COLORADO
Department of Transportation

COLORADO DEPARTMENT OF TRANSPORTATION

Guidelines for Traffic Signal Vehicle Change and Clearance Intervals

2024 Edition

Prepared by

MULLER ENGINEERING COMPANY

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Introduction

Background

It is the mission of CDOT to provide the best multimodal transportation system for Colorado that most effectively and safely moves people, goods, and information. CDOT policy, state statute, and federal surface transportation regulations place a strong emphasis on creating a system for use by persons of all ages and abilities for safe and convenient access to jobs, services, schools, and recreation. The Chief Engineer Design Guidance expresses support for taking a flexible approach when designing and planning our state transportation system and helps identify resources to provide context sensitive.

Yellow change and red clearance intervals at traffic signals are critical timing parameters defined in a traffic signal controller. Incorrect calculation of these intervals may contribute to drivers illegally entering the intersection on red and not having sufficient time to safely clear the intersection. Studies have found that updating yellow and red clearance intervals using practices similar to those identified in these guidelines have resulted in safety improvements including an 8% to 14% reduction in total crashes and a 12% decrease in injury crashes (McGee et. al. 2012). This will help with CDOT's goals of advancing the safety of Colorado's transportation system, so all travelers arrive at their destination safely.

Purpose

The following guidance has been developed to clarify and provide consistent CDOT recommended practice for timing yellow and red clearance intervals at signalized intersections and crossings. This includes guidance on minimum and maximum values, rounding and field measurements.

CDOT practices for calculating traffic signal vehicle change and clearance intervals have been developed to incorporate the recommendations of the *Manual on Uniform Traffic Control Devices* MUTCD (FHWA 2023). Section 4D.17 of the MUTCD provides recommended ranges of values. Practices have also been developed based on the findings of previous research (*National Cooperative Highway Research Program Report 731*) and guidelines (Institute of Transportation Engineers 2015).

General Information

Abbreviations

ATSPM – Automated Traffic Signal Performance Measures

CDOT – Colorado Department of Transportation

FHWA – Federal Highway Administration

Ft. – Feet

Mph – Miles per hour

MUTCD – Manual on Uniform Traffic Control Devices

Sec. – Seconds

Definitions

85th percentile speed – The speed at or below which 85 percent of motor vehicles travel.

ATSPM – Automated Traffic Signal Performance Measures, a suite of performance measures, data collection, and data analysis tools to support traffic signal operations, maintenance, management, and design to improve the safety, mobility, and efficiency of signalized intersections for all users.

Engineering Judgement – The evaluation of available pertinent information including, but not limited to, the safety and operational efficiency of all road users, and the application of appropriate principles, provisions, and practices as contained in these guidelines, the MUTCD and other sources, for the purpose of deciding upon the design, use, installation, or operation of a traffic control device. Engineering judgment is exercised by a professional engineer with appropriate traffic engineering expertise, or by an individual working under the supervision of such an engineer, through the application of procedures and criteria established by the engineer. Documentation of engineering judgment is not required.

Flashing Yellow Arrow Left Turn – A type of traffic signal display that provides a permissive left turn display with a flashing yellow arrow that permits left turns after a user yields to conflicting traffic. This type of display helps to reduce “yellow trap” issues when yellow change intervals are displayed asymmetrically to opposing directions of traffic.

MUTCD – *Manual on Uniform Traffic Control Devices*, developed by FHWA to establish uniform national criteria for the use of traffic control devices that meet the needs and expectancy of road users on all streets, highways, pedestrian and bicycle facilities, and site roadways open to public travel.

Permissive left turn – A mode of traffic signal control in which left turns are permitted to be made after yielding to pedestrians, if any, and/or opposing traffic, if any.

Protected left turn – A mode of traffic signal control in which left turns are permitted to be made only when a left GREEN ARROW signal indication is displayed.

Red Clearance Interval – An interval that follows a yellow change interval and precedes the next conflicting green interval.

Vehicle Change Interval – Refer to Yellow Change Interval.

Vehicle Clearance Interval – Refer to Red Clearance Interval.

Yellow Change Interval – The first interval following the green or flashing arrow interval during which the steady yellow signal indication is displayed. It provides motorists approaching a traffic signal with sufficient warning that a phase is terminating. Also, known as the vehicle change interval. In the State of Colorado, drivers are permitted to enter the intersection during the yellow change interval. Also referred to as the vehicle change interval.

Applicable Statutes

The Colorado Revised Statutes (CRS) contains motorists’ rights and responsibilities related to driving through signalized intersections and crossings. The State of Colorado has a “permissive” entry law for the yellow change interval allowing drivers to enter the intersection during the yellow change interval and legally be in the intersection while the red signal is displayed, as long as entrance occurred during the yellow change interval. Key elements of the CRS as pertaining to this guidance include:

Section 42-2-604. Traffic control signal legend

(1b) Steady yellow indication:

(I) Vehicular traffic facing a steady circular yellow or yellow arrow signal is thereby warned that the related green movement is being terminated or that a red indication will be exhibited immediately thereafter.

(II) Pedestrians facing a steady circular yellow or yellow arrow signal, unless otherwise directed by a pedestrian-control signal as provided in section 42-4-802, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown, and no pedestrian shall then start to cross the roadway.

(1c) Steady red indication:

(I) Vehicular traffic facing a steady circular red signal alone shall stop at a clearly marked stop line but, if none, before entering the crosswalk on the near side of the intersection or, if none, then before entering the intersection and shall remain standing until an indication to proceed is shown; except that:

(A) Such vehicular traffic, after coming to a stop and yielding the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection, may make a right turn, unless state or local road authorities within their respective jurisdictions have by ordinance or resolution prohibited any such right turn and have erected an official sign at each intersection where such right turn is prohibited.

(B) Such vehicular traffic, when proceeding on a one-way street and after coming to a stop, may make a left turn onto a one-way street upon which traffic is moving to the left of the driver. Such a turn shall be made only after yielding the right-of-way to pedestrians and other traffic proceeding as directed. No turn shall be made pursuant to this sub-subparagraph (B) if local authorities have by ordinance prohibited any such left turn and erected a sign giving notice of any such prohibition at each intersection where such left turn is prohibited.

(C) To promote uniformity in traffic regulation throughout the state and to protect the public peace, health, and safety, the general assembly declares that no local authority shall have any discretion other than is expressly provided in this subparagraph (I).

Additional Resources

In addition to these guidelines, CDOT encourages the use of the following resources when planning or designing traffic signal timing and operations on Colorado's transportation network.

FHWA 2023, *Manual on Uniform Traffic Control Devices*, 11th edition., Section 4I, pp. 718-726, Federal Highway Administration, Washington, DC, https://mutcd.fhwa.dot.gov/kno_11th_Edition.htm.

FHWA 2024, "Proven Countermeasures – Yellow Change Intervals", Federal Highway Administration, Washington, DC, https://highways.dot.gov/safety/proven-safety-countermeasures/yellow-change-intervals.

ITE 2015, *Guidelines for Determining Traffic Signal Change and Clearance Intervals*, Publication No. RP-040-E, Institute of Transportation Engineers, Washington, DC.

McGee, H, Moriarty, K, Eccles, K, Liu, M, Gates, T & Retting, R 2012, *Guidelines for Timing Yellow and All-red Intervals at Signalized Intersections*, NCHRP Report 731, Transportation Research Board, Washington, DC, https://nap.nationalacademies.org/catalog/22700/guidelines-for-timing-yellow-and-all-red-intervals-at-signalized-intersections.

Urbanik, T, Tanaka, A, Lozner, B, Lindstrom, E, Lee, K, Quayle, S, Beaird, S, Tsoi, S, Ryus, P, Gettman, D, Sukari, S, Balke, K, & Bullock, D 2015, *Signal Timing Manual*, 2nd edition., NCHRP Report 812, Transportation Research Board, Washington, DC, https://nap.nationalacademies.org/catalog/22097/signal-timing-manual-second-edition. ..

UDOT 2017, *Guidelines for Traffic Signal Timing in Utah*, Utah Department of Transportation, Salt Lake City, UT, www.udot.utah.gov/connect/docs/traffic-signal-timing-guidelines.

Minimum and Maximum Values

The range of typical values for yellow change and red clearance intervals is shown in **Table 1**. Yellow change and red clearance intervals shall not be less than the minimum values. MUTCD guidance recommends that yellow change or red clearance intervals *should* not exceed 6 seconds. However, in some circumstances, longer yellow change or red clearance intervals may need to be considered. Examples where longer intervals may be required include yellow change intervals on downhill gradients for faster approach speeds, red clearance intervals for slower approach speeds and exceptionally wide intersections, or signalized two-way operation on a one-way roadway.

Table 1: Minimum and Maximum Values

Timing parameter	Minimum (Seconds)	Typical Maximum* (Seconds)
Yellow change interval	3.0	6.0
Red clearance interval	1.0	6.0

*Typical maximum may be exceeded in some circumstances.

Rounding Practices

Agency practices may vary for rounding calculated yellow change and red clearance interval timing. Typical rounding practice is to round so that the yellow change or red clearance intervals meet or exceed the calculated values. For yellow change and red clearance interval times, values should be rounded up. Input parameters should also be rounded up except for gradients. For gradients, an uphill gradient should be rounded down (e.g., 3.2 percent to 3.0 percent). Downhill gradients are negative and should also be rounded down (e.g., minus 3.7 percent to minus 4.0 percent).

Most modern traffic signal controllers are technically capable of programming values to the tenth of a second. However, rounding should be consistent with the accuracy of the input parameters. **Table 2** identifies rounding considerations depending on the accuracy of the input data for calculating yellow change and red clearance intervals.

Table 2: Input Parameter Rounding Considerations

Input Parameter	Half Second Rounding	Tenth of Second Rounding
Approach speed	Round up to posted speed limit, posted speed limit plus 7 mph, or approach speeds determined to nearest 5 mph	Round up to approach speed measured to nearest mph
Gradient	Round down to nearest half percent	Round down to nearest tenth of a percent
Intersection width	Round up to nearest five feet	Round up to nearest foot

When considering the accuracy of the input values used for calculating the yellow change and red clearance intervals, if approach speed values of posted speed or posted speed plus 7 miles per hour are used as input values. These values are effectively rounded to the nearest five miles per hour interval. It may be more appropriate to round to the nearest half second in these instances. Where approach speed data is available and speeds are input to the nearest mile per hour, rounding to the nearest tenth of an interval may be more appropriate. Practitioners should also consider the accuracy of grade and intersection width measurements to be consistent with rounding practices.

YELLOW CHANGE INTERVAL – CALCULATION

A yellow change interval provides approaching vehicles with sufficient warning that a phase is terminating. **Equation 1** is recommended for determining yellow change interval timing.

Equation 1

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

Where:

Y	=	Yellow change interval (seconds)
1.47	=	Conversion factor from ft/s to mph
t	=	Perception-reaction time (seconds); set at 1.0 seconds.
a	=	Deceleration rate (ft/sec^2); set at 10 ft/sec^2
V	=	85th percentile approach speed (mph)
g	=	Approach grade (percent grade divided by 100, positive for upgrade and negative for downgrade)

APPROACH SPEED FOR YELLOW CHANGE INTERVALS

Where approach speed data is available, the approach speed is recommended to be calculated based on the 85th percentile speed under free-flow conditions or as determined by a speed study. For signalized intersection approaches where Automated Traffic Signal Performance Measure (ATSPM) approach speed data is available, the 85th percentile speed should be evaluated over a minimum of several days during off peak time periods. If the intersection is located on a corridor where other intersections have similar traffic characteristics, the 85th percentile speed may be compared to develop a consistent approach speed for the corridor.

Where approach speed data is unavailable, typical practice is:

- For through movement phases: posted speed limit plus 7 mph
- For protected left turn phases: posted speed minus 5 mph

APPROACH GRADE

Approach grades should be field measured where grades are expected to be an incline or downslope of 3% or greater or if approach speeds are greater than 30 mph. For relatively level gradients (i.e., -3% to 3% grade) and slower approach speeds of 30 mph or less, the gradient can be assumed to be zero. The approach grade will be negative for downhill grades and positive for uphill grades.

Approach grades should be measured on the intersection approach, from the upper boundary of the dilemma zone (i.e., approximately 5.0 seconds of travel time upstream of the stop line based on the yellow change interval approach speed) and at the stop line for the approach with the approach grade being calculated as the average of the two measurements.

Approach grades are best determined from field conditions or as-built design plans confirmed with field observations. Where gradients are field measured, typical practice is to collect grade measurements at the upper boundary of the dilemma zone and at the stop line. The calculated distances between the stop line and the upper boundary of the dilemma zone for different approach speeds is shown in **Table 3**. To support field collection of measurements, devices such as a smart level to record grade measurements and a measuring wheel to determine the distance to the stop line and upper boundary of the dilemma zone will be required.

Table 3: Distance between Stop Line and Upper Boundary of Dilemma Zone

	Approach Speed (mph)										
	15	20	25	30	35	40	45	50	55	60	65
Distance from Stop Line to Dilemma Zone Upper Boundary (ft)	110	147	184	220	257	294	330	367	404	440	477
	Approach Speed (mph)										
	22	27	32	37	42	47	52	57	62	67	72
Distance from Stop Line to Dilemma Zone Upper Boundary (ft)	162	198	235	272	308	345	382	418	455	492	528

Note: Distances calculated based on 5 sec. of travel time at approach speed rounded up to the nearest foot.

If the grade changes over this distance or where grade information is limited or unavailable, engineering judgement should be applied to estimate an appropriate value. For example, if there is less of an incline or downslope at the upper boundary of the dilemma zone than at an intermediary point in the dilemma zone, it may merit measuring the slope at the intermediary point to provide a more conservative gradient measurement.

Alternative approaches for field collecting grade data include electronic and on-line sources, which should be checked to confirm they represent up-to-date field conditions.

Calculated Yellow Change Interval Timings

Table 4 applies **Equation 2** and shows the calculated yellow change intervals for approach speeds in five miles per hour increments rounded up to the nearest tenth of a second. This table may be applied to 85th percentile speeds calculated for through movements or left turn movement approach speeds. Where through movements are based on posted speed plus 7 mph, refer to **Table 5**.

Table 4: Yellow Change Interval Calculation for Through (Calculated Approach Speed) or Left Turn Movements

Approach speed	Yellow change interval (rounded up to nearest tenth of a second)												
	Downhill							Uphill					
	6%	5%	4%	3%	2%	1%	0%	1%	2%	3%	4%	5%	6%
25	3.3	3.2	3.2	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
30	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0	3.0	3.0
35	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.3	3.2
40	4.7	4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5
45	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8
50	5.6	5.4	5.3	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1
55	6.1	5.9	5.7	5.5	5.4	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4
60	6.5	6.3	6.1	5.9	5.8	5.6	5.5	5.3	5.2	5.1	5.0	4.8	4.7
65	7.0	6.7	6.5	6.3	6.2	6.0	5.8	5.7	5.5	5.4	5.3	5.2	5.1

Table 5: Yellow Change Interval Calculation for Through Movements (Based on Posted Speed plus 7 mph)

Posted speed	Design approach speed	Yellow change interval (rounded up to nearest tenth of a second)												
		Downhill							Uphill					
		6%	5%	4%	3%	2%	1%	0%	1%	2%	3%	4%	5%	6%
25	**32**	4.0	3.9	3.7	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0
30	**37**	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3
35	**42**	4.9	4.7	4.6	4.5	4.3	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6
40	**47**	5.3	5.2	5.0	4.9	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9
45	**52**	5.8	5.6	5.4	5.3	5.1	5.0	4.9	4.8	4.6	4.5	4.4	4.3	4.3
50	**57**	6.2	6.0	5.9	5.7	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.7	4.6
55	**62**	6.7	6.5	6.3	6.1	5.9	5.8	5.6	5.5	5.3	5.2	5.1	5.0	4.9
60	**67**	7.2	6.9	6.7	6.5	6.3	6.1	6.0	5.8	5.7	5.5	5.4	5.3	5.2
65	**72**	7.6	7.4	7.1	6.9	6.7	6.5	6.3	6.2	6.0	5.9	5.7	5.6	5.5

RED CLEARANCE INTERVAL – CALCULATION

A red clearance interval follows the yellow change interval and provides time for a vehicle to exit an intersection before a conflicting movement begins. **Equation 2** is recommended for calculating red clearance intervals.

Equation 2

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

Where:

R	=	Red clearance interval (seconds)
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.
L	=	Length of vehicle; set at 20 feet
V	=	85^{th} percentile approach speed (mph)
1.47	=	Unit conversion factor for converting feet/second to mph
– 1	=	Conflicting movement start up intersection entry delay factor – subtracted from red clearance interval as long as result is not less than 1.0 seconds.

APPROACH SPEED FOR RED CLEARANCE INTERVALS

Through Movements

Where approach speed data or a speed study is unavailable, the posted speed limit is recommended to be used for the approach speed for red clearance interval calculation.

Where approach speed data is available, the red clearance interval should be based on the minimum of the 85^{th} percentile speed or posted speed limit.

Left Turn Movements

The recommended practice to calculate red clearance intervals for left turn movements is to apply a turning path speed of 20 mph. However, if speed data or speed studies for left turning movements under free flow conditions are available, this value may be adjusted. The procedure calculating 15th percentile and 85th percentile speeds identified for through movements may also be applied to left turn movements. However, where an approach speed is calculated, the slower of the calculated approach speed or 20 mph assumed speed should be used to determine the red clearance interval.

For wider intersections or where intersection approaches have an angle of intersection greater than 90 degrees (e.g., single-point interchanges), the approach speed for left turns may need to be adjusted on a case-by-case basis.

INTERSECTION WIDTH

For determining intersection width, recommended practice is to measure the width based on the distance between the stop line and the far side of the intersection as defined by the extension of the curb-line or outside edge of the farthest travel lane.

The outside edge of the farthest travel lane is typically used as the far point for measuring intersection width and does not include the far-side crosswalk. However, where the far-side crosswalk is located further away from the farthest conflicting traffic lane, extending the intersection width measurement to the far-side crosswalk may need to be considered.

Previous guidance (McGee et al. 2012) identified that pedestrian crossings on the receiving lane that are 40 feet or more from the extension of the farthest edge of the farthest conflicting travel lane may need to consider extending the intersection width to include the far-side pedestrian crossing. This value was determined based on pedestrian reaction time at the start of the Walk interval and the distance a vehicle would travel during this time.

Through Movements

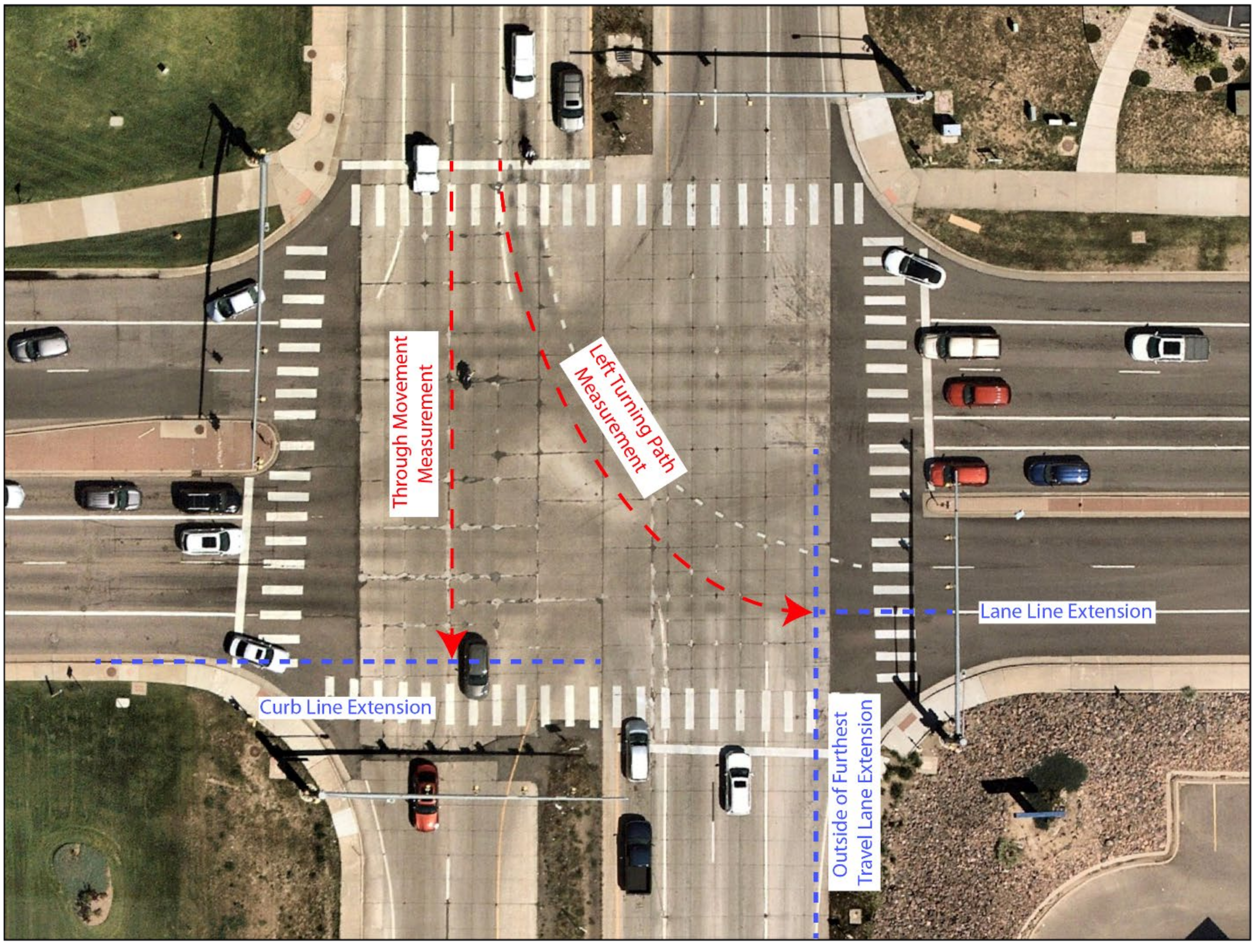
For through movements, it is preferable to collect field measurements of intersection width. Alternatively, practitioners may consider determining intersection width using up-to-date aerial imagery or mapping software. Any aerial images or mapping software used to determine intersection widths should also be checked to confirm that the images represent up-to-date field conditions.

Left Turn Movements

For left turn movements, the intersection width will be defined by a turning path between the stop line and the far side of the intersection as defined by the extension of the curb line or outside edge of the farthest travel lane and any considerations for including the far-side crosswalk. It may be challenging to safely field collect the path length for a left turning vehicle and necessary to use aerial imagery or mapping software.

An example of intersection width measurements for through and left turn movements is shown in **Figure 1**.

Figure 1: Through Movement and Left Turning Path Measurements

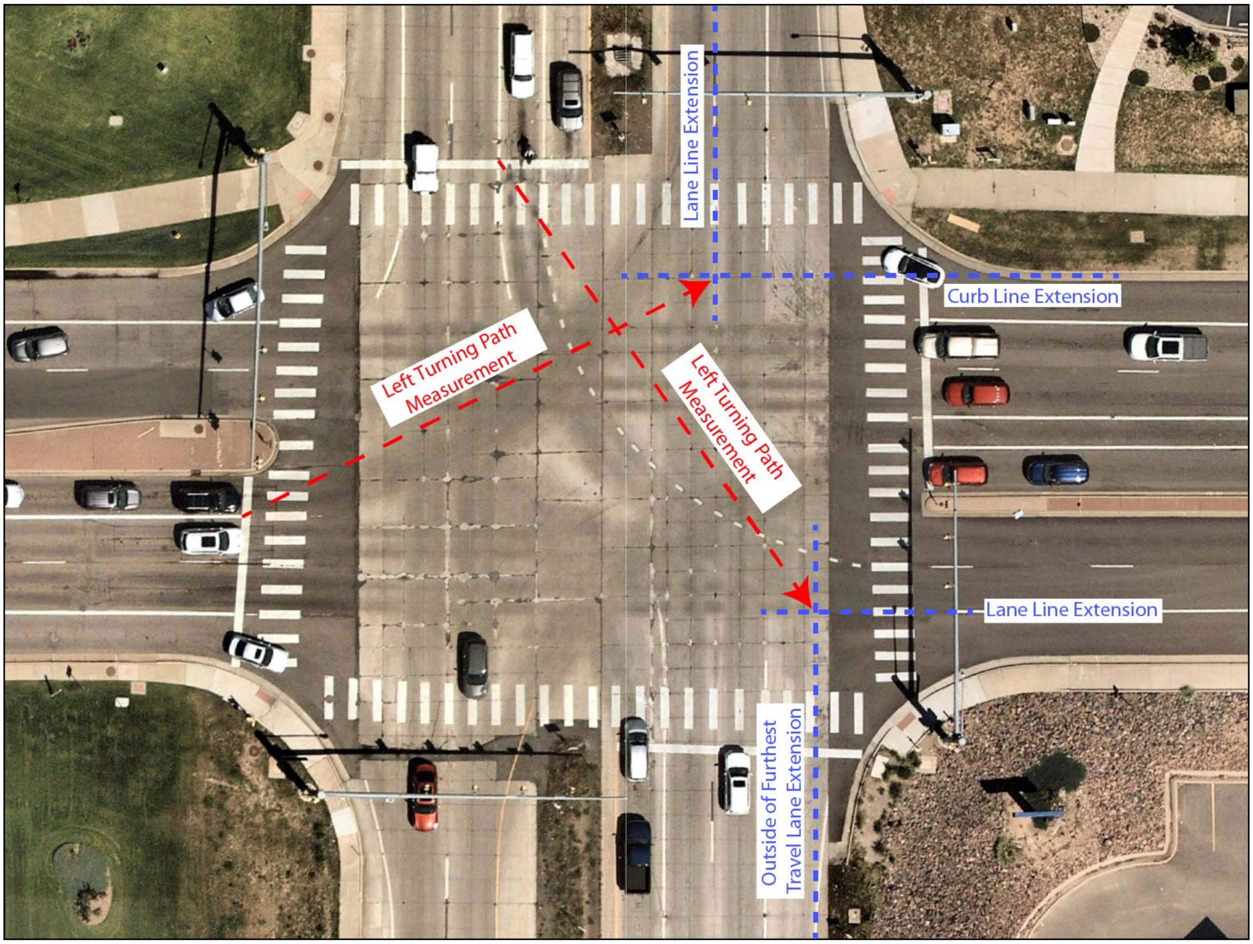


Alternative Method for Determining Width for Left Turn Movements

An alternative method for determining the turning path for measuring the intersection width of a left turn movement is the “straight-line” method. This consists of measuring the straight-line distance between the outer corner of the approach left turn lane and stop line to the corner of the curb line or outside travel lane edge and the extension of the outer edge of the receiving lane. **Figure 2** shows examples of straight-line left turn measurements for single and dual left turn movements.

The straight-line method typically provides comparable results for calculating the red clearance interval to the turning path method. However, there are exceptions where results will differ, and measuring the left turning path is recommended. This may include intersections where there is an acute angle of intersection between the left turn approach and receiving leg, where there is a setback stop line on the receiving leg of the turning path, intersections that include frontage roads, or where there is a single wide receiving lane. In many of these instances, the straight-line method will result in a longer intersection width measurement. Engineering judgement should be applied on a case-by-case basis for applying the straight-line method.

Figure 2: Straight-Line Left Turn Intersection Width Measurement Method



Permissive Left Turn Considerations

For through movements with permissive left turn movements, the red clearance interval should be calculated by measuring both the permissive left turn movement and the through movement. This includes permissive-only, protected and permissive, and Flashing Yellow Arrow displays. The total change and clearance interval should consider the longer calculated values for the permissive left or through movement.

Calculated Red Clearance Interval Timings

Calculated values for red clearance intervals based on **Equation 2** are shown in **Table 6** and **Table 7** for through movements by approach speed and intersection width. Calculated red clearance intervals for left turn movements are shown in **Table 8** and **Table 9**. For some locations, such as at wider intersections, an approach speed of faster than 20 mph for left turn movements may need to be considered.

Table 6: Red Clearance Interval Calculation for Through Movement (Narrower Width)

Approach speed	Red clearance interval (rounded up to nearest tenth of a second) for Through Movements (50 ft to 120 ft)														
	Intersection Width (ft)														
	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
25	1.0	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.7	2.9
30	1.0	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.2
35	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
40	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.3	1.3	1.4
45	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2
50	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
55	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
60	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
65	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Table 7: Red Clearance Interval Calculation for Through Movement (Wider Width)

Approach speed	Red clearance interval (rounded up to nearest tenth of a second) for Through Movements (125 ft to 200 ft)															
	Intersection Width (ft)															
	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
25	3.0	3.1	3.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.0
30	2.3	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.9	4.0
35	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3
40	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8
45	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4
50	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.0
55	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.8
60	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.5
65	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.4
70	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2

Table 8: Red Clearance Interval Calculation for Left Turn Movement (Based on 20 mph, Narrower Width)

Design Approach speed	Red clearance interval (rounded up to nearest tenth of a second) for Through Movements (50 ft to 120 ft)														
	Intersection Width (ft)														
	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
20	1.4	1.6	1.8	1.9	2.1	2.3	2.5	2.6	2.8	3.0	3.1	3.3	3.5	3.6	3.8

Table 9: Red Clearance Interval Calculation for Left Turn Movement (Based on 20 mph, Wider Width)

Design Approach speed	Red clearance interval (rounded up to nearest tenth of a second) for Through Movements (125 ft to 195 ft)														
	Intersection Width (ft)														
	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
20	4.0	4.2	4.3	4.5	4.7	4.8	5.0	5.2	5.3	5.5	5.7	5.9	6.0	6.2	6.4

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