



Traffic Signal Clearance Policy

April 2020

Purpose

The traffic signal clearance policy outlines and establishes the methodology used to determine the duration of the traffic signal phase change intervals, which consists of the yellow change interval and the red clearance interval, as well as the pedestrian clearance interval. Any deviations from this policy must be approved by the City Traffic Engineer.

A Traffic Signal Clearance Memorandum is required for all traffic signal projects (new design or modification to an existing signal) in the City. The memorandum is required with the first submittal of the traffic signal plans and must be sealed by a professional engineer registered in Arizona.

Yellow Change Interval

The duration of the yellow change interval shall be determined based on the formula shown below:

$$Y_c = t + \frac{1.47V}{2a + 64.4G}$$

Where:

Y_c = Yellow Change Interval, in seconds

t = Perception-reaction time (assume 1.0 second)

V = Approach speed, in miles per hour

a = Deceleration rate, in feet per second (typically 10 feet per second)

G = Percent grade (positive for upgrade, negative for down grade) divided by 100

Notes:

1. Yellow change interval shall be a minimum of 3 seconds and a maximum of 6 seconds, rounded to the nearest 0.1 sec.
2. Approach speed for through movement phases, V, shall be closely approximated to the posted speed limit plus 7 miles per hour

3. Approach speed for the protected left-turn phases, V , shall be the posted speed limit minus 5 miles per hour.
4. The terminating approach of a tee intersection shall be treated as a protected left-turn movement for change interval calculations.
5. Assumed grades for the intersection will be 0%, unless the approach grades are 3% or greater.
6. Where the calculated yellow change interval for the co-terminating phases are different, the larger of the two intervals shall be implemented.
7. The duration of the yellow change interval shall not vary on a cycle-to-cycle basis within the same signal timing plan
8. The yellow change interval for the flashing yellow arrows (FYA) shall be equal to the yellow change interval for the adjacent through movement or the opposing through movement, whichever is greater.

Red Clearance Interval

The duration of the red clearance interval shall be determined based on the formula shown below:

$$R_C = \frac{W + L}{1.47V} - 1$$

Where:

R_C = Red clearance interval, in seconds

W = Width of intersection, in feet

L = Length of vehicle (assumed to be 20 feet)

V = Intersection entry speed, in miles per hour

Notes:

1. The red clearance interval shall be a minimum of 1 second and a maximum of 2 seconds, rounded to the nearest 0.1 sec.
2. Entry speeds for through movement phases, V , shall be closely approximated to the posted speed limit plus 7 miles per hour.
3. Entry speed for the protected left-turn phases, V , shall be 20 miles per hour.
4. Width of an intersection (W) is measured from the stop bar to the curb prolongation of the farthest conflicting movement (including bike lanes). If there is a striped-out lane (unused pavement width) adjoining the curb prolongation, then the intersection width will be measured from the stop bar to the outside edge of the farthest conflicting lane. See Figure 1 below.
5. For a single left-turn lane, the width of the intersection shall be measured from the stop bar to the curb line or outside edge of the farthest travel lane along the center of the vehicle path. See Figure 2 below.

6. For dual left-turn lanes, the width of the intersection shall be measured from the stop bar to the curb line or outside edge of the farthest travel lane along the striped lane line between the two left-turn lanes.
7. The terminating approach of a tee intersection shall be treated as a protected left-turn movement for clearance interval calculations.
8. Where the calculated red clearance interval for the co-terminating phases are different, the larger of the two intervals shall be implemented.
9. The red clearance interval for the flashing yellow arrows (FYA) shall be equal to the red clearance for the adjacent through movement or the opposing through movement, whichever is greater.

Pedestrian Clearance Interval

A flashing DON'T WALK indication begins at the end of the WALK indication to provide pedestrians time to clear the crosswalk. The pedestrian clearance is calculated using the following equation:

$$Ped_{clear} = \frac{W}{S} - Y_c$$

Where:

W = Pedestrian crossing distance, in feet

S = Pedestrian speed (usually 3.5 ft/sec)

Y_c = Yellow Change Interval, in seconds

Notes:

1. The pedestrian crossing distance is measured from the center of the ramp to the center of the ramp along the center of the marked crosswalk. See Figure 3 below.
2. The pedestrian clearance interval shall be rounded up to the next higher integer.
3. Where the same pedestrian phase is used for multiple pedestrian crossings, the longest crossing shall be used to determine the pedestrian clearance interval.
4. Extended pedestrian clearance times should be considered where pedestrians frequently cross slower than 3.5 ft/sec. For example, signals near schools with adult crossing guards and higher pedestrian volumes.

Figures

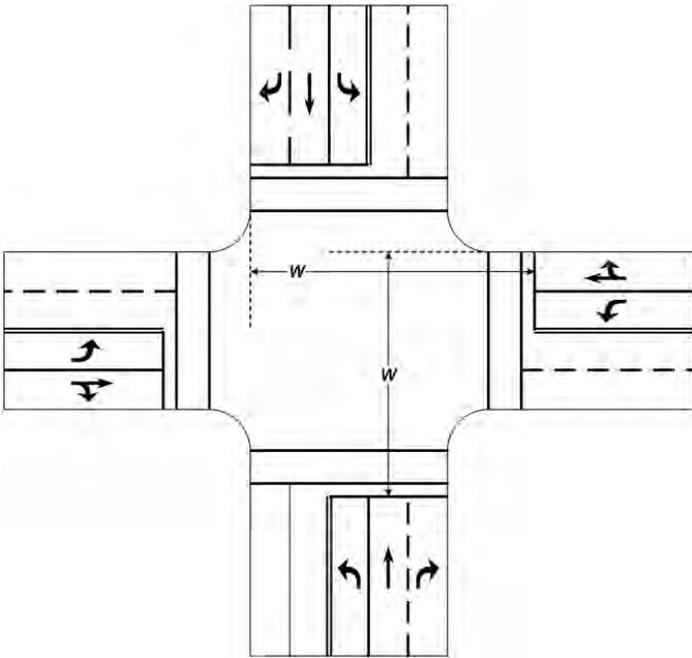


Figure 1: W, width of intersection, for through movements

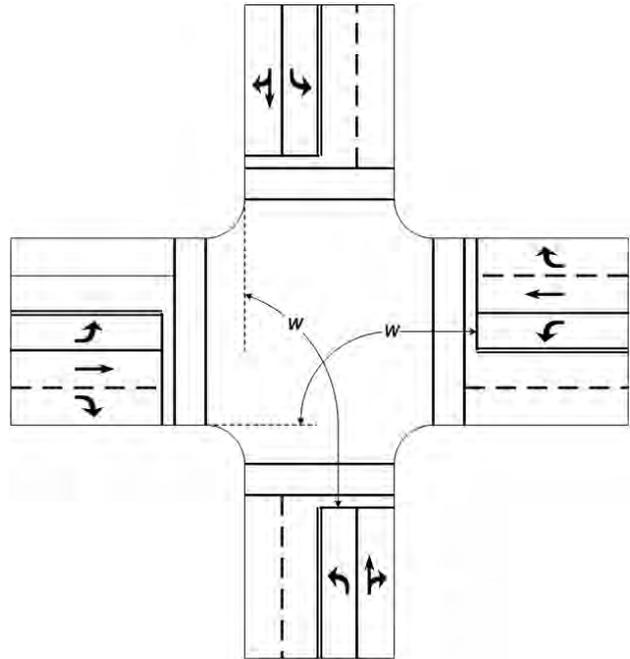


Figure 2: W, width of intersection, for left turn movements

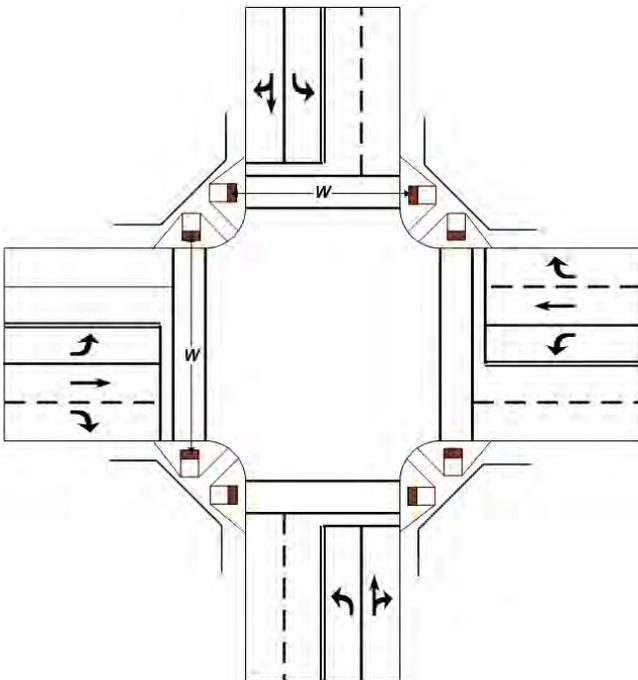


Figure 3: W, Pedestrian Crossing Distance