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## The Flaw in the Formula

The ITE (Institute of Transportation Engineers) yellow change interval formula calculates the duration of the yellow light. The flaw is not the formula itself. The flaw is how traffic engineers misapply the formula. The misapplications short the yellow light by several seconds. The misapplications adversely affect every intersection. Every driver, good or bad, is susceptible. These misapplications cause crashes, and within a few years the issuance of more red-light tickets than the city's population:

1. Traffic engineers use the formula universally but the formula works only for one special case.
2. Traffic engineers plug the wrong approach speed into the equation.
3. Traffic engineers misapply stochastic methods. Engineers input perception-reaction time and deceleration values for the average passenger car driver. By using *average*, the engineer de facto forsakes half of driving population as well as all commercial vehicle drivers.
4. Traffic engineers misapply an analytic solution to a physical solution. Engineers misapply grade term  $Gg$  to uphill traffic.
5. Traffic engineers omit the calculation of the tolerance of the yellow change interval. Engineers set the red-light camera grace period to 0.3 seconds (less time than the blink of an eye), but the tolerance for a properly-applied formula exceeds 2 seconds. 70% of camera revenue comes from vehicles entering intersections within 1 second of the light turning red.

## Two More Flaws Specific to North Carolina

6. NCDOT traffic engineers use AASHTO's emergency-stopping values for perception-reaction time and deceleration: 1.5 seconds and  $11.2 \text{ ft/s}^2$ . These values are not comfortable stopping values required by a yellow light.
7. NCDOT traffic engineers can no longer claim to adhere to the federal guidelines\*. ITE raised the bar in December 2016 by lessening the magnitude of flaw 2. NCDOT still perpetuates flaw 2 to its full measure.

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\*Engineers may invoke the name of the "federal guidelines" to justify using the ITE formula. The ITE formula, however, is neither a federal standard nor guideline. The formula is only an indirect reference of an option in the Manual of Uniform Traffic Control Devices (MUTCD). As an option, engineers use the formula at their own discretion and responsibility.