NORTH CAROLINA BOARD OF EXAMINERS
FOR ENGINEERS AND SURVEYORS
4601 Six Forks Road, Suite 310
Raleigh, North Carolina 27609

COMPLAINT FORM

Complainant	Brian Ceccarelli, B.Sc. Physics 4605 Woodmill Run Apex, NC 27539 919-815-0126 canute@redlightrobber.com
Complaint Against	
Witness	Joseph Shovlin, Ph.D. Physics
Witness	William Lynch, Ph.D. Physics
Witness	Miroslav Hodak, Ph.D. Physics
Witness	Johnnie Hennings, B.Sc. Engineering
Witness	Joshua Bressler, J.D., M.Sc. Engineering
Witness	Charles Elms, Motorcyclist

Summary of Complaint

The Engineer does not comply with NCGS 89C's requirement that he "must possess the special knowledge of the mathematical and physical sciences which he needs to do his creative work." In the absence of that knowledge, he misapplies the "ITE yellow change interval formula" thereby setting yellow lights too short causing drivers to inadvertently run red lights, which causes safety hazards, and at intersections with red light cameras, unjustified civil fines.

NCGS 89C requires the Engineer to safeguard life, health and property. The Engineer does the opposite. His practices put life, health and property in harm's way. This complaint was instigated by, but is not limited to, the fact that the Engineer and his colleagues have enabled North Carolina municipalities to take over $100,000,000.00 of capital property from innocent motorists via red light camera tickets since the beginning of these programs.

Engineering judgment begins with the proper application of the mathematical, engineering and physical sciences, not the omission or misapplication of those sciences.

Violations' Checklists

I separate the Engineer's violations into 5 categories:

1. Physical Sciences Violations
2. Mathematical Sciences Violations
3. General Engineering Violations
4. MUTCD Violations
5. Ethics Violations

Definitions

Yellow Change Interval: is the amount of time the traffic signal indication is a steady yellow light whose length is that amount of time it takes a driver to traverse the *critical distance*.

Critical Distance: Also known as *the safe and comfortable stopping distance*. It is the distance the driver travels at his initial speed while he perceives and reacts to a light change from green to yellow, plus the distance it takes the driver to brake to a stop.

Formula: is the ITE yellow change interval formula. The Formula computes the yellow change interval for the case when the driver is going the *maximum allowable speed* throughout the critical distance. The driver does not slow down on route into the intersection.

Maximum Allowable Speed: must be the speed limit or by engineering guidelines, at least the 85th percentile speed, whichever is greater. The 85th percentile "v" is that speed of freely-flowing vehicles at which 85% of the vehicles travel slower than "v" and 15% travel faster than "v". The Engineer usually uses the term "approach speed" instead of maximum allowable speed. The Engineer gets confused about the meaning of approach speed and where to measure it because the Engineer does not know physics. Physics tells us that "v" is the speed of the vehicle at the critical distance upstream from the intersection stop bar.

The Formula works only for drivers initially going speed v, who traverse the safe and comfortable stopping distance at speed v or greater. Drivers must be not be impeded by traffic or other obstacles. v must be at least the speed limit because law enforcement *allows* vehicles to go the speed limit regardless of lane or turn bay. The Formula yields the shortest yellow time among all traffic movements. All other traffic movements require up to twice the time.

The Formula is about the time it takes to traverse the critical distance—a fixed distance. The distance is equal for all traffic lanes. The slower the average speed through the fixed distance, the longer the yellow light has to be. Any vehicle beyond its ability to stop, if it slows down, increases the amount of time it takes to get to the intersection. *Therefore the formula does not work for any kind of traffic movement which slows down just before entering the intersection*. The Formula causes such traffic to run red lights inadvertently.

Physics Violations

These violations occur because the Engineer does not properly apply Newton's Second Law of Motion. The Engineer is guilty of the items that are checked ✓.

✓ 1. The Engineer does not know the meaning of the Formula.

✓ 2. The Engineer does not know that the Formula itself by its very nature creates dilemma zones, areas upstream from the intersection where if the driver is in it when the light turns yellow, the driver does not have a solvable stop or go decision, or there is a solution but the driver does not know what it is. A different formula (one without the 2 in the denominator) would remove dilemma zones altogether. It would always give the reasonably perceptive driver the solution of slowing down without penalty. The Engineer does not know this is possible.

✓ 3. The Engineer misapplies the Formula to traffic turning left where the maximum allowable speed is greater than the intersection entry velocity.

✓ 4. The Engineer misapplies the formula to traffic turning right where the maximum allowable speed is greater than the intersection entry velocity.

✓ 5. The Engineer misapplies the formula to traffic executing a U-turn. A U-turn requires almost double the time computed by the Formula.

✓ 6. The Engineer misapplies the formula to signals at two close-by intersections. Traffic may have to slow down for the second light (or traffic waiting for the second light) before arriving at the first light.

✓ 7. The Engineer misapplies the formula to traffic proceeding straight that slows down for vehicles entering or egressing to and from business entrances and side-streets near the intersection.

✓ 8. The Engineer misapplies the formula to traffic slowing down because of traffic density in the intersection makes it impossible to continue at the initial velocity when entering the intersection.

✓ 9. The Engineer misapplies the formula to traffic slowing down because the maximum allowable speed on the far side of the intersection is less than that on the near side.

✓ 10. The Engineer misapplies the formula to traffic slowing down because vehicles are changing lanes in front of them.

✓ 11. The Engineer misapplies the formula to traffic slowing down for railroad tracks, bumps or potholes near the intersection.

✓ 12. The Engineer misapplies the formula to traffic slowing down for hazards like pedestrians suddenly entering the highway near or in the intersection in front of them.

✓ 13. The Engineer plugs in the wrong speed into the formula. The Engineer erroneously plugs in "v" as measured at the stop bar instead of at the speed limit's critical distance.

✓ 14. The Engineer plugs in the wrong speed into the formula. The Engineer plugs in "v" which is not the 85th percentile speed but rather the speed limit or less.

✓ 15. The Engineer plugs in the wrong grade into the formula. The Engineer plugs in "g" as measured at the stop bar, not the average grade of the road throughout the critical distance.

_____ 16. The Engineer believes that he can ignore the Formula and set the yellow shorter than the Formula. (The Engineer altogether ignores physics.)

✓ 17. Though responsible for the motion of traffic at signalized intersections, the Engineer does not know Newton's Laws of Motion.

✓ 18. The Engineer believes that Newton's Laws of Motion do not apply to the motion of vehicles.

Mathematics Violations

The Engineer is guilty of the items that are checked ✓.

✓ 1. The Engineer does not know the mathematical technique of error propagation. For example, the Engineer declares that the yellow change interval is 4.5 seconds, but the interval should really be 5.3 +/- 2.3 seconds. Because the variables plugged into the equation have an equally valid range of values, the yellow change interval has an associated range.

Because the Engineer does not know this, he leads law enforcement to believe that this yellow change interval is exact. He allows law enforcement to punish innocent motorists.

General Engineering Violations

The Engineer is guilty of the items that are checked ✓.

✓ 1. The Engineer designs for traffic flow, traffic safety and legal movement--in that order. The Engineer violates the statutory mandate of a professional engineer. The statute requires the Engineer to safeguard life, health and property, not to safeguard the quickest means to the destination.

Traffic flow, safety, legal movement . . . pick any two. When flow is the goal (which it always is), safety and legality cannot happen at the same time. This tradeoff is crucial

to understand because the traffic engineering business revolves around it. *An intersection being safe does not mean that the intersection allows traffic to move legally.*

Example. In January 2010, the NCDOT decreased the left turn yellow 1 second while increasing the all-red clearance ½ second. The crash rate remained the same but the red light violations instantly surged from 60/month to a permanent 450/month. Because the new sum of the yellow and all-red intervals is ½ second less per signal cycle than before, the green light is ½ second more per signal cycle. This repetitive extra ½ second for the green makes traffic flow more efficiently—the ultimate goal of the traffic engineer.

One way to illustrate this is to imagine an intersection which is a 4-way stop with red lights instead of signs. The intersection is safe but everyone is running red lights. It is true of course that a normal red/yellow/green signal is not a 4-way stop, but its safety can be simulated by lengthening the all-red clearance interval while decreasing the yellow change interval. Red light running increases dramatically because physics makes it so, but drivers can still be safe. There comes a point where the yellow gets too short and causes rear-end collisions.

✓ 2. The Engineer ignores the yellow change interval requirements for commercial vehicles or vehicles pulling trailers or boats. The Engineer always assumes that approaching vehicles are solo passenger sedans. The Engineer forces a greater percentage of school buses, public buses, tractor trailers and vehicles hauling trailers/boats/other to run red lights. Because of their weight and concerns over jack-knifing, these vehicles need about 2 seconds more yellow.

✓ 2a. The Engineer ignores the extra yellow time requirements for vehicles with air brakes. The Engineer always shorts a yellow by about 0.75 seconds for such vehicles.

✓ 2b. The Engineer plugs in 11.2 ft/s^2 for deceleration rate. At best, commercial vehicles have a safe and comfortable deceleration rate of 8.0 ft/s^2 on wet pavement.

✓ 3. The Engineer does not consider motorcyclists at intersections. This is especially a problem at red light camera intersections. Motorcyclist Charles Elms says it best:

"My main concern as a motorcycle rider is the psychological part of the problem. With fear of getting a ticket most motorcycle riders are now choosing to slam on the brakes so they do not get a camera ticket. This means the car behind has to try and stop as well. Very few cars can stop as fast as a typical bike that weighs about 500 lbs. This can lead to death. In a car what is just a rear bumper smashed or maybe a trunk smashed is instead a fatality."

Had the Engineer used a formula that properly models the yellow light interval problem, the psychological problem and its deadly possibilities go away. The yellow light would be long enough so that all types of vehicles would be able to safely and comfortably slow down to a stop without fear of penalty.

✓ 4. The Engineer plugs in 11.2 ft/s^2 for deceleration rate. That rate is good only for dry pavement. When it is raining making the pavement wet, the deceleration rate decreases 20 – 30%. Deceleration rate is a function of friction between road and tire.

✓ 5. The Engineer uses 11.2 ft/s^2 which is the 85th percentile deceleration rate for passenger vehicles. That is aggressive and considered uncomfortable in other States. Most States use 10 ft/s^2--the 50th percentile.

✓ 6. The Engineer does not do a speed study. He sets "v" to the posted speed limit instead of using the potentially higher speed of traffic at the critical distance. The 85th percentile speed of freely-flowing traffic is generally 7 mph more than the posted speed limit. The Engineer plugs in the lower speed and thus shorts the yellow. The Engineer does not accommodate human factors for the intersection thus forcing drivers to run red lights.

✓ 7. After the yellow indication terminates, the Engineer does now allow the slowest driver the time to traverse the intersection. The Engineer uses the maximum allowable speed instead of the intersection traversal speed of a vehicle turning left. The Engineer shorts the all-red clearance time.

✓ 8. When setting the yellow change interval, the Engineer ignores the fact that a train trestle blocks the signal head for 100 feet within the critical distance upstream from the intersection. For 2 seconds when it is most critical, the driver cannot see the signal head. The Engineer did not add 2 seconds to the yellow change interval to compensate.

✓ 9. The Engineer did not put back-plates on the signal head. Therefore there is no contrast between signal and background. The driver has a hard time seeing the light.

✓ 10. The Engineer did not put back-plates on the signal head *and* the roadway stretches East and West such that the brightness of the Sun masks the signal indications in the morning and evening hours.

✓ 11. The Engineer created a visual problem for drivers at the intersection. Straight-through signals are in front of the left turn lanes.

_____ 12. The Engineer created a visual problem for drivers at the intersection. The signal head is not in line-of-sight throughout the entire critical distance.

✓ 13. The Engineer set the max-green too short. The green light does not last long causing an unreasonable bottleneck at the intersection. Drivers run the red lights because of the unreasonableness.

✓ 14. The Engineer did not use a loop to detect traffic waiting at the stop bar. It takes too long for the light to turn green and drivers must wait for nothing.

✓ 15. The Engineer placed the red light camera detector loops in the intersection, not before the stop bar. Vehicles enter the intersection legally on a yellow. The light turns red and the vehicles pass over the detector loops. Drivers receive a ticket for running a yellow light.

✓ 16. The Engineer did not mark the stop bar properly. The stop bar is not clearly defined, or looks different than the stop bars on the other approaches to the intersection. The stop bar may also be worn off. Drivers are confused about where exactly to stop.

✓ 17. The Engineer set up the red light camera such that it gives tickets to people running yellow lights.

✓ 18. The intersection is under construction. The lights are not functioning properly but the Engineer failed to turn off the red light cameras. The Engineer violates the engineering-first, enforcement-second rule.

_____ 19. The State (e.g., Louisiana, West Virginia, Rhode Island, Tennessee, Oregon) has a restrictive yellow law and that requires the yellow light to be long enough for the driver to traverse the critical distance *and clear* the intersection. But the Engineer treats the yellow change interval as if the State has a permissive yellow law. The Engineer shorted the yellow change interval by not adding to it the all-red clearance interval. The Engineer designs the intersection so that conflicting traffic can be in the intersection at the same time.

The Manual of Uniform Traffic Control Devices Violations

In the State of North Carolina, the MUTCD is law. The Engineer is guilty of the items that are checked ✓.

✓ 1. For the same yellow light indication, the Engineer violates the MUTCD by setting it to different durations depending whether the signal phase is in protected turn mode or permissive mode. This creates an unpredictability to the length of the yellow light. A driver can see 4.5 seconds, go around the block and then see 3 seconds from the same yellow indication. This practice violates MUTCD 4D.17-07, 4D.26-09, 4D.04-3B, 1A.13-258.

✓ 2. The MUTCD 4D.26-01 standard requires the yellow light in the yellow change interval to be a *steady* yellow. Only when the yellow light reaches full luminosity can one consider the yellow light *steady*. The Engineer does not discern between the traffic signal plan's values for the yellow change intervals and what appears in real world. The signal plan's values are actually the yellow light *electric circuit-on times*, not the real yellow change intervals.

Once the traffic controller computer turns on the yellow light circuit, it takes about 0.2 seconds for relays to fire, rectifiers to condition the current, and the bulbs to illuminate. When the traffic signal plan says the yellow change interval is 3.8 seconds, the fully-illuminated yellow the driver sees is 3.6 seconds.

A driver's decision to stop or go hinges on the length of the steady yellow light. 0.2 seconds is significant to the legal motion of traffic. Red light camera data shows that 20% of drivers run the red light within 0.2 seconds of the light turning red.

By not discerning *steady* in the MUTCD requirement, the Engineer makes an engineering violation. The Engineer does not set the yellow light long enough so that the steady portion of the yellow indication equals or exceeds that of the Formula.

_____ 3. For the same yellow light indication, the Engineer violates the MUTCD by using a traffic controller which randomly varies the yellow light duration over +/- 0.1 seconds for different signal cycles. This happens when the Engineer uses LEDs for the lights but the electric current from the traffic controller to the LEDs is AC. Because LEDs are DC devices, a rectifier converting AC to DC has to be put in the circuit between the traffic controller and the LEDs. Rectifiers contain electrolytic capacitors. Capacitors take time to charge. The phase of AC sinusoidal wave form coming from the traffic controller determines how fast the rectifier's capacitors charge and thus its turn-on point. Because each signal cycle begins at a different AC phase, this gives the yellow light duration a randomness. The hardware is faulty by design. The traffic controller should send DC directly to the LEDs. By using this type of traffic controller, the Engineer violates MUTCD 4D.17-07, 4D.26-09, 4D.04-3B, 1A.13-258.

✓ 4. In the turn lane phasing of the intersection, the Engineer did not follow the steady yellow arrow by a steady red indication. Instead a flashing yellow arrow appears immediately after the steady yellow arrow. This violates MUTCD 4D.05 (03) B.3. A steady red light must follow any steady yellow light. Without the all-red clearance interval, turning vehicles can be in the intersection at the same time conflicting traffic has the right-of-way.

Ethics Violations

The Engineer is guilty of the items that are checked ✓.

✓ 1. The Engineer fails to tell law enforcement of the error range built into his calculation of the yellow change interval. He allows law enforcement to precisely enforce the local ordinances even though his engineering is imprecise. See Mathematics Violation 1.

✓ 2. The Engineer fails to tell law enforcement that using the Formula demands that some drivers must accelerate to beat the light. The Formula's demand conflicts with the DMV Driver Handbook's command to not beat the light. Some municipalities use their red light cameras as speed cameras. By legal definition, the Engineer has caused entrapment.

✓ 3. The Engineer allows red light cameras to go up in spite of the fact that the presence of red light cameras takes the driver's attention away from the road. The driver is over concerned with the financial consequences for running a red light than paying attention to hazards.

✓ 4. The Engineer knew about a failure in the traffic signal plan of record. The failure even violates the DOT's own specifications. The Engineer lies to the public and allows the public to take the penalty for the failure so that his employer, the municipality or the NCDOT, won't be held responsible.

✓ 5. By design the Engineer tunes the yellow change interval according to the ITE recommendation of allowing up to 3% of drivers to run red lights. ITE states that increasing the yellow time can reduce the percentage to 0% but ITE simultaneously subscribes to the fact that the DOT's goals trump those of law enforcement. Therefore the Engineer's practice is to force drivers to run red lights but the Engineer does not inform law enforcement of the conflict of interest.

✓ 6. The Engineer has committed fraud by omitting a persons' legal rights in legal documents (red light camera citations) in order to secure payment for the red light camera company and/or City. Because the amount of the fraud totals millions of dollars, the Engineer committed a felony.

✓ 7. The Engineer has committed fraud by overstepping the State's enabling statutes. He forces or encourages drivers to incriminate themselves and/or sign affidavits beyond the statutes' mandates. He does this is order to secure money for the red light camera company and/or City.

✓ 8. In full knowledge that he or his fellow engineers were responsible for sudden permanent increases in red light running, the Engineer allows innocent motorists to take the penalty for engineering changes. The Engineer washes his hands of his contribution and blames the City for penalizing such motorists.

✓ 9. The Engineer knows the posted speed limit is 45 mph. The Engineer allows the yellow change interval to be set to around 3 seconds, a MUTCD *minimum*, which algebraically makes the speed limit 23 mph. The Engineer acknowledges the engineering discrepancy but allows law enforcement to punish drivers for it.

✓ 10. The Engineer increased the overall signal cycle time. The traffic signal changes to red less frequently during the day giving drivers fewer opportunities to run a red light. The effect causes a dramatic decrease in the red light running violation rate.

The problem is not the change to the signal cycle time. It is the Engineer's failure to inform the city and police that it was the signal cycle time change which induced the decreased violation rates. The Engineer allows the city to believe the decrease was due to the effectiveness of the cameras. This omission allows the city to continue defrauding the public.

_____ 11. The Engineer does not notify law enforcement of possible faulty pedestrian walk controller hardware and allows cities to unjustly punish drivers. The pedestrian walk button is stuck in the on position. This gives priority to non-existent pedestrians but minimizes or eliminates the green time for conflicting traffic movements. This causes traffic to jam and drivers to ignore the red light.

Cathedral of Assumptions

The Engineer has built a cathedral of assumptions which he substitutes for his lack of knowledge of the mathematical and physical sciences. Be aware that this Engineer is not an isolated case. He represents his profession at large. Dr. Joshua Bressler, a lawyer and engineer in New York City puts it this way:

> "It is easy to call a doctor a quack when he is the only doctor, who when performing an appendectomy, removes the heart instead. In the case of traffic engineers, all of them are removing hearts."

I acknowledge that the Engineer uses *methodologies*. But I discern between a *methodology* and an *engineering practice*. Here is where the rubber meets the road. *I assert that these methodologies are not engineering practices*. These methodologies *oppose* the laws of the mathematical and physical sciences therein disqualifying them as engineering practices. These methodologies are not arbitrary; they are worse than arbitrary. The methodic nature of these practices introduces *systematic* error creating predictable illegal movement of traffic and harm to motorists. The red light camera companies have picked up on it and are exploiting these systematic errors for financial gain. Redflex, a red light camera company, boasts of its "accurate and robust violation calculator" which predicts the revenue from intersections based solely on the existence of these systematic traffic engineering flaws. Redflex, instead of recommending that the city fix the engineering, recommends that cities place the cameras there to obtain maximum profit. Police and city government are not aware of these issues and so have become marks for the red light camera industry charlatans.

Traffic engineers rely on publications by the Institute of Transportation Engineers (ITE). To traffic engineers, ITE is the gold standard. In this singular area of the yellow light duration, ITE has proliferated publications teeming with contradictory methodologies whose common origin is the misunderstanding of math and physics.

In ITE publications circa 1982-1989, ITE described the physical behavior of the Formula correctly. ITE publications have gone downhill since. Over the past 20 years, the meaning of the formula has been lost.

The math and physics errors actually began earlier than 1982. The errors formally began in 1920 with the invention of the yellow light. The length of the yellow light was a free-for-all until 1959. In 1959 Gazis, Herman and Maradudin, derived the yellow light Formula in order to get some consistency in duration. In 1965, ITE miscopied their formula into its Traffic Engineering Handbook. ITE omitted the "naught" in v_o (the "naught" in the Formula implicitly specifies that the initial velocity used in the Formula is measured at the critical distance) and the conditions under which the Formula properly operates. To this day these omissions cause traffic engineers confusion and error. This confusion and error are what give rise to this complaint. A person who knows the lingua franca of math and physics should understand where v and g should be measured and know under what restrictions the Formula operates.

But the Engineer does not know. Instead of a relying on the immutable foundation of math and physics, he justifies his methodologies by cherry-picking quotes from the Traffic Engineering Handbook or the MUTCD. The confrontation between the Engineer and the Board of Engineers will take place at the border separating science/math from his methodologies.

Confrontation

I ask you to confront the Engineer over the meaning of the physics in his Formula. The Engineer has literally picked his Formula off a shelf. He never considered how the Formula should be physically applied in the real world. The Engineer will deflect your questions away from basic physics and will attempt to turn your attention to his cathedral of assumptions.

The Engineer will assert that he follows accepted guidelines. The Engineer will point out, "The MUTCD says yellow must be from 3 to 6 seconds. I obey that." The Engineer will assert, "ITE and NCHRP-731 state that I can apply the Formula to all traffic lanes. ITE says that in the left lane, cars go slower and so I can use a v smaller than the speed limit. That is common sense. So I do that." The Engineer does not know that the Formula computes the time it takes to traverse a fixed distance which is the same for all lanes of traffic, and that the slower a driver goes though the fixed distance, the more yellow time he needs to traverse it. When you suggest, "Why not lengthen the yellow light?" the Engineer will reply, "If we make the yellow light too long, drivers will disrespect the yellow and treat it like a green." When you counter, "Is it not better to run a yellow light than a red light?" or "What study shows that?" The Engineer cannot reply. He has nothing. The unsubstantial assertion has a long history which I traced back to the 1940s.

He will vehemently defend himself, "We have used formula for years. It is proven. You don't see mayhem at traffic signals do you?" But if you measure his success by the profits of the red light camera companies, whose accounting ledgers reveal that entire city populations have become violators by running red lights, the engineers have clearly failed. The Engineer's practices oppose the laws of physics. He makes everyone break the local ordinances. Enforcing the Formula to precision is like enforcing a law forbidding gravity.

The Engineer says, "When ITE, MUTCD or NCDOT says it, it is an established engineering practice and I must follow it."

Engineering practices are established by the proper application of the mathematical and physical sciences. Engineering practices are not established by ITE, the MUTCD or the NCDOT. Most of the time ITE, MUTCD and NCDOT do not address issues of math or physics. But when they do, the Engineer should use math and physics to recognize whether ITE, the MUTCD and the NCDOT got it right. In our case, there is a red-flag discrepancy between the Formula and the basic equation of motion $t = v/a$. Without knowledge of physics, the Engineer did not recognize the problem let alone see its ramifications.

The more the Engineer knows math and physics, the more he condemns himself. One cannot know what the Formula does and then in good conscience use it without expressing its numerous problems. The Engineer ends up trying to support his own practice and that of his colleagues in full knowledge that the practice forces drivers to run red lights. At this point the Engineer is guiltier of an ethics violation than of incompetence.

Supporting Documents

It is crucially important for you to understand the mathematical steps in the *Derivation* paper. The level of math used in deriving the Formula is college freshman physics. Dr. Shovlin and I derive the Formula from Newton's Second Law of Motion. We show every algebraic step and notate the physics assumptions made at each step.

The level of math in the *Uncertainty* paper is college sophomore physics—error propagation. This paper mathematically expresses common sense. The computation of the yellow change interval is not exact. There are statistical human factors' variables used in the Formula and so the Formula computes a result which has a range of error. Red light camera systems do not grant the driver the necessary tolerance, instead they enforce imprecise engineering precisely. People with slow reaction times or heavy vehicles (with lower deceleration values than used in the Formula) are shorted by the yellow light interval calculation. These people and vehicles are more prone to be caught by the red light cameras. Many other factors can induce categories of people into being more likely to technically run a red light and to trigger a red light camera violation.

Derivation of the Yellow Change Interval Formula

In the light of knowing what the Formula means, you will be able to discern the ways the Engineer misuses it. It is easier to show you what the Formula means than it is to enumerate the ways of what it does not mean.

http://redlightrobber.com/red/links_pdf/Yellow-Light-Duration-Derivation.pdf

Traffic Technology International, the world's largest transportation engineering journal, published a synopsis of our math paper in the language of English at:

http://viewer.zmags.com/publication/ecd7d66f#/ecd7d66f/1

Uncertainty in the Yellow Change Interval Formula

This paper demonstrates that the Engineer does not know the mathematical sciences.

Red light cameras enforce the law precisely, but the yellow change interval is imprecise. For example an engineer sets a yellow change interval to 4.3 seconds but the interval is really a range of equally valid values: 5.3 +/- 2.3 seconds. The Engineer does not inform law enforcement.

http://redlightrobber.com/red/links_pdf/Uncertainty-in-the-Yellow-Change-Interval.pdf

Third-Party Confirmation

Dr. Shovlin and I wrote the *Derivation* and *Uncertainty* papers to expose the engineering malpractices. We are not the only ones to do this. The inventor of the Formula himself, Dr. Alexei Maradudin, intervened to say the same thing as us in the summer of 2013. Also the chief traffic scientist at CalTrans, Dr. Chiu Liu, came to the same conclusion in his paper in the Sept/Oct 2002 edition of ASCE's Journal of Transportation Engineering, a peer-reviewed journal.

Determination of Left Turn Yellow Change and Red Clearance Interval

Dr. Chiu Liu, a physicist and civil engineer for the CalTrans (California DOT), said the exact same thing in ASCE's Journal of Transportation Engineering, a peer-reviewed journal:

http://redlightrobber.com/red/links_pdf/Determination-of-Left-Turn-Yellow-Change-and-Red-Clearance-Interval.pdf

Dr. Alexei Maradudin's Letter to the CalTran's Traffic Devices Committee

This letter was written by the inventor of the Formula. Dr. Maradudin accuses Engineers of "misusing his formula." I wrote the section listing the Formula's misuses. Maradudin simply verified and signed it. I copied the list into this complaint's Physics Violations section. The Engineer is guilty of every one of them.

http://redlightrobber.com/red/links_pdf/Yellow-Change-Interval-Dos-and-Donts-Alexei-Maradudin.pdf

Steven Strength, P.E., Louisiana DOTD

This YouTube video demonstrates that right-turn movements require about 6.2 seconds for a 40 mph road. Traffic engineers around the country give only about 4 seconds. Traffic engineers misapply the Formula to turning movements. Turning motions require up to twice as much time as straight-through movements.

http://www.youtube.com/watch?v=P3j2p5SNKIE&feature=youtu.be

The Problem with the Amber Signal Light in Traffic Flow

This 1959 paper is the origin of the yellow change interval formula. It includes a definition of the approach velocity (v_0) and a list of situations for which it does not apply (including turns, close-by intersections and cases where the driver is unable to continue to the intersection through the critical zone at the posted speed limit). Six years after its publication, ITE miscopied the formula 9 into ITE's traffic engineering handbook. Missing from ITE's handbook are page 2's "Analytical Considerations" and the "naught" in v_o.

http://redlightrobber.com/red/links_pdf/The-Problem-of-the-Amber-Signal-Light-in-Traffic-Flow.pdf

North Carolina Supporting Documents

North Carolina DOT Specification for the Yellow Change Interval

This NCDOT official spec sheet is a smoking gun. This spec sheet tells the Engineer to incorrectly set "v" to the speed at the stop bar. Per the original paper referenced above, "v" should be the speed at the critical distance. This spec also tells the Engineer to apply the Formula to left turn lanes. Physics and the original publication deriving the Formula say the Formula does not apply to left turn lanes. This spec tells the Engineer to do a speed study *if convenient*. The Engineer applies these specs even though they are not physically correct. A knowledgeable engineer should recognize this fact and dig deeper.

http://redlightrobber.com/red/links_pdf/NCDOT-Yellow-Change-Interval-Spec-Sheet.jpg

North Carolina NCSITE Meeting

The local chapter of ITE is called NCSITE. NCSITE tells NCDOT to ignore the yellow change interval requirements for school buses, public buses, commercial truckers and any vehicle with air-brakes. NCDOT obeyed NCSITE and now forces all of these vehicles to run red lights. In the following document, go to page 21 and search for "unique":

http://redlightrobber.com/red/links_pdf/Application-of-the-ITE-Change-and-Clearance-Interval-Formulas-in-North-Carolina.pdf

This following YouTube video was taken by a red light camera in Knightdale, North Carolina. It illustrates the consequence of NCSITE's decision. All vehicles are having a hard time stopping. For the school bus, though, stopping is impossible. The bus nearly overturned in order to avoid hitting the sedan that stopped shortly for the red light camera.

The video also contains clips illustrating the consequences of misapplying the Formula to left turning movements. The left turners have to enter the intersection a few seconds into the red. It looks like the left turn drivers are scofflaws, but they are being framed by the NCDOT's short turning yellow.

http://www.youtube.com/watch?v=h31jJ_DoCb0

Tracking Changes to the Yellow Change Interval by Graphing Red Light Running Violations

The following document graphs red light violation rates vs. time in Cary, North Carolina for 17 intersection approaches. Once the engineer shortens the yellow, one sees a dramatic permanent increase in red light violations. The opposite is also true. Once the engineer lengthens the yellow, one sees a dramatic permanent decrease in red light violations.

http://redlightrobber.com/red/links_pdf/north-carolina/Cary-Citations-By-Intersection.pdf

The disparity of the violation rates between intersections is what gives it away that the red light violations are solely induced by traffic engineers. Had traffic engineers correctly designed these intersections, the higher violation rates would correspond to intersections with the larger traffic volumes. But that is not what the numbers say. There are roads less travelled which have far more violations than the busy roads. The higher violation rates primarily correspond to the magnitude of misuse of the Formula, and secondarily correspond to other engineering flaws mentioned in the check lists.

Violation rates are obviously a function of yellow change interval. These graphs raise the question, "How long does the yellow change interval have to be to drop the violate rate to 0?" The question is answered by physics. The amount of additional time drivers need equals the difference between the time required by the physics for all traffic movements minus the time provided by the singular movement handled by the Formula. In order words, drivers need the yellow duration to be equal to the time it takes a driver to stop his car: Y = v/a. That solution is simple and is what Nature has said all along.

http://redlightrobber.com/red/links_pdf/north-carolina/Cary-Time-Into-Red-Histograms.zip

Documents Specific to the Engineer

The Engineer drafted signal plans at these intersections:

_____
Signature of Complainant

NOTARY STATEMENT

State of North Carolina

County of Wake

I _____, a Notary Public for Wake County and said state do hereby certify that Brian Ceccarelli personally appeared before me and being by me duly sworn, stated the he executed the foregoing instrument.

Witness my hand and official seal, this the _____ day of _____, _____

(Official Seal)

_____
Notary Public

My commission expires _____

Draft 12 April 9, 2014