Is the Current MUTCD Really Better Than the 1961 Edition?

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Abstract
The 1961 MUTCD had six chapters, including a very short one on Signing for Civil Defense; it had 333 pages in a 6" by 9" format. The current MUTCD consists of nine chapters, two appendices, cover material, and a section on retroreflectivity; the document now has 868 pages in an 8.5" by 11" format. Adjusting for margin size, the 2009 MUTCD has over 5 times as much material as the 1961 edition, but is it actually any better? This paper will explore the commonalities and the differences between the two editions (and some intermediate editions), examine the roles of engineering judgment in selecting traffic control devices, and identify some devices that are specified as mandatory.

Background
The American Association of State Highway Officials published a control device manual for rural highways in 1927. Two years later, the National Conference on Street and Highway Safety published a similar manual for urban streets. The initial edition of what the transportation engineering community now knows as the Manual on Uniform Traffic Control Devices for Streets and Highways was published in 1935. The initial purposes were to assist state and local highway agencies in standardizing the signs, markings, and signals used on roadways. The Manual evolved through several subsequent editions. By 1960, representatives from the following five organizations were responsible for periodically revising the document:

- American Association of State Highway Officials
- Institute of Traffic Engineers
- National Committee on Uniform Traffic Laws and Ordinances
- National Association of County Officials
- American Municipal Association

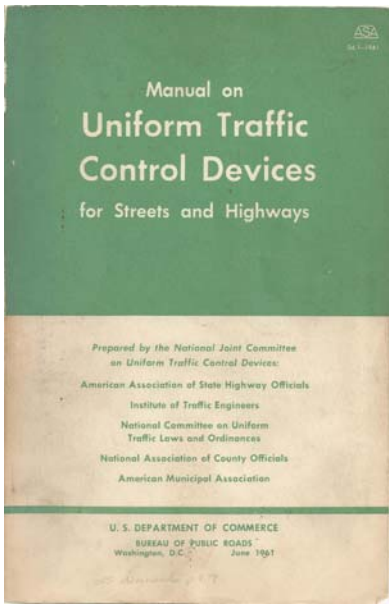
As a point of trivia, four of these organizations continue to exist, but under different names; the National Committee on Uniform Traffic Laws and Ordinances, which published the Uniform Vehicle Code, appears to have gone out of business.

The 25 members of the National Joint Committee on Uniform Traffic Control Devices who prepared the 1961 MUTCD are listed on page iii of the publication. They are a true Who's Who of the profession, and include:

- E. H. (Ted) Holmes, Assistant Commissioner for Research, Bureau of Public Roads
- F. Bruce Crandall, Oregon Traffic Engineer and first International Director from ITE's Western District†
- Wilbur S. Smith, Wilbur Smith and Associates†
- George Howie, 1953-54 International Director from ITE's Western District†
- D. Grant Mickle, Automotive Safety Foundation†
- Donald S. Berry, Professor, Northwestern University, 1954 Western District President
- Burton W. Marsh, American Automobile Association†
- Marble J. Hensley, Chattanooga Traffic Engineer†

† Served as International ITE President

The 1961 MUTCD was printed in a 6 inch by 9 inch format. Following a brief introduction, the document had six parts (chapters) on Signs, Markings, Signals, Islands, Highway Construction and Maintenance Operations, and Signing for Civil Defense, followed by an Appendix with definitions. The 1961 MUTCD was printed by the US Government Printing Office and sold for $2.00.

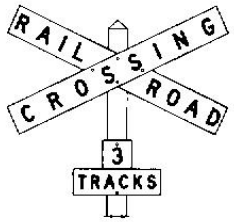


The 2009 MUTCD has grown to nine chapters; it has approximately five times as much material, but some of that growth is due to the more extensive use of figures and the inclusion of both English and metric units. At the ITE Bookstore, members can purchase the hard copy document for $100, reflecting an annual cost increase of 8.5% from the 1961 edition. On the other hand, the 2009 edition is available for free on FHWA's website, but you or your employer will have to pay for the paper, ink, and printer wear if you want to print a copy.

Assuming, perhaps erroneously, that most not-yet-retired ITE (i.e., younger) members are familiar with the current version of the MUTCD, it might be useful to share some of the elements of the 1961 MUTCD that they are likely to be less familiar with. The following bulleted list does so, following the order of the chapters noted in the first paragraph on this page:

- The terms "shall," "should," and "may" are not explicitly defined. "Should" is used sparingly, as in the five elementary requirements that every traffic control device should meet. "Shall" is used much more, primarily in describing individual traffic control devices: "The Stop sign shall be octagonal in shape, shall have a red background, and shall carry the word STOP in white letters …."
- With the exception of the Islands chapter, the manual has relatively few figures. A paltry seven typical applications are given in the Construction and Maintenance chapter.
- The Yield sign was a yellow equilateral triangle with one point downward and black lettering.
- The DO NOT ENTER sign was a rectangular sign with black lettering on a white background. The manual did not have a WRONG WAY sign.
- Other than various arrows, curve/turn/winding road, intersection advance warning signs, and the road narrows sign, symbols were not used. Signs for CATTLE CROSSINGs, DEER CROSSINGs and similar signs all employed word messages rather than symbols.

- Those regulatory signs that were normally black on white, but had dimensions of 30 inches by 36 inches, or larger, could be switched to white on black.
- The size guidance for signs was fairly limited. For example, the STOP sign "shall have a standard size of 30 inches by 30 inches. On minor roads and secondary streets a sign 24 inches by 24 inches in size may be used."
- The recommendations for advance placement of warning signs was not very specific: 750 feet in rural areas, 1500 feet on high speed roads, and 250 feet in urban areas. It goes without saying that no dimensions in the manual were in metric.
- According to the 1961 MUTCD, a turn sign was warranted if the ball bank indicator reading was 10° or more at 30 mph; when a turn sign was warranted, a large arrow on the outside of the turn was also required. A curve sign was warranted for ball bank readings of 10° or more for speeds between 30 and 60 mph.
- The manual is more specific about the use of the Winding Road sign. Specifically, it shall be used when there is a series of five or more turns or curves separated by tangent distances of less than 400 feet. If the first turn or curve is to the right, a Right Winding Road sign (W1-5R) shall be used, and if the first turn or curve is to the left, a Left Winding Road sign (W1-5L). The current edition specifies three or more changes in alignment separated by 600 feet or less; nothing is said about the direction of the first change in alignment.
- The T symbol sign (W2-4) should not generally be used on an approach where traffic is required to stop before entering the intersection, nor at a T intersection that is channelized by traffic islands, nor where Junction signs or Advance Turn Arrows are present. (It's interesting to contrast the use of the conjunction *nor* twice in this single sentence with its use only 10 times in the 2009 edition's 868 pages.)



W10-2

- The black and white Railroad Crossbuck sign was designated in the 1961 MUTCD as W10-2, a warning sign.
- The Distance Sign (D2), a horizontal rectangle with the mileages to two or three incorporated cities, villages or towns, had black lettering on a white background.
- Milepost signs in the manual were to use four to six inch high letters with no legend, with a color combination of black on white or white on green. In the current MUTCD, mileposts have been replaced with *Reference Location Signs*, which are, in fact, mileposts.
- The 1961 MUTCD called for white centerlines on 2-lane rural roads and on city streets.
- 8-inch traffic signal lenses were in common use. Experience with 12-inch lenses was limited, but it was recommended that they be considered where greater signal conspicuousness was needed; some signal assemblies used 12-inch red lenses with 8-inch yellow and green.
- There were only six warrants for traffic signals: minimum vehicular volume, interruption of continuous flow, minimum pedestrian volume, progressive movement, accident experience, and combinations of warrants.
- The 1961 manual devotes a couple of pages to a discussion of traffic signals at drawbridges; this shrinks to a couple of small paragraphs in the current edition.
- The 1961 MUTCD did not have a separate chapter devoted to rail-highway grade crossings. Instead, six pages in the traffic signals chapter addressed train-approach

signals and gates.

- One of the acceptable grade crossing signal types was a wigwag.
- The diagonal stripes on a gate at a crossing were black and white.
- The 1961 MUTCD devoted 46 pages to construction and maintenance area traffic control; the warning signs were black on yellow; barricades were black on white.
- The drums mentioned in the construction and maintenance chapter were, in fact, 30 to 50 gallon metal drums with black and white stripes.

The 2009 MUTCD

The evolution of the Manual on Uniform Traffic Control Devices over the past half century has included new editions in 1971, 1978, 1988, 2000, 2003, and 2009, along with 22 revisions. The most significant changes include the following:

- The addition of new chapters devoted to low volume roads, school areas, railroads and light rail, and bicycles. Some chapters have grown in size; for example, the temporary traffic control chapter, which replace the previous one on construction and maintenance areas, has four times as many pages.
- Clear explanations are provided for the four text headings: Standards, Guidance, Option, and Support.
- Recent editions of the MUTCD provide considerably more detail on the minimum size of signs. Sizes are given for conventional roads, both single lane and multi-lane, and where relevant, for expressways and freeways; in addition, for those signs where it makes sense, a size is specified for oversized signs. The sizes are a Shall condition, meaning that they are required.
- The move to signs with symbols/pictograms began with the 1971 edition and has continued to expand. In the beginning, the manual noted:

  > Sometimes a change from word messages to symbols requires significant time for public education and transition. Consequently, this Manual includes educational plaques to accompany some new symbol signs. All symbol signs which are readily recognizable by the public may be erected without educational plaques. New warning or regulatory symbol signs not readily recognizable by the public shall be accompanied by an educational plaque which is to remain in place for at least 3 years after initial installation. No special effort need be made to remove educational plaques as long as they are in serviceable condition.

  The 2009 edition provides for the continued use of educational plaques, which may still be left in place as long as they are in serviceable condition; they're probably not the ones erected in the 1970s.

- Consider the differences between the earlier and current editions of the MUTCD. In the former, the R9-4 has the word message NO HITCH HIKING, while R9-4a was the symbol sign with a hand with a thumb and a red circle and slash. In the current edition, R9-4 is the

aforementioned symbol, while the word message is now R9-4a. The relatively simple divided highway crossing signs, R6-3 and R6-3a, has the words DIVIDED HIGHWAY in both editions; haven't motorists learned this by now? At perhaps a deeper level, the 1970s pictogram version of the DO NOT ENTER SIGN, adapted from the European sign design, incorporated the words DO NOT ENTER on the symbol. After more than 40 years, shouldn't we be able to assume that the equivalent of an educational plaque could be removed from this sign?

R6-3a

- The 2009 MUTCD section on warning signs makes extensive use of symbol signs; the following signs, now symbols, were either word signs or not included in the 1961 edition: Chevron, Truck rollover warning, Hill, Divided Highway/Ends, Vertical clearance, STOP/YIELD/Signal Ahead, Slippery When Wet, Shoulder Drop-off, Reduced Speed Limit Ahead, Merge signs, Two-way Traffic, Roundabout, Vehicle crossing signs, Non-vehicular crossing signs, and Playground.

- Two moves to symbols have been reversed. In the 1970s, the word signs for Narrow Bridge and Pavement Ends were both changed to symbols. In the 2001 edition, the symbol for Pavement Ends was switched back to the word message; the Narrow Bridge symbol was changed back to a word message in the 2003 edition.

- Another warning sign that was introduced in the 1970s with good attentions was dropped because of misuse by engineers and/or poor understanding by road users. The MUTCD stated:

  > The LIMITED DIGHT DISTANCE sign (W14-4), with supplemental Advisory Speed plate, is designed for use on vertical curves which do not have adequate safe stopping sight distance available. This type signing is not to be a substitute for sound engineering judgment that would warrant improving the sight distance by an engineering solution.

  It appears that some traffic engineers using this sign simply read the **sign message** without reading/understanding the caveats about *vertical curves* nor the requirement for an accompanying *Advisory Speed plate*; the latter point is especially critical in an era when positive guidance for motorists was an FHWA emphasis area. In the 2003 edition, the MUTCD introduced a more explicit word message HILL BLOCKS VIEW (W7-6) sign, noting that when used, *it should be accompanied by an Advisory Speed plaque.*
- Prior to the MUTCD 2000, there was some confusion regarding the Crash Experience

traffic signal warrant. Specifically, it was not clear if the traffic volume part of this warrant required 80% of the volume specified for the minimum traffic volume or interruption of continuous flow values, or if 80% of 70% (i.e., 56%) of the volume for roads with speeds in excess of 40 mph. This confusion was eliminated in the Millennium Edition, which clearly indicated that the traffic volume requirement was 80%, not 56%, for higher speed conditions. In the 2003 MUTCD, however, the traffic volume tables included a 56% column, and the text for the Crash Experience warrant indicated that "traffic volumes in the 56 percent columns in (the table) may be used in place of the 80 percent columns."

- The MUTCD 2000 included a new Part 5 on traffic control devices for low-volume roads, defined as facilities outside the built-up areas of cities with traffic volumes of less than 400 vehicles per day. The most notable accommodation for low-volume roads is reduced sign size, typically by 6 inches, for some signs. Among the signs that may use smaller sizes are YIELD, NO PARKING, two-direction large arrow, NARROW BRIDGE, PAVEMENT ENDS, truck crossing, and NO PASSING ZONE.
- Probably the most unique traffic sign in Part 5 that is not found elsewhere in the MUTCD is the NO TRAFFIC SIGNS sign, which may only be used on unpaved low-volume roads. However, the MUTCD does not go as far as the US Forest Service, which specifies lower speed values for curves and terms, and permits smaller letter sizes on some guide signs on its roads.

- Part III of the 1961 MUTCD was titled Highway Traffic Signals, but throughout it used the term *traffic signals*. By the 1971 edition, this was not enough; Part IV Signals referred to traffic control signals, beacons, lane-use control signals, drawbridge signals, emergency control signals, and train approach signals. Part 4 (no more Roman numerals) of the 2009 MUTCD identified eleven types of highway traffic signals: traffic control signals; pedestrian signals; hybrid beacons; emergency-vehicle signals; traffic control signals for one-lane, two-way facilities; traffic control signals for freeway entrance ramps; traffic control signals for movable bridges; toll plaza traffic signals; flashing beacons; lane-use control signals; and in-roadway lights. It's enough to make one wonder if those responsible for the MUTCD are being paid by the word.
- One could make a good case that the most significant and substantial changes between the 1961 MUTCD and the current edition involve control for construction and maintenance areas, now characterized as temporary traffic control (TTC). There are several reasons for this, including the fact that with the completion of the Interstate Highway System, the construction of new roadway alignments has evolved to the reconstruction of existing highways in the presence of vehicular and pedestrian traffic. The challenge is reflected by the fact that in some recent years, more than 1,000 construction workers and road users had died in work zones. Recent editions of the MUTCD have emphasized the need for temporary traffic control plans, knowledgeable individuals who have received proper training in plan design and certified individuals to place and maintain TTC devices. The MUTCD now includes 46 Typical Applications for projects ranging from moving operations to freeway projects.
- Part 7 of the 2009 MUTCD addresses the traffic control for school areas. This seems to be in response to the question that traffic engineers may hear at school meetings: "how

many children have to be killed before you will …?" Other than the change to fluorescent yellow-green for warning signs, there's not much new here that couldn't have been incorporated in the regulatory and warning sections of Part 2.

- The 2009 MUTCD devotes 42 pages to the intertwined topics of traffic control devices of railroad and light rail transit (LRT) grade crossings; this represents a substantial expansion from the treatment in the 1961 edition. Over this same period, railroad ton-miles of freight movement nearly tripled from 0.6 trillion to 1.7 trillion, and LRT passenger travel has grown exponentially. But highway fatalities at these crossings have decreased from nearly 1200 in 1960 to 270(est) in 2012. While programs like Operation Lifesaver obviously deserve some credit, the improvement of traffic control devices at and near these crossings clearly deserves some credit.

Conclusions

This admittedly soft research sought to answer a question that's simplistic on its surface - have 50 years of changes to the MUTCD produced a better document? The answer, if it exists, depends on the metric one chooses to use in the analysis. Because engineers are wont to consider measurements, it's relevant to note, as the abstract does, that the 2009 MUTCD is about five times the size of the 1961 version. Alternatively, assume that you want to print the current version doubled-sided on 24 lb paper; your version would weigh 5.2 lb, over four times as much as the 1.2 lb for the 1961 edition.

Eight of the 25 individuals on the National Joint Committee for the 1961 MUTCD were identified earlier; six of these served as president of ITE. The February 2013 membership of the National Committee on Uniform Traffic Control Devices consisted of 61 members and associate members; only one has served as president of ITE. This is not intended to disparage the current membership, but rather to note that ITE participation is not at the highest level.

The 2009 MUTCD contains more standards than the 1961 edition, as reflected by the use of the word **shall**. For example, in Chapter 2B of the current edition, **shall** or **shall not** is used 192 times. In the corresponding chapter on regulatory signs in the 1961 edition, **shall** or **shall not** is used 115 times, but 35 of those are statements about minimum sign size, e.g. The STOP sign *shall have a standard size of 30 inches by 30 inches*. By comparison, in the 2009 MUTCD, regulatory sign sizes are specified in Table 2B-1, with a single use of **shall**, i.e., *Except as provided in Section 2A.11, the sizes for regulatory signs shall be as shown in Table 2B-1*. Therefore, the net use of **shall** and **shall not** for regulatory signs has grown from 80 to 191. A similar pattern is found in Chapter 2C for warning signs. Excluding the 12 **shall** and **shall not** in this chapter of schools and railroads (which have a separate chapter in the 2009 edition), the net use has increased from 57 to 108. Although both editions stress the importance of engineering studies and engineering judgement, the more extensive specification of standards through the use of **shall** and **shall not** clearly limits *imaginative application of the standards and principles* encouraged by the 1961 MUTCD.

Nevertheless, the 2009 MUTCD contains some improvements, several actually introduced in intermediate editions. In the opinion of this author, the most significant/meaningful changes are:

- Expanded coverage of temporary traffic control, including numerous typical applications and details on personnel qualifications

- Greatly expanded and detailed coverage of traffic control at rail-highway grade crossings
- Introduction, over time, of the colors brown, fluorescent pink, fluorescent yellow-green, orange, and purple, allowing road users to sense the nature of the message before being able to read it
- The incorporation of 259 definitions in Chapter 1, standardizing terminology throughout the entire MUTCD
- Increased size of sign faces and traffic signal lenses to enhance visibility
- Revision and enhancement of guidelines, initially introduced in 1988, on the advance placement of warning signs for various conditions
- Considerably more detail on sign letter size and style (font), especially for guide signs, providing a benefit to all road users but especially senior citizens
- Extra attention devoted to often neglected road users, school children and bicyclists, each now having their own chapters with signing and marking examples
- Special attention devoted to the traffic control needs on low-volume rural roads for the numerous counties that have them
- Two concomitant advancements closely related to the MUTCD, the enhanced 2004 edition of the Standard Highway Signs book and the dramatic improvements in retroreflective sheeting for signs, provide opportunities for better design and application of traffic control devices.

References

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