

## Significant Changes to California's Yellow Signal Timing Protocols

Previous Yellow Interval Timing Rules	New Yellow Interval Timing Rules
Permitted to use posted speed limit or prima facie speed limit in calculating the minimum yellow interval. No requirement to set yellow time based on actual speed of traffic on roadway.	Must use 85 <sup>th</sup> percentile speed of free-flow traffic rounded up to next highest 5 mph increment or If no speed survey has been done for that section of roadway, must add 7 mph to posted speed limit for posted speeds 30 mph and above and add 10 mph to posted speed limit for posted speeds 25 mph and below.
No requirement to consider grade of roadway in setting yellow interval.	New Guidance <sup>1</sup> statement added that practitioners should consider grade of roadway when setting yellow interval.
No requirement to consider perception-reaction time of drivers beyond the 1 second PRT most often used in calculating yellow interval.	New Guidance statement added that practitioners should consider perception-reaction time of drivers in the area when setting yellow interval.
Specific permission to use 3 second minimum yellow interval for any protected right or left-turn movement. Optional for practitioners to consider longer yellow intervals for protected left-turn and right-turn movements.	Specific reference to permission for use of 3 second minimum yellow interval for protected right or left-turn movements deleted. New Guidance statement added that practitioners should consider longer yellow intervals for protected left-turn and right-turn movements, especially where the exclusive turn lane exceeds 150 feet in length.

### **What This Means**

Previously, there was no opportunity to challenge a red light camera ticket based on the length of the yellow interval provided that the jurisdiction set the yellow time at or above the minimum time based on the posted or prima facie speed limit. This allowed jurisdictions to place red light cameras at locations where the yellow interval was shorter than what was needed based on the actual speed of the traffic on the roadway (85<sup>th</sup> percentile speed). This practice resulted in numerous fraction of a second violations and tens of thousands of red light camera tickets to be issued. Further, jurisdictions did not have to implement a longer yellow interval even where a significant downgrade was present on the approach to the intersection. (Grades of as little as 3% require an additional 0.2 to 0.5 second yellow time.) Finally, jurisdictions could set the yellow interval for protected right-turn and left-turn movements to as little as 3.0 seconds without any regard to the length of the turn lane or the speed of the vehicles approaching the intersection within that lane.

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<sup>1</sup> Guidance - a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. All Guidance statements are labeled, and the text appears in unbold type. The verb “should” is typically used. The verbs “shall” and “may” are not used in Guidance statements. Guidance statements are sometimes modified by Options. (California MUTCD 2014 Edition, Page 68)

As of August 1, 2015, jurisdictions must calculate their minimum yellow signal times at red light camera locations based on the actual speed of the traffic on the roadway or if no speed survey has been performed, 7 to 10 mph higher than the posted speed limit. This should result in an additional 0.5 second or more of yellow time and prevent jurisdictions from ticketing large numbers of drivers traveling at or near the 85<sup>th</sup> percentile of free-flow traffic. Furthermore, defendants will now be able to challenge whether the yellow time is set appropriately for the roadway. For example, the new protocols require that, where a speed survey has been performed, the yellow interval must be based on the 85<sup>th</sup> percentile of free-flow traffic rounded up to the next highest 5 mph increment. It is possible that challenges can be brought where it can be shown that the speed survey is insufficient and/or not based on free-flow traffic.

Also, where a down-grade exists at the approach to an intersection, engineers may be challenged as to why they did not consider this condition when setting the yellow interval. While it is not mandatory to do so, the new Guidance Statement requires that grade be considered when setting the yellow interval unless “engineering judgment or engineering study indicates the deviation to be appropriate”. If the yellow interval has not been lengthened where a down-grade exists, engineers will have to justify why a longer interval is not appropriate based on their engineering judgment. This could prove difficult since accepted engineering protocols and the ITE formula for setting the minimum yellow interval dictate that roadway grade is an important factor in a vehicle's total stopping distance and consequently the minimum yellow interval needed.

Finally, for protected right or left-turn movements, the yellow interval could be challenged if engineers have not set the yellow interval with consideration to the approach speeds of vehicles in dedicated turning lanes especially where they exceed 150 feet. While not mandatory, engineers will have to justify, based on their engineering judgment, why a longer yellow interval is not appropriate.

### **Mandatory Compliance Dates**

Red Light Camera Intersections - August 1, 2015

All Other Signalized Intersections - August 1, 2017

Please contact Jay Beeber, Executive Director, Safer Streets L.A. at 505-500-4790 or [Jay@SaferStreetsLA.org](mailto:Jay@SaferStreetsLA.org) for more information.

Option:

<sup>11</sup> The duration of a red clearance interval may be extended from its predetermined value for a given cycle based upon the detection of a vehicle that is predicted to violate the red signal indication.

<sup>12</sup> When an actuated signal sequence includes a signal phase for permissive/protected (lagging) left-turn movements in both directions, the red clearance interval may be shown during those cycles when the lagging left-turn signal phase is skipped and may be omitted during those cycles when the lagging left-turn signal phase is shown.

<sup>13</sup> The duration of a yellow change interval or a red clearance interval may be different in different signal timing plans for the same controller unit.

Guidance:

<sup>14</sup> A yellow change interval should have a minimum duration of 3 seconds and a maximum duration of 6 seconds. The longer intervals should be reserved for use on approaches with higher speeds. Refer to Table 4D-102(CA).

Support:

<sup>14a</sup> The purpose of the yellow signal indication is to warn traffic approaching a traffic signal that the related green movement is ending or that a steady red indication will be exhibited immediately thereafter and traffic will be required to stop when the red signal is exhibited.

Standard:

<sup>14b</sup> The minimum yellow change interval for through traffic movement shall be determined by using the 85th percentile speed of free-flow traffic rounded up to the next 5 mph increment. Where the posted or prima facie speed limit is higher than the rounded value, use the posted or prima facie speed limit for determination of the minimum yellow change interval for the through traffic movement. See Table 4D-102(CA) sub-heading "a".

<sup>14c</sup> If the 85th percentile speed data is not available, the minimum yellow change interval for through traffic movements shall be determined by adding 7 miles per hour to the posted or prima facie speed limits of 30 mph or higher, and by adding 10 miles per hour to the posted or prima facie speed limits of 25 mph or less. See Table 4D-102(CA) sub-heading "b".

Guidance:

<sup>14d</sup> Practitioners should exercise engineering judgment for determination of the minimum yellow change interval. Judgment should be based on numerous factors including, but not limited to, field observation of traffic behavior, intersection geometrics, downhill grade, perception-reaction time of drivers in the area, and actually driving the protected left-turn or protected right-turn movements to assess the need for longer yellow change intervals. Particular attention should be paid where setting minimum yellow change interval timing when exclusive turn lane exceeds 150 feet in length excluding the transition..

Option:

<sup>14e</sup> The minimum yellow change interval for the through movement and the protected left-turn or protected right-turn may be increased based on appropriate engineering judgment.

<sup>15</sup> Except when clearing a one-lane, two-way facility (see Section 4H.02) or when clearing an exceptionally wide intersection, a red clearance interval should have a duration not exceeding 6 seconds.

Support:

<sup>15a</sup> When used, red clearance intervals normally range from 0.1 to 2.0 seconds.

Standard:

<sup>16</sup> Except for warning beacons mounted on advance warning signs on the approach to a signalized location (see Section 2C.36), signal displays that are intended to provide a "pre-yellow warning" interval, such as flashing green signal indications, vehicular countdown displays, or other similar displays, shall not be used at a signalized location.

Support:

<sup>17</sup> The use of signal displays (other than warning beacons mounted on advance warning signs) that convey a "pre-yellow warning" have been found by research to increase the frequency of crashes.

**Table 4D-102 (CA). Minimum Yellow Change Interval Timing**

$$\text{Yellow Time} = \frac{\text{Detector Setback Distance}}{\text{Speed}}$$

$$T = \frac{D}{V} = \text{The minimum yellow change interval (sec)}$$

V = Speed (ft/sec)

d = Deceleration Rate (10 ft/sec<sup>2</sup>)

t<sub>R</sub> = Reaction Time (1 sec)

Reaction Distance = Vt<sub>R</sub>

Deceleration Distance =  $\frac{1}{2}dt^2$  or  $\frac{1}{2}Vt$  or  $\frac{V^2}{2d}$

D = Detector Setback = Deceleration Distance + Reaction Distance =  $\frac{V^2}{2d} + Vt_R$

$$T = \frac{\frac{V^2}{2d} + Vt_R}{V}$$

$$T = \frac{V}{2d} + t_R$$

**a - For Speed determined by 85th Percentile**

SPEED (Determined by 85th Percentile Speed)*	MINIMUM YELLOW INTERVAL
mph	Seconds
25 or less	3.0
30	3.2
35	3.6
40	3.9
45	4.3
50	4.7
55	5.0
60	5.4
65	5.8

\*See Section 4D.26 Standard under paragraph 14b

**b - For Posted or Prima Facie Speed**

POSTED SPEED or UNPOSTED PRIMA FACIE SPEED	MINIMUM YELLOW INTERVAL *	MINIMUM YELLOW INTERVAL *
mph	Seconds	Seconds
15	N/A	3.0
20	N/A	3.2
25	N/A	3.6
30	3.7	N/A
35	4.1	N/A
40	4.4	N/A
45	4.8	N/A
50	5.2	N/A
55	5.5	N/A
60 or higher	5.9	N/A

\*Speed values for Table 4D-102b (CA) are inclusive of the 7 MPH added for speeds equal to 30 MPH or higher and 10 MPH for speeds equal to or lower than 25 MPH for determining the minimum values of the yellow intervals.

**Table I-2. Target Compliance Dates Established by the FHWA**

2009 MUTCD Section Number(s)	2009 MUTCD Section Title	Specific Provision	Compliance Date
2A.08	Maintaining Minimum Retroreflectivity	Implementation and continued use of an assessment or management method that is designed to maintain regulatory and warning sign retroreflectivity at or above the established minimum levels (see Paragraph 2)	<del>2 years from the effective date of this revision of the 2009 MUTCD*</del> June 13, 2014
<del>2A.10</del>	<del>Lateral Offset</del>	<del>Crashworthiness of sign supports on roads with posted speed limit of 50 mph or higher (see Paragraph 2)</del>	<del>January 17, 2010 (date established in the 2009 MUTCD)</del>
2B.40	ONE WAY Signs (R6-1, R6-2)	New requirements in the 2009 MUTCD for the number and locations of ONE WAY signs (see Paragraphs 4, 9, and 10)	December 31, 2019
2C.06 through 2C.14	Horizontal Alignment Warning Signs	Revised requirements in the 2009 MUTCD regarding the use of various horizontal alignment signs (see Table 2C-5)	December 31, 2019
2E.31, 2E.33, and 2E.36	Plaques for Left-Hand Exits	New requirement in the 2009 MUTCD to use E1-5aP and E1-5bP plaques for left-hand exits	December 31, 2014
4D.26	Yellow Change and Red Clearance Intervals	New requirement in the 2009 MUTCD that durations of yellow change and red clearance intervals shall be determined using engineering practices (see Paragraphs 3 and 6)	<del>5 years from the effective date of this revision of the 2009 MUTCD, or when timing adjustments are made to the individual intersection and/or corridor, whichever occurs first</del> June 13, 2017
4E.06	Pedestrian Intervals and Signal Phases	New requirement in the 2009 MUTCD that the pedestrian change interval shall not extend into the red clearance interval and shall be followed by a buffer interval of at least 3 seconds (see Paragraph 4)	<del>5 years from the effective date of this revision of the 2009 MUTCD, or when timing adjustments are made to the individual intersection and/or corridor, whichever occurs first</del> June 13, 2017
6D.03**	Worker Safety Considerations	New requirement in the 2009 MUTCD that all workers within the right-of-way shall wear high-visibility apparel (see Paragraphs 4, 6, and 7)	December 31, 2011
6E.02**	High-Visibility Safety Apparel	New requirement in the 2009 MUTCD that all flaggers within the right-of-way shall wear high-visibility apparel	December 31, 2011
7D.04**	Uniform of Adult Crossing Guards	New requirement in the 2009 MUTCD for high-visibility apparel for adult crossing guards	December 31, 2011
8B.03, 8B.04	Grade Crossing (Crossbuck) Signs and Supports	Retroreflective strip on Crossbuck sign and support (see Paragraph 7 in Section 8B.03 and Paragraphs 15 and 18 in Section 8B.04)	December 31, 2019
8B.04	Crossbuck Assemblies with YIELD or STOP Signs at Passive Grade Crossings	New requirement in the 2009 MUTCD for the use of STOP or YIELD signs with Crossbuck signs at passive grade crossings	December 31, 2019

\* Types of signs other than regulatory or warning are to be added to an agency's management or assessment method as resources allow.

\*\* MUTCD requirement is a result of a legislative mandate.

Note: All compliance dates that were previously published in Table I-2 of the 2009 MUTCD and that do not appear in this revised table have been eliminated.

**Table I-2(CA). Target Compliance Dates Established by the CTCDC/Caltrans**

2014 CA MUTCD Section Number(s)	2014 CA MUTCD Section Title	Specific Provision	Compliance Date
4D.26	Yellow Change & Red Clearance Intervals	Signalized intersections equipped with Red Light Cameras shall comply with 2014 CA MUTCD, Section 4D.26	August 1, 2015
4D.26	Yellow Change & Red Clearance Intervals	All signalized intersections shall comply with 2014 CA MUTCD, Section 4D.26	August 1, 2017