How Much Do You Know About the Yellow Light?

There is an equation, called the "ITE formula", which calculates the duration of yellow lights:

$$Y = t_p + \frac{1}{2}\left[\frac{v}{a + Gg}\right]$$

Y = yellow change interval (yellow duration)
t_p = perception-reaction time
v = approach speed
a = deceleration
G = Grade of road
g = Earth's acceleration due to gravity

All traffic engineers in the world use this equation. Given the equation, the driver approaches the intersection at speed limit "v" and the light turns yellow . . .

Question 1. 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 2.

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 3.

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—in preparing to turn) into the intersection.

Question 4. To give the driver the distance to stop, what must be the minimum value for "v" for any traffic lane?

A. 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 5. Where is "v" supposed to be measured?

A. At the stop bar
B. At the critical distance
C. 600 feet upstream from the intersection
D. Depends on the traffic lane

Question 6. 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 7. There is a "2" in the ITE formula. Where does the "2" come from?

Question 8. A driver approaches the intersection. The light turns yellow. What does the physics of the ITE formula require the driver to do?

Question 9. 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 10. Because perception/reaction time, deceleration rate and road grade have known statistical errors and ranges, so does the resulting computation of the yellow change interval. The error in the yellow change interval can be computed by the technique of error propagation. What is the approximate *engineering error* 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