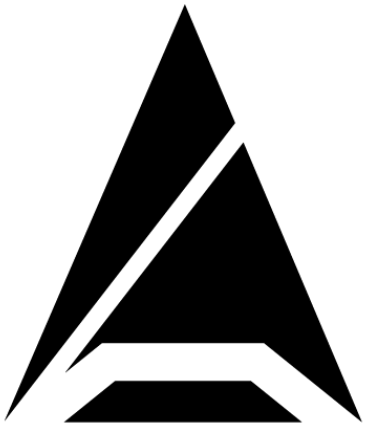
MUTCD – ENGINEERING REQUIREMENTS DOC

How to Read the MUTCD for Lawyers



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The Issue

When prosecuting traffic engineers over the duration of the yellow light, traffic engineers or their counsel will invoke the Manual of Uniform Traffic Control Devices (MUTCD). The defense will say, "We set the yellow light to 3 seconds according to the MUTCD." The judge then rules, "Because the MUTCD is a federal guideline saying that the yellow duration must be set to at least 3 seconds, the defense's setting of the duration of the yellow light to 3 seconds falls within range of the regulation and is therefore legitimate. Case dismissed."

This paper shows you the counter-argument.

The Traffic Engineer's Fallacious Argument

The MUTCD does not tell the traffic engineer to set the yellow light to 3 seconds. The MUTCD is not a federal guideline either. The setting of the yellow light and the legal culpability of that setting rest solely on the traffic engineer. By engineering practice law, the traffic engineer must set the duration of the yellow light according to physics, not to some arbitrary number taken out of context in some manual, and the traffic engineer has responsible charge over its setting and the legal consequences of that setting. Here are the specifics:

1. Federal regulation 23 CFR 655 points to the MUTCD but the MUTCD is a not a law. The MUTCD is not a regulation. The MUTCD is not in the language of law. The MUTCD is in the language of engineering, specifically in the language of a Systems Requirement Specification (SRS). The MUTCD states both requirements and options for traffic control devices. The 3-second yellow is optional, not a requirement.

2. The reason why it is optional and not a requirement is because the 3 second yellow cannot apply to all cases. Even the very MUTCD statement that mentions the 3 second minimum makes it clear that 3 seconds cannot be applied to all cases. It is a minimum and higher approaches need more time.

3. The MUTCD forbids the reader the right to treat its *statements* with equal weight.

The Engineering Language of a Requirement

The MUTCD contains 4 levels of *statements*. The statements of each level carry different weight. The 4 levels are *Standard*, *Guidance*, *Option* and *Support*. Only a Standard is required. The traffic engineer must implement a Standard because only the Standard written in the lingual form of an engineering requirement. The Statements at the other levels are to be used at the engineer's discretion. The language of an engineering requirement is written in this format[1]:

[identifier] [Noun phrase] shall (not) [verb phrase].

Here is the pertinent example from the MUTCD. This is what you need to remember:

Standard

4D.26 (03) The yellow change interval shall be determined using engineering practices.

The MUTCD defines the 4 levels in section 1A.13. Guidance, Option and Support statements are not requirements because such statements cannot be applied all the time. If the statements should be applied all the time, then the statements would become requirements and elevated to the *Standard* level.

Engineers may use guidance, options or support statements only when such statements do not conflict with standards.

The 3-second yellow is *Guidance*:

Guidance:

4D.26 (13) The yellow change interval should have a minimum duration of 3 seconds and a maximum duration of 6 seconds. The longer intervals should be reserved for use on approaches with higher speeds

Note:

1. The 3 second yellow cannot be applied all the time else the statement would be a *Standard*.
2. Within the context of the statement, 3 seconds should not be applied to higher approach speeds.
3. The guidance is ambiguous. It does not define what speed qualifies as "higher". Physics does determine what high is. Physics says that 3 second minimum can only be used for straight-through unimpeded traffic on roads with speed limits less than 24 mph.
4. The guidance contains the word "should". "Should" does not carry the weight of "shall." Forgive the illustration:

Consider a requirement from the Ten Commandments:

> Thou shall honor your father and your mother.

God did not write:

> Thou should honor your father and your mother.

"Should" leaves the action to your discretion; "shall" requires you to do the action.

The MUTCD itself defines a distinction between "shall" and "should" (1A.13). Engineering Requirements textbooks[1] point out the difference too. Requirements language is exact. Requirements language has been used for decades. Its form is readily recognizable. The purpose of requirements language is to prevent ambiguity.

A person, whether judge or engineer, shall not come along and play games with the English, pull phrases out of the context of requirements language, treat them equally or arbitrarily, and thus introduce ambiguity.

Requirements

With regards to the duration of the yellow light, the pertinent MUTCD Standard is:

Standard

4D.26 (03) The yellow change interval shall be determined using engineering practices.

The statement is a standard; therefore, the statement is a requirement. Note that the statement is in standard requirements lingual form. All traffic engineers shall conform to this statement all the time for determining the durations of all yellow lights.

Engineering Practices

What are engineering practices? Your State laws or regulations clearly define engineering practice. The definition of engineering practice is "the application of the special knowledge of the physical and mathematical sciences." This definition originates from the Accreditation Board of Engineering and Technology (ABET). The definition appears also in the Encyclopedia Britannica and in Merriam Webster's dictionary.

The physical sciences are physics, chemistry and geology.

In requirements engineering, there are three types of requirements. 1) Functional, 2) Nonfunctional and 3) Domain. Domain requirements, in this case, are those requirements inherited by the science involved. The *domain requirement* for determining the yellow change interval is the requirement to conform to the laws of physics. Physics is what determines the kinetics of a car approaching an intersection. Therefore physics is what determines the proper calculation of a yellow change interval.

By transitive logic:

A. MUTCD 4D.26 (03) invokes **engineering practice** at the federal level.
B. **Engineering practice**, via Brooks Act and State law, invokes **physics**.

Therefore:

C. 4D.26 (03) can be restated as, "**The yellow change interval shall be determined using physics**."

And this is the only way to win the battle of the yellow light. The Code of Federal Regulation invokes the laws of physics. The laws of physics provide the way to solidly demonstrate that the yellow change interval as set by the average traffic engineer is too short.

Traffic Engineers Calculate Yellow Change Intervals That Oppose The Laws of Physics

The engineer does not determine the yellow change interval by applying physics. He determines it by *misapplying* physics. The traffic engineers use the wrong math equation, use the wrong numbers to plug into the math equation, and omit calculations such as tolerance. These physics errors and omissions cause everyone to run red lights. Misapplying physics is engineering *mal*practice, not engineering practice. Determining the yellow change interval using engineering malpractice violates the federal Systems Requirement Specification for traffic control devices--MUTCD 4D.26 (3). 4D.26(03) is a Standard. Violating a Standard violates the Code of Federal Regulation 23 CFR 655. The traffic engineer has broken a federal law.

The engineer uses the wrong equations to the set the duration of the yellow change interval[2, 3]. For a 45-mph posted speed limit, he will set the yellow change interval for a protected left turn yellow to 3 seconds. Physics requires that yellow shall exceed 7.4 seconds.

References

1. Phillip A. Laplante, Requirements Engineering for Software and Systems, Second Edition, CRC Press, 2014

2. Dr. Chiu Liu, Traffic Safety Program Manager--CalTrans, Determination of Left Turn Yellow Change and All-Red Clearance Interval, Journal of Transportation Engineering, 2002, p. 454
3. Brian Ceccarelli, 5 Errors and Omissions of the Yellow Change Interval