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July 29, 2015

Mr. Douglas Noble
Institute of Transportation Engineers
1627 Eye Street, NW, Suite 600
Washington, DC 20006

Dear Mr. Noble:

I note with interest that the Institute of Traffic Engineers has published a new Proposed Recommended Practice (PRP) for yellow change intervals. It is gratifying that the work that I and my fellow researchers, Denos Gazis and Robert Herman, did on this issue more than fifty years ago and which resulted in the equation that is now known as the Kinematic Formula, is still in use today.

However, in reviewing the PRP document, I am concerned that some of our work has been taken out of context, which will result in the Kinematic Formula being misapplied to situations where it cannot, by its very nature, be applied. I am specifically referring to the recommendation found on pages 38 – 39 of the PRP to calculate the change interval for turning lanes using the Kinematic Formula.

This formula, which we derived, cannot be applied to turning lanes or to any situation where the driver must decelerate within the critical distance. The formula can only be applied to vehicles which start at the maximum allowable speed measured at the critical stopping distance and which proceed at a constant speed into the intersection.

Applying the formula to circumstances where a driver must decelerate within the critical distance into the intersection results in a minimum amber time which is shorter than what is necessary to eliminate the dilemma zone.

Any method chosen to determine the proper yellow time for turning lanes must account for the driver to slow down in order to make the turn safely. However, I wish to make clear that when calculating the critical distance, only the driver's initial approach speed is relevant, not the speed to which he slows down in order to navigate the turning maneuver.

Additionally, the following statement appears on page 6 of the PRP:
"The application, as noted by the authors, in the original derivation is for the through movement at a single traffic signal, although they mention that results can be obtained using analogous methods for closely spaced signals at a divided highway or other variations such as turning movements."

This passage appears to suggest that the methods we used in our 1959 study can be used to obtain results for closely spaced signals at a divided highway or other variations such as turning movements. **This would not be a correct interpretation of our work.** Our methods are applicable only to through movements where drivers are able to maintain their speed, not on roadways with closely spaced signals or for turning movements.

I respectfully request that the above passage be modified to make it clear that the application may **not** properly be applied to turning movements or closely spaced signals. Further, I would encourage your organization to adopt protocols for turning lanes that account for the need for drivers to slow to navigate the turn safely.

One such method would be to determine the critical stopping distance using the initial approach speed and then determining the time it takes a driver to slow down and traverse that distance.

Finally, I would like to comment on the recommendation which appears on page 39 for the Approach Speed to be used in left turn lanes. It appears that the recommended practice allows for yellow times in turning lanes to be based on approach speeds lower than the legal speed limit. Our 1959 study focused extensively on the need for man-made laws and human behavior to be made compatible. It was with this consideration in mind that our methods required that "a motorist driving along a road <u>within the legal speed limit</u>" be provided with a solvable solution to the stop or go problem encountered when the amber signal is illuminated. Setting a yellow interval based on an approach speed lower than the legal speed limit does not fulfill this requirement. Any driver approaching an intersection within the legal speed limit, but at a speed higher than the assumed approach speed (in your recommendations the posted speed limit minus 5 mph), may encounter a dilemma zone and have no solvable solution to the stop or go problem. This is exactly the situation our work was meant to address. As long as a driver is capable of achieving the speed limit while approaching a signalized intersection, even within a turning lane, that must be the minimum approach speed used to calculate the yellow interval. To do otherwise violates the very foundation of our work.

While I concur that using the 85th percentile speed is preferable, *when that speed is greater than the posted speed limit,* I respectfully urge you to include within your recommended practice the requirement that the approach speeds used in any calculations, whether they be for through movements or turning lanes, be at a minimum the posted speed limit.

Sincerely,

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