearest whole percent (negative for downgrade)

RED CLEARANCE INTERVAL
(Equation 2)

$$R = \frac{w + L}{1.47 * V} - 1$$

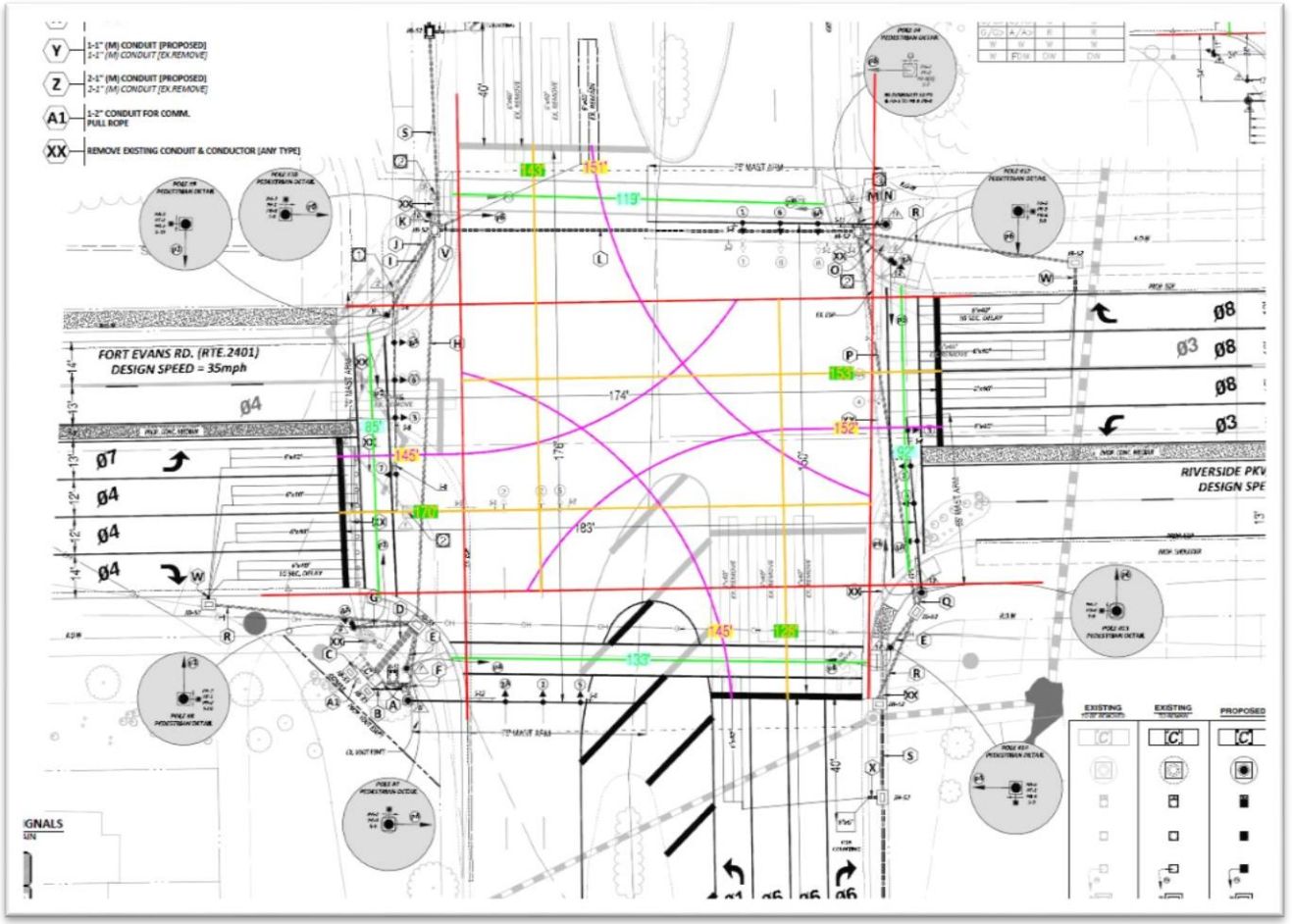
where:

R =	red clearance interval, in seconds (s)
w =	intersection width, in feet (ft)
L =	length of vehicle, in feet (ft)
V =	vehicle approach or turning speed, in miles per hour (mph)

- **Verify Approach Speed**
- **Provide supporting documentation: Approach Grade "g" & Intersection Width "w".**

Yellow Change and Red Clearance Interval, Contd.

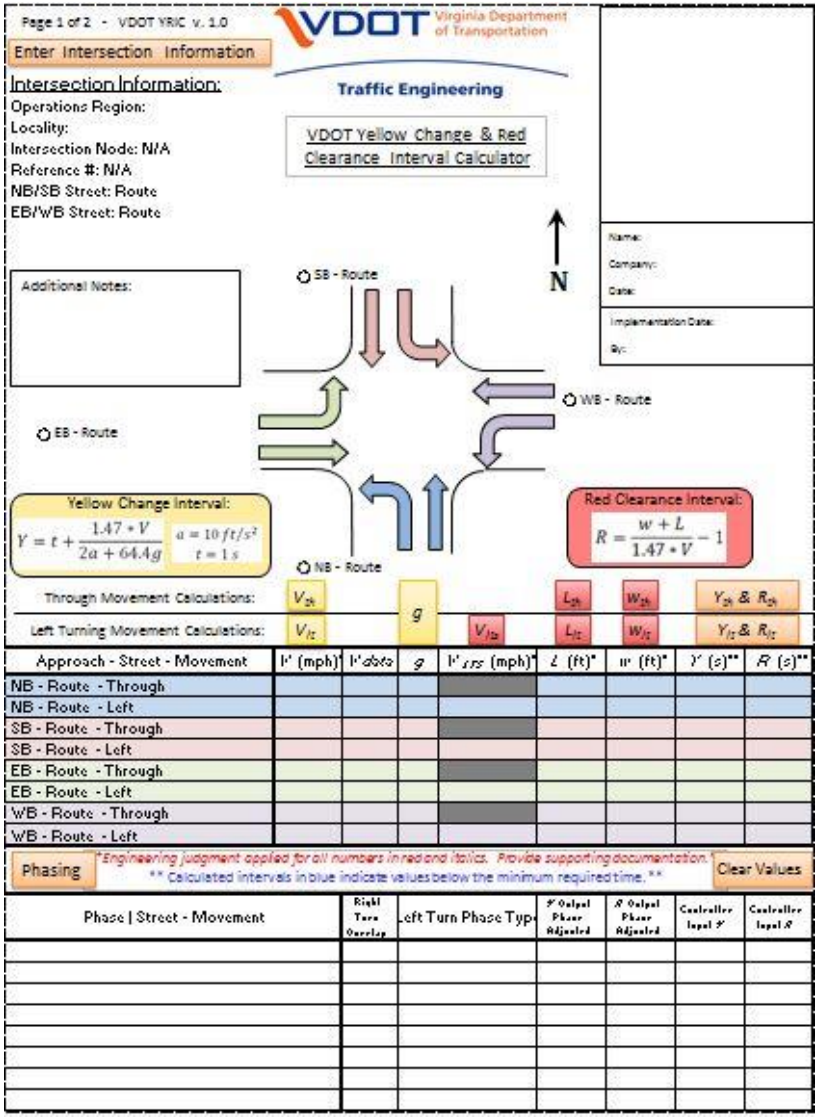
- **Intersection Width ‘w’ – Natural driving path**
  - **Measured from back edge of the stop line to the extension of the curb line or outside edge of farthest travel lane.**



Yellow Change and Red Clearance Interval, Contd.

- **Grade 'g'**
  - **Measured approx. 400 ft. upstream from stop line.**
    - Measure elevation at 100 ft, 200 ft, 300 ft, and 400 ft from stop line.
      - If steady profile pattern, use elevation at stop line and 400th ft for Grade measurement.
      - If any significant changes in profile patterns, use engineering judgement and document methodology.
  - **Rounded down to the nearest whole percent (3.6 → 3.0; - 3.6 → - 4.0)**
  - **Applied to all movements on the measured approach.**

Yellow Change and Red Clearance Interval, Contd.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Enter Intersection Information

Traffic Engineering

Intersection Information:
Operations Region:
Locality:
Intersection Node: N/A
Reference #: N/A
NB/SB Street: Route
EB/WB Street: Route

VDOT Yellow Change & Red Clearance Interval Calculator

Name:
Company:
Date:
Implementation Date:
By:

Additional Notes:

N

SB - Route
WB - Route
EB - Route
NB - Route

Yellow Change Interval:
$Y = t + \frac{1.47 * V}{2a + 64.4g}$ $a = 10\ ft/s^2$ $t = 1\ s$

Red Clearance Interval:
$R = \frac{w + L}{1.47 * V} - 1$

Through Movement Calculations: V_{1k} g L_{1k} W_{1k} Y_{1k} & R_{1k}
Left Turning Movement Calculations: V_{1t} V_{1a} L_{1t} W_{1t} Y_{1t} & R_{1t}

Approach - Street - Movement	V (mph)*	V_{adv}	g	V_{crs} (mph)*	L (ft)*	w (ft)*	Y (s)**	R (s)**
NB - Route - Through								
NB - Route - Left								
SB - Route - Through								
SB - Route - Left								
EB - Route - Through								
EB - Route - Left								
WB - Route - Through								
WB - Route - Left								

Phasing

*Engineering judgment applied for all numbers in red and italics. Provide supporting documentation.
** Calculated intervals in blue indicate values below the minimum required time. **

Clear Values

Phase	Street - Movement	Right Turn Overlap	Left Turn Phase Type	# Output Phase Adjusted	# Output Phase Adjusted	Controller Input #	Controller Input #

- **Use "Yellow Change & Red Clearance Interval Calculator" to develop Timing.**
- **VDOT must approve Timing data before use.**
  - Submit P.E. sealed and signed copy of final Yellow Change and Red Clearance data for Approval.

Pedestrian Signal Timing

- **NRO TEP 401.1 (Pedestrian Timing at Traffic Signals)**
  - WALK and FDW Calculation (Computation Look-up Table included)
  - Length measured (ft) curb to curb. Speed at 3.5 feet per second
  - Complies with the 2009 MUTCD

- **NRO TEP 403.1 (Pedestrian Accommodations at Traffic Signals)**
  - Pedestrian Signal Heads and Crosswalk Markings
  - Pedestrian Pushbuttons
  - Pedestrian Phasing: WALK Extension; Rest-in-WALK; LPI.