Traffic Signal Guideline for

VEHICLE CHANGE INTERVALS

Definition:
Vehicle Change Interval: The period of time in a traffic signal cycle between conflicting green phases. It includes a yellow interval and an all-red interval.

Guideline:
The following guideline is based on the Kinematic method of determining change intervals.\(^1\)

The change interval is made up of a Yellow interval and an All-Red interval. The Yellow interval is made up of the time it takes for perception reaction time and the time it takes to decelerate the vehicle to a stop. The All-Red interval is the time it would take a vehicle to proceed through the intersection at the posted speed.

Left turn phase Vehicle Change Intervals shall be identical to the adjacent thru movement Vehicle Change Interval.

Any Yellow interval calculated by the formula less than 3.5 seconds should be rounded up to 3.5 seconds.

All-Red intervals should be a minimum of 1 second and a maximum of 2.5 seconds.

Formula:
The total length of the clearance interval should be calculated according to the following equations:

Clearance Interval:
\[
CI = Y + AR
\]

Where:
\[
CI = \text{Clearance Interval} \\
Y = \text{Yellow Interval (Minimum 3.5 seconds)} \\
AR = \text{All-Red Interval (Minimum 1.0 seconds, Maximum 2.5 seconds)}
\]

\(^1\) Determining Vehicle Change and Clearance Intervals, ITE Technical Council Task Force 4TF-1, August 1994

Michigan Department of Transportation, Traffic and Safety

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Yellow Interval:

\[ Y = t + \frac{v}{2 (a + Gg)} \]

Where:

- \( t \) = driver perception-reaction time for stopping, taken as 1.0 seconds, based on ITE recommendation.
- \( v \) = approach speed, feet per second, taken as the posted speed limit. At ramps, driveways and crossovers the approach speed will be assumed to be 25 mph.
- \( a \) = deceleration rate for stopping, taken as 10 feet per second, based on ITE recommendation.
- \( g \) = percent grade, divided by 100
- \( G \) = acceleration due to gravity, taken as 32.2 feet per second\(^2\)

All-Red Interval:

\[ AR = \frac{W + L}{v} \]

Where:

- \( W \) = width of intersection in feet, measured from the near side stop line to the far edge of the farthest thru lane.
- \( L \) = length of clearing vehicle, taken as 20 feet

The following table provides the results for various speeds and intersection widths:
### Intersection Width in Feet

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Do not add the vehicle length to the width of the intersection as it is already accounted for.

Michigan Department of Transportation, Traffic and Safety
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Traffic Signal Guideline for

WALK/DON’T WALK INTERVAL

Definition:

Walk: A pedestrian facing the signal indication may proceed across the roadway in the direction of the indication. There may or may not be possible conflicts of pedestrians with turning vehicles.

Flashing Don’t Walk: A pedestrian shall not start to cross the roadway in the direction of the indication, but a pedestrian who has partly completed his crossing during the steady walk indication shall proceed to a sidewalk, or to a safety island.

Steady Don’t Walk: A pedestrian shall not enter the roadway in the direction of the indication.

Guideline:

The walk interval should normally be at least 7 seconds long. If pedestrian volumes are low and it is desirable to favor the length of an opposing phase, a walk interval of as little as 4 seconds is allowed by the MMUTCD. A walk interval need not equal or exceed the total crossing time calculated for the street width, as many pedestrians will complete their crossing during the flashing don’t walk clearance interval.

A pedestrian clearance interval shall always be provided where pedestrian signal indications are used. It shall consist of a flashing don’t walk indication. The duration should be sufficient to allow a pedestrian crossing in the crosswalk to leave the curb and travel to the far edge of the farthest travel lane extended. The Flashing Don’t Walk Interval should normally end with the end of the adjacent street Yellow Interval. If pedestrian volumes are low and it is desirable to favor the length of an opposing phase the Flashing Don’t Walk Interval may be extended thru the All Red Interval. On a street with a median width sufficient for pedestrians to wait, it may be desirable to allow only enough pedestrian clearance time on a given phase to cross from the curb to the median. In the later case, if the signals are pedestrian-actuated, an additional detector shall be provided on the island.

Normal walking speed is assumed to be 4 feet per second. If there is a high volume of senior citizens or children, 3.5 feet per second may be used. The length of the crosswalk is measured along the edge of the crosswalk closest to the stop bar. If no crosswalk is present it should be measured just in front of the Stop Bar. If no Stop Bar is present it should be measured along a line between the pedestrian signals.
At intersections equipped with pedestrian signals, the pedestrian signals shall be displayed except when the traffic signal is being operated as a flashing device. At those times, the pedestrian indications shall not be illuminated.

If the length of the walk and flashing don’t walk intervals exceeds the length of the preferred green interval and the yellow interval of the adjacent roadway, consideration should be given to installing pedestrian detectors.

**Formula:**

The total length of the clearance interval should be calculated according to the following equations:

Clearance Interval:

\[ FDW = \frac{CWL}{WS} \]

Where:

- \( FDW \) = Flashing Don’t Walk Interval, in seconds.
- \( CWL \) = Cross Walk Length, in feet. Measured along the crosswalk edge closest to the stop bar.
- \( WS \) = Walking Speed, in feet per second. Assumed to be 4 feet per second.