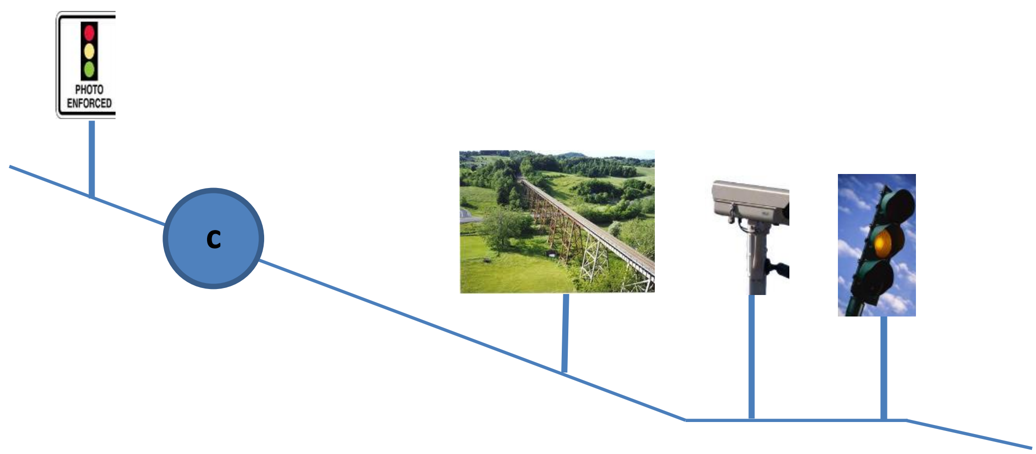
INTERSECTION ANALYSIS

Intersection

Peace Street (EB) at West Street
Raleigh, North Carolina

[Google Street View]

Illustration



C = critical distance[1]

Test Time

August 25, 2012 12:00 PM

Approach Speed & Grade

mph	Actual[2]	Signal Plan[3]
Speed	~45	35

degrees	Actual[4]	Signal Plan
Grade	-6%	0

Yellow Change Interval

seconds	Actual[5]	Signal Plan	ACS[6]	NCDOT Min Requirement	Physics[7]
Straight	3.7	3.8	3.78	7.2	10.7
Left Turn		3.5		5.5	10.7

Signal Plan

[August 2007, Natasha Rodevick]

Red Light Camera

Only for straight-thru traffic

Description

The intersection is on a small level plateau, downhill on both sides. The small level plateau is only 40 feet. The camera faces downhill waiting to catch drivers proceeding downhill. The downhill approaching this intersection is very long and extends beyond the previous intersection which is Glenwood Ave.

Conclusion

This intersection is dangerous. The engineer did not compensate for the obstructing train trestle, did not measure the approach speed and did not compensate for the grade

	of the road. The yellow light duration does not meet NCDOT specifications, does not comply with sound engineering practices, and by applying the federal standard ITE formula, opposes the laws of physics, all which forces drivers to run red lights.
Photo Enforcement Sign	The engineer placed the sign correctly for a critical distance computed for an approach speed of 35 mph, for a level road where the driver has an unobstructed view of the traffic signal.
Failures	1. The yellow light duration does not take into account the grade of the hill. The critical distance for a 35 mph level road is 195 feet. 195 feet back from the intersection stop line places the point of measurement of v_0 and g on the hill. The signal plan says the approach has grade 0, but at the point of measurement is a downhill grade of 6^o. This one problem shorts the yellow by 0.5 seconds. 2. The engineer did not take into account the presence of the train trestle. At the critical distance and for 50 feet up and down the hill from the critical distance (a road segment extending 100 feet), the train trestle completely blocks the view of the traffic signal. The driver does not have line-of-sight at the most critical part of his approach. In order to give the driver fair warning, the driver needs an extra 2 seconds (35 mph = 50 ft/s) of perception time to cover the blind area. This video illustrates the two seconds of blindness. 3. The signal heads do not have back plates. It is difficult to discern the color the signal light especially in the morning when the glare of the sun is behind the signal. 4. The engineer did not measure the approach speed. At the Test Time, I could not measure the approach speed at the critical distance. That is because there was no freely flowing traffic at the Test Time. The previous traffic signal (Glenwood Ave) is out of synch with the signal at West. While the West St. signal is green, the Glenwood light is red. When the Glenwood light is green, the West St. signal is red. The distance between Glenwood and West is just long enough for cars to accelerate to 35 mph but then they immediately have to decelerate for traffic backed up at the red light at West. However at night I have been travelling eastbound along Peace when Glenwood and West are in synch. This is when one measures freely flowing traffic. At night, I have easily gone down this hill at 45 mph. 5. ITE Yellow Change Interval Formula fails to provide fair warning for drivers who tap their brakes while inside the critical distance. The Formula always induces a type 1 dilemma zone for any act of deceleration with intent to enter the intersection. Drivers within the dilemma zone on the onset of yellow will have to run a red light. a. There is much opposing traffic coming up the hill turning in front of drivers going down the hill. The downhill drivers tap their brakes often. b. There is a small short-cut road which eastbound drivers can take to turn right

	onto West St. The short-cut is about 20 feet before the signalized intersection with the camera. The ITE Yellow Light Formula does not work for close-by intersections. Downhill drivers must tap their brakes within the critical distance of the signalized intersection in order to avoid rear-ending the right-turning drivers.
NCDOT Requirement	The perception time must increase by 2 seconds to 3.5 seconds because of the obstructing train trestle. The approach speed is about 45 mph. The grade of road is -6°. Using the AASHTO values, the [ITE Formula yields the yellow change interval]() = 7.2 s.

Footnotes

For definitions of approach speed, critical distance the yellow change interval formula and for an explanation of the various types of problems, refer to *Misapplied Physics in the International Standards that Set Yellow Light Durations Forces Drivers to Run Red Lights*.

1. I measured the approach speed of vehicles at the critical distance using a Bushnell Speedster III Radar Gun. The accuracy of this model is +/- 1 mph. I did not take into account the cosine law, so the actual approach speed is greater than that shown here. The difference is insignificant.

2. The approach speed in the signal plan is that the traffic engineer plugged into the yellow change interval formula.

3. I measured the grade of the road using an iPad clinometer app.

4. I measured the yellow time using a Dakota Compass Stop watch. I take several measurements and then average them. So far my measurements have matched the signal plan by +/- 0.10 seconds.

5. Affiliated Computer Services (ACS) stamps a red light camera citation with the camera system's measured yellow time. The system measures the yellow time using passive magnetic inductance. The system senses a change in the intersection's yellow light circuit by sensing a magnetic field induced by its initiating electric current. It may take several tenths of a second before the yellow circuit completely closes and the yellow light bulbs illuminate. The ACS yellow interval is usually longer than the yellow duration the driver actually sees.

6. Any duration less than the laws of physics forces certain drivers to run red lights. Physics dictates the necessary yellow duration such that both drivers progressing at a constant

approach speed and drivers progressing but decelerating toward the intersection can stop or go safely without running a red light.

7. I computed the critical distance, **C**, by plugging the signal plan's speed limit and grade into the critical distance formula. I located the critical distance point using a Rolatape measuring wheel, measuring out the critical distance from the intersection's stop line.