Questions to a Traffic Engineer

Engineering Basics

Question 1. What is engineering practice?

Question 2. What are the physical sciences?

Question 3. What is physics?

Question 4. Does physics apply to the motion of vehicles approaching a signalized intersection?

Questions about the ITE Yellow Change Interval Formula

A driver is approaching the intersection at the speed limit and the light turns yellow . . .

Regarding the ITE formula that sets the duration of yellow lights:

$$\boldsymbol{Y = t_p + \frac{1}{2}\left[\frac{v}{a + \mathrm{G}g}\right]}$$

Question 5. Using the ITE formula, how long is the yellow light?

A. 50% of the time it takes a driver to stop
B. 100% of the time it takes a driver to stop
C. 150% of the time it takes a driver to stop

Question 6. What kinds of traffic movement does the ITE formula apply thereby giving sufficient yellow time? (For other movements, the ITE formula computes too short of a yellow time.)

A. Turning traffic
B. Traffic moving toward and straight through the intersection
C. Unimpeded traffic approaching straight toward and going through an intersection at the constant speed of the speed limit, where the driver knows the exact location of the critical distance (The critical distance is the closest point upstream from the intersection where the driver can still react and stop comfortably.)
D. Traffic performing avoidance maneuvers
E. Commercial vehicle movements

Question 7. The moment the driver no longer has the distance to comfortably stop, at what speed must he maintain in order to reach the stop bar (limit line) before the light turns red?

A. He must continue at the speed limit.
B. He can go faster than the speed limit (beat the light).
C. He can be cautious and go less than the speed limit.
D. He can decelerate (for example—to prepare to turn) into the intersection.

Question 8. To give the legally moving driver the distance to stop, what must be the minimum value for "v" for any traffic lane?

A. The speed limit or approach speed, whichever is greater
B. Half the speed limit
C. The approach speed
D. It does not matter. The yellow only needs to be the MUTCD 3.0 second minimum.

Question 9. Where is "v" supposed to be measured?

A. At the stop bar
B. At the critical distance upstream from the intersection. The critical distance is also known as the comfortably stopping distance, or the point of no return.
C. 600 feet upstream from the intersection
D. Depends on the traffic lane

Question 10. Is deceleration "a" is supposed to be . . .

A. Comfortable deceleration
B. Emergency deceleration

Question 11. Deceleration 11.2 ft/s^2 is . . .

A. A comfortable deceleration measurement.
B. An emergency deceleration measurement.

Question 12. Where is "G", the grade of the road, supposed to be measured?

A. At the stop bar
B. At the critical distance
C. At the midpoint between the stop bar and the critical distance
D. It is the average grade of road through the critical distance.
E. 600 feet upstream from the intersection

Question 13. What is kinematics?

Question 14. There is a "2" in the ITE formula. Where does the "2" come from?

Question 15. A driver approaches the intersection. The light turns yellow. What must the driver do?

Question 16. True or False? "If we increase the length of the yellow light, drivers will treat the yellow as a green light, drivers will disrespect the yellow and/or drivers will crash more."

Question 17. Because perception-reaction time and deceleration have known ranges, and measurements of road grade and approach speed have statistical error, the computation of the yellow change interval has a tolerance. The tolerance in the yellow change interval can be computed by the mathematical technique of error propagation. Error propagation is a standard practice by engineers and physicists. What is the approximate *engineering tolerance* of the yellow change interval when properly using the ITE formula?

A. ± 0.0 seconds
B. ± 0.3 seconds
C. ± 3.0 seconds
D. ± 6.0 seconds

Prepared by Brian Ceccarelli, P.E. I explain the mathematics behind these answers in "The Derivation of the Yellow Change Interval Formula" and "The Uncertainty in the Yellow Change Interval".