Northern Region Traffic Engineering Practice	No. 406.1
Yellow Change and Red Clearance Intervals	February 28, 2013

Traffic Engineering Division Memorandum 306.1[1] (TE-306.1) provides statewide direction on timing of yellow change and red clearance intervals at traffic signals. The following document outlines related implementation strategies specific to the Northern Region.

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2013.02.28 16:31:54 -05'00'

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SPLIT PHASING AND LAGGING LEFT TURNS

TE-306.1 requires the following:

- Yellow change and red clearance intervals for lagging protected-only left-turns are calculated independent of the parallel through movement.
- Yellow change and red clearance intervals for split-phased approaches where a shared signal face is not used are calculated independently for left and through movements.
- Yellow change and red clearance intervals for split-phased approaches where a shared signal face is used are the same for left and through movements.

Traffic signal controllers in the Northern Region are not able to provide different clearance intervals by movement when multiple movements are combined in the same signal phase (as is typical with split phasing). Furthermore, timing a signal differently depending on whether it has a shared signal face presents concerns about consistency and effects of future signal display changes.

In many cases, a lagging protected-only left-turn movement is unable to end at a different time than the parallel through movement. For instance, in a case where a gap in a lagging left-turn movement is configured to terminate both the left and parallel through movements, the controller will display yellow to both movements simultaneously, regardless of the values input for yellow change and red clearance intervals. In this case, the displayed red clearance interval for one phase is longer than the input value, and the phase with the larger sum of yellow change and red clearance intervals controls when the barrier can be crossed.

[1] Traffic Engineering Division Memorandum 306.1. January 7, 2013.

Because of these technical limitations, it is not always possible to comply with the direction in TE-306.1.

As such, for lagging protected-only left-turn movements and split-phase approaches where simultaneous termination is desired, the implemented yellow change and red clearance intervals shall be the longer of the calculated values for the left-turn and through movements.

This diversion from statewide practice complies with the "Engineering Judgment" section of TE-306.1, provided that this document is filed with the signed and sealed clearance interval timings.

ROUNDING

TE-306.1 suggests rounding yellow change and red clearance intervals to the nearest 0.1 second, but permits rounding to other intervals as long as they are not less than 0.1 second.

The Northern Region is currently upgrading its traffic signal controllers from 170 models running BiTrans software to 2070 models running D4. As of early 2013, this transition is about 12 percent complete. With 170 controllers, force-off points must be calculated manually for each phase in every timing plan, a labor-intensive process. Although rounding to the nearest 0.1 second is feasible in 170 controllers, it would increase the possibility of error because of the manual computation required. With the new 2070 controllers, the force-off points are computed automatically, which greatly simplifies the ability to use 0.1-second rounding.

The 170 controllers are currently expected to be completely replaced by 2016 or 2017. Once this occurs, it is expected that 0.1-second rounding can be implemented regionwide. *Until then, a 0.5-second rounding interval should be used with yellow change and red clearance intervals at all signals.* This will allow consistent timing and rounding application throughout the region, and will avoid a situation where the implemented signal timing is dependent on the type of controller.

Where it is desired to use a 0.5-second rounding interval with yellow change and red clearance intervals, it shall be implemented as follows:

Calculated digits after the decimal	Implemented digits after the decimal
.000 to .149	.0
.150 to .649	.5
.650 to .999	.0, with the integer value increased by 1

This rounding methodology is more conservative than rounding to the nearest 0.5 second since it reduces the maximum difference when the rounded value is less than the calculated value.