Determination of Yellow Change and Red Clearance Intervals

Yellow Change Interval

Speed Limit mph (km/hr)	Yellow Change Interval seconds
≤ 40 (64)	4.0
45-50 (72-80)	4.7
55 (88)	5.1

Red Clearance Interval

Calculate recommended clearance intervals using the Clearance Spreadsheet. Subtract the appropriate yellow change interval (using the above chart) from the spreadsheet recommended total clearance time and put the remaining time in red clearance, rounding up to the nearest 0.5 second.

Notes

-In general, for the usual NEMA phase designation, use the same clearance times for:

Phase 2 and Phase 6
Phase 4 and Phase 8

And, if they do not vary greatly:

Phase 1 and Phase 5
Phase 3 and Phase 7

-Red clearance intervals of less than 1.0 second and greater than 3.0 seconds require special circumstances.

-For most left turn lanes, assume a speed of 20 mph (32 kph). For high speed locations with turning angles greater than 90 degrees, a higher speed may be used.

These paragraphs refer to red clearance intervals, not yellow intervals. The next 2 editions makes this clear.

Determination of Yellow Change and Red Clearance Intervals

Yellow Change Interval

Speed Limit or Estimated Traveling Speed mph (km/hr)	Yellow Change Interval seconds
≤ 40 (64)	4.0
45-50 (72-80)	4.7
55 (88)	5.1

Red Clearance Interval

Calculate recommended clearance intervals using the Clearance Spreadsheet. Subtract the appropriate yellow change interval (using the above chart) from the spreadsheet recommended total clearance time and put the remaining time in red clearance, rounding up to the nearest 0.5 second.

Notes

-In general, for the usual NEMA phase designation, use the same clearance times for:

Phase 2 and Phase 6
Phase 4 and Phase 8

And, if they do not vary greatly:

Phase 1 and Phase 5
Phase 3 and Phase 7

-Red clearance intervals of less than 1.0 second and greater than 3.0 seconds require special circumstances.

-For most left turn lanes, assume a speed of 20 mph (32 kph). For high speed locations with turning angles greater than 90 degrees, a higher speed may be used.

Protected left phases are intersections with green arrows. Note that the yellow interval is 4 seconds, not 3. When a left lane does not have a green arrow, then the yellow interval is the same as that for forward movement. There is no other choice for this.

→

-Use a 4.0 second yellow change interval for protected left phases.

In this edition, the NCDOT introduced the "ITE Yellow Light Interval Equation."

Determination of Yellow Change and Red Clearance Intervals

Yellow Change Interval

Design Speed* mph (km/hr)	Yellow Change Interval** seconds
≤ 40 (64)	4.0
45-50 (72-80)	4.7
55 (88)	5.1

Mentioning "20 mph" means nothing for yellow intervals in 2002. Because anything less than 20 mph always get 4 seconds.

*Design speed is the speed limit unless a speed study determines that the 85th percentile speed is faster or intersection geometrics compel vehicles to traverse the intersection slower. When designing for something other than the speed limit, use the ITE formula to calculate values for design speed and the speed limit. Use the highest yellow interval and enough red clearance to total the highest total clearance interval.

**If the yellow change interval calculated by the ITE formula is higher than the table value, use the calculated value.

For most left turn lanes, assume a speed of 20 mph (32 kph). For locations with unusual conditions a higher or lower speed may be appropriate.

For separate left turn phases, use 4.0 seconds for the yellow change interval. For left turns without a separate phase, use the yellow change interval calculated for the adjacent through lanes.

Red Clearance Interval

Calculate recommended clearance intervals using the ITE formula. Subtract the appropriate yellow change interval (using the above chart) from the ITE formula recommended total clearance time and put the remaining time in red clearance, rounding up to the nearest 0.5 second.

Red clearance intervals of less than 1.0 second and greater than 3.0 seconds require special circumstances.

Notes

-In general, for the usual NEMA phase designation, use the same clearance times for:

Phase 2 and Phase 6
Phase 4 and Phase 8

And, if they do not vary greatly:

Phase 1 and Phase 5
Phase 3 and Phase 7

The top paragraph just moved, by technical writer error, to under the yellow change interval. But this paragraph still applies only to red clearance intervals as confirmed by the next paragraph. The next paragraphs covers all left turn lanes. Note that separate phase left turns get 4.0 (not 3) seconds and all other lefts get the same as the forward yellows. .

Determination of Yellow Change and Red Clearance Intervals

Yellow Change Interval

$$\text{Yellow interval} = t + \frac{v}{2a + 64.4g}$$

t = perception reaction time, typically 1.5 seconds
v = design speed*, in ft/s
a = deceleration rate, typically 11.2 ft/s^2
g = grade (for positive grades, use 0%)

Round up to nearest 0.1 second

Minimum yellow change interval is 3.5 seconds and generally should not be greater than 6 seconds.

Red Clearance Interval

$$\text{Red interval} = \frac{w + l}{v}$$

w = width of intersection, in feet
l = vehicle length, generally assumed to be 20 feet
v = design speed*, in ft/s

Round up to nearest 0.1 second

Red clearance intervals of less than 1.0 second and greater than 3.5 seconds require special circumstances.

Notes

* Design speed is the speed limit unless a speed study determines that the 85th percentile speed is faster or intersection geometics compel vehicles to traverse the intersection slower.

For most left turn lanes, assume a speed of 20 mph (32 kph) to 30 mph (48 kph). For locations with unusual conditions a higher or lower speed may be appropriate.

For separate left turn phases, calculate yellow and red intervals.

For left turns without a separate phase, calculate yellow and red times for both the through movement and the left turn movement. Use the highest yellow and enough red to equal the highest total time.

Where existing times are higher than calculated times, use the calculated values unless there is a documented history of the need for higher times. If approach is high speed and existing times are significantly higher than the calculated times, use the calculated values but consider adding a note to the plan to direct field forces to reduce the time incrementally. Include in the note how much and how often to reduce time until the final value is reached. (Ex. Existing Yellow Change Interval for phase 2 may be decreased by 0.2 seconds per week until the required value is reached.)

Sources:
Traffic Engineering Handbook, Fifth Edition, Institute of Transportation Engineers, 1999.
A Policy on Geometric Design of Highways and Streets, Fourth Edition, American Association of State Highway and Transportation Officials, 2001.

Determination of Yellow Chang and Red Clearance Intervals

ERROR and CONFUSION introduced in this edition. As opposed to previous editions, engineers now incorrectly apply paragraph "For most left turn lanes ..." to yellows too. The next sentence makes the engineer think that 20 mph of the previous sentence applies to both yellow and red, wherein by historical context, we know it only applies to red. Without the out-of-context top paragraph, this edition would make the left turn yellows the same as the forward yellows.

Yellow Change Interval

$$\text{Yellow interval} = t + \frac{v}{2a + 64.4g}$$

t = perception reaction time, typically 1.5 seconds
v = design speed*, in ft/s
a = deceleration rate, typically 11.2 ft/s$_2$
g = grade

Round up to nearest 0.1 second.

Minimum yellow change interval is 3.0 seconds.

Hold stakeholder discussion** when calculated yellow change interval is longer than 6.0 seconds.

Red Clearance Interval

$$\text{Red interval} = \frac{w}{v}$$

w = width of intersection, in feet
v = design speed*, in ft/s

If the initial calculation results in an all red time longer than 3.0 seconds, recalculate the red time as follows:

$$\text{Recalculated red interval} = \frac{1}{2}\left(\frac{w}{v} - 3\right) + 3$$

Round up to nearest 0.1 second.

Minimum red clearance interval is 1.0 seconds.

Hold stakeholder discussion** when recalculated red clearance interval is longer than 4.0 seconds.

* Design speed is the sp
that the 85th percenti
geometrics compel vehi

** The purpose of a stake
notification and involvement to stakeholders and provide an opportunity to consider possible countermeasures.

For most left turn lanes, assume a speed of 20 mph (32 kph) to 30 mph (48 kph). For locations with unusual conditions a higher or lower speed may be appropriate.

For separate left turn phases, calculate yellow and red intervals.

For left turns without a separate phase, calculate yellow and red times for both the through movement and the left turn movement. Use the highest yellow and enough red to equal the highest total time.

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Where revising a location or adding a new signal along a corridor, consider comparing clearance times at adjacent intersections to new calculations to meet driver expectations.

Sources:
Traffic Engineering Handbook, Fifth Edition, Institute of Transportation Engineers, 1999.

A Policy on Geometric Design of Highways and Streets, Fourth Edition, American Association of State Highway and Transportation Officials, 2001.

There is nothing new in this edition. The same confusion introduced in 7-2005 continues here. Remember, the March 2002 edition explicitly reveals the mistake.

Determination of Yellow Change and Red Clearance Intervals

Yellow Change Interval

$$\text{Yellow interval} = t + \frac{v}{2a + 64.4g}$$

t = perception reaction time, typically 1.5 seconds
v = design speed*, in ft/sec
a = deceleration rate, typically 11.2 ft/sec^2
g = grade

Round up to nearest 0.1 second.

Minimum yellow change interval is 3.0 seconds.

Hold stakeholder discussion** when calculated yellow change interval is longer than 6.0 seconds.

Red Clearance Interval

$$\text{Red interval} = \frac{w}{v}$$

w = width of intersection, in feet
v = design speed*, in ft/sec

If the initial calculation results in an all red time longer than 3.0 seconds, recalculate the red time as follows:

$$\text{Recalculated red interval} = \frac{1}{2}\left(\frac{w}{v} - 3\right) + 3$$

Round up to nearest 0.1 second.

Minimum red clearance interval is 1.0 seconds.

Hold stakeholder discussion** when recalculated red clearance interval is longer than 4.0 seconds.

Notes

* Design speed is the speed limit unless a speed study determines that the 85th percentile speed is faster or intersection geometrics compel vehicles to traverse the intersection slower.

** The purpose of a stakeholder discussion is to provide advance notification and involvement to stakeholders and provide an opportunity to consider possible countermeasures.

For most left turn lanes, assume a speed of 20 mph (32 kph) to 30 mph (48 kph). For locations with unusual conditions a higher or lower speed may be appropriate.

For separate left turn phases, calculate yellow and red intervals.

For left turns without a separate phase, calculate yellow and red times for both the through movement and the left turn movement. Use the highest yellow and enough red to equal the highest total time.

Where existing times are higher than calculated times, use the calculated values unless there is a documented history of the need for higher times. If approach is high speed and existing times are significantly higher than the calculated times, use the calculated values but consider adding a note to the plan to direct field forces to reduce the time incrementally. Include in the note how much and how often to reduce time until the final value is reached. (Ex. Existing Yellow Change Interval for phase 2 may be decreased by 0.2 seconds per week until the required value is reached.)

Where revising a location or adding a new signal along a corridor, consider comparing clearance times at adjacent intersections to new calculations to meet driver expectations.

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