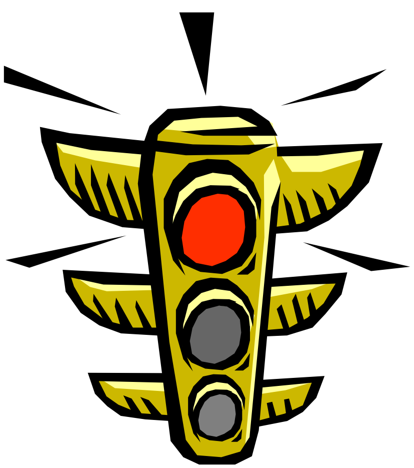
Signal Timing Information

Many who oppose the use of red light enforcement cameras often argue that signal timing is incorrectly calculated at the enforced intersection. This presentation provides the public with information on signal timing for all of the Virginia Beach red light photo enforced intersection approaches. VDOT Memo TE-306.1 provides guidance for the calculation of signal timing at photo enforced intersections in the state of Virginia.

What does VA law state about the amber, red, and green signals? (VA 46.2-833 / 46.2-835)

46.2-833 Green indicates the traffic shall move in the direction of the signal and remain in motion as long as the green signal is given, except that such traffic shall yield to other vehicles and pedestrians lawfully within the intersection.

46.2-833 Steady amber indicates that a change is about to be made in the direction of the moving of traffic. When the amber signal is shown, traffic which has not already entered the intersection, including the crosswalks, shall stop if it is not reasonably safe to continue, but traffic which has already entered the intersection shall continue to move until the intersection has been cleared. The amber signal is a warning that the steady red signal is imminent.



46.2-833 Steady red indicates that moving traffic shall stop and remain stopped as long as the red signal is shown, except in the direction indicated by a lighted green arrow. Flashing red indicates that traffic shall stop before entering an intersection.

46.2-835 Right Turn on Red…except where signs are placed prohibiting turns on steady red, vehicular traffic facing a steady red signal, after coming to a full stop, may cautiously enter the intersection and make a right turn. Such turning traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic using the intersection.

Frequently Asked Question: What does the Yellow and Red signals mean to drivers?

The presentation of the yellow signal provides drivers with a warning that a change in intersection right of way is about to occur. When properly calculated, the length of the yellow signal will provide drivers with an adequate amount of time and distance to bring their vehicle safely to a stop before the signal changes to red. When the yellow is shown, traffic which has not already entered the intersection should slow to a stop in anticipation of the red signal.

The presentation of the red signal directs drivers to stop. RED MEANS STOP!

The red clearance interval or "all red" is a period in which all approaches are red at the same time. The red clearance period is an important crash prevention countermeasure because it provides for the safe exit of vehicles that enter the intersection as (or shortly after) the signal turns red. The red clearance period is completed before the opposing or conflicting traffic gets a green signal.

§ 15.2-968.1 Use of photo-monitoring systems to enforce traffic light signals

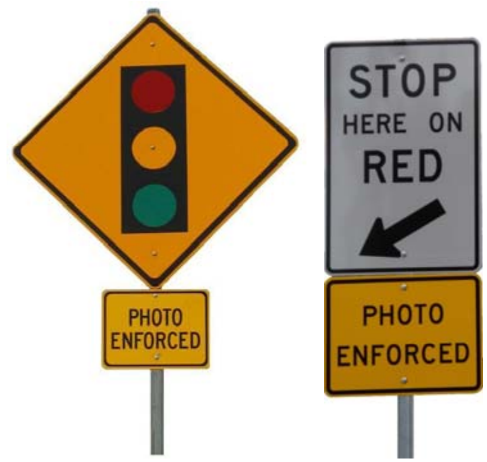
Virginia Law on the Calculation of Traffic Signal Timing at Photo Enforced Intersections

K. Before the implementation of a traffic light signal violation monitoring system at an Intersection that addresses signal timing and other, the locality shall complete an engineering safety analysis location-specific safety features.

The **length of the yellow phase** **shall be established** based on the recommended methodology of the Institute of Transportation Engineers. Please visit the VDOT web site to obtain a copy of the TE-306.1.

All traffic light signal violation monitoring systems **shall provide a minimum 0.5-second grace period** between the time the signal turns red and the time the first violation is recorded.

Virginia Law on the use of Violation Monitoring System Signs



M. Any locality that uses a traffic light signal violation monitoring system to enforce traffic light signals **shall place** **conspicuous signs** **within 500 feet** **of the intersection approach** at which a traffic light signal violation monitoring system is used. There shall be a rebuttable presumption that such signs were in place at the time of the commission of the traffic light signal violation.

Note: Additional signs have been placed at the enforced right turn stop bars.

Signal timing calculations at Virginia Beach intersections are in accordance with guidelines provided by the Virginia Department of Transportation. VDOT Memorandum TE-306.1 dated January 7, 2013 provides that yellow and red clearance intervals be calculated using equations A and B below.

Yellow Change Interval

The yellow change interval (Y) is calculated using Equation A:

$$Y = t + \frac{1.47V}{2a + 64.4g} \qquad \textbf{Equation A}$$

Where:

t = PRT (s); *set at 1.0 seconds*

a = deceleration rate (ft/s^2); *set at 10 ft/s^2*

V = 85th percentile approach speed (mph)

g = approach grade (percent divided by 100, negative for downgrade)

Note: Signal timing at the Virginia Beach photo enforced intersections was implemented using the VDOT guidelines at 5 pm on January 10, 2013.

Yellow timing calculations are provided for review on the next slide. V= posted speed limit +7.

Red Clearance Interval

The red clearance interval (R) is calculated using Equation B:

$$R = \frac{W + L}{1.47V} - 1 \qquad \textbf{Equation B}$$

Where:

W = intersection width measured from the back/upstream edge of the approaching movement stop line to the far side of the intersection as defined by the extension of the curb line or outside edge of the farthest travel lane (ft)

L = length of vehicle (ft); *set at 20 feet*

V = 85th percentile approach speed (mph)

Virginia Beach all red clearance interval timing is an engineering countermeasure and an important crash reduction strategy. The existing Red Clearance Intervals are based on engineering judgment using intersection data and driver behavior.

Signal Timing Calculation for the Yellow Interval

There are three posted speed limits associated with the enforcement of Virginia Beach intersections.

They are:

35 mph +7 = 42 mph

45 mph +7 = 52 mph

50 mph +7 = 57 mph

Note: VDOT TE-306.1

V= Speed Limit +7

All approaches have a flat grade which = 0 in the calculation formula.

The standard perception reaction time for this calculation is 1.0 as determined by Virginia Beach and VDOT Traffic Engineers.

Yellow Change Interval = t + V/(2A+-64.4g)		
Perception Reaction Time (t)	1	
Posted Speed in (V in MPH)	42	61.6 ft/ sec
Deceleration Rate (a = 10 ft/ sec^2)	10	
Grade (g, use zero for flat grade) + for downhill, - for uphill	0	
Yellow Change Interval =	**4.08** Sec.	

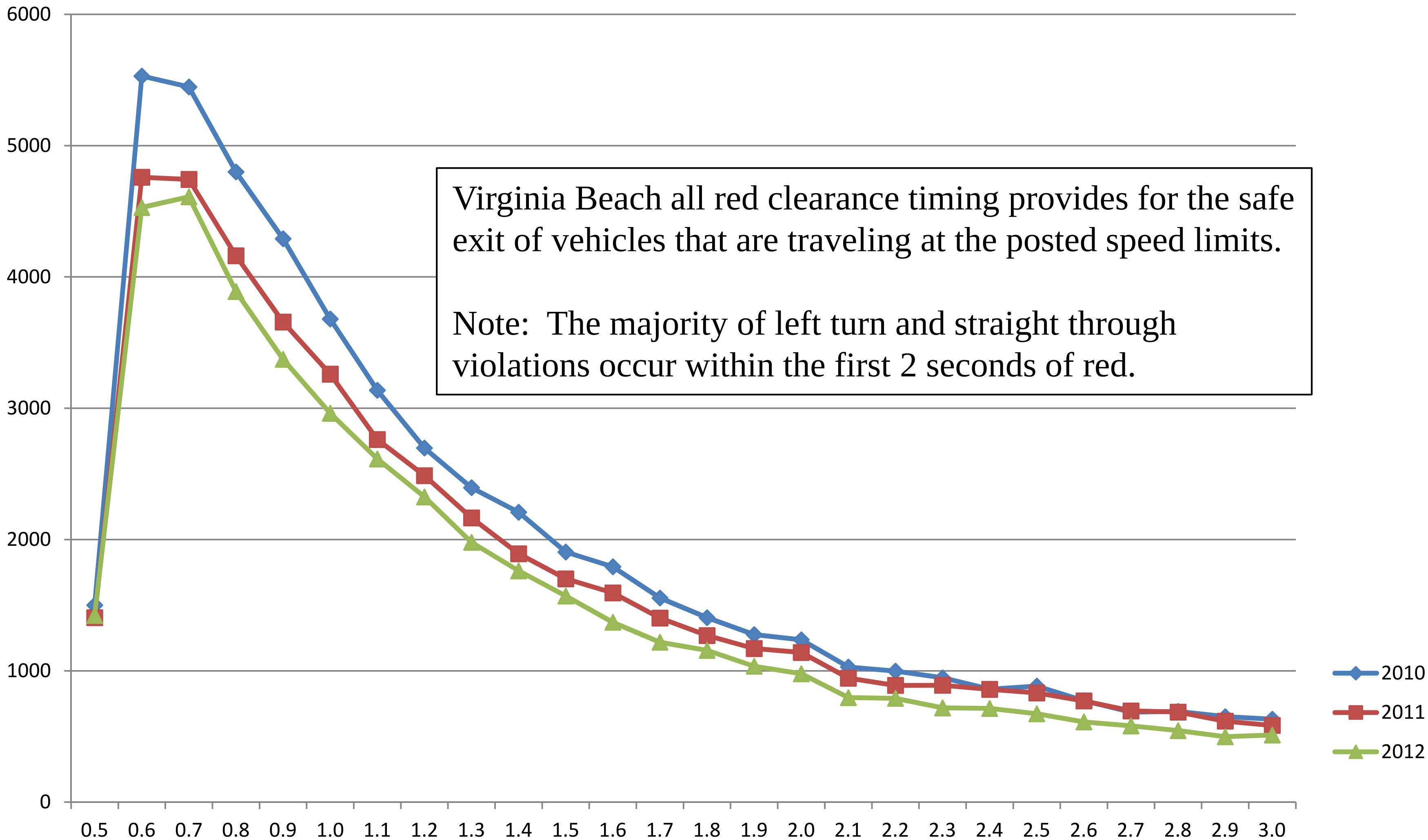
Yellow Change Interval = t + V/(2A+-64.4g)		
Perception Reaction Time (t)	1	
Posted Speed in (V in MPH)	52	76.267 ft/ sec
Deceleration Rate (a = 10 ft/ sec^2)	10	
Grade (g, use zero for flat grade) + for downhill, - for uphill	0	
Yellow Change Interval =	**4.81** Sec.	

Yellow Change Interval = t + V/(2A+-64.4g)		
Perception Reaction Time (t)	1	
Posted Speed in (V in MPH)	57	83.6 ft/ sec
Deceleration Rate (a = 10 ft/ sec^2)	10	
Grade (g, use zero for flat grade) + for downhill, - for uphill	0	
Yellow Change Interval =	**5.18** Sec.	

This chart contains approved signal timing for Virginia Beach's 20 monitored intersection approaches	Posted Speed Limit	Adjusted Speed Limit *	Grade	Width of Intersection	Yellow Interval		All Red Interval	
					Existing	* Adjusted Calculated	Existing	* Adjusted Calculated
Baxter Rd (East) at Independence Blvd	45	52	level	184 ft	4.8	4.81	3.0	1.7
Bonney Rd (West) at Independence Blvd	35	42	level	173 ft	4.1	4.08	3.0	2.13
Dam Neck Road (East) at General Booth Blvd	45	52	level	135 ft	4.8	4.81	3.0	1.03
General Booth Blvd (South) at Dam Neck Rd	45	52	level	166 ft	4.8	4.81	3.0	1.44
Great Neck Rd (South) at Virginia Beach Blvd	45	52	level	165 ft	4.8	4.81	3.0	1.43
Holland Road (East) at Rosemont Rd	45	52	level	102 ft	4.8	4.81	2.3	.60
Holland Road (West) at Rosemont Rd	45	52	level	124 ft	4.8	4.81	2.3	.89
Independence Blvd (North) at Bonney Rd	45	52	level	122 ft	4.8	4.81	3.0	.86
Independence Blvd (North) at Virginia Beach Blvd	45	52	level	174 ft	4.8	4.81	3.0	1.54
Indian River Rd (West) at Kempsville Rd	45	52	level	150 ft	4.8	4.81	2.9	1.23
Indian River Rd (West) at Military Highway	45	52	level	145 ft	4.8	4.81	3.0	1.16
Kempsville Rd (North) at Indian River Rd	45	52	level	140 ft	4.8	4.81	3.0	1.10
London Bridge Rd (North) at Dam Neck Rd	45	52	level	190 ft	4.8	4.81	3.0	1.75
Lynnhaven Pkwy (South) at International Pkwy	45	52	level	91 ft	4.8	4.81	2.1	.46
Military Highway (South) at Indian River Rd	45	52	level	183 ft	4.8	4.81	3.0	1.66
North Hampton Blvd (S/W) at Diamond Springs Rd	45	52	level	133 ft	4.8	4.81	2.8	1.01
Princess Anne Rd (South) at Dam Neck Rd	50	57	level	154 ft	5.2	5.18	3.0	1.08
Princess Anne Rd (North) at Lynnhaven Pkwy	50	57	level	157 ft	5.2	5.18	2.5	1.12
Virginia Beach Blvd (East) at Great Neck Rd	45	52	level	145 ft	4.8	4.81	3.0	1.16
Virginia Beach Blvd (West) at Independence Blvd	45	52	level	176ft	4.8	4.81	3.0	1.57

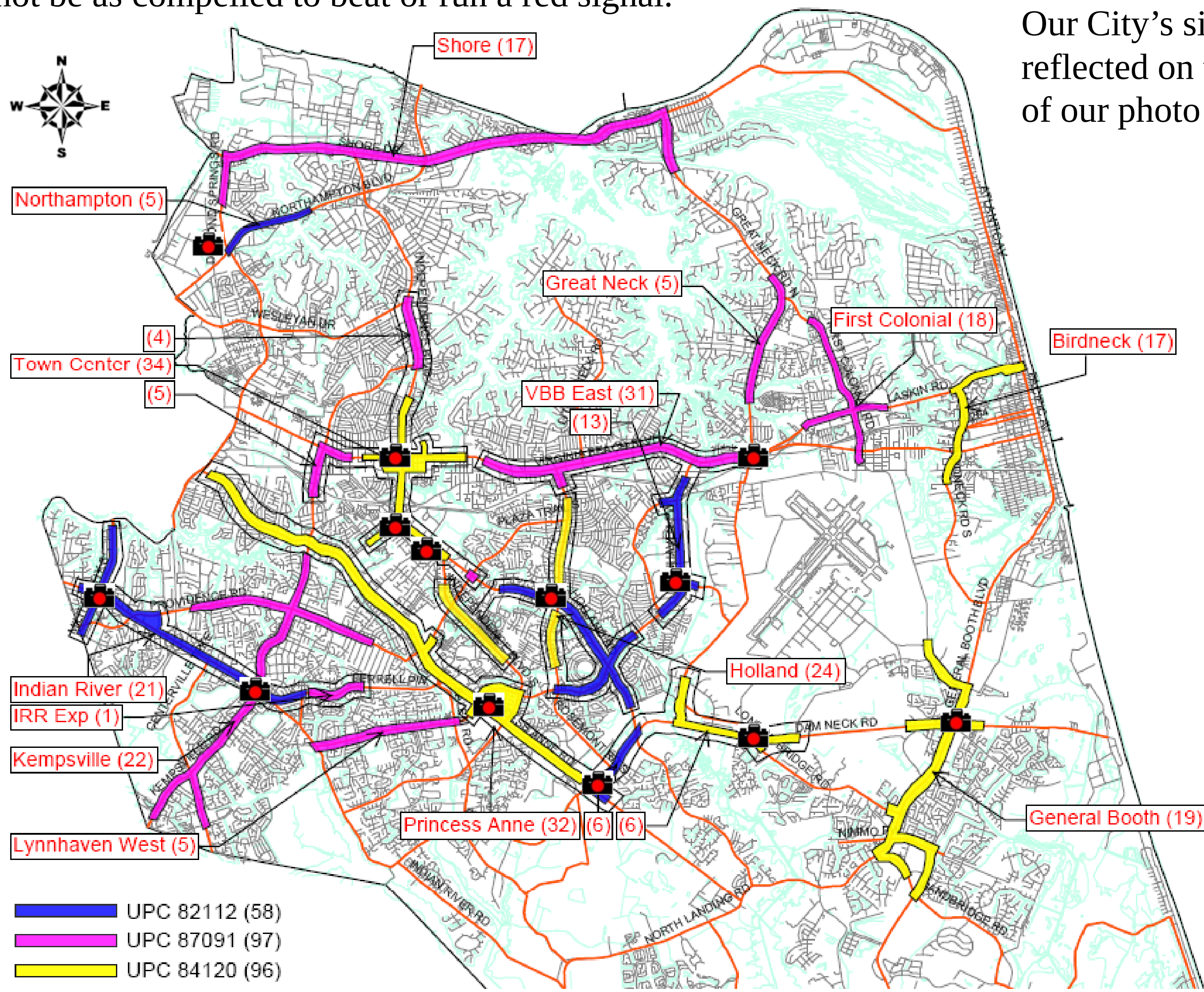
*Reference VDOT Traffic Engineering Division Memorandum TE-306.1 dated January 7, 2013

The chart below provides 3 years of Virginia Beach red light running data. It is represents the number of violations occurring up to 3 seconds after the light was red.



Virginia Beach Signal Timing Coordination Project

According to the Federal Highway Administration, the solution to the red light running problem involves a combination of engineering, education, and enforcement measures. Interconnected signal systems provide coordination between adjacent signals and are proven to reduce stops, reduce delays, decrease accidents, increase average travel speeds, and decrease emissions. If drivers are given the best signal coordination practical, they may not be as compelled to beat or run a red signal.



Our City’s signal coordination project is reflected on this map along with the location of our photo enforcement cameras.

All signal heads used at photo enforced intersections are LED.

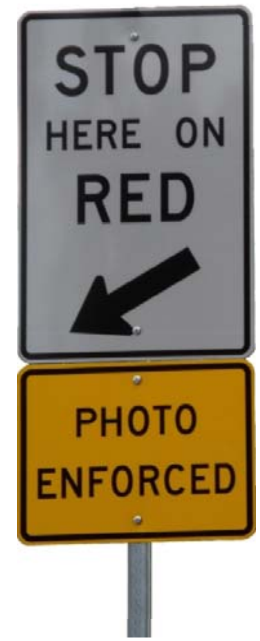
LED units are used for three reasons:

(1) they are energy efficient
(2) they are brighter than incandescent bulbs
(3) have a longer service life

All signal heads are 12 inches in diameter and have back plates to improve signal visibility.

Signal ahead signs are used at all photo enforced locations.

PHOTO *Safe*
Virginia Beach
RED *Means Stop*



Still have Questions?

One of the main goals of the **PHOTO*Safe*** program is public education and awareness. The information provided in this document is based on the inquiry of citizens who have requested information specific to the City of Virginia Beach automated enforcement program's signal timing calculations. Always remember, RED MEANS STOP!

Please email any questions on signal timing to VBPDphotosafe@vbgov.com. The **PHOTO*Safe*** program coordinator, traffic engineer, or the supervisor of traffic signal operations will address any concerns with the Virginia Beach signal timing calculations.