Typical Red Light Camera Before/After Safety Studies – Deceit & Pseudoscience

RED LIGHT CAMERA STUDIES USE STATISTICS TO JUSTIFY USE OF RED LIGHT CAMERAS. THE CONDEMNING FACTOR AMONG THE STUDIES IS THAT THEY AVOID THE SCIENTIFIC METHOD. STATISTICS WITHOUT THE SCIENTIFIC METHOD DEMONSTRATES THAT, "ANYONE CAN PROVE ANYTHING WITH STATISTICS."

THESE STUDIES AVOID THE SCIENTIFIC METHOD IN TWO MAJOR WAYS: 1) THE STUDIES *START* WITH A CONCLUSION: DRIVERS ARE GUILTY. THE STUDIES DO NOT ENTERTAIN THE QUESTION, "ARE TRAFFIC ENGINEERS FORCING DRIVERS TO RUN RED LIGHTS?" THE CONCLUSION IS CONVENIENT THOUGH. TRAFFIC ENGINEERS OR POLICE WRITING THE REPORT GET THEMSELVES AND THEIR GOVERNMENT PATRON OFF THE HOOK. 2) THE STUDIES PRESUME THAT THE PURPOSE OF THE CAMERA IS TO PREVENT CRASHES. BUT THERE IS NOTHING IN A CAMERA, LIKE A BIG NET, THAT PREVENTS CRASHES. A CAMERA'S PURPOSE IS NOT EVEN TO MEASURE CRASHES. THE CAMERAS' DESIGNED PURPOSE IS TO PHOTOGRAPH RED LIGHT RUNNING EVENTS AND MAKE MONEY BY ISSUING TICKETS. OTHER PRESUMPTIONS: THE AVERAGE PERSON PRESUMES THAT CRASHES AND RED LIGHT RUNNING ARE TIED TOGETHER. THEY ARE NOT. TRAFFIC ENGINEERS CONSIDER FLOW, SAFETY AND THE LEGAL MOTION OF TRAFFIC AS 3 SEPARATE ISSUES AND PRIORITIZE THEM IN THAT ORDER. ENGINEERS INTENTIONALLY DESIGN INTERSECTIONS TO MAKE PEOPLE RUN RED LIGHTS FOR THE SAKE OF FLOW. AN ENGINEER WILL CAUSE MORE AND MORE DRIVERS TO RUN RED LIGHTS UNTIL THE CRASH RATE STARTS INCREASING.

	Scientific Method Step		**Red Light Camera Safety Study**
1	Formulation of Question	✗	Never asks the question why drivers run red lights. Instead asserts conclusion up front. Implicit in a study of an *enforcement* tactic is the conclusion that drivers are at fault.
2	Discovery and Observations	✗	No discovery. Presumes bad driving is only causality of crashing contrary to prior knowledge that engineering failures play the dominant role.
3	Hypothesis	✗	Biased and misdirected hypothesis: *Red light cameras will decrease crashes because cameras make drivers behave better*. Hypothesis misdirects cause of crashes and purpose of red light cameras (RLCs). RLCs tally red light violations (RLVs); they do not intervene in crashes.
4	Prediction	✗	Biased prediction with unsubstantiated premise: *Once an intersection is treated with red light cameras, there will be fewer crashes*. RLVs do not always imply crashes.
5	Experiment	✗	Observes wrong data set, crashes not RLVs--a result of the misdirected RLC purpose.
6	Analysis	✗	Analysis of wrong data set. When results do not favor bias, researcher cherry picks data set. Lack of scientific controls (e.g., no measurements of traffic flow or other intersection variables). Researcher omits RLV analysis showing the effects of traffic signal timing changes.
7	Conclusion	✗	Inconsistent results. In the scientific method, inconsistent results conclude a false hypothesis. The hypothesis that "drivers are the cause of red light running and crashes" is false according to the scientific method. Despite that, the Red Light Camera Safety Study still concludes that drivers are guilty.
8	External Reviews	✗	Debunk prediction, persist conclusion of inconsistent results and expose biases.

Details

#	Step in Scientific Method	Proper	Improper – The Before/After Study
1	Formulation of a Question	"Why do people run red lights?"	The red light camera safety study never asks a question. Instead it immediately asserts the conclusion, "Drivers are guilty." The conclusion makes a presumption of guilt which is not only bad science but also bad law. Even if the conclusion that drivers are guilty is true, the scientific method invalidates the study for making that assertion up front. The premature conclusion contains a two-fold lie: 1) The study misdirects readers to the *cause* of red light running. By confining its investigation to an *enforcement* tactic, the study implicitly faults the driver. 2) The study misdirects the reader as to the *purpose* of the red light camera. The study diverts the reader's attention toward crashes but red light cameras do not prevent crashes. Cameras are not gigantic foam cushions which descend into an intersection when they see two cars about to crash. Cameras are only devices which detect and tally red light incursions. This misdirection of *purpose* falsely implies that red light running always means crashes. But traffic engineers already know this implication is false. Engineers can design a safe intersection yet force thousands of drivers a day to run its red lights. Engineers even design intersections knowingly making people run red lights so that the roadway can attain traffic efficiency goals.

			Unknown to the reader, traffic flow, safety and the legality of motion are disparate goals, one obtained while sacrificing the others. This two-fold lie establishes a *hindsight bias*. A bias is a blatant violation of the scientific method. The bias immediately invalidates the study. The conclusions of such a study are called *specious*. It may be pleasing to the eye but it is deceptive.
2	Discovery and Observations	In a proper step 2, the researcher would discover different causes as to why people run red lights. On the top of this list are engineering failures. Engineering failures are short yellow lights, line-of-sight issues, traffic capacity issues, light cycle length, absence of detection plates, absence of signal head back-plates, etc. These are well-known problems existing at all intersections. Errant driver behavior can be a cause but it can only be considered after engineering failures are removed from the equation. In the presence of engineering failures, the driver may have to run red lights. To an observer watching a driver, what looks like bad driving can really be the outcome of bad engineering. Only a trained eye knows what to look for. Also in a proper step 2, the researcher would examine the federal guidelines. Are the guidelines correct? A researcher would not assume they are. The case in point is a math formula that models vehicle motion when a driver sees a light turn yellow. The formula is called the ITE yellow change interval formula. Does the	The study never discovers, observes or acknowledges engineering causes of red light running. The before/after study never performs step 2. The study misses the observation that the yellow change interval formula is wrong. The missing observation is exactly where the red light running problem becomes known. A researcher who knows introductory physics would immediately spot the error in the formula. There is a wild “2” in the denominator. The relationship between velocity, time and acceleration has no “2”. Therefore the model for vehicle motion subjected to the yellow light duration opposes the laws of physics. That would certainly make drivers run red lights.

		physics of this ITE formula model motion correctly? The answer is, “No! The physics of the ITE formula does not model the motion correctly for all valid traffic movements.” By the laws of physics this formula makes people run red lights. The observation “No” changes the direction of the entire investigation. It changes the *hypothesis*. If one was considering the hypothesis, “Red light cameras change driver behavior so that drivers run red light runs less often,” that hypothesis changes here. Before one can assign blame to the driver, one must first remove the engineering failures. The ITE formula is a physics formula. Engineering is the “application of the mathematical and physical sciences.” Where there is a physics failure, there is an engineering failure. One must first address the ITE formula problem, then one can move on to other causes like bad driving. The scientific method is often a set of *iterative* investigations. The first would be to investigate the ITE formula; then after that, the next iteration would perhaps investigate bad driving.	
3	Hypothesis	“The failure of ITE yellow change interval formula to describe vehicular motion for all types of traffic motion is the reason why drivers run red lights.” This hypothesis is a beautiful thing because the laws of motion have been well-established since 1687. A prediction is easily forthcoming.	“Red light cameras will decrease crashes because red light camera make drivers behave better.” The two-fold lie is present. Hindsight bias invalidates the hypothesis.

4	Prediction	The ITE formula only provides enough yellow time when the driver maintains a constant speed of v_o through the critical distance. Depending on the driver's distance from the intersection when the light turns yellow, the ITE formula may not provide enough time if he must decelerate through the critical distance into the intersection; for example, turning. The most time a driver needs is when his need to decelerate almost makes him come to a *stop*; for example, a U-turn. Therefore, the prediction is, "The ITE yellow change interval formula causes drivers to run red lights up to the amount of time the yellow duration falls short of the *time to stop* as computed by Newton's Laws of Motion. "We predict the amount of time that the vast majority of drivers will run red lights will be up to $\{v_o/2a\}$ seconds. "The stopping time is $t_p + v_o/a$."	"Once an intersection is "treated" with red light cameras, there will be fewer crashes." The two-fold lie is present. Hindsight bias invalidates the prediction.
5	Experimentation For any researcher, this step can never be perfect. One cannot carry out a pure scientific experiment because of the operational practices of the DOT. DOTs do what they want and when they want (often too late),	The test equipment measuring the red light running is the red light camera itself. So the presence of the red light cameras is tainting the data. Does this matter? The presence of the red light cameras does not invalidate the prediction, because driver behavior cannot change the laws of physics. Drivers may change their behavior. They may be opting to slam on their brakes more out of fear of getting a ticket. But in the end the laws of physics trump human behavior. The effects of physics outweigh any reasonable aberrations of human	There are more problems with data-collecting in a typical red light camera before/study experiment than the ones listed to the left in the blue column. 1. Many researchers are aware of pre-existing engineering problems (like Cunningham and Hummer). But because "it is not feasible" for the DOT to fix the problems, they bury the engineering problems under the rug, push blame upon the driver and hope no one catches them doing it.

	and will not allow a researcher to research for the sake of researching. Even if the DOT was willing to experiment with an intersection, it is nearly impossible to assure that other contributing factors to red light incursions are kept constant. The "controls" of the experiment are always out of control.	behavior. This is a reasonable assertion yet must still be kept in mind. When traffic engineers change an intersection's yellow duration, they often change other things too. It is hard to collect data due to a single change. Does this matter? Depending on what other changes have been made, it does matter. For instance, if the traffic engineer increased the signal cycle length from 2 minutes to 3 minutes, drivers would see red lights 33% less during the course of a day. That would mean a 33% decrease in red light incursions.	2. Before/After studies divert the reader's attention away from red light violation data to crash data. There are two reasons researchers do this: A. Subterfuge. If a reader becomes aware of what RLV data looks like, then he will immediately notice that the vast majority (nearly 100%) of red light running is caused by traffic engineers. All the reader has to do is compare one intersection's RLV rates with another. Because drivers drive the same regardless of location in the city, the gaping disparity of RLVs points to engineering differences. For a single approach to a single intersection, a reader only has to see the RLV rate dramatically spike to a higher level to know that a traffic engineer caused it. DOTs change intersection yellow durations every 2 to 5 years. There is a good chance the reader will see such changes implemented during the experiment period. The very day the engineer shortens the yellow light duration, the reader will see the RLV rate dramatically spike to a new higher permanent level. The reverse is also true. The very day the engineer lengthens the yellow light duration, the reader sees the RLV rate dramatically dip to a new permanent low. B. The numerical magnitude of crash rates is not significant. The rates fluctuate widely from year to year, season to season, with or without cameras. It is easy to find a period of time in the "before" phase where the crashes are more than in the "after" phase. Pro-camera researchers jump on this data like a cat to a bird. But because the magnitude of the crashes is insignificant, the researcher will report *percentage* decreases instead of actual numbers. For example, the crash rate goes from 3 crashes/year to 2. The researcher will announce, "There has been a 33%

			decrease in crashes." The whole truth, "from 3 to 2 crashes," does not sound appealing. 3. Before/After studies are notorious for ignoring engineering changes during the experiment period. A. For example the yellow light duration was 4.3 seconds before RLCs were installed, 4.7 seconds after. The change drastically reduced RLVs but researcher attributes the reduction to the presence of the cameras in order to appease his prediction (step 4). B. Knightdale, North Carolina attributes its lower crash rates to red light cameras but does not mention that the new I540 and US Bypass 64 diverted about 70% of the traffic away from its red light camera corridor. 4. These studies are notorious for cherry-picking data. What constitutes a RLV crash and what doesn't? A. Studies will use non-RLV crashes to justify a "camera-treatment." Just because a crash happens near an intersection does not mean it is red light running related. B. Non-RLV crashes are convenient to include in the "before" phase but not in the "after" phase. A non-RLV crash would be a drunk driver. C. In its 2011 report, the Insurance Institute of Highway Safety (IIHS) cherry picks city-wide crash statistics as opposed to the data at RLC intersections. It also only picks the fatal crashes. Yet even with two basketfuls of cherries, IIHS reports three large cities seeing an increase of fatalities in the presence of red light cameras.

			(IIHS's hindsight bias is based on its financial goal. IIHS represents car insurance companies whose goal is to increase insurance premiums justified by the red light running counts.) D. Suffolk County considers only right-angle crashes. Red light cameras are notorious for making drivers slam on the brakes causing rear-end crashes. E. Suffolk County considers only crashes involving injuries. Red light cameras, notorious for creating fender benders, are conveniently ignored. F. Tampa, Florida and Tucson, Arizona change the definition of an intersection. G. Arnold, Missouri plays a distance game counting only RLV crashes within 50 feet instead of the federal standard 133 feet. The federal standard is also incorrect. According to the laws of physics, RLV crashes can occur within the *critical distance* on both sides of intersection. For a 45 mph road, the critical distance is about 300 feet. H. Winnipeg, Manitoba takes Missouri's distance game to its extreme. Winnipeg counts only crashes inside the intersection. That removes evidence of increased rear-end crashes--a known consequence of red light cameras. I. Illinois cities play a dollar game skewing data based on costs of crashes. J. Philadelphia, Pennsylvania chooses "reportable" crashes. Reportable crashes exclude crashes which do not need a tow.

6	Analysis	Given the red light camera data which contains “time into red” for every lane of traffic, graph the red light violation rate versus time-into-red. The resulting curve indicates that a law of physics is at play. The curve is not random. That is to say the curve is not Gaussian, Poisson or any random distribution which would imply the cause is human behavior. Instead the curve follows a law of physics. The curve of red light runners starts high just after the light turns red. The curve drops to zero at $v_o/2a$ into the red phase. Time vo/2 into red is the time a driver needs to stop according to the laws of physics. Drivers need the full to stop to obey the traffic signal. The curve definitely hits RLV rate = 0 at t = $v_o/2a$ into the red. After $v_o/2a$, where physics is no longer at play, then we see a uniform random distribution of red light running. Example. When $t_p + v_o/a$ requires the driver to have 7.4 seconds of yellow but the yellow is 3 seconds, the curve of RLV rate drops to zero at 4.4 seconds into the red. If the yellow is 4.5 seconds, the curve of the RLV rate drops to zero at 2.9 seconds into the red phase.	The two-fold lie is still present. Hindsight bias invalidates the prediction. Most before/after studies do not analyze much. Usually a policeman will sum up the crashes at one intersection in one year, then sum the crashes up in another year. If he doesn’t get the results he wants, he excludes the intersection from his analysis or he sums up the crashes from all intersections to come up with a “net benefit.” Other companies like AECOM will spent a lot of time analyzing the crash data for their city client. AECOM performs a full-blown statistical analysis complete with naïve and an empirical Bayes analyses. The analyses look impressive but AECOM’s analysis is just as invalidate as the policeman’s. Without using the scientific method, both analyses are specious.
7	Communicating Conclusions	1. Drivers always require the stopping time, $t_p + v_o/a$, to react to a yellow. This is what Newton’s Laws predict for the traffic movements discussed in the prediction. The yellow should be this long to allow valid traffic motions to enter the intersection legally. 2. From step 6, 92% of drivers run the red light under the “curve” from the analysis. These	“Red light cameras are good for the city. They increase safety.” The conclusion is the premise for the study and the conclusion still contains the two-fold suppositions neither supported nor mentioned. Therefore the conclusion, whether good or bad from the point of view of the city, is fiction. In spite of the fallacious methods, most red light camera studies show an increase in rear-end collisions. When the

		are the drivers which can be caused to run red lights unintentionally by the ITE yellow light formula. The remaining 8% of drivers run the red lights for other reasons. 3. The length of the yellow does not significantly change the driver's behavior. Physics is dictating the time requirement, not a driver's prior knowledge (if any) of the length of the yellow change interval. Once the light turns yellow, a driver does what he needs to.	researcher observes this, the researcher has a choice. Does he continue the research because cameras did not do as he predicted? Or does he redefine "safety" to appease his patron? Remember the researcher's prediction: "Red light cameras will decrease crashes because red light camera make drivers behave better." Yet the analysis shows that some drivers do not behave better but worse! Therefore his prediction is false. That invalidates his hypothesis. The researcher must now revise his hypothesis. He may need to go back to step 1 and actually formulate a question. Will he do this? No. The researcher does not do the right thing. Instead he redefines safety to appease his patron. His motive is either ignorance (he does not know what to do with the results he sees), money (gets paid for writing these reports) or needs to save face (a city councilman who if admits a problem makes the city look like it stole millions of dollars from the innocent). So the researcher redefines "safety": "Safety is the increase of rear-end crashes." Of course the researcher does not redefine safety quite like that. He wants to emphasize the decrease of right-angle collisions without mentioning the increase of rear-end collisions. "Safety is the increase of rear-end crashes as long as right-angle crashes decrease." This twist is perverted but it is exactly how the camera advocate researcher skews his conclusion. In logic-speak the redefinition is a fallacy.

			The true definition of safety is the decrease of rear-end crashes and right-angle crashes in both number and type. James Walker of the National Motorists Association expresses the rebuttal to the researcher's redefinition: "If it were possible to interview the victims of the 'extra' rear-end crashes caused by the presence of red light cameras and to ask the victims if the trade-off was OK, I think you would get a very strong 'No!' " Even if the analysis shows both rear-end and right-angle crashes decrease, the conclusion of such a before/after study is still fictitious. A study without the scientific method is deceptive. One must address causality and not presume it. There are engineering factors *known* to be at work.
8	Replication, External Review	The conclusion is verified with physics in Dr. Chui Liu peer-reviewed paper in American Society of Civil Engineers *Journal of Transportation Engineering*. The conclusion is verified by Dr. Alexei Maradudin, the inventor of the root formula which the Institute of Transportation Engineers (ITE) has been using since 1965. The partial conclusion that any increase in yellow light duration decreases RLVs is verified in Effect of Yellow Interval Timing on Red-Light Violation Frequency at Urban Intersections by Bonneson and Zimmerman. And verified by every city that lengthens the yellow light duration. There are no exceptions. Red light violations *always* and *immediately* plummet dramatically to a new lower level. Here is a sampling of cities: Albuquerque, New Mexico	Never once has a Before/After study been verified. On the contrary, every Before/After have been debunked. When red light camera before/after studies are considered in one big lump, the results are always mixed. There is always inconsistency. Some studies show more rear-end crashes. Some show less. Some studies show more right-angle crashes, some show less. Some show an increase in everything. Some show a decrease in everything. Inconsistency is the synonym for a bad hypothesis. Acknowledging inconsistency normally results in redoing the investigation with a new question and with a new hypothesis: "Why do drivers run red lights?" But such a question leads to the verifiable, externally affirmable conclusion that the ITE formula makes the vast majority of drivers run red lights. That means government and traffic engineer are to blame. That is an inconvenient truth. In spite that the scientific method requires a new

		Cary, North Carolina Chandler, Arizona Fairfax County, Virginia Libern, Georgia Loma Linda, California	iteration with a revised hypothesis, the government and the traffic engineers choose to stop the study.