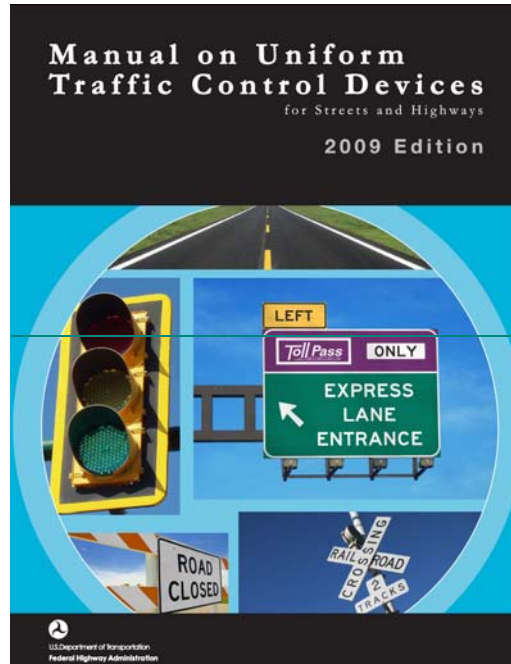


Highlights of the 2009 Edition of the MUTCD

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A new edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) is here! The 2009 MUTCD incorporates many new Standards, Guidance, and Option statements that reflect the advancing state of the art and practice in traffic control devices, as well as successful safety research, new technologies, and important operational strategies such as tolling and managed lanes. The MUTCD is the national standard with which all States and local highway agencies must comply. You can access the 2009 MUTCD on-line and also find out where to purchase it in printed form at <http://mutcd.fhwa.dot.gov>.

The Final Rule for the 2009 MUTCD was published in the Federal Register on December 16, 2009, culminating a rulemaking process that began in January 2008, when the Federal Highway Administration (FHWA) published a Notice of Proposed Amendments (NPA) to the 2003 MUTCD. About 2,000 letters containing more than 15,000 comments to the docket were received in response to the NPA and these were all analyzed and considered by FHWA in making decisions on the content of the 2009 MUTCD.

Highlights of the significant changes and additions that are included in the 2009 Edition of the MUTCD are described in this article.

General

- **MUTCD Format and Style** – In addition to its new cover, the 2009 MUTCD looks slightly different from previous editions. Paragraph numbers are now provided in the margins for each paragraph of each section, in order to aid practitioners in referencing

the MUTCD, as well as to assist readers of future MUTCD notices of proposed amendments. Additionally, Guidance statements in the 2009 MUTCD are now shown in italics to better distinguish them from Option and Support statements.

- **English Units Only** – Because metric units are not currently used in the U.S. for traffic control device applications, the new MUTCD only uses English units in the text, figures, and tables. This change provides a document that is less cumbersome to read and apply and is consistent with the current FHWA policy that the use of metric measurements is optional in all FHWA documents. To preserve the soft conversions of the English-to-metric values in the MUTCD, the new MUTCD has an Appendix that lists the metric equivalent values for all English unit values used in the MUTCD.

Introduction

- **Applicability to Private Roads Open to Public Travel** – Clarification has been added that, for the purpose of MUTCD applicability, the phrase “open to public travel” shall include toll roads and roads within shopping centers, airports, sports arenas, and other similar business and recreation facilities that are privately owned but where the public is allowed to travel without access restrictions. This reflects the 2006 modifications to the Code of Federal Regulations (23 CFR 655) to add this definition. The new MUTCD text further clarifies that except for gated toll roads, private gated properties where public access is restricted at all times shall not be considered to be open to public travel. In regard to parking lots and garages, there are some MUTCD provisions that do not easily translate to conditions typically found in parking facilities. Therefore, in the new MUTCD, parking spaces and driving aisles in parking facilities, both privately and publicly owned, are exempted from MUTCD applicability. Additional future consideration will be needed to determine appropriate and feasible standards and guidance for the application of traffic control devices in parking facilities. The MUTCD continues to be applicable to ring roads, access and circulation roads, and driveways on private property open to public travel, and MUTCD general principles and standard traffic control device designs should be used in parking facilities to the extent feasible.
- **Compliance Dates** – “Compliance dates” only refers to dates for bringing existing devices in the field into compliance with new Standards. As soon as a new MUTCD (such as the 2009 Edition), or a revision to the MUTCD, becomes effective in a State (this ranges from immediately to 2 years after the Federal Register final rule, depending on the State), any new devices being installed and any device replacements or rebuilds must be devices that comply with the new Standards. However, in regard to existing devices in the field, most of the significant new Standards in the 2009 MUTCD have no specific compliance date for bringing existing devices in the field into compliance with the new requirements. Each State is required by Federal law and regulations to have a systematic program of upgrading substandard devices in the field to meet new MUTCD standards, and generally this is done by replacing non-compliant devices at the end of their service life or when they need to be replaced because of roadway reconstruction or other events. For only 11 of the new Standards

in the 2009 edition, FHWA has established specific compliance dates to retrofit or replace non-compliant devices that exist in the field because of critical safety considerations that would occur if only the “systematic upgrading” (end of service life) provisions were relied upon, or because the new Standard requires a critical safety action (such as a study or a retiming of signals) that is not directly related to the service life of the device. For these 11 new compliance dates, specific dates (December 31 of a particular year) have been set, rather than the previous practice of setting compliance dates as a certain number of years from the effective date of the final rule.

Part 1 – General

- **New Color (Purple)** – The color purple is now assigned for exclusive use to indicate facilities or lanes restricted to use only by vehicles with registered electronic toll collection (ETC) accounts, in order to readily identify such facilities or lanes using signs and pavement markings. Purple is not appropriate for use on signs and markings if any vehicle is allowed to use a toll facility or lane even if it does not have a registered toll collection account, such as where the facility takes photos of license plates and sends bills for the toll by mail. Specific applications of purple for use in signs and markings are identified and prescribed in detail in newly-created chapters in Parts 2 and 3 for toll-related signing and pavement markings and for preferential and managed lane signing and pavement markings.
- **Definitions** – All definitions now appear in Part 1 (Section 1A.13), rather than being dispersed throughout the Manual. Many existing definitions from other Parts of the MUTCD have been relocated to Section 1A.13, approximately 70 new definitions for words and phrases used in the MUTCD have been added, and approximately 35 existing definitions have been revised.

Part 2 – Signs

- **New Signs and New Standard Symbols** – Many new uniform sign designs for regulatory, warning, and guide signs have been added to the MUTCD based upon the Synthesis of Signs developed by FHWA of signs in common use in the States. Additionally, a variety of new symbols have been added to the set of standard sign symbols such as the roundabout directional arrow and symbols for the pedestrian pushbutton, photo enforcement, pay to park, and for toll plaza signing.
- **Sign Lettering and Legibility** – Based upon definitive older driver research, the recommended convention for legibility in relation to the height of lettering has been revised to be 30 feet of legibility for each 1 inch of letter height. This corresponds to the needs of a person with 20/40 visual acuity, at which drivers are eligible for licensure in the majority of the states.
- **Place Names and Destinations Shall Be in Mixed-Case Lettering** – The option to use all upper-case lettering for place names and destination has been discontinued,

based upon research that has demonstrated that mixed-case legends for destinations and roadway names provide improved recognition distances for these types of legends.

- **Larger Size Signs for Multi-Lane Conventional Roads** – Where supplementary regulatory and warning signs of conventional road size cannot be placed on the left-hand side of a multi-lane roadway with a speed limit of 40 mph or higher, larger size signs are required for some critical regulatory signs and for all warning signs. Additionally, 36” x 36” STOP signs are required for all multi-lane approaches and for side road approaches to multi-lane roads that have speed limits of 45 mph or more.
- **New Provisions for the Establishment of Right-of-Way Control** – MUTCD provisions on establishment of right-of-way control at intersections has been significantly rewritten to comprehensively address a hierarchy of no control, yield control, stop control, and multi-way stop control. Specific criteria are provided in terms of traffic volumes and crashes and other engineering conditions.
- **Signing for Jughandle Intersections** – New designs for regulatory and guide signs for jughandle intersections have been added to the MUTCD to address road user information needs at the increasing number of locations with this geometric design, which can violate road user expectancy regarding direction of left and U-turns.
- **Revised Requirements for ONE WAY or KEEP RIGHT Signing for Divided Highways** – Based upon research for older drivers, for divided highways with median widths of less than 30 feet, either ONE WAY signs on the near right and far left corners are required or KEEP RIGHT signs are required in the median noses of the divided highway. A compliance date of December 31, 2019, has been established for installing any additional signs to meet these new requirements at existing intersections.
- **Overhead Lane-Use Control Signs** – A new recommendation has been added that overhead lane control signs should be installed over the appropriate lanes on signalized approaches where lane drops, multiple-lane turns with shared through-and-turn lanes, or other lane-use regulations that would be unexpected by unfamiliar road users are present. This will enhance safety and efficiency by providing for more effective signing for these potentially confusing situations.
- **New Roundabout Sign Designs** – A new horizontal rectangle design with black chevron symbols on a white background is now recommended for application in the central island of a roundabout facing traffic approaching the roundabout. Also, the option of using fish-hook style arrows on regulatory lane-use control signs for approaches to roundabouts has been added.
- **New Pedestrian Pushbutton Symbol and Signs** – Based upon successful application in Canada, a new symbol for use on pedestrian pushbutton signs has been adopted and many pushbutton signs have been revised to incorporate the symbol.

- **New Ramp Metering Sign Designs** – To provide uniform regulatory and warning sign designs, new signs with legends such as ONE VEHICLE PER GREEN and RAMP METERED WHEN FLASHING have been adopted for optional use for ramp metering applications.
- **Barricades and Object Markers Moved to Part 2** – Provisions for the sign design elements of barricades have been moved from Part 3 to Chapter 2B, and provisions for object markers have been moved from Part 3 to Chapter 2C, because these devices are now considered to be signs rather than markings.
- **New Provisions for Traffic Gates** – Chapter 2B now has a section providing consolidated provisions for gates, which are used not only at highway-rail grade crossings, but also for many other applications. The most significant change regarding gates is that the red and white stripes on gates are now required to be vertical rather than diagonal, in order to not encourage road users to go around the gate.
- **Fluorescent Yellow-Green Color** – The use of a fluorescent yellow-green background color for pedestrian, bicycle, and playground warning signs remains optional; the use of a fluorescent yellow-green background color is now required for school warning signs.
- **Warning Signs for Horizontal Curves** – Where the differential between the posted speed on the tangent and the recommended curve advisory speed is more than 10 mph, the application of advance horizontal curve warning signs is now required. Where the differential speed is 15 mph or more, the application of chevron warning signs is now required. Also, new criteria are now provided for determining the recommended curve advisory speed. These changes are aimed at improving safety at horizontal curves, where 28 percent of all highway fatalities occur. A compliance date of December 31, 2019, has been established for installing any additional signs to meet these new requirements at existing horizontal curves.
- **Many New Warning Sign Designs** – New warning sign designs have been added, such as combined Horizontal Alignment/ Advisory Exit and Ramp Speed, Freeway and Expressway Ends, All Traffic Must Exit, Shoulder Ends, No Shoulder, Shoulder Drop-Off, Uneven Lanes, Fallen Rocks, Gusty Winds Area, Fog Area, Road May Flood, large animals, New Traffic Pattern Ahead, Ramp Metering, Offset Side Roads, and combined Pedestrian and Bicycle Crossing.
- **Warning of Speed Limit Reductions of More than 10 mph** – New text recommends that a Reduced Speed Limit Ahead (W3-5) sign should be used to inform road users of a reduced speed zone where the speed limit is being reduced by more than 10 mph, or where engineering judgment indicates the need for advance notice to comply with the posted speed limit ahead.

- **New Definition and Applications for Pictographs on Guide Signs** – The use of pictorial representations of the official seal of governmental jurisdictions or agencies, military bases, or government-approved colleges, universities, or institutions, as well as the logo of a toll payment system, is now permitted on certain guide signs, such as Street Name and political boundary signs. However, limitations on size and designs of such pictographs are also specified.
- **New Provisions for Background and Legend Colors on Street Name Signs** – It is now allowable to use blue, brown, or white as an alternative to green as the background color on Street Name signs. The legend color with green, blue, and brown backgrounds shall be white. For white backgrounds, the legend color shall be black. Limiting to these color combinations retains the same levels of contrast as when used on other types of signs while reserving other color combinations, such as white on red, for more critical uses such as STOP and Do Not Enter signs.
- **Guide Signs on Multi-Lane Conventional Road Approaches to Freeway and Expressway Entrance Ramps** – A new provision requires guide signs to indicate the direction of turn to enter a freeway or expressway on multi-lane conventional road approaches to interchanges. This information is critical on multi-lane approaches because it allows the driver to choose the proper lane well in advance of the turn and reduces the need for erratic lane changes and disruption to the traffic flow in the immediate vicinity of the entrance ramp. A compliance date of December 31, 2019, has been established for installing any additional signs to meet these new requirements at existing interchange approaches.
- **Design and Use of Community Wayfinding Guide Signs** – Community Wayfinding Guide signs have become increasingly prevalent within cities and local urbanized areas to direct road users to key civic, cultural, visitor, recreational, and other local destinations. The design and placement of these signs currently vary widely and the aesthetics of the sign assemblies are often prioritized above the effective conveying of information to the observer in a dynamic driving environment. New provisions have been added that describe the allowable methods of implementing these optional signs, including criteria for design elements such as background and legend color, legend height, the number and order of destinations, and the placement of directional arrows. The new provisions bring uniformity of critical design elements to this type of signing, but a level of flexibility is maintained to establish identity for these signs on a community level and to adequately distinguish them from other guide signs to primary destinations, the latter of which have primacy in placement and prominence over Community Wayfinding Guide signs. Community Wayfinding Guide signs are not considered to be a replacement for standard Guide signs that display direction to nearby cities, highways, and streets; such information is not allowed to be incorporated into a Community Wayfinding Guide sign.
- **Guide Signs for Option Lanes and Freeway and Expressway Splits** – New provisions have been added that significantly change the manner in which splits and

option lanes are signed. A new concept that uses an upward-pointing arrow above each lane has been found to more positively convey lane use, specifically in the case of an option lane, in which traffic has the option to choose either route from that lane. Previously, this condition was signed using diagrammatic signs on which lane lines were displayed on a single large arrow at the center of the sign. This design required interpretation of very fine details by the observer at high speeds, with only the message of general direction clearly communicated while the presence of the option lane was subtle and often lost. The new design, called the Overhead Arrow-per-Lane sign, is required for new and reconstructed facilities. Existing facilities may continue to use the previous designs for diagrammatic signing where the existing overhead sign support structures are still serviceable. Where dedicated lanes exist at a major split and no option lane is provided, the use of down arrows to positively convey lane assignment is required; the use of diagrammatic signing for this condition is no longer recommended. Additional recommendations for signing are provided for intermediate and minor interchanges that have option lanes with multi-lane exit ramps, featuring a combination of overhead guide signs and post-mounted regulatory lane-use signs to indicate the presence of the option lane.

- **New Requirement for the Designation of Exits to the Left** – Freeway and expressway exits to the left continue to violate driver expectancy. In response, a recommendation in the 2003 MUTCD has been expanded to a requirement to address both numbered and non-numbered exits to the left. A black-on-yellow LEFT plaque is now required at the top left edge of the advance and exit direction guide signs for all non-numbered exits to the left. For numbered exits, a black-on-yellow LEFT panel has been incorporated into the exit number plaque, and is required at the top left edge of all advance and exit direction guide signs for numbered exits to the left. A compliance date of December 31, 2014 has been established for this change on existing signs to reflect a recommendation by the National Transportation Safety Board regarding recent findings about the operation of exits to the left.
- **New Chapter for Signing of Toll Roads** – New provisions have been added that cover regulatory, warning, and guide signs on toll roads and at toll plazas. Included are such items as toll rate signs and guide signing for entrances to toll highways that use various collection modes such as cash, electronic toll collection only (requiring registration in a toll account program), or electronic toll collection using license plate character recognition in which users are billed. Criteria for guide signs on toll plaza canopies and the approaches to toll plazas and open-road tolling lanes are also provided.
- **New Chapter for Signing of Preferential and Managed Lanes** – The existing information for signing of preferential lanes has been relocated to a new chapter and has been significantly expanded to address signing for managed lanes, with specific emphasis on priced managed lanes that offer an alternative to adjacent congested freeway lanes along the same route. Regulatory, warning, and guide signs for these facilities are combined in this new chapter. Additional provisions are included that address signing for variable toll rates and comparative travel times.

- **New Chapters for General Service and Specific Service Signs** – The existing information for General and Specific Service signs has been relocated to two new chapters. For Specific Service signs, up to 12 logos for one service type are now permitted to be displayed on two separate signs that follow one another in sequence. The maximum number of logos on any one sign assembly remains at six, and the maximum number of Specific Service signs on the approach to an interchange remains at four. Provisions are now included to permit the display of supplemental messages that convey essential information about the business operation within business logo panels, such as the hours of operation, accessibility for larger vehicles, availability of alternative fuels, or the designation of the business as an Interstate Oasis facility.
- **New Chapter for Changeable Message Signs** – Provisions for changeable message signs have been significantly expanded based on the results of several research evaluations. Among the expanded provisions are criteria on legend height, color, number of phases per cycle, and display time for each phase of message. Further, these signs are now distinguished from other signs with changeable legends that display only limited, pre-programmed messages at any one time, such as non-electronic display changeable message signs and electronic-display blank-out signs, commonly used for facility closures and part-time turn prohibitions. Additional information specific to portable changeable message signs is included in Part 6.

Part 3 – Markings

- **Dotted Lane Lines for Non-Continuing Lanes** – Dotted lane lines, rather than broken lane lines, are now required to be used for non-continuing lanes, including lane drops approaching interchanges and intersections, auxiliary lanes up to 2 miles in length between two freeway ramps/interchanges or up to 1 mile in length between two intersections, and acceleration and deceleration lanes. The use of a normal broken lane line for any of these types of non-continuing lanes does not adequately inform road users of the lack of lane continuity ahead. Dotted lane lines will reduce any confusion about the function of these lanes. The new Standards require the dotted lane line to be “wide” for lane drops and auxiliary lanes, and “normal” width for acceleration and deceleration lanes. A compliance date of December 31, 2016, or resurfacing, whichever occurs first, has been established for replacing any existing broken lane lines with dotted lane lines for the specified conditions. It should be noted that the provisions for lane lines at lane-reduction transitions that occur between interchanges or intersections have not been revised and are to continue to be marked as provided in the 2003 Edition. However, new guidance has been added recommending the use of lane-reduction arrows where the lane-reduction transition occurs on a road with speeds of 45 mph or higher.
- **Revised Conditions for Providing Marked Crosswalks across Uncontrolled Approaches** – Guidance has been added that the provision of crosswalks across uncontrolled approaches (midblock or at intersections with minor side roads) should

be based on engineering judgment and engineering studies that consider volumes, speeds, number of lanes, the presence of a median, and various other appropriate factors. Guidance has also been added, based on the findings of an FHWA report entitled, “Safety Effects of Marked versus Unmarked Crosswalks at Uncontrolled Locations,” that new marked crosswalks alone (without other substantial measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence) should not be installed across uncontrolled roadways having four or more lanes, a speed limit exceeding 40 mph, and an ADT of 12,000 or 15,000 (without or with a raised median or pedestrian refuge island, respectively.)

- **New Markings for “Do Not Block Intersection,” Speed Reduction, and Route Shields** – Provisions have been added for specific markings to use when it is necessary to indicate that it is illegal for a driver to block an intersection. These optional markings are useful when a downstream condition, such as a signalized intersection, creates a queue of traffic that impacts the safety or operation of an upstream location. The provisions include four options, including word messages such as DO NOT BLOCK or KEEP CLEAR, a white “box,” and cross-hatch markings. Optional speed reduction markings have also been added. These are transverse “tick marks” that may be placed on the roadway within a lane, in a pattern of progressively reduced spacing to give drivers the impression that their speed is increasing. These markings have been found by various studies to be effective in reducing approach speeds. Speed reduction markings should be reserved for approaches to unexpected curves and should not be used in areas frequented mainly by local or familiar drivers. New provisions also have been added to allow the use of appropriate route shield pavement marking symbols for Interstate as well as other numbered routes, and a figure illustrating them is included. These types of markings can be very useful in guiding road users to their destinations. Pavement marking colors other than red/white/blue for Interstate shield markings and white for U.S. and State route shield markings now can also be used for route shield markings if they simulate the colors of official route shield signs, such as those of some States that use different colors for their State route shield signs.
- **Roundabout Markings** – A new Chapter 3C has been added that includes updated practices for pavement markings at roundabouts, including lane lines, edge lines, yield lines, crosswalk markings, and pavement word, arrow, and symbol markings. Chapter 3C includes more than a dozen new figures that illustrate examples of markings for roundabouts of various geometric and lane-use configurations, reflecting the state of the practice. For multi-lane roundabouts, safe and efficient operation dictates that specific markings be used to enable drivers to choose the proper lane before entering the roundabout, and to enable the driver to exit from the roundabout without having to change lanes while in the circulatory roadway. Chapter 3C emphasizes this principle. Also included are optional fish-hook lane-use arrows, which complement similar optional type arrows on roundabout regulatory and guide signing. Either fish-hook style lane-use arrows or normal lane-use arrows may be used on roundabout approaches.

- **New Chapters for Preferential Lane Markings and Toll Plaza Markings** – The existing information for marking of preferential lanes has been relocated to a new Chapter 3D and has been expanded to cover markings for buffered and counter-flow preferential lanes. Also, a new Chapter 3E has been added with provisions for markings specifically applicable to toll plazas, including the optional use of purple markings as a supplement to lane lines approaching an ETC Account-Only lane at a toll plaza.
- **Delineation of Guard Rail and Barriers** – Guidance has been added that delineators should be used wherever guard rail or other longitudinal barriers are present. Guard rail and barriers are typically located close to the roadway, and delineation of these features will not only enhance delineation of the roadway alignment but also make road users aware of the potential to collide with the barrier during conditions of darkness. Also, a new option now permits the use of delineators mounted on the face of or on top of guard rails or other longitudinal barriers in a very closely-spaced manner, so that they are continuous or nearly continuous. This type of application, typically referred to as “ribbon delineation,” can improve safety and visibility, particularly on sharp curves. This practice is now permitted, as long as the delineation color matches the color of the adjacent edge line.

Part 4 – Highway Traffic Signals

- **Revised and New Signal Warrants** – Warrant 4, the Pedestrian Volume Warrant, has been significantly revised, based on an extensive NCHRP research study. The former warrant’s criteria are replaced with two new criteria that are based on a combination of vehicular and pedestrian volumes for either four hours or a single peak hour, and only one of the criteria needs to be met. Similar to Warrants 2 and 3, points are plotted on a graph. The net effect of the revisions is that Warrant 4 is slightly easier to meet with lower pedestrian volumes on streets with high vehicle volumes, but it is slightly more difficult to meet on streets with low vehicle volumes. Also, a new Warrant 9 has been added for use at locations where the proximity of the intersection to a highway-rail or highway-LRT grade crossing is the principal reason to consider installing a traffic control signal, and other warrants are not met. This new warrant is added because at some stop-controlled approaches to intersections just beyond a grade crossing, the stop line is closer to the track than the length of a long vehicle, and sight distances might preclude the long vehicle from waiting on the upstream side of the grade crossing before entering the intersection. The new warrant is based on a research study and includes risk-based adjustment factors such as the amount of rail traffic per day, the percentage of tractor-trailer trucks, and the percentage of high-occupancy buses.
- **Flashing Yellow Arrow and Flashing Red Arrow for Permissive Turns** – In 2006, the FHWA issued an Interim Approval for the use of a flashing yellow arrow signal indication in a separate signal face as an optional alternative to a circular green signal indication for permissive left-turn movements, and this display is now in use at 500 or more intersections in 30 States across the U.S. The provisions of the Interim

Approval have now been incorporated into the MUTCD. Research found that a flashing yellow arrow is the best overall alternative to the circular green as the signal display for a permissive left-turn movement. The flashing yellow arrow has a high level of understanding and correct response by left-turn drivers and a lower fail-critical rate than the circular green. The flashing yellow arrow display in a separate signal face for the left-turn movement also offers more versatility in field applications. It is capable of being operated in any of the various modes of left-turn operation by time of day, and it is easily programmed to avoid the “yellow trap” that is associated with some permissive left turns at the end of the circular green display. A logical extension is the application of flashing arrow indications for right-turn movements. This has also been added to Part 4 for optional use in separate right-turn signal faces, to provide jurisdictions with a useful tool to effectively control a wide variety of situations involving right turns. A new option has also been added allowing the use of a flashing red arrow for permissive turn movements, but only in certain unusual circumstances where an engineering study determines that each successive vehicle must come to a full stop before making the turn permissively.

- **Upgraded Signal Design Provisions** – (1) *12-inch signal indications* are now required for all new signal faces, with six specific exceptions that allow 8-inch signal indications for approach speeds of 30 mph or less and in some other applications where 8-inch indications can be advantageous. Existing 8-inch signal indications are “grandfathered” in, allowing them to be retained for the remainder of their useful life. The predominant current signal design practice is to use all 12-inch signal indications regardless of speeds, resulting in significant safety benefits. (2) *Displays for permissive left turns* – A new recommendation has been added that, for new or reconstructed signals, signal faces containing a circular green signal indication for a permissive left-turn should not be located overhead above an exclusive left-turn lane or the extension of the lane, nor should they be post-mounted on the far side median in front of the left-turn lane. That display causes the largest amount of driver confusion and inappropriate behavior when turning left and a higher left-turn crash rate than “shared” displays with a circular green that is placed over the lane line between the left-turn lane and the adjacent through lane, or to the right of that lane line. In conjunction with this change, provisions that previously allowed what has been called “Dallas phasing” displays have been eliminated. (3) *High-speed approaches* – For new or reconstructed signals on approaches with speeds of 45 mph or higher it is now recommended to locate signal faces overhead on the far side (rather than at the roadside or in the middle of the intersection on diagonal spans or mast arms), provide one overhead signal face per through lane when there is more than one through lane, provide supplemental near-side and/or far-side post-mounted faces for added visibility, and include backplates on the signal faces. Reconfiguring diagonal spans to box spans or mast arm layouts with far-side signal face locations has been shown to produce major reductions in the number of red light violations and entries into the intersection late in the yellow change interval. These design and layout provisions (far-side face-per-lane, backplates, and supplemental faces) should also be considered for any major urban or suburban arterial street with four or more lanes, even if the approach speeds are less than 45 mph. (4) *Red arrows for*

protected-only left turns – Red arrow indications, rather than circular red, must now be used for protected-only mode left-turn signal faces. Red arrow signal indications have been in use for over 35 years, are extensively implemented for protected turn movements in the majority of the States, are well understood by road users, present a clear message regarding which movement is prohibited when the red indication is displayed, and eliminate the need for a supplemental LEFT TURN SIGNAL sign. (5)

Backplate borders – The optional use of a yellow retroreflective strip along the perimeter of a signal backplate to increase the conspicuity of the signal face at night has been added. During night-time power failures, the retroreflective backplate borders also help road users identify the presence of a signalized intersection where they need to exercise extra caution or treat it like a 4-way stop. This option was given Interim Approval in 2004 and has been put into use by an increasing number of jurisdictions.

- **Yellow Change Intervals and Red Clearance Intervals** – It is now required that the durations of the yellow change interval and, when used, the red clearance interval, shall be determined using engineering practices, rather than “rules of thumb” or randomly. Engineering practices for determining the durations of these intervals are identified as being found in two books published by the Institute of Transportation Engineers. Also, when the application of engineering practices indicates that a red clearance interval is needed to provide additional time before conflicting movements are released, it is now recommended that such an interval be provided. Safety studies have documented significant reductions in crashes when jurisdictions have revised the durations of the yellow change and red clearance intervals using the accepted engineering practices. The new requirement to use engineering practices for determining durations of yellow change and red clearance intervals has a specific compliance date of December 31, 2014 or when timing adjustments are made to the individual intersection and/or corridor, whichever occurs first.
- **Back-up Power for Signals with Railroad Preemption** – New Guidance has been added that agencies should provide back-up power supplies for traffic control signals that have railroad preemption or that are coordinated with railroad flashing light signal systems (except for traffic control signals interconnected with light rail transit systems) to ensure that the primary functions of the interconnected signal systems still function in a safe manner in the event of a power failure.
- **Revised Pedestrian Signal Timing Provisions** – As a result of research that has demonstrated the need to use lower walking speeds to accommodate a larger percentage of the walking public, the recommended walking speed for calculating the pedestrian clearance time has been reduced from 4 feet per second to 3.5 feet per second, except where extended pushbutton presses or passive pedestrian detection has been installed for slower pedestrians to obtain additional crossing time. Also, the total of the walk interval and pedestrian clearance time should be long enough to allow a pedestrian to walk from the pedestrian detector to the opposite edge of the traveled way at a speed of 3 feet per second. If this second calculation finds that sufficient crossing time is not available, additional time should be added to the walk

interval. A new requirement has also been added that requires a “buffer” interval of at least 3 seconds between the end of the pedestrian change interval (flashing upraised hand display) and the release of any conflicting vehicular movements. During the buffer interval, a steady upraised hand must be displayed. The sum of the time of the pedestrian change interval and the buffer interval shall not be less than the calculated pedestrian clearance time. The buffer interval must start during the green interval or yellow interval and cannot start after the beginning of the red clearance interval, if a red clearance is used. This new buffer interval provides a margin of safety of at least 3 seconds that allows a pedestrian who underestimates the time needed to cross a roadway, with or without a countdown display, to better avoid a conflict with a vehicle. The new requirements for a buffer interval and that the pedestrian change interval shall not extend into the red clearance interval have a specific compliance date of December 31, 2014 or when timing adjustments are made to the individual intersection and/or corridor, whichever occurs first.

- **Pedestrian Countdown Displays Are Now Required** – Pedestrian countdown displays, which have previously been optional, are now required for all new installations of pedestrian signals, except where the duration of the pedestrian change interval is 7 seconds or less. A comprehensive multi-year study of several hundred intersections with and without pedestrian countdown displays in San Francisco found that the addition of the countdowns produced significant reductions in pedestrian-vehicle crashes, as well as in all types of crashes. An option allows pedestrian countdown displays to be used even if the pedestrian change interval is 7 seconds or less.
- **Revised Provisions for Pedestrian Pushbutton Locations and Accessible Pedestrian Features** – Revisions have been made to the Guidance on the location of pedestrian pushbuttons, to make the button locations more consistent, put them within easy reach of pedestrians, make it obvious which button applies to which crosswalk, and position the pushbutton poles in optimal locations for future installation of accessible pedestrian signals (APS). Various revisions in the provisions regarding APS have also been made, reflecting recent research, including new requirements for the use of locator tones, tactile arrows, speech walk messages, and a speech pushbutton informational message if two APS pushbuttons need to be located on a single pole.
- **Hybrid Beacons** – New devices called the Pedestrian Hybrid Beacon and the Emergency-Vehicle Hybrid Beacon have been added for optional use. These hybrid beacons combine the features of a traffic control signal and a warning beacon, and they warn and control traffic at unsignalized marked crosswalk locations or emergency-vehicle access points. The signal faces used for these devices contain a circular yellow signal indication centered below two circular red signal indications, and they are dark between activations. The Pedestrian Hybrid Beacon is basically what has been known as the “HAWK,” which has been found to be extremely effective in studies in Arizona and elsewhere. The Pedestrian Hybrid Beacon displays steady red when the “walk” is displayed, and changes to alternating flashing

red while the flashing upraised hand is displayed, allowing vehicles to proceed, after a full stop, if the pedestrians have already cleared the driver's path. The Emergency-Vehicle Hybrid Beacon operates similarly to accommodate an egressing emergency vehicle, but typically goes directly to alternating flashing red without a steady red interval. Both of these types of hybrid beacons are not intended to be used at intersections and should be located at least 100 feet from any intersection that has a STOP-sign controlled side street.

- **Highway Traffic Signals at Toll Plazas** – A new Chapter 4K has been added that provides for the application of highway traffic signals at toll plazas. This includes red-yellow-green traffic control signals, lane-use signals, and flashing beacons. A new Standard states that traffic control signals and devices that resemble traffic control devices with red or green circular indications shall not be used at toll plazas to indicate the open/closed status of toll lanes – because lane-use control signals are the appropriate uniform device that shall be used for displaying lane open/closed status at toll plazas. There is also new Guidance that devices with red or green circular indications should not be used for new or reconstructed installations at toll plazas to alternately direct drivers making cash payments to stop and then proceed, or to indicate the success or failure of electronic toll payments. There are a variety of other devices, such as changeable message signs or other displays that do not resemble traffic signals that are being successfully used by toll agencies for these purposes. Additionally, an option has been added that allows warning beacons mounted on toll plaza islands, toll plaza impact attenuators, or toll booth ramparts to be mounted at a height which is appropriate for viewing in the toll plaza context, even if that height is lower than the normal minimum height above the pavement.

Part 5 – Traffic Control Devices for Low-Volume Roads

- **Applicability of Part 5** – A clarification has been added that Part 5 shall apply only outside of built-up areas of cities, towns, and communities and shall not apply to neighborhood and residential streets.
- **Center Lines** – For consistency with Part 3, a provision has been added in Part 5 stating that center lines may be placed on low-volume roads with or without edge lines.

Part 6 – Temporary Traffic Control

- **High-Visibility Apparel** – Provisions have been added to Chapters 6D and 6E that require all workers, including flaggers, to wear high-visibility apparel meeting the ANSI 107-2004 Class 2 or 3 standards. The requirement applies to all workers, including emergency responders, within the right-of-way who are exposed to either traffic or work vehicles, on all roads open to public travel (not just Federal-aid highways, on which this requirement has already been in effect). There is an option for law enforcement and other emergency responders to wear a garment meeting the ANSI 207-2006 standard. There are also some exceptions for these workers under

certain conditions. A compliance date of December 31, 2011, has been established for these provisions regarding high-visibility apparel on roads that are not Federal-aid highways.

- **Pedestrians** – The provisions for pedestrians, including those with disabilities, have been reorganized to include all of the ADA provisions and requirements in one section. These provisions were previously scattered throughout and repeated in Part 6. New devices have also been added that may be used to provide guidance for pedestrians.
- **Automated Flagger Assistance Devices** – Automated Flagger Assistance Devices (AFADs) have been added in Chapter 6E as acceptable optional devices to use for controlling traffic in temporary traffic control zones. These devices have undergone extensive experimentation and use following the issuance of an Interim Approval for their use in 2004. There are two types of AFADs, one that uses a STOP/SLOW sign to provide the message and one that incorporates a two-color traffic signal face with a gate arm to positively convey the message to approaching road users. AFADs are not to be used instead of flaggers, but are to be operated by flaggers as a different method of controlling traffic.
- **Revised Provisions for Arrow Boards** – In Typical Applications 37, 38, 39, 42, and 44, a new requirement is added that an arrow board shall be used for all freeway lane closures and that a separate arrow board shall be used for each closed lane when more than one freeway lane is closed. An arrow board is essential for safety at all lane closures on freeways because of the high speeds. Also, a new caution pattern has been added for arrow boards. Several agencies conducted experiments with an alternating diamond pattern – one on the left-hand and then the right-hand side of the board, to convey a “caution” message to approaching road users. Based upon the positive results of these experiments, this pattern has been added and may be used in addition to the horizontal row of lights or the 4-corner light display.
- **Delineation of Temporary Paths** – The sections describing the use and requirements for temporary pavement markings have been revised to clarify their intent. There are many methods that can be used to delineate a temporary path to road users through a temporary traffic control zone. Pavement markings are one method, but for some applications, the use of channelizing devices provides a better method.

Part 7 – Traffic Control for School Areas

- **Fluorescent Yellow-Green School Warning Signs** – The use of fluorescent yellow-green as the background color for all school warning signs and plaques is now required rather than an option, because the use of fluorescent yellow-green has become the predominant practice in most jurisdictions. Fluorescent yellow-green provides enhanced conspicuity for these critical signs, especially in dusk and dawn periods, and the uniform use of this background color for all school warning signs and plaques will enhance safety and road user recognition.

- **New Plaques for School Areas** – New optional ALL YEAR and directional arrow plaques have been added to supplement the School Zone (S1-1) sign where appropriate.
- **New Symbol Design for the School Bus Stop Ahead Warning Sign** – Based upon the successful West Virginia and Canadian symbol design and modified slightly based on a human factors study, a new School Bus Stop Ahead symbol sign has replaced the existing word message sign.
- **Higher Fines and Begin Higher Fines Zone Signs** – New signs and provisions have been added to inform motorists about higher fines zones in school areas. The existing requirement regarding the use of either a Speed Limit sign or an END SCHOOL ZONE sign at the end of an authorized and posted school speed zone is changed to a requirement that the end of a designated school zone shall be marked with an END SCHOOL SPEED LIMIT or an END SCHOOL ZONE sign, as it is important and sometimes legally necessary to mark the end points of designated school zones. However, to retain the option for jurisdictions to post the speed limit for the section of highway that is downstream from the school zone, a new option is being added permitting a standard Speed Limit sign to be mounted on the same post as the END SCHOOL SPEED LIMIT or END SCHOOL ZONE sign.
- **High-Visibility Apparel for Adult School Crossing Guards** – A new requirement has been added that adult school crossing guards and law enforcement officers performing school crossing supervision shall use Class 2 high-visibility safety apparel labeled as ANSI 107-2004. This change incorporates into the MUTCD the provisions of 23 CFR Part 634 that were published in the Federal Register on November 24, 2006, and makes those provisions applicable to all roads open to public travel, not just Federal-aid highways. A compliance date of December 31, 2011 has been established for this new requirement.

Part 8 – Traffic Control for Railroad and Light Rail Transit Grade Crossings

- **Combining of Parts 8 and 10** – Parts 8 and 10 have been combined into a new Part 8 that covers both highway-rail grade crossings and highway-LRT grade crossings. The combining of these two parts eliminates a lot of duplication in text and figures. Unless it is specifically stated that a particular provision is relevant to only one of the types of grade crossings, all of the provisions of the new Part 8 apply to both types of grade crossings.
- **Crossbuck Assemblies** – Crossbuck Assemblies are now required at all passive grade crossings to enhance the safety of grade crossings, especially at night, except where road users are directed by an authorized person on the ground to not enter the crossing at all times that an approaching train is about to occupy the crossing. A Crossbuck Assembly is comprised of a Crossbuck sign, a Number of Tracks plaque

(only at multi-track crossings), and either a YIELD sign or a STOP sign. The YIELD sign is the default sign, and STOP signs shall only be used where an engineering study shows that a YIELD sign would not provide adequate safety. A compliance date of December 31, 2019, has been established for YIELD or STOP signs to be installed at existing passive crossings.

- **Stop Lines at Grade Crossings** – Stop lines are now required at all paved approaches to active grade crossings to show road users where to stop when the crossing devices are activated. Stop lines are now recommended at all paved approaches to passive grade crossings that include a STOP sign as a part of the Crossbuck Assembly. Yield lines or stop lines are now recommended at all paved approaches to passive grade crossings that include a YIELD sign as a part of the Crossbuck Assembly.
- **Grade Crossings Within or Near Roundabouts or Other Circular Intersections** – Where circular intersections include or are within 200 feet of a grade crossing, there is a new requirement that an engineering study shall be made to determine if queuing could impact the grade crossing. If traffic queues impact the grade crossing, provisions shall be made to clear highway traffic from the grade crossing prior to the arrival of rail traffic. A compliance date of December 31, 2014, has been established for the required engineering study to be done at existing grade crossings within or near circular intersections.
- **Pathway Grade Crossings** – A new chapter has been added that provides information regarding the traffic control devices that are used at pathway grade crossings. Because shared-use paths and other similar facilities often cross railroad and light-rail transit tracks, it is important that suitable traffic control devices be used to provide for the safe and effective operation of such crossings.

Part 9 – Traffic Control for Bicycle Facilities

- **Bike Lanes Designated with Pavement Markings Only** – The use of bicycle lane regulatory signs and plaques are no longer required where marked bicycle lanes are present. This change provides flexibility for jurisdictions that do not desire to use the bicycle lane signs, without restricting the ability of jurisdictions that prefer to use the signs to continue to do so.
- **Selective Exclusion Signs and Mode Specific Guide Signs** – New selective exclusion signs for modes other than bicycles and pedestrians have been added, and new mode specific guide signs have been added that may be used to guide different types of users to separate pathways where they are available.
- **New Bicycle Guide Signs** – New bicycle guide signs that show destinations and/or distances along bicycle routes have been added for optional use to provide flexibility and potentially reduce the costs for signing bicycle routes in urban areas where multiple routes intersect or overlap.

- **Reduced Versions of Object Markers and Reference Location Signs** – Proportionately reduced versions of object markers and reference location signs have been added for optional use because the reduced size is suitable for the lower operating speeds on shared-use paths.
- **New Shared Lane Pavement Marking and New Bikes MAY USE FULL LANE Sign** – A new shared lane pavement marking to assist bicyclists in determining the appropriate line of travel and a new Bikes MAY USE FULL LANE sign have been added for use at locations where it is important to inform road users that the travel lanes are too narrow for bicyclists and motor vehicles to operate side by side and to remind motorists to pass with sufficient clearance. These optional devices may be used in conjunction with one another or independently of each other.

Conclusion

In addition to the major items discussed above, there are many other changes with which users of the MUTCD should become familiar. A good way to become familiar with all the changes, large and small, is to review the documents posted on FHWA's MUTCD website (<http://mutcd.fhwa.dot.gov>) that identify all of the text, table, and figure changes from the 2003 Edition.

State and local highway agencies and owners of private roads open to public travel should take steps as soon as possible to update their policies, practices, standards drawings ("typicals"), and other documents to bring them into conformance with the 2009 MUTCD's new provisions and designs of traffic control devices. Also, highway agencies and private road owners should begin planning their systematic upgrading actions to bring outdated devices that exist in the field into conformance with the new MUTCD, giving special attention to the 11 new Standards that have specific compliance dates. Implementing all of the many MUTCD changes might entail significant efforts, but the end result will be improved uniformity of traffic control devices for road users, no matter where they travel, benefitting all citizens and communities in the form of safer and more efficient streets, highways, and roads, both public and private.