Ceccarelli PE
Expert in Traffic Engineering as Applied to Photo & Police Enforcement

The Legal Breadcrumbs

1. North Carolina red-light camera statute NCGS § 160A-300.1 (c1) explicitly requires that the yellow change interval must comply with the *Manual of Uniform Traffic Control Devices* (MUTCD).

2. The NCDOT's yellow change intervals no longer comply with the MUTCD. That is because the NCDOT uses the Institute of Transportation Engineer's ITE formula to determine yellow change intervals, and the MUTCD rejected ITE's formulas. (NCDOT ITS and Signals Unit Design Manual Std 5.2.2 Sheet 4 of 4 search for "deceleration")

3. The Federal Highway Administration (FHWA) is the author of the MUTCD. The FHWA removed all references to the ITE Formula from § 4F.17. Obsolete editions of the MUTCD used to declare the ITE Formula an engineering practice in § 4D.26 (07).

   The FHWA intentionally removed the ITE references. In 2020, ITE acknowledged that its old ITE formula is incorrect—that its formula forced drivers to run red lights by getting the physics wrong. In 2020, ITE then replaced the old ITE formula with the "Extended Kinematic Equation" (EKE). The EKE is different algebra. Although the EKE adds several seconds of yellow for left-turn arrows, the EKE still makes drivers run red lights. The FHWA rejects both old and new ITE formulas. *Any ITE formula does not comply with the MUTCD.*

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4. The current MUTCD retains one requirement for the yellow change interval. That requirement is standard § 4F.17 (03). The standard requires that the yellow change interval must be determined by *engineering practices*. Engineering practices are defined by State law. The NCDOT practice flunks the State definition of engineering practice too.

5. North Carolina's Engineering Practice Act NCGS 89C-3(6a) defines an *engineering practice* as the *application of the mathematical and physical sciences*. (This definition is also in dictionaries and encyclopedias.)

6. The ITE formula is not an engineering practice because the ITE formula is *misapplications* of the mathematical and physical sciences. Not "applications". It is the

opposite of an engineering practice. It is engineering *malpractice*. One cannot declare that 2 + 2 = 5 is an engineering practice.

7. Using the ITE formula to determine yellow change intervals violates many laws: the 1) state engineering practice law, 2) the state law which adopts the MUTCD as law -- NCGS § 136-30(d) and violates 3) 23 CFR 655.601 Subpart F(a) which is the MUTCD. All DOTs use this formula and have been for decades. The formula is the reason the red-light camera industry exists and reason behind 90% of the crashes we see.

8. The difference between Isaac Newton's physics of motion t = v/a and the ITE yellow change interval formula (t = v/2a), the "2" being problematic, combined with the data analysis of raw red-light running events in Cary, North Carolina, reveal that 90% of all red-light running is caused by the formula. I estimate 9999 out of 10,000 are framed by the formula or caused by other engineering defects. I estimate that only 1 red-light runner out of 10,000 actually may be a result of bad driving. The solution is to give drivers the time to stop, not just the distance to stop.

9. ITE never states that its yellow change interval formula is an engineering practice. ITE puts an explicit disclaimer upon its accuracy.

Justifications and Rebuttals to Using the ITE Formula

1. All DOTs use it.
    a. Everyone saying the 2 + 2 = 5 does not make 2 + 2 = 5.
    b. Frequency of use does not imply validity.
2. The ITE formula is a standard of care.
    a. Incorrect! It is true that DOT's adopt the ITE formula as a standard. But the formula is a standard of *practice*, *not* a standard of *care*. To be a standard of care, the standard has to first rise to the bar of an engineering practice. The formula is misapplications of the mathematical and physical sciences. 2 + 2 = 5 does not rise to any engineering standard of care.
    b. The standard of care in the 14th century was that doctors used leeches to lower a fever.
3. I have been using the formula for all my career.
    a. Frequency of use does not imply validity.
    b. I frequently eat candy bars. That does not mean it is good for me.
4. The formula works. I don't see any crazy movements when vehicles approach an intersection.
    a. Seeing crazy movements at every light cycle is irrelevant. Yet we do see some crazy movements like "beat the light" frequently, or cars entering the intersection when cross traffic just gets the right-of-way. The formula does require some drivers to do this.
    b. To reveal the scope of the problem, it takes science.
    c. When I look up at the sky, I see stars going from east to west. An uneducated person believes that from what he sees, the earth is at the center of the universe and the universe revolves around the earth. Man believed this for thousands of years until Nicolaus Copernicus set everyone straight using science with higher precision instruments.
    d. For a hundred years, man thought red-light running was caused by bad driving until red-light cameras ticket everyone. A city issues more tickets than its

population in a few years. Is everyone a reckless driver? No. Drivers run red lights because ITE's math conflicts with physics. It is not bad driving at all.

5. The MUTCD says the yellow can be between 3 and 6 seconds.
    a. Irrelevant. If spoken in a court, this statement is perjury. It is not the whole truth.
    b. The MUTCD has 4 groups of statements: Standard, guidance, options and support. MUTCD describes what they mean in § 1C.01 (01). The only rule a DOT must obey is a **standard**.
    c. 3 to 6 seconds is guidance. MUTCD § 4F.17 (13) Therefore an appeal to 4F.17 (13) is irrelevant. Guidance, options and support statements exist because they do not apply all the time or there is disagreement within the engineering community.
    d. The latest edition (ed 11) of the MUTCD has removed all references to ITE. ITE has been demoted. The previous edition, MUTCD 2009 Rev 3 July 2022, mentioned in an option that ITE had "engineering practices" § 4D.26(07) for the yellow change interval. FHWA has changed its mind.
6. We are following the federal *guidelines*.
    a. You are not following the federal guidelines. The federal government dropped the ITE formula. There are no federal guidelines to follow or hide behind.
    b. "Guidelines" never carry authority. Only standards do.
    c. A licensed professional engineer is *always* responsible for the work he does.
    d. A professional engineer blaming his errors on federal guidelines is unprofessional.
    e. The licensed professional engineer must know what the equation he uses makes drivers do. Out of hundreds of traffic engineers I have encountered, only one could describe what the equation does.
    f. The professional engineer cannot point his finger of blame at the federal guidelines, ITE, the State DOT standard of practice or his colleagues.

g. A professional engineer cannot go shopping at Walmart, purchase a yellow signal light, erect it at the corner of Walnut and Meeting Place, and blame its improper operation on Walmart.
h. The licensed professional engineer has *responsible charge*.
i. The licensed professional engineer is powerful.
j. The licensed professional engineer tells the government what to do, not vice-versa. If he uses a faulty formula, the professional engineer is responsible. His employer may share liability, but the PE is responsible.
k. The engineer has authority over a standard. If the standard is wrong, the engineer has the obligation and authority to revise the standard.
l. "I am just using the federal guidelines", makes it appear that the engineer is appealing to a higher authority. The feds are not a higher authority. Unlike State laws that are subject to the US Constitution's Article VI Supremacy Clause, the engineering habits of federal agencies have no authority. The federal government delegated engineering authority to the States (e.g., the MUTCD).
m. Many federal agencies, including the FHWA, do a poor quality of work. If I claim that "I follow the federal guidelines", I am insulting myself. States' statutes are what hold engineers personally accountable to get the math right. Federal agencies have no such statutes.
n. There is much frustration between States' boards of engineers and the chaos performed by federal agencies.

Manual of Uniform Traffic Control Devices

Is the MUTCD a standard of care? Yes. The answer comes with the proviso of understanding what the MUTCD is.

1. The Federal Highway Administration (FHWA) publishes the MUTCD.
2. The purpose of the MUTCD is to ensure that traffic signals, traffic signs and other traffic control devices look the same throughout the United States. For example, "a stop sign is a red octagon".
3. The MUTCD is a *Systems Requirements Specification* (SRS). "SRS" is an engineering term. The acronym "SRS" speaks volumes in the technical world but its full meaning is initially hidden from attorneys. SRSes are used in all disciplines of engineering.
4. "Standard of care" is a legal term. This term is independent from the MUTCD. Standard of care's meaning has much larger scope than a single MUTCD "standard" statement.
5. As a standard of care, the MUTCD is a moving target. The MUTCD changes frequently.
6. A licensed professional engineer has the authority to deviate from the MUTCD.
7. A licensed professional engineer is legally obligated to do the right thing regardless what the MUTCD says.
8. Many States have a *supplement* to the MUTCD. The supplement overrides the MUTCD. Some of these supplements are shady--they attempt to legally conceal a State DOT's engineering mistakes.
    a. For example, many red-light camera States have a MUTCD supplement provision that overrides the MUTCD-standard *Photo Enforced* sign:

The MUTCD sign is on the left. Some states have the sign on the right. Some states have the sign on the right without a supplement.

b. Is using the sign on the right lawful? No. With or without the supplement, the sign on the right is bad. The sign is stupid and violates the engineering standard of care. It is stupid (bad *engineering judgment*) to place a *picture* of a traffic signal next to a real traffic signal.
c. Then why does the "Photo Enforced" sign on the right exist in the first place?
    i. The red-light camera company makes stuff up.
    ii. The red-light camera company does not know the MUTCD.
    iii. The red-light camera company does not have real engineers.
        1. The red-light camera companies are not licensed to practice engineering.
        2. Red-light camera companies do not have licensed professional engineers drafting red-light camera installation plans.
d. Why does a State add to its MUTCD supplement a provision that allows for the sign on the right?
    i. Because the state already has red-light camera installations with the wrong sign. Instead of replacing the sign, the State changes the law.
    ii. I have experienced that when a DOT makes errors, the DOT changes the law to allow its errors. It is a way for DOTs to sweep their far-and-widely implemented mistakes under the rug in order to avoid

liability. In 2010, *Ceccarelli v Town of Cary*, started out with the NCDOT doing this.

At this very moment (June 2026), the NCDOT is doing it again. The NCDOT has introduced bill (H189) to allow it to continue miscalculating its yellow change intervals. The NCDOT expects me to be thankful.

9. Many a red-light camera court case was lost because attorneys take the MUTCD out of context.
10. The most common mistake is elevating the MUTCD *guidance* statement "the yellow light should be 3 to 6 seconds" to a MUTCD standard: "the yellow light *shall be* 3 to 6 seconds". There is big difference between "should be" and "shall be".

    Attorneys incorrectly argue that the 3 second yellow, by following the MUTCD 3 to 6 guidance, makes 3 seconds legal. Not only is the 3 second yellow just guidance, but also the guidance requires that faster speed limits require yellows longer than 3 seconds.
11. On top of promoting MUTCD guidance to MUTCD standard, attorneys incorrectly further promote the standard to the "standard of care". It is a double mistake. The attorney loses his case when he entertains that that 3 to 6 seconds has authority.
12. The MUTCD **standard** 4F.17 (03), that if adhered to by DOTs, would make red-light cameras go away. *Yellow change interval must be determined by engineering practices*.
13. Engineering practices are defined at the state level. An engineering practice is not defined by what an engineer does (like go to the bathroom or implement the wrong equation). An engineer practice is one that begins with being an "application of the mathematical and physical sciences".