Washington State Department of Transportation

Transportation Building
310 Maple Park Avenue S.E.
P.O. Box 47300
Olympia, WA 98504-7300
360-705-7000
TTY: 1-800-833-6388
www.wsdot.wa.gov

May 14, 2021

U.S. Department of Transportation
Dockets Management Facility
1200 New Jersey Avenue SE
Washington, DC 20590-0001

RE: Federal Register – FHWA Docket Number 2020-0001
National Standards for Traffic Control Devices – MUTCD Revisions

Thank you for the opportunity to comment on FHWA Docket Number 2020-0001. The Washington State Department of Transportation (WSDOT) has reviewed FHWA Docket Number 2020-0001, Notice of Proposed Amendments (NPA) as it pertains to 23 CFR, Parts 470, 635 and 655.

WSDOT has six major areas of concern for FHWA to consider:

1. The MUTCD needs a much stronger foundation for multimodal safety and mobility grounded in a safe systems approach. Improvements can start by recognizing that streets in different places fulfill different needs. Rather than try to prescribe uniformity that is appropriate for limited-access and high-speed highways, the manual should support practitioners' ability to flexibly apply traffic control devices appropriate for places with a mix of users, needs, destinations, and context. This need for more context-sensitive treatments that better support connectivity, mobility, and safety for all road users applies to markings, signing, warrants, and a number of other topics we have addressed in our detailed comments. Consolidating information around pedestrian topics into a chapter or section with appropriate cross-references, similar to the handling of bicyclist topics, would represent another significant improvement.

2. The MUTCD must address speed management more thoroughly. The proposed changes make improvements but do not put enough emphasis on setting speed limits with the priority of preventing fatal and serious injury crashes. It would be better to see the guidance prioritize contextual measures to set speed limits for population centers, where driving speeds vary naturally due to intersection frequency, on-street parking, destination density or driveways. It should not recommend the primary use of existing driver operating speeds to set vehicle speed limits in multimodal settings where there are vulnerable road users moving along and across the roadway.

3. WSDOT recognizes there is a need for 6-inch wide striping, especially with the growth of automated systems, however, this is a complex issue. There has been limited time to fully address the costs, benefits and impacts of this topic. Though detailed one-time restriping costs are currently unknown, WSDOT estimates the cost to replace current striping equipment will exceed $4.2 million for WSDOT facilities alone. While we recognize and support ultimately using 6-inch striping, available funding does not make this currently feasible. As a result, we recommend 6-inch striping be an option. See enclosure for Section 3B.09.

4. We are concerned that Ramp Meters must meet all the requirements of traffic control signals. Ramp Meters only control the concurrent movement of ramp traffic. Ramp Meters do not assign right of way or control intersections as required with a traffic control signal at an intersection. We recommend language be added to Section 4P to clarify this point.

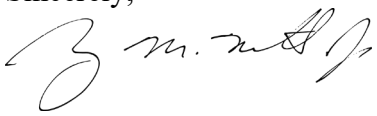
5. We agree policies, directives, manuals, specifications, standard drawings, or other documents related to traffic control devices need to conform to the MUTCD. If these documents are required to supplement the MUTCD per 23 CFR 655.603(b)(1), this will result in delays when updating these documents. The proposed change is not consistent with the purpose of the NPA of streamlining the process and reducing the burden on State and local agencies.

6. We appreciate the addition of the sixth standard in 2L.02 allowing flexibility in how states display emergency messages on changeable message signs. Moving forward, we think states should have additional flexibility to tailor safety messages to improve road user behavior. We interpret the new MUTCD requirement to develop and maintain a CMS use policy as flexibility to do so.

The MUTCD serves a critical purpose. A great deal of research is being conducted on issues not fully addressed in the existing document, particularly those concerning vulnerable road users and connected vehicles and highways. WSDOT recommends future revisions be on an update schedule that enables incorporation of new information more rapidly and frequently.

WSDOT has reviewed the proposed revisions to the MUTCD, and our specific comments are on the enclosed pages.

Sincerely,



Roger Millar, PE, FASCE, FAICP
Secretary of Transportation

RM: jd
Enclosures

cc: Dan Mathis, FHWA – Washington State Division
Joel Barnett, FHWA – Washington State Division

Proposed Changes: MUTCD Response Part 3. Markings, Section 3B.09 (existing Section 3B.06)

The following information addresses concerns from the standpoint of Roadway Maintenance Operations specific to Item 329, Section 3B.09 (existing Section 3B.06), where "*FHWA proposes to add guidance recommending that edge lines on two-lane roadways should be at least 6 inches wide, regardless of the width of the normal line used on the roadway. FHWA proposes to modify existing P2 from Standard to Guidance to recommend against, instead of prohibit, the use of edge line markings through intersections or major driveways. FHWA proposes this change to provide additional practitioner flexibility.*

Though positive and ongoing discussion of this topic specific to aging drivers, autonomous vehicles and improved safety can quickly be mentioned, the proposed changes are significant. A few of the items that need much deeper discussion are the current and future costs, undetermined impacts to maintenance operations, and agency operational plans as outlined below.

Current Costs

The Washington State Department of Transportation (WSDOT) currently places 4-inch-wide pavement markings with 15 mil thick paint and standard reflective beads that are applied at 7 lbs/gal. This costs Maintenance and Operations approximately $8,848,478 annually. This total is based on 2019 data that includes Materials ($5,647,182), labor ($2,166,954), and other costs ($1,034,342) consisting of ongoing vehicle, traffic control, support vehicle, and other costs. These costs were based on placement of 21,899.4 line-miles with a B Level of Service (LOS) score for the Maintenance Accountability Process (MAP).

Current Statewide Total (based on 2019 data)

Material Costs	Labor Costs	Other Cost (Equipment, WZ TC, etc.)	Total Costs	Total Inventory Line Miles	Total Line Miles Painted
$5,647,182	$2,166,954	$1,034,342	$8,848,478	26088.4	21899.4

Future Costs

If the WSDOT is expected to place 6-inch-wide line for all state roadways, it is estimated that it will cost a minimum of $11,582,855 (based on 2019 data) to accomplish. This assumes the same line-miles completed in 2019 and after minor equipment upgrades are made. Material costs would be approximately $8,470,772 with labor costs estimated to be $3,112,083. These costs are only estimates based on the functionality of current equipment and assuming no other costs or change in the current application process is needed. Other costs are not included because current equipment is due for replacement.

Future Cost Total (based on 2019 data)

Material Costs	Labor Costs	Other Cost* (Equipment, WZ TC, etc.)	Total Costs	Total Inventory Line Miles	Total Line Miles Painted
$8,470,772	$3,112,083	---	---	26088.4	21899.4

Unknown Impacts and Future Cost Discussion

There are quite a few operational items that could impact future costs, and these include:

- extended drying times,
- reduced travel speed for application,
- added traffic control for ramps,
- expanded crew size and/or additional crew,
- potential for increased tort liability,
- and the hauling/staging of additional paint materials

Because it is not known how these operational items will ultimately impact maintenance operations, the future costs for labor and other costs need further discussion.

Labor Costs

With reduced application speed, increased changing of paint containment systems, and the potential need for additional personnel, the labor costs would be increased. If it is necessary to achieve the same LOS for striping placed in 2019, then additional labor would be needed, and the labor cost could be dramatically increased.

Other Costs

Other costs include equipment, support vehicles, and traffic control items, to name a few. These too could be substantially higher as equipment is outdated and in need of replacement. Exact costs for new pavement marking vehicles cannot currently be made and this is due to two primary reasons. First, vehicles are due for replacement, however; since there are no current plans for replacing these vehicles, there is no standard for vehicle components layout. Second, some of the equipment used for maintaining paint application pressures is manufactured by a company that no longer builds the system. Based on past vehicle cost, technology upgrades, and current buying power, conservative estimated starting cost is approximately $700,000 per vehicle. Because replacement of current striping equipment is needed, the minimum replacement cost would be greater than $4,200,000 and that added upgrades or purchase of any pavement marking vehicle, would likely take one year to materialize.

Agency Operational Plans

From an agency perspective there are quite a few questions that will also need to be answered and these include:

- How will implementation of the new standards be made?
- Will the process begin during a construction project?
- What liability exists if Maintenance converts stripes from 4-inch to 6-inch?

- If operations are slowed, will increased labor costs be made or will a reduction of line miles painted be acceptable?
    - It is noteworthy to mention that the 2020 Maintenance Accountability Process (MAP) Level of Service (LOS) score for pavement marking dropped to an F because of restrictions placed on the workforce and additional work will be needed consequently.
- Is it feasible to purchase new marking trucks to replace current trucks and what if more than six are needed to achieve an acceptable level of service (LOS)?
- Given the current condition of the pavement asset, is it reasonable to fully implement 6-inch pavement markings statewide?

Extended Discussion

It is understandable that there is a growing need for 6-inch striping, especially with the growth of automated systems, however, this is not a simple decision to be made. Though autonomous assisted vehicle technology is rapidly expanding, and lane departure has been notably reduced, construction and maintenance work zones are still not able to assist drivers using the automated vehicles from entering work zones. This is an area of great concern, especially with maintenance workers who daily setup temporary work zones all across the state.

It is also noteworthy to mention that the WSDOT has always been advanced at accepting new proposals, however, there has been limited time to fully address the impacts of this topic. In addition to the varied climates of our State and the significant role studded tires have on how pavement markings perform, it could be suggested that we see how other states go about implementation prior to moving forward with accepting this proposal.

Summary

To summarize what has been covered it can certainly be said that there are many unknowns associated with implementation of this MUTCD proposed change. Future costs specific to labor and equipment is at the forefront of the unknowns followed by what the agency operational plans might be. Though specific one-time costs are not currently known, it can be said that this cost would be greater than the $4,200,000 needed to replace current striping equipment. While we recognize and support going to a 6-inch line, the current funding position is one that doesn't make this a feasible option. As a result, we do not support mandating that all edge line be a 6-inch line.

Recommendations

Because there are so many questions that still need to be answered, the following are current recommendations:

- Do not support moving to a 6-inch line because of unknown associated costs.
- Allow for clear agency operational planning to take place.
- Identify what other costs might be encountered before implementing 6-inch striping.
- If the 6-inch line is adopted, we will be forced to approach the Legislature for additional funding support.
- Implement recommendations based on capital preservation project completion after funding has been addressed.

Comments on Docket No. FHWA-2020-0001 National Standards for Traffic Control Devices; the *Manual on Uniform Traffic Control Devices for Streets and Highways*; Revision

TABLE 1. ORIGINAL COMMENTS ON PROPOSED CHANGES. Please indicate the applicable proposed Section numbers in the far-left column. In the next three columns, please indicate your agreement, disagreement, or whether the column is applicable to your response by placing a, "YES," "NO," or "N/A" in the appropriate column of the row. If you agree with a proposed change, then there is no need to fill out the additional columns beyond the first two. However, it can be helpful to explain why you agree with a proposed change based on your objective experience as a roadway operator and/or empirical data. If you disagree in part or in whole, then please provide additional information that FHWA may find helpful.

Proposed Section Number(s)	Agree with concept and text as proposed	Agree with concept; suggested rewording of text in Comments	Disagree with concept	Comments *Please include justification for your position based on objective experience and empirical data. If there is a specific statement with which you take exception, please provide the Page and Line numbers from the mark-up version of the proposed MUTCD text.*
General				Document could continue to be Plain Talked. For example: replace words like "utilization" with simpler words like "use". Remove "that" where it is not needed. Etc.
General Comment	NO	YES	N/A	Work to remove the bias in the manual against people walking. The existing language frequently discourages the installation of pedestrian safety measures. It shows up in how the manual treats crosswalks, traffic signals, ADA accommodations, etc. For example, the manual does not currently have "uniformity" in guidance regarding safe pedestrian crossings. This is a serious concern especially for school crossing locations. The Zegeer research is clear in showing that higher volume, higher speed roadways present safety dangers to pedestrians and recommends the installation of hybrid beacons and signals to aid in crossing. The manual currently requires warrants to use these pedestrian safety devices. Minimum pedestrian volumes are needed to justify installation. The vast majority of agencies strictly adhere to the warrants and rely upon existing counts to meet them even where it is clear that existing conditions suppress pedestrian activity. Another example is in the guidance for the use of pedestrian traffic signal heads. Research indicates that they are key to improving safety, yet the proposed guidance allows them to be excluded at signalized intersections. There are multiple comments below regarding these issues. Another option would be to develop a separate pedestrian chapter.
Throughout	N/A			Sequencing of Standard, Support, Option, and Guidance varies. It would be easier to follow if greater consistency were applied with a logical sequence.
Throughout the document	N/A			The term "vehicle" is frequently used to refer to actions of a driver or motor vehicle operator, which should instead be used throughout. The future legal question of whether AV software will be defined as a "driver" is not a question to be settled through the MUTCD. Wherever traffic control devices are meant to signal information to drivers that is the term that should be used. Similarly, in some places the word "bicyclist" has been struck and replaced with "bicycle" where the reference should be to the person, not the device. In those locations do not change "bicyclist" to "bicycle"; use "bicycle" only when referring to the actual vehicle (as defined with recommended changes to be inclusive of more types of cycling equipment).
1A.02	NO	YES	N/A	Page 2, Lines 11-21: For B. recommend revising to "…fire or law enforcement or public health and safety personnel". Please add "changeable message signs" to the examples list. For example, WSDOT advertises the use of seat belts, masks, etc.

				For C. recommend rewording to “Provide basic principles, including reference information…” For F. recommend adding “silver” alert along with AMBER. Silver is used in Washington state when a senior citizen is missing.
1A.02	NO	NO	YES	Like a changeable message sign used to set variable speeds on a freeway, a traffic calming device that controls speed, such as a speed hump, should be a traffic control device.
1A.03	NO	NO	YES	Page 2, Line 37: Recommend removing “This target user is an alert and attentive individual who is functioning in a lawful manner that is appropriate for the facility and conditions, while demonstrating due care for the current conditions on the roadway.” Washington state has pedestrians that do not fit this description. Also, our state does not test or have a test to determine if a pedestrian fits the description written. Also recommend rewriting the last sentence to something like, “Pedestrians may be blind, deaf, have vision or hearing impairments, have ambulatory/physical disabilities, have cognitive disabilities, or a combination of these.”
1A.03	NO	NO	YES	Page 2, Line 38: Recommend removing everything after the words “including bicyclists”. Washington state has individuals who use bicycles that do not fit this description. Also, our state does not test or have a test to determine if a person riding a bicycle fits the description written.
1A.04	NO	YES	N/A	Page 3 Lines 1-5: Recommend combining the two standard sentences to simplify.
1A.04	NO	YES	N/A	Page 3, Line 10: Recommend revising to “…efficiency (mobility) and access…” Also, the MUTCD (full manual) needs to come up with a better term than “road user” that encompasses all modes/means using a facility and that is inclusive of shared use paths that are not on a road. “Transportation system user” or something similar would be better.
1A.05	NO	YES	N/A	Page 4, Lines 21-24: Recommend revising to “…information with respect to the use of this Manual include, but are not limited to:” This would capture the many other documents missing from this list and future documents.
1A.05	NO	YES	N/A	Pages 4-6, Line 48, item 11, the Guide for the Planning, Design and Operation of Pedestrian Facilities is in publication and should be released this year, update to "2021 Edition". This list does not provide sufficient information for discussion of more urban and non-limited-access contexts and roadways. A number of publications from FHWA and other sources need to be added. Add the NACTO Urban Street Design Guide, City Limits Guide, Global Street Design Guide, Don't Give up at the Intersection Guide, Urban Bikeway Design Guide and Transit Street Design Guide, FHWA Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations, FHWA Bicycle Safety Guide and Countermeasure Selection System, FHWA Pedestrian Safety Guide and Countermeasure Selection System, and others. Consult with the FHWA Bicycle and Pedestrian Program for a complete list of appropriate publications.
1A.05	NO	YES	N/A	Recommend adding NACTO documents to the list, including “Urban Street Design Guide”, “Urban Bikeway Design Guide”, “Guidelines for Regulating Shared Micro-mobility”, and “Transit Street Design Guide”. Recommend adding “Guidelines for the Location and Design of Bus Stops”
1A.05	NO	NO	YES	Page 6, Line 8: Recommend removing from “The provisions of this Manual…” through “until such time as it is officially revised.” This

				because the list is supposed to be supplementary information that is "not regulatory in nature".
1B.01	NO	YES	N/A	Page 7, Lines 16-17: Recommend rewording to "Although the MUTCD may also be used for the following types of facilities, this is not required."
1B.01	NO	YES	N/A	Page 7, Line 18: For A. Recommend revising to, …owned, including facilities within park and ride lots; rest areas; airports; and ferry ingress/egress and parking areas."
1B.02	NO	N/A	YES	Page 8, Lines 14-20: Disagree with the proposed Standard paragraph as it suggests that all agency documentation relative to traffic control devices is subject to FHWA approval. The term "substantial conformance" can be subject to interpretation and is often interpreted differently. The proposed Guidance would essentially make it impossible for agencies to utilize Interim Approval items as they would not be able to document implementation. Lines 14-16 essentially conflict with lines 18-20. Recommend deleting guidance on lines 18-20 against interim approval devices. It is common and necessary for agencies to create standards, policies, and guidance regarding traffic control devices that have interim approvals. As an example, RRFBs necessitate all of these documents but RRFBs have an interim approval status. This proposed Guidance statement conflicts with normal and necessary practice by agencies.
1B.02	NO	N/A	YES	Page 8, Lines 14 -16. WSDOT agrees documents related to traffic control devices need to conform to the MUTCD. WSDOT is concerned making all these documents be supplements to the MUTCD a requirement will delay the process in updating these documents. The MUTCD is not entirely "black and white", there are "grey" areas that may require transportation agencies to develop policy's when to implement guidance and option statements. WSDOT has a Traffic Manual to handle these situations, many cities and counties in Washington have similar documents. Does FHWA expect each FHWA Division Office to review and approve these documents for substantial compliance?
1B.06	NO	NO	YES	Page. 10: Experimentation is critical for development and testing of new technologies and controls. The Support language appears to interfere with participation in NCHRP or UTC research. An agency should need to agree to experimentation, but it should be permissible for research partnerships to be approved. Recommend modifying the requirements to allow roadway owners to add themselves to existing approved experiments and clarify the process for permitting a second stage of testing for new traffic control devices.
1B.07	NO	YES	NO	Page. 12: Revise lines 19-20 to "Support: Continuing advances in technology and understanding of traffic safety approaches will...". Revise lines 26-28 as follows: "A change includes consideration of new approaches to traffic safety, ..." Overall, this section does not appear to consider the possibility of changes to the philosophy, definitions, or any other element beyond technology. Recommend it be written more broadly to enable incorporation of research findings that support safety.
1C.02	NO	YES	NO	Page 16: Bicycle (20): By using "pedal-powered", definition of "bicycle" does not clearly include Class 2 electric-assist bicycles; those have pedals but may be powered solely using the throttle; hand-cranked or rowed bicycles; and treadle-action bicycle-like devices, all of which are appropriately used in a bike lane. Add clarity by revising definition: "Bicycle—a vehicle upon which the human operator sits, regardless of the number of wheels, that may

				be powered by feet or hands either with or without an electric-assist battery.
1C.02	NO	YES	N/A	Recommend adding definitions for “bus stop”, “bus pullout”, “near-side bus stop and pullout”, “far-side bus stop and pullout”, “bus/rail platform” “park and ride lot”, “transit/transfer center”, “high occupancy toll lane”, “midblock”, “boarding and aligning area”, “accessible route” , “leading pedestrian interval”
1C.02	NO	YES	NO	Page 18: Definition of "detector" should be amended for clarity and specificity to read as follows: "a device used for determining the presence or passage of vehicles, including bicycles, or pedestrians." Detectors may determine the presence of a motor vehicle without detecting the passage of a bicyclist.
1C.02	NO	YES	NO	Page 18, Lines 34-36: Designated Bicycle Route 51: Definition would be improved by adding at the end to read: "with or without specific bicycle route numbers or bike lane markings"
1C.02	NO	YES	NO	Page 19, lines 37-44: Clarify definition of "engineering study" to require that walk/bike/transit needs be explicitly considered, and then address wherever it's discussed in this document with respect to engineering studies required as assessment for walk/bike movements. Engineering studies often focus on driver convenience even when the goal is to study implementation of safety/mobility improvements for active transportation.
1C.02	NO	NO	YES	Page 20, lines 50-51: Highway 94: The definition of "highway" as a public way "for purposes of vehicular travel" completely leaves out other legal road users such as pedestrians who may legally be using a shoulder, someone riding or driving an animal or animal-drawn conveyance (an animal is not a "device"), and other uses that may be permitted under state law. This is unnecessarily restrictive and does not match federal law. The term "highway" is defined in 27 CFR 555.11 as "any public street, public alley, or public road, including a privately financed, constructed, or maintained road that is regularly and openly traveled by the general public." Use this "traveled by the general public" definition to be mode neutral.
1C.02	NO	YES	N/A	Page 21, line 36: Intersection 106(b): Possible typo with use of "side roadway". This term is not defined or used elsewhere in the document; "site roadway" is likely the intended term here.
1C.02	NO	YES	N/A	Page 22, line 9: Island 109: Recommend adding for specificity "or for pedestrian and bicyclist refuge". Depending on location, use of island as refuge by bicyclists may have implications for lane markings, signalization, detection, and other controls, and in other definitions you distinguish between vehicle operators and bicyclist (for example, "Road User").
1C.02	NO	YES	N/A	Page 24, line 39: Pedestrian 154: This definition does not incorporate use of mobility assistive devices other than wheelchairs, such as a motorized scooter (not a foot scooter) and does not address other micro mobility devices such as foot scooters (manual or e-scooter). Modify to include these. "Pedestrian—a person on foot, using a mobility assistive device such as ~~in~~ a wheelchair, on skates, or on a skateboard or other small wheeled personal mobility device."
1C.02	N/A			Page 24, line 54: Permissive Mode 160: Add so it reads: "after yielding to pedestrians or bicyclists, if any…"
1C.02	NO	NO	YES	Page, 27: Roadway 198: This definition does not clearly include bicycle use in travel lanes including bike lanes and leaves out use of small wheeled personal mobility devices such as skateboards that may be used in a bike lane or roadway rather than sidewalk, depending on local jurisdiction. The definition of Shared Roadway on p. 28 further confuses the issue. Suggested wording: "Roadway—that portion of a highway improved, designed, or

				ordinarily used for vehicular travel including bike lanes and parking lanes, but exclusive of the sidewalk, berm, or shoulder even though such sidewalk, berm, or shoulder is used by persons riding bicycles or other ~~human-powered vehicles~~ small wheeled personal mobility devices."
1C.02	NO	YES	N/A	Page. 27, lines 29-33: Rumble Strip 201: This definition uses "road user" where you mean to indicate "vehicle operator". Pedestrians are not alerted by rumble strips that they are leaving the travel lanes. Assuming that "road user" and "vehicle operator" are synonyms is highly problematic.
1C.02				Page. 28, lines 13-17: Shared-Use Path (211): The term "trail" is not defined in the document and is used over 20 times. It needs a definition that considers the variety of treatments found in state and federal laws. Trails are often not subject to rules of the road and tend not to be regulated in a standard way by agencies. The definition here should be clear about the type of travel way that might be the subject of this manual, not all trails (including, for example, soft-surface, back-country, or water trails).
1C.02	NO	NO	YES	Page 28, lines 18-21: Shoulder 212: This definition does not comport with laws in many states. Paved shoulders are considered by some agencies to be a bicycle facility type; pedestrian travel may also be allowed; and transit stops or school bus stops may be located on shoulders. Revise to read: "Shoulder---a longitudinal area contiguous with the traveled way that ~~is primarily for~~ may accommodate stopped vehicles for emergency use; bicyclist travel; transit or school bus stops; and pedestrian use in some locations. A shoulder provides ~~and for~~ lateral support of base and surface courses, and ~~that~~ is graded for emergency stopping. A shoulder might be paved or unpaved. A paved shoulder might be opened to part-time travel by some or all vehicles and is generally open to full-time use for bicyclists where bicycle use is not otherwise prohibited on limited access highways."
1C.02	NO	NO	YES	Page, 28, lines 8-9: Shared Roadway (209): Under state law in many states, all roadways are "shared" in the meaning of the second portion of this definition: "...open to motor vehicle travel and upon which no bicycle lane is designated." This definition seems to imply that roadways not officially designated/marked as bicycle routes are somehow not shared. Why is this definition even necessary? You have "Designated Bicycle Route" defined--that's sufficient.
1C.02	NO	YES	N/A	Page. 29, lines 36-45: Speed: No definition provided for the established concept of "target speed": the design speed you intend for drivers to travel at. This concept is important for the safe systems approach, particularly on urban and suburban roadways, and is one of the concepts recommended in FHWA EDC-4 and EDC-5 pedestrian safety action plans. Recommend adding this to the speed definitions to make the MUTCD more applicable to a variety of contextual conditions beyond high-speed interstates and to bring federal resources more directly into alignment.
1C.02	NO	YES	N/A	Page 31, lines 25-26 Traveled Way 269: This definition centers on the movement of vehicle operators as written. The document appears to include bicyclists as vehicle operators in some sections but not others; here it does not clearly include bicyclists as present in the traveled way. It also appears to assign the roadway entirely to driver use without noting that crosswalks transverse the traveled way and thus are within it whether or not they are marked crosswalks.
1C.02	N/A			Page 31, lines 27-31: Turn Bay 270: Another instance where it is not made clear that "turning vehicles" may include people on

				bicycles, particularly clear since the definition specifies "drivers who desire to turn". Correct by changing "drivers" to "road users".
1C.02	NO	YES	N/A	Page 32, lines 5-10: Warrant 282: The definition should be clarified to add "a threshold condition based upon average, normal, or projected conditions….". Add: "When a warrant is not met that is not conclusive evidence for non-installation" to provide the other half of the engineering judgment decision.
1C.02	NO	YES	N/A	Pages 16, 17: The document refers to bike lane types elsewhere in the document without including definitions in the Definitions section. "Barrier-separated lane" and "Buffer-separated lane" are defined on Page. 16. Recommend including definitions for clarity along these lines: "A separated bicycle lane is a bicycle lane that is physically separated from motor vehicle traffic. Physical separation consists of vertical elements which include, but are not limited to channelizing devices, parked vehicles, or raised islands." Refer to the comment on 9E.07 concerning barrier separated bike lanes and barrier protected bike lanes as an additional useful distinction. "Counter-flow" should be changed to "Contra-flow" when referring to bike lanes. Counter-flow lanes are defined in this document as opposing-direction lanes "designated for peak direction of travel", which is inappropriate for bicycle facilities. Change to "contra-flow" throughout the document when referring to these bike lane types. Suggested definitions: "A contra-flow bicycle lane is one-directional and provides a lawful path of travel for bicycles in the opposite direction from general traffic on a roadway that allows general traffic to travel in only one direction." "A buffered bicycle lane is a conventional bicycle lane paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane."
1C.02	NO	YES	N/A	Page. 17, line 28: Paragraph 28 defines a "busway" as exclusive for buses. Paragraph 25 defines "bikeway" as being for either the exclusive use of bicycles or to be shared between bicycles and other modes. Some places have combined bus/bike lanes, which presents somewhat different issues than an ordinary travel lane. Paragraph 132 describes a mixed-use alignment but does not discuss bicycle use. Consider more consistency with definitions. Perhaps "bikeway" should be those lanes designed for use by bicyclists and "shared bus/bikeway" should be added.
1C.02				Page. 18, line 17: Start definition with a simple statement that a crosswalk is a marked or unmarked, legal location for a pedestrian crossing location. A number of places in the document do not appear to take legal unmarked crosswalks into account; this change would provide clarity and support existing state laws.
1D.01	NO	YES	N/A	Page 34, line 23: Change "Vehicle speed" to "driving speed". The presence of a vehicle operator should not be ignored--that is still the predominant audience for traffic control devices.
1D.01	NO	NO	YES	Page 34, lines 4-7 and 26: Refer to comment under 1A.03 concerning "reasonable and prudent" and definition of roadway users. Recommendation: Strike "reasonable and prudent" and strike cross reference to 1A.03 and leave it at "orderly movement of all road users". Traffic control devices cannot determine or dictate whether an individual is reasonable or prudent.
1D.05	NO	YES	N/A	Page 38, lines 3-5: Existing text omits reference to pedestrian/bicyclist spaces and should be amended for

				completeness. "Early in the processes of location and design of roads, ~~and~~ streets, bike lanes, shared-use paths, and sidewalks, engineers should coordinate such location and design with the design and placement of the traffic control devices to be used with such roads, ~~and~~ streets, bike lanes, shared-use paths, and sidewalks.
1D.06	NO	YES	NO	Page 38, Line 48. The use of the word “unusual” in the sentence could be interpreted differently by different. Recommend the sentence not be revised.
1D.09	NO	YES	NO	Page 40, lines 33-35: Tourists may be traveling by bicycle, not motor vehicle. Change "motorist" to "traveler" service signs.
2A.04	NO	YES	N/A	Page 44, line 53: The phrase "and not visible to operators of motor vehicles...” is too restrictive to fit every possible configuration and unnecessarily lumps together pedestrians and bicyclists with motor vehicle operators. Separate Option for signage such as changeable message signs presented at a size that a motor vehicle operator might respond to from Option for signage appropriate to pedestrian/bicyclist facilities. The latter might be somewhat visible to the operator of a motor vehicle depending on the configuration of a shared-use path approaching an intersection, for example, but not interfere or distract due to its size, placement, and design.
2A.05	NO	YES	N/A	Page 45, lines 35-50: Recommend that signage placement include reference to mounting so as not to interfere with movement of bicyclists/pedestrians, particularly where space is constrained as on bridges and where shoulder is minimal. Suggested addition: "G: Place the sign so it does not interfere with through movements of bicyclists and pedestrians, particularly where lateral movement to avoid the sign might place the vulnerable road user into the travel lane."
2A.08	NO	YES	N/A	Page 47, lines 48-52: Restriction on use of symbols and diacritical marks does not allow for rendering names that may be given in tribal languages and other languages that are not entirely adapted to the English alphabet. This section needs to include Support or Option for use of appropriate markings to respect language of origin when the decision has been made to use that name and to avoid inadvertent mis-rendering when lack of a diacritical mark changes the meaning of a word.
2A.12	NO	YES	N/A	Page 51, lines 16-34: Guidance on placement assumes motor vehicle travelers. Recommend that signage placement include reference to mounting so as not to interfere with movement of bicyclists/pedestrians, particularly where space is constrained as on bridges and where shoulder is minimal. Suggested addition to lines 26-34: "G: Placed so they do not interfere with through movements of bicyclists and pedestrians, particularly where lateral movement to avoid the sign might place the vulnerable road user into the travel lane." Update associated figures as needed to illustrate this point.
2A.12	N/A			Page 52, lines 16-18: Legal crosswalks, both marked and unmarked, exist in urban, suburban, and rural areas. The Guidance on lines 16-18 only contemplates crosswalks in urban areas, but speeds may be higher in suburban or rural areas. A safety concern is created by Guidance that sign placement approaching crosswalks is a "should" for maintaining line of sight for driver to see someone crossing, not a "shall". If a sign is closer than 4 feet, it is blocking the view of someone at the crosswalk for a driver traveling 30mph or more and they do not have sufficient reaction time + braking time to stop as legally required. Change this from Guidance to Standard. If this is meant to be limited to marked crosswalks, indicate that but have a research basis that indicates there isn't a safety concern associated with signage placed within 4 feet of unmarked

				crosswalks, and/or require that signage height not interfere with visibility for drivers to see pedestrians preparing to cross.
2A.14	NO	YES	N/A	Page 53, line 23: Reference to minimum height needs explicit reference to bicyclists, who move faster than pedestrians. Add so it reads: "in business, commercial, or residential areas where parking, bicyclist, or pedestrian movements are likely to occur…"
2A.14	NO	YES	N/A	Page 53, lines 32-33: Placement of secondary signage needs reference to paths and trails: "lower than 7 feet above a pedestrian sidewalk, pathway, shared-use path or bikeway (see Section 6D.026C.03), the secondary sign shall not project more than 4 inches into the pedestrian or bicycle facility.
2A.17	NO	N/A	YES	Page 56, Lines 4-8. Install solar panels below or behind the sign is not practical for northern tier States during winter months with limited solar exposure.
2A.22	NO	YES	N/A	Page 59, Lines 25-31, Guidance: As written the only reasons for treating a divided highway as separate intersections relate to motorist interactions with each other. This section needs to add consideration of crossing time and distance required for pedestrian and bicyclist movements as a third condition that creates reason to mark/sign divided highway as separate intersections: "C: The time and/or distance required for pedestrian or bicyclist crossing increases exposure to turning and/or high-speed driver movements." This then becomes an A or B or C condition to consider. Related comment is add an additional factor under Support section.
2A.22	NO	YES	N/A	Page 59, line 48: Add additional factor under Support: "I. time and/or distance required for pedestrian/bicyclist crossing and observed prevailing driver vehicle speed and behavior with regard to yielding to crossing movements"
Figure 2A-4	No	No	Yes	R3-8 Series sign is not useful only 50 feet from the intersection, as there is no longer opportunity to make a different lane selection, and few drivers will be able to see the sign. If information on movement restrictions is necessary this close to the intersection, they should be overhead R3 series signs on the signal mast arm or a comparable overhead installation.
2B.04	NO	NO	YES	Page 64, lines 21-24: Existing Option language for sign permitting right-turning traffic without stopping at a stop sign does not refer to the potential presence of pedestrians/bicyclists in a legal crosswalk. It refers only to "a special combination of geometry and traffic volumes" that would permit this signage to be used. Where used, it creates a potential scenario in which a driver assumes the right to turn without stopping while a pedestrian or bicyclist is using a legal crosswalk at a location that has a stop sign, they expect the driver to respect. This condition does not create respect for the meaning of the stop sign. Recommend adding to the end of the sentence " to be permitted to enter the intersection without stopping, only in locations where pedestrian and bicyclist crossing movements are not permitted" or similar language.
2B.05	NO	YES	N/A	Page 63, line 38: Here and elsewhere the word "vehicles" is used when it should be "drivers" or "motor vehicle operators". Drivers are controlled by a yield sign--not vehicles. (In a future scenario in which AVs are in widespread use it will be a matter of statute to define whether they are considered drivers or some other type of vehicle operator. In the meantime, drivers are the ones who need to slow down to a reasonable speed.)
2B.06	NO	YES	N/A	Page 65, line 12: Recommend adding at end of sentence for completeness and specificity: "…that provides appropriate levels of safety and efficiency for all road users." This fits with the Guidance

				references to bicyclists and pedestrians in addition to drivers below in this section.
2B.06	NO	YES	N/A	Page 65, line 29: Recommend change to text as follows: "A. Vehicular, ~~bicycle, and pedestrian~~ traffic volumes on all approaches. Where the term units/day or 30 units/hour is indicated, it should be the total of vehicular, ~~bicycle, and pedestrian~~ volume." Add new letter B and re-letter list items below (current markup lettering repeats the letter B and needs to be corrected in any case): "B. Pedestrian bicyclist generators in the vicinity, land use context and/or other indicators such as sidewalks, bike lanes and shared use paths that signal a need for pedestrian or bicyclist crossing for network connectivity (do not rely on pedestrian or bicycle volume where vehicle speeds and/or vehicular volume present a barrier to the uncontrolled crossing)." Explanation: Crossing the street is the most frequent pedestrian action in fatal and serious injury crashes involving pedestrians. Making this change allows for a multimodal systemic safety approach that does not rely on people walking or biking where fatal or serious injuries are more likely to occur in order to justify the need for traffic control.
2B.06	NO	YES	N/A	Page 66, line 5: Change the text to read, "Appropriate traffic calming or other speed-control measures should be used to control driving speeds." Delete the rest of the sentence; it is unclear.
2B.06	NO	NO	YES	Page 66, line 9: Edit changes Guidance to Standard. Recommend making this an Option: "Yield or Stop signs may be used for speed control when engineering judgment determines this is expected to be an effective approach for reducing fatal and serious injuries." This is a context-specific question and the Standard as written does not provide sufficient flexibility for the variety of roadway types and traffic settings.
2B.06	N/A			Page 66, line 18: Add text "D. Where a minor street is part of an intersection being controlled by a pedestrian hybrid beacon (as provided in section 4J.3E)."
2B.07	NO	YES	N/A	Page 67, line 2: Change the sentence in the following way, "C. A roadway with the lower traffic volume (to include actual and projected counts of people walking and biking)." In some cases, the intersecting travel way is a shared use path.
2B.07	NO	YES	N/A	Page. 67, line 4: Change the sentence in the following way, "E. A roadway that intersects with a roadway or shared use path that has a higher priority for one ~~of~~ or more modes of travel." In some cases, the intersecting travel way with higher volumes is a shared use path.
2B.08	N/A			Page 67, lines 35-38: Delete items I. and J. These will increase the possibility of pedestrian and bicyclist fatal and serious injury crashes at the intersection. Regarding (I.) Adding lanes increases crossing distances (which increases crossing exposure and burden for pedestrians), increases unpredictable driver movements, and encourages faster driving speeds. For (J), channelization encourages higher driving speeds and less attention to presence of pedestrians and bicyclists by motorists when merging onto minor streets (especially where pedestrian and bicyclist activity is intermittent). Research indicates that the addition of slip lanes is not safer for pedestrian crossings and bicyclists in minor street travel lanes have an additional traffic movement to attend to where they would otherwise have the ROW. If this is kept, make note that it shall be reserved for areas where there is not a likelihood of pedestrian activity (even if that activity is not frequent). Both existing and potential pedestrian activity should be understood (based on density of destinations and any expected land development that will change context in the near term).

2B.09	NO	YES	N/A	Add an option for using a bicycle symbol, or a pedestrian and bicycle symbol on the R1-5 sign. These signs can be commonly used ahead of crossing locations that are predominately made by bicyclists, or by bicyclists and pedestrians, such as shared use paths. This reason is similar to the R1-6 and R1-9 signs, which are proposed to have a version with the bicycle and pedestrian symbol.
2B.10	N/A			Page 68 line 52: Add text at the end of the sentence, "only where pedestrians and bicyclists will not be present (especially not in school zones and where there are bicyclist and pedestrian facilities such as bike lanes, sidewalks and/or shared-use paths)
2B.11	NO	YES	N/A	Page. 69 line 43: Add text "E. One of the intersection crossroads is a shared use path that has greater user volumes than the intersecting roadway." In some locations the shared-use path carries more traffic than the intersecting roadway.
2B.19	NO	NO	YES	Page 73, Lines 14 – 16. There may be cases due to site specific conditions the 20 to 50 feet is workable. Recommend the Guidance statement from 2009 Edition remain.
2B.20	NO	NO	YES	Page 74: Revise the Standard to follow the research. Remove the proposed Standard requiring the W11-2 or W11-15 sign be used with the R1-6 sign; the gateway configuration of the R1-6 increased yielding most, and the warning signs will add unnecessary sign clutter. Extensive research has been conducted on the R1-6 sign by Western Michigan University. This research indicated that yielding behavior improved most significantly when the signs were applied in a gateway configuration. The proposed changes to the Standards remove the option for locating a sign in a gateway configuration by placing it on the outside of the lane. It is important for FHWA to follow published research on proven safety treatments, particularly given the pedestrian safety crisis. If FHWA believes there is research supporting the proposed changes that contradicts the research conducted by Western Michigan University on this topic, it should be shared to justify the direction proposed.
2B.21	NO	YES	N/A	Page 76 line 4: All discussion of speed limits needs to consider safety and mobility for all modes and all roadway users. Change the text to read "The goal of speed zones (set independent of statutory speed limits, i.e., those established by Federal or state law) is to set them with the prevention of fatal and serious injury crashes as a priority. Roadway context, changing development, bicyclist and pedestrian activity, and transit are all significant factors that need to be considered in addition to an engineering study." As noted under Definitions comment on engineering studies, this requirement for an engineering study must very clearly require consideration of all modes and all roadway users. This is especially critical in all sections related to establishment of speed limits.
2B.21	NO	YES	N/A	Page 76 Lines 12-18: Recommend reordering the Guidance factors listed as follows: A: Road context. B. Reported crash experience. C. Road characteristics. D. Speed. Comments on each of these are included here in this reordered sequence. Road context: Change the text to read as follows: "Road context (such as roadside development and environment (number of driveways, land use); parking practices, schools, transit stops and other nearby pedestrian and bicycle traffic generators, should be used as a priority factor for roads in population centers on roads that are not limited access."

				Crash experience: Change text to read as follows: "Reported fatal or serious injury crash experience for the most recent three years of crash history and using a safe systems approach. Evaluate if a reduced speed limit would change the severity of crashes." Speed distribution: Change text to read as follows: "Speed distribution of free-flowing vehicles (such as current 85th percentile; the pace; review of past speed studies) shall be considered only for limited access roads and other roads outside of population centers (defined as incorporated and census designated places)". Engineering speed study approaches such as the 50th percentile, 85th percentile and 10 MPH pace speed evaluate speeds based on motorist perceptions. Such studies can bias results towards higher speeds regardless of whether they are appropriate, as drivers will be responding to design cues and the behaviors of other drivers. Their use to establish the "appropriate" speed essentially rewards speeding and the results of these studies do not equate to the speed with the lowest crash involvement rate or to the desired target speed. Such studies are appropriately used to identify the degree of change needed and may serve as evaluation tools for progress toward the target speed. The Washington State Injury Minimization and Speed Management Policy Elements and Implementation Recommendations provides a discussion and citation of relevant research: https://wsdot.wa.gov/travel/commute-choices/walk/pedestrian-safety.
2B.21	NO	YES	NO	Page 76, Lines 19 & 20. When a speed limit within a speed zone is posted on freeways or expressways, in addition to the review of crash data and roadway context, the 85th percentile in free-flowing conditions may be considered. ~~it should be within 5 mph of the 85th-percentile speed of free-flowing traffic vehicles.~~ (By placing an emphasis on the 85th under this direction, it dilutes our ability to effectively conduct an engineering study. Setting speed limits on freeways and expressways should be determined by an engineering study that includes roadway context and crash history, not solely on the 85th percentile speed that is inferred here.)
2B.21	NO	YES	N/A	Page 76 Lines 24-28: Add to discussion of significant changes: changes in pedestrian facilities including crossings, changes in transit stops.
2B.21	N/A			Page 76 line 29: At the beginning of the sentence add "On roads that are not in population centers, speed studies for signalized intersection approaches…
2B.21	NO	YES	N/A	Page 76 Lines 34-37: The FHWA Safe Transportation for Every Pedestrian guidance speaks directly to the importance of speed management for injury minimization. This section and other references to speed limits should refer to that guidance and support it directly with Standards as well as Guidance, Options, and Support statements. Add a reference to it here.
2B.21	N/A			Page 77 line 8: Change the text to read "B. As altered speed zones - based on considerations above."
2B.21	NO	YES	N/A	Page 76 line 36: In between the words "web page" and "provides information" add "and the NACTO City Limits (https://nacto.org/publication/city-limits/) web page". This resource provides contextual guidance appropriate for urban settings that are not interstate highways.

2B.38	NO	YES	N/A	Page 79: Recommend that the "Slower Traffic Keep Right" sign be limited to locations where there is an issue with drivers driving below the speed limit in the left-hand lane, not drivers driving below "the normal speed of traffic". Since the "normal speed" may reflect drivers responding to design cues and traveling well in excess in posted speed, a driver observing the speed limit does not need to be scolded via signage for following the law.
2B.50	NO	NO	YES	Reinstate R6-4 language, remove Large Arrow Warning sign and One-way directional arrow options, support and statements as they do not generally support state of the practice based on 2009 MUTCD.
2B.59	NO	YES	N/A	Pages 106-107: Sign should read "push button for warning lights - wait for traffic to stop". Pedestrians should not have to wait for a gap in traffic and walk out into moving traffic in order to cross.
2B.60	NO	YES	N/A	Page 109: Traversable paddle version of the R10-15 sign should be allowed as a standard sign to allow for more conspicuous sign placement. (Example image: https://www.google.com/maps/@42.0596375,-87.6770986,3a,75y,36.32h,69.24t/data=!3m6!1e1!3m4!1sxv_--mXzv7Dx03dxFbpasA!2e0!7i16384!8i8192?shorturl=1).This sign is commonly applied to uncontrolled locations, meaning that it shouldn't be listed only in the Traffic Signal Signs section; any jurisdiction would be allowed to install a soft-hit version of the sign.
2B.60	NO	NO	YES	Page 108; also in 9B.21, Pages 746 & 750: FHWA has proposed adding a new sign, the R10-12b, rather than provide a modification to a commonly used, well researched, and easy to understand existing sign, the R10-15, to alert left-turning motorists to the presence of bicyclists. When there is an option to provide modifications to existing signs to better alert road users to the right-of-way responsibilities, the modification should be favored over the creation of a new sign unless sufficient supporting evidence is provided showing how the new sign significantly improves comprehension, yielding, or other desired effect. If supporting evidence does not exist, remove this new sign and provide the modification to the R10-15, with the option to add the bicycle symbol, or add the bicycle and pedestrian symbol, as this clearly identifies the right-of-way responsibilities for roadway users and is widely used today. Additionally, when bicyclists and pedestrians are present, the use of one sign (rather than a sign for bicyclists and a sign for pedestrians) reduces sign clutter. Secondly, the use of this sign should not be restricted to signalized intersections, but should be allowed in advance of driveways, unsignalized intersections, or other higher conflict locations, based on context and engineering judgment. Revise the corresponding text to allow the modified R10-15 sign to be used in unsignalized locations.
2B.61	N/A			Page 109: Line 29: Add so It reads "An exclusive pedestrian or bicyclist phase" so this is an option for consideration where a bicycle traffic signal is in use. Lines 30-31 list "An unacceptable number of pedestrian conflicts" with RTOR. What defines "unacceptable"--and what would an "acceptable" number of such conflicts be? Line 32: Change the word "accidents" to "crashes or collisions". This is the only place in the document where "accident" appears, and its use is not appropriate.
Figures 2B-22 & 2B-23	NO	NO	YES	See comment for Section 2B.50

2C.03	YES	NO	NO	Page 120, Lines 42 & 43. Concur with minimum size for diamond shaped warning sign sizes for exit and entrance ramps.
2C.10	NO	NO	YES	Page 125, Lines 31 & 32. Recommend deleting this sentence. Washington State Law – RCW 46.61.135 requires vehicles to be driven to the right of a rotary island. The use of Large Arrow (W1-6) sends a mixed message to vehicle operators. See comments for Section 2B.50.
2C.13	NO	YES	N/A	Page 127, Lines 28-40: Recommend deleting “horizontal alignment” from text, as feedback signs should be available for any advisory speed condition.
2C.13	NO	NO	YES	Page 127, Lines 45-47: There should be an option to install a feedback sign with a curve warning speed sign, as a point of reference for the driver. Agree that this should be separate from the curve warning sign, which is too early.
2C.13	NO	YES	NO	Page 127, Lines 48-50: Starting with the text “The legend YOUR SPEED...” should be a new paragraph.
2C.40	NO	YES	NO	Page 138, Line 48. Add Truck Speed Limit (R2-2) to this sentence.
2C.56	NO	YES	N/A	Page 147: The Guidance concerning marked crossings where a Playground Sign is used should be made a Standard, given the likely ages and developmental stages of children who will be crossing at such a location, or at a minimum provide more information about consideration of posted speed, volume, and other considerations with the Standard applied to higher-speed and higher-volume roadways. Refer practitioners to the FHWA STEP guidance here and everywhere that crosswalk treatments are discussed.
Table 2D-5	NO	NO	YES	Overhead signing should have speed limit variations (over 40 MPH, 40 MPH or less) the same as for post-mounted signs. 12/9-inch letters on a 25 MPH approach are ridiculously huge, and the allowance for 6/4.5-inch letters on post-mounted for 40 mph or less undermines the credibility of having 12/9 inch letters overhead for the same speed.
2D.55	NO	NO	YES	Pages 189-192: This section is not treating modes uniformly. There is no reason based in research or safety that community wayfinding guide signs need to be limited to "conventional roads" while eliminating the same flexibility for trail signage. On line 7,13, and elsewhere, eliminate restrictions that confine this to use on "conventional roads", which is not a defined term in the manual. It should be made clear that these can be used on both neighborhood roads and trails, where communities may choose to express unique local character through an internally consistent approach to trail signage. Within Section 2D.55 add a reference to Section 9D.12 for bicycle wayfinding. Recommend adding statement that community wayfinding signs should be coordinated across all modes of travel. Decisions made regarding signs intended for motorists also apply to bicyclists and other trail users where paths intersect with streets and this should be considered for legibility and consistency. In all cases whether or not community wayfinding is designed locally, where trails and streets intersect, directional signage for both facilities should be provided; trail users need information about what street they have reached, and motorists should know which trail they're crossing since trails may serve as landmarks for location.
2D.55	NO	NO	YES	Pages 191-192: Disagree with the proposed change to modify the current Guidance statement about the rectangular shape of a

				community wayfinding sign to a Standard statement. This change greatly limits the creation of signs that identify the community, and this restriction adds unnecessary conformity to signs that should represent the unique qualities, identity, and desires of individual municipalities. Outside of high-speed environments, it is not clear that the restriction on the sign shape provides any safety advantage nor is this restriction supported by any research. There is a reference on Page. 192 lines 8-12 that recognizes that pedestrians or bicyclists are not moving at the same speed as a driver; this recognition should be extended to permitting lettering appropriate to the typical speed of travel on trails rather than extending highway standards to a very low speed environment. This is implicit in the Support language on Page. 191, lines 26-30; it simply needs to be extended to trails.
2E.50				Page 234, Line 11. No more than four supplemental destinations shall be signed from a single … Please verify four is correct in the sentence. The use of four contradicts line 44 on page 233.
Figure 2E-29				No edge line breaks for the exits.
2G.24	NO	NO	YES	Page 278, Lines 27 – 30. The requirement of lane use control signal approximately ½ mile in advance of the location where part-time travel on the shoulder ends is not always practical, for example existing evaluated bridge structure may not accommodate the installation of a lane-use control signal indication. The requirement needs to be change to a guidance statement.
2G.25	NO	NO	YES	Page 279, Lines 1-3. The use of the YELLOW X is antiquated and does not provide positive guidance to motorists when there is a blocking incident that occurs in a middle lane(s) on a roadway with three or more lanes in one direction. The use of merge left or right with arrows should be allowed.
2J.06	NO	YES	NO	Page 308, Lines 23 & 24. Revise the spacing from at least 200 feet to 100 feet minimum to 200 feet desirable to be consistent with 100 feet spacing currently allowed in the 2009 MUTCD.
2L.01	NO	NO	YES	Page 316, Lines 34-37: Manufacturer name/logo restrictions may be excessive, as manufacturers have been providing equipment with unobtrusive names/logos on the front for decades. Consider making an allowance for unobtrusive logos, possibly with specific size restrictions, and only on CMS with a bezel around the display (as opposed to “edgeless” design).
2L.08	NO	NO	YES	Page 323, Lines 30 & 31. In Washington State, we run state specific traffic safety campaigns that NHTSA does not address in their annual calendar. Recommend changing this Guidance statement to an Option statement.
3A.01	NO	YES	N/A	Page 335, lines 34-36: Consider adding that all pedestrian and bicycle markings should be retroreflective and in good condition. These elements should be updated or refreshed as frequently or more frequently than lane striping. Often crosswalk, bike, bike crossing, bike shared lane and other markings are faded or damaged to the point of losing conspicuity.
3A.03, 3B	NO	YES	N/A	Recommend adding in red paint for bus lanes and green pavement for bike lanes and bike boxes since these are interim approvals and shown in section 3H.
3A.04	NO	NO	YES	Line visibility is the desired outcome. The proposed language is mandating increased line width to improve line visibility. A durable 4” visible line is more effective than a 6” line that has degraded over time. Agencies should be allowed to determine what materials and widths are most cost effective in maintaining line visibility (e.g., 4” durable stripe vs 6” paint stripe)

3B.10	NO	YES	N/A	Page 349, lines 5-6: Add at end of line so it reads as follows: "Edge line markings should not be placed where an engineering study or engineering judgment indicates that providing them is likely to decrease safety for all road users. Without this addition the assumption may be that edge line markings are solely for the safety of motor vehicle operators. They also delineate space that may be used by bicyclists or pedestrians on the rural arterials included in this section.
3B.19	NO	YES	N/A	Page 357: The use of yield markings on separated bike lanes without signs should be an option. Separated bike lanes are frequently built in constrained, urban environments with short blocks. The requirement to place a sign at every yield marking increases sign clutter; with crowded curb space, it can be difficult to find a place for the sign. Given the slow speeds of bicyclists in these environments, the practitioner should have the option to exclude this sign based on engineering judgment. NPA #40 in Section 2A.19 adds additional information regarding avoiding sign clutter, and this comment seems in line with that change. Remove the Standard to have signs accompany yield markings on separated bike lanes, unless there is research that backs up the requirement that this results in better safety outcomes.
3B.19	NO	YES	N/A	Page 357: In previous edition of the manual, the R9-6 sign was predominantly used in areas where shared use paths entered congested zones. The way this sign is used in the NPA is nearly the same as how the R1-5 is used for motor vehicles. As such, a version of this sign must address "STOP FOR" states in the same manner as the R1-5a. Figure 9B-4D, when considering a "STOP FOR" state makes it clear why another version is necessary. Add a second version of this sign.
3C.01	NO	YES	N/A	Crosswalk Markings sequence is confusing; starting with a Standard in 3C01 about marking mid-block crossings, then discussing things that apply to all crosswalks, is poor organization. Crosswalks need a discussion somewhere that does not only refer to marked crossings. A Pedestrian Chapter would provide a logical organizing structure for that discussion and other missing pieces. In the absence of that chapter, reorganize this one to present overall information with clear discussion of unmarked crosswalks as well as marking standards, then address the less common uses such as mid-block. FHWA has not proposed consistent treatments for crosswalks in the revisions as combined with existing language. Proposed changes to Section 3C.01 and 9E.13 require marked crosswalks at non-intersection locations and at shared use path crossings. However, FHWA proposes to leave the Guidance statement in this section, rather than revise to a Standard. It is not clear why these locations should be treated differently. Marked crosswalks at signalized intersections should be the default application, with justification provided for why they are not appropriate. To address this current Support language can become a Standard by changing this sentence as follows: "In conjunction with signs and other measures, crosswalk markings help to alert road users of a designated pedestrian crossing point across roadways. at locations that are not controlled by traffic control signals or STOP or YIELD signs. All of this discussion should refer people to Table 1 on page 16 of

				FHWA's own STEP guidance (https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf), which provides needed information for consideration of context, posted speed, road width, and other design factors. Restore title to "Crosswalk Markings" and move the text "General Standard: Crosswalk markings shall be provided at non-intersection crosswalk locations" to end of this section. At the new location create a title called "Standards" and group the various standards for this section together, numbering them (1), (2) . . . Currently there are two standards. A third standard regarding crosswalk markings for intersections should be included to say "Crosswalk markings should be provided at intersection locations where one or more of the following are true: (a) signalized intersections where pedestrian access is not otherwise restricted (b) school zone crossings (c) transit stop crossings (d) park crossings (e) crossings in urbanized areas (d) crossings associated with destinations where pedestrian activity can be assumed. Rationale: Restoring the title and moving the non-intersection standard to the end reflects the fact that this section makes general statements about when crosswalk markings are used. Starting with the title "General Standard" is confusing because the Standard given applies to a specific context. Adding a standard regarding intersection crossings will help improve pedestrian networks (particularly in population centers) that are currently fragmented or require undue out of direction travel.
3C.02	NO	NO	YES	Page 369 line 4: Remove first sentence: "Crosswalk markings should not be used indiscriminately". This statement creates a presumptive judgement that crosswalk markings are overused. The guidance indicates an engineering study should be used when considering crosswalks at uncontrolled locations and is sufficient if coupled with a reference to the FHWA STEP guidance. In addition, MUTCD should provide support throughout this section for higher marked crossing densities in population centers, based on data concerning the high proportion of pedestrian deaths that occur while crossing and human factors research.
3C.02	NO	YES	N/A	Page 369 lines 25-35: Rewrite this information and relocate to more appropriate place. Suggest: "In addition to pavement markings, new crosswalks at uncontrolled crossings may need additional enhancements. Where the need for a pedestrian crossing treatment has been determined the following criteria may be used in an engineering study to evaluate the need for treatments in addition to pavement markings: • Total number of approach lanes • The presence of a median • The distance from adjacent signalized intersections where crosswalks are provided • Average daily traffic (ADT) • Speed limit or operating speed • The geometry of the crossing location • The availability of illumination • Motorist and pedestrian sight distance • Presence of on-street parking Enhancements for the above conditions should be selected to improve pedestrian conspicuity, decrease exposure, and/or reduce traffic speeds. Enhancements could include traffic calming measures, shortened crossing distances, enhanced driver awareness of the crossing, and/or active warning of pedestrian

				presence. The FHWA Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations can be used to determine the best treatment for the location and should be added to the list of publications that begins on page 4.
3C.02	NO	YES	N/A	Page 369: Rewrite guidance for mid-block crossings. Suggest: "Guidance: An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign to determine if additional treatments are needed to support a marked crosswalk or if a marked crosswalk should be considered for an intersection not defined in 3C.01 [note the recommended changes to 3C.01]. The following criteria should be considered to determine the need for the installation of a crosswalk treatment: A. Pedestrian/bicyclist crash history B. Known pedestrian/bicyclist crossing activity especially in dark or nighttime conditions C. Proximity and density of transit stops, trails/shared-use paths, or other pedestrian/bicyclist generators (employment centers, schools, parks, restaurants, bars, businesses, health services, etc.) D. Land use context (urban, suburban or rural town center) and future land use changes, growth, or development patterns E. Demographics of the population within the walk shed of the location (give special consideration in communities where there are higher numbers of people over 65 and people with disabilities) F. Pedestrian Consistency with local agency plans that include the location as a part of their pedestrian/bicycle network G. Pedestrian/bicyclist delay"
3C.03	NO	YES	N/A	Page 370 lines 1-19: Change "should" to "shall" in line 19. Also add to line 19 where it states, "crosswalks at non-intersection locations . . . " Suggest adding: "or a combination of treatments (such as installation of an RRFB, providing a raised crossing or installing pedestrian scale lighting) to increase pedestrian conspicuity, reduce driver speed and/or increase driver awareness, should be considered."
3C.04	NO	YES	N/A	Page 370 lines 33-40: Consider adding on line 33 to read "if an engineering study or engineering judgment determines that... ". This would be consistent with the Option in 3C.05 for adding high-visibility crosswalk markings without an engineering study. The MUTCD does not require an engineering study to establish the need to stripe motor vehicle travel lanes; this would be more consistent with how that mode is treated and allows practitioners to implement pedestrian safety plans based on FHWA STEP guidance without adding cost of an engineering study that may not be needed. Also consider adding to the list of factors following line 40: "E. Provide consistency of crosswalk treatments based on context." This gives practitioners the ability to plan and implement a consistent approach appropriate to their community context.
3C.10	NO	YES	N/A	Page 373: Reflect the need to extend the markings across the full width of pavement for low-speed urban environments.
3C.12	NO	YES	N/A	Page 373, lines 36-43: Add a "should" Guidance, such as: Pedestrian protection islands can be used in a variety of contexts but should be considered where roadways consist of more than three lanes. There is a reluctance to use pedestrian protection islands due to maintenance concerns (snowplows) or concern that drivers will run into the islands (which suggests that they might also run into pedestrians if no island is provided). Other guidance documents provide best practices to deal with these concerns. Without "should" language, they will likely be underutilized."

3D	NO	NO	YES	See comments in “Agree with another commenter (NCTUCD - Markings Technical Committee)”
3D.02	NO	NO	YES	See comments in “Agree with another commenter (NCTUCD - Markings Technical Committee)”
3D.03	NO	NO	YES	See comments in “Agree with another commenter (NCTUCD - Markings Technical Committee)”
3D.04	NO	NO	YES	See comments in “Agree with another commenter (NCTUCD - Markings Technical Committee)”
3D.06	NO	NO	YES	See comments in “Agree with another commenter (NCTUCD - Markings Technical Committee)”
3D/9E.05/9E1.0	NO	NO	YES	3D page 374, 93.05 page 771, 9E.10 page 776: Circular intersection markings need more development and research to consider movements of bicyclists who may or may not exit to a sidewalk/crosswalk to traverse the intersection. There is no direct guidance for signage or pavement markings that will help bicyclists who wish to remain in the lane to use roundabouts or help drivers recognized the bicyclist's right to be there. The only MUTCD guidance regarding bicycles in roundabouts refers users out of the MUTCD to AASHTO "Guide for Development of Bicycle Facilities" Section 1A.05; there is no Section 1A.05 in the current edition (2012) of that guide so this may refer to the new draft AASHTO Bike Guide, which is premature so this should be planned for an early update. Section 3D.01 (page 374) refers to 9E.05 (page 771) for guidance on bicycles. That section then refers to 9E.10 (page 776), which says only that "Shared-lane markings should not be used in the circulatory roadway of the circular intersection if the circulatory roadway is multi-lane." This suggests that shared lane markings might be appropriate for single lane roundabouts, but no guidance is provided on when to use them, just when not to. Guidance for shared lane markings in 9E.09 talks about using shared lane markings in mixing zones or more general use, but not roundabouts. Some single lane roundabouts have design speeds that could make shared lane markings a poor choice. Some bicyclists ride through roundabouts instead of switching from the bike mode to the pedestrian mode (a loss of efficiency) for the purpose of crossing. They see the exit ramps from the bike lane as riding on a sidewalk, which may or may not be permitted under local ordinances. The circumstance of a bicyclist riding in a multilane circular intersection and exiting in their direction of forward travel needs to be clarified. Bicyclists who wish to remain in the travel lane have concern that drivers think they don't belong there. Shared lane markings are one way to indicate that bicyclists can use the lane and need to be allowed in multilane roundabouts based on context and engineering judgment. This does not fully address concerns and this topic requires research.
3E.03	NO	NO	YES	Page 381, Line 38: Recommend replacing “LRT” with “RAIL” because the public will not know what LRT is. Even though light rail is not technically RAIL, the public will understand this concept better than LRT.
3E.03	NO	NO	YES	Page 382, Lines 5, 6, 8, & 10: Recommend removing the ILEV acronym.
3H.03	NO	YES	N/A	Page 390 lines 20-22: The Guidance language on line 20 is both incorrect and inappropriate. The right-of-way is not "dedicated exclusively to highway-related functions", particularly as inaccurately defined above in this document where it was defined as restricted to motor vehicle use, inconsistent with federal law. Communities make use of the right-of-way for community events, exercise of their First Amendment rights, parades, and certainly for walking and bicycling. Restrictions on the use of decorative

				crosswalks can be contextualized to be limited to high speed, limited-access highways instead of applying a one size fits all approach that treats neighborhood streets as if they are interstates. The first sentence of Guidance should read simply: "A policy for using aesthetic treatments in crosswalks should consider whether their use or design is appropriate for the community context." The Support language in lines 28-34 and Standard on lines 36-38 are unnecessarily restrictive. The MUTCD is not the place to decide whether use of earth tones alone can adequately reflect a community's unique character and research on this color palette for decorative crosswalks is not in evidence. No study has ever been conducted to establish that aesthetic crosswalks reduce safety; in fact, in some locations where aesthetic crosswalks have been installed news reports indicate that crashes have been reduced thanks to a traffic-calming effect. The requirement on lines 43-44 that aesthetic treatments should not confuse pedestrians with low/no eyesight is essential. It should be updated to read: "Aesthetic treatments for the interior portions of crosswalks shall not be of a surface that can confuse ~~vision-impaired~~ pedestrians <u>with low or no eyesight</u> that rely on tactile treatments or cues for navigation." Avoid "impairment" language for disabilities. Highway treatments routinely employ both context sensitive designs and use of artistic and aesthetic elements. Aesthetic treatments are applied to highway sound walls, public art and landscaping are placed in medians, with no concern stated for driver distraction because it's different than the last median they passed. Especially where highways pass through communities, it would be appropriate to consider contextual treatments in association with appropriately conspicuous crossing treatments. Until such time as evidence is provided that decorative crosswalks perform worse than other types of crosswalks, agencies should be able to apply engineering judgment and install community-identifying crosswalks that reflect local character and context.
3H.06	NO	NO	YES	Page 392: not add language that prohibits the use of green pavement on shared-use paths, shared-lane markings, crosswalks, on separated bicycle lanes on an independent alignment, and across driveways or ramps. All of these fit the discussion in the Support language on lines 1-5. The discussion of green paint in bike lanes should be in Part 9 with a cross-reference here (reverse of what they did). Color works. Green pavement marking should be allowed on shared-use path where bicyclist movement is separated from pedestrian movement, which is a common enough instance to provide guidance for. Green-backed shared lane markings are subject to requests to experiment; the proposed language would explicitly and unnecessarily disallow this without any research to justify it. Research shows just the opposite--that it enhances road user awareness of the presence of bicyclists and encourages use, which is useful in contexts where bike movement may be unexpected. Green-backed sharrows add conspicuity to unexpected lateral shifts approaching intersections and in other configurations where line of travel may shift and should be allowed with

				engineering judgment. Independent alignment of separated bike lanes may also be needed to clarify right-of-way and presence of bicyclists. In some context extending the green paint across a ramp or driveway provides information for the driver to expect bicyclists. Keep its use in those contexts available subject to engineering judgment.
3I.01	NO	YES	N/A	Page 395, lines 6 and 8: Add figure to show use in protected bike lane. Could not find figure 6F-7. It would be helpful to have a figure that shows a number of applications/types including where it is used in a buffered and/or protected bike lane.
3J.07	NO	NO	YES	Page 400 lines 7-9: Curb extensions defined only by pavement markings should be considered inside of the street. When curb extensions are painted in, pedestrians who enter them are vulnerable to traffic. Entering such a space should trigger the requirement for a driver to stop at any associated crosswalk just as they would have to if a pedestrian left the protection of a physical sidewalk.
3J.07	NO	YES	N/A	Page 400, lines 24-25: Remove reference to the area between the double line and curb as being outside the street since this negates the appropriate use of detectable warning surfaces, which are the interface with the street. Provide an additional Option C which is similar to Option B but provides a detectable warning surface at the edge of the travel way, requires vertical elements along the edge of the curb extension, and removes the detectable warning surface at the curb line.
4A.03	NO	YES	N/A	Page 402, lines 31-34: Language in the Standard on lines 31-34 seems to suggest that a driver should not yield the right of way to a pedestrian who is not "lawfully within an associated crosswalk". Recommend that this be reviewed for alignment with ADA accessibility and state laws and that the Standard be updated accordingly. The manual should require crosswalk markings at all signalized intersections, as noted elsewhere. The question of whether a driver is required to yield to someone is addressed under state law in ways not fully accounted for here. Washington state law (RCW 70.84.040) says drivers "shall take all necessary precautions to avoid injury" to pedestrians using a white cane, dog guide, service animal, or wheelchair. In an example of a common circumstance, on a street where the curb cut directs the wheelchair user diagonally into the intersection, they roll into the travel lane and have to circle back to be "lawfully within an associated crosswalk".
4A.05	NO	YES	NO	Pages 405 & 406, lines 30 and 1: references to “RX-XX” signs should at least be more limited to “R10-XX Series” signs
4A.05	NO	NO	YES	The addition of the R10-XX series bicycle signal signs is going to need additional clarification to explain protected vs. permissive movements. The concern is that generally, with vehicle signals, directional arrow signs (R3-X series) are associated with unconflicted movements. Will cyclists seeing an R10-41b sign believe that they can make a protected left turn against oncoming bicycle traffic? See additional comments RE: Section 9B.22
4A.05 (and subsequent references)	NO	YES	N/A	Pages 405-406 and elsewhere that refers to this section: Need to clarify use of colors and flashing for consistent meaning across modes. The proposed Section 4A.05 uses the same language to describe the meaning of a steady GREEN BICYCLE and a flashing YELLOW BICYCLE indication; these two indications cannot have the exact same meaning. Remove the word "cautiously" from the meaning of a steady GREEN BICYCLE on line 18 so that it is consistent with the existing meaning of a steady GREEN indication to motorists in 4A.03 under

				the Standard. The proposed text in Section 4H.01 allows the practitioner to use either indication in situations where permissive turns are permitted across the bicycle facility at signalized intersections. Unclear and inconsistent. Further, if a flashing YELLOW BICYCLE indication is presented to bicyclists, and a flashing YELLOW ARROW indication is presented to turning motorists, there is some confusion as to who has the right-of-way. Bicyclists should always have the right-of-way in this scenario. The proposed signal indication setup (flashing YELLOW BIKE and flashing YELLOW ARROW) should be reserved only for situations where the normal right-of-way is not present. The discussion on when to use a flashing YELLOW BICYCLE indication must be expanded upon in Section 4H to clarify its use. Finally, NCHRP Report 273 researched the current application of bicycle signal indications throughout the country. The paper identified several needs for future research based on current use and agency interviews. One of these research ideas was to "identify guidance on ways to communicate with a person on a bicycle that their movement is protected or permissive and whether it conflicts with other road users." Since this research is not completed, it is appropriate that the proposed changes do not recommend a method for making this distinction; however, FHWA should prioritize funding in this area and make subsequent changes to the Request to Experiment process to enable easier experimentation to accomplish this goal.
4A.06	NO	YES	N/A	Page 406 lines 13-19: The Standard should be labeled Guidance to allow for state or local laws that allow entry during the flashing hand where a countdown timer provides additional information.
4B.02	NO	YES	N/A	Page 409 lines 14-17: Change the text to read, "A series of signal warrants, described in Chapter 4C, provide guidance for the conditions under which installing traffic control signals might be justified. This includes a careful analysis of traffic operations, pedestrian and bicyclist needs, combined with engineering judgment." As written, "define the minimum conditions" reads as a Standard, which is not consistent with the shift away from standards towards guidance.
4B.02	NO	NO	YES	Page 409 lines 41-43: Change the text to read, "Traffic control signals may be operated for the purposes of speed management to set platoon speeds or rest in red operations. Additional speed management treatments may be needed to obtain driver compliance with the traffic signal." Signals that have advance speed detection or rest in red to explicitly control speed (i.e., you don't get a green if you're speeding) are already being used in some jurisdictions. Not aware of any research that indicated this was an unsafe application. In an urban core or on a bicycle boulevard signal timing may be set to encourage smooth flow for all based on an average bicyclist pace (the "green wave" described in FHWA's Bicycle Safety Guide and Countermeasure Selection System). Jurisdictions need the ability to implement appropriate speed management tools based on context.
4B.04	NO	YES	N/A	Page 410 lines 21-33: The beginning of section 4B mentions special attention being paid to bicyclist and pedestrian movements. 4B.04 as written does not adequately incorporate recognition of the movements of bicyclists and pedestrians as "traffic", particularly with item D's emphasis on "nearly continuous movement of traffic" and

				the discussion of "progressive traffic flow" under 4C.01. This description is appropriate for a limited-access high-speed highway but inappropriate for a dense urban core. This section needs an update to reflect the variety of contexts within which traffic signals are used. It needs to explicitly recognize that pedestrian, bicyclist, and transit movements also need to be considered and that in some places far more people are moving through an intersection in the crosswalk than in the travel lane. Item C should be updated to replace "especially right-angle collisions" with "especially serious and fatal collisions" to reflect a safe systems approach.
4B.05	NO	YES	N/A	Page 411 line 17: Add "Rectangular Rapid Flashing Beacon (see Chapter 4L)," after reference to pedestrian hybrid beacon.
4C.01	N/A			Page 412: This section needs to incorporate FHWA's own STEP guidance that takes into consideration roadway width, volume, and posted speed to indicate where a signal should be installed to improve pedestrian safety. This can be done in a way that acknowledges context and distinguishes between limited-access roadways and other situations. Safety criteria need to be clear and measurable factors in the decision for when to install or how to operate the signals, approached within a proactive safe systems approach. Requiring pedestrian volumes to reach a certain level in a system not designed or operated for their safety is not sufficient as a reasonable or research-based approach to identifying the need for greater controls in a multimodal context. Lines 20-21: To create a balanced Standard this sentence should be followed by a statement that completes the basis for the Guidance and Option language below this: "Failure to satisfy a traffic signal warrant or warrants shall not in itself rule out the installation of a traffic control signal." This would then also be added to the definition of "Warrant" on Page. 31, lines 5-10, and in other places where the Standard or Guidance implicitly accommodates engineering judgment in decisions about adding or not adding intersection controls. Line 33: This statement needs exceptions. As written the only kind of traffic to be factored in is vehicular traffic. This could directly conflict with the language on lines 31-32 if signals that "seriously disrupt progressive traffic flow" are appropriate and necessary due to existing or planned changes in context, in keeping with a speed management plan, part of an overall safety plan, necessary to provide network connectivity for pedestrians and bicyclists to reduce the number of fatal/serious crashes, etc. etc.
4C.01	NO	YES	N/A	Page 413 lines 25-28: The Support statement would be improved with the addition of language that addresses the need for a signal to eliminate a gap in the bicyclist network. Existing volumes may not be representative of need if bicyclists avoid this location due to the lack of a signalized crossing. Count bicyclists in whichever way prioritizes movements of vulnerable road users and supports network connectivity and completeness.
4C.01	N/A			Pages 413-414: Under Option, add to the engineering study data information sources to include information that situates the crossing within the overall network: p. 414 after lines 1-2, add H: A diagram showing existing and planned pedestrian and bicyclist facilities, including distance to the

				nearest signalized crossing or other controlled crossing and to transit stops/stations or trailheads that lie within one-half mile of the intersection. p. 414 line 5 item A: This should include calculation of stopped time delay for all user types, not just vehicle users. p. 414 line 10 item D: Add so this addresses pedestrians and bicyclists. Question that needs to be addressed, p. 414, line 6, item B: Is an "acceptable gap" defined in terms of the speed with which a driver can cross the road without a signal? The definition of "acceptable" needs to consider crossing speed of pedestrians and bicyclists relative to speed of oncoming drivers.
4C.05	N/A			Pages 416-17: This section should not lower or eliminate the option of using a traffic signal to provide for pedestrian movements. Nor should the manual require more people walking at a subject intersection than cars to meet a signal warrant. Recommend that the National Council on Uniform Traffic Control Devices (NCUTCD) integrate the 2017 NTSB recommendations to incorporate a safe systems approach and strengthen protection for vulnerable road users. Change the title of this section to, "4C.05 Traffic Signals for Pedestrians" (this will require changing the name where is it referenced in other parts of the document) Page. 416 line 42 to line 20 on page 417, change the text to read, "Support: The need for a pedestrian crossing treatment should be based on findings from Section 3C.02 (proposed revised language above). Guidance: Do not use pedestrian or bicyclist volume warrants to determine need for a traffic control signal. Especially where traffic speeds and volumes would create conditions where pedestrians or bicyclists would experience excessive stress or delay. Where the need for a pedestrian crossing treatment has been identified, use the table on page 16 of FHWA's STEP guidance (https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf), to determine if a traffic signal is the right treatment for the location based on posted speed, road width, and other design factors." Delete the other text. Page.417, line 21, change the text to read, "Standard: If installed the traffic control signal shall be equipped with pedestrian signal heads...". Delete the text on line 26 "If this warrant..." and lines 39-43 "Option" If it is kept, there is a reference on line 24 to pedestrian signal head requirements in 4I. As noted in comments on 4I, pedestrian signal heads need to have an APS; no engineering study should be required given that the ADA governs accessibility standards. (This comment applies wherever pedestrian signal heads refer to 4I as the standard.)
4C.06	N/A			Page 417 line 48: A pedestrian traffic signal is an important treatment option for school crossings and the safety of vulnerable road users with less ability to determine an "adequate gap in the traffic stream" (Page. 418 lines 3-4) than pedestrians at other types of crossings. The decision needs to take posted speed into account.

				Change the title of this section to, "4C.05 Traffic Signals for School Crossings" (this will require changing the name where it is referenced in other parts of the document) Page. 417 line 46 to line 12 on page 418, change the text to read, "Support: This section is intended for application where the fact that schoolchildren need to cross a major street is the principal reason to consider installing a traffic control signal. The need for a school crossing treatment should be based on findings from Section 3C.02 (proposed revised language above). Guidance: Do not use pedestrian or bicyclist volume warrants to determine need for a school crossing traffic control signal. Especially where traffic speeds and volumes would create conditions where children would experience excessive stress or delay. Where the need for a school pedestrian crossing treatment has been identified, use the table on page 16 of FHWA's STEP guidance (https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf) to determine if a traffic signal is the right treatment for the location based on posted speed, road width, and other design factors." Delete the other text. On line 14 change text to read, "If a school crossing traffic control signal is installed, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4I." On line 18 change text to read, "If a school crossing traffic signal is installed then"
4C.08	NO	YES	N/A	Pages 418-419: This warrant should use a safe systems approach that is proactive and determines the need for a signal based on the crash performance of all intersections with similar road characteristics over a 3-year time period.
4C.09	NO	YES	N/A	Page 420: The concept of network organization needs to be extended to consider pedestrian/bicyclist network connectivity as described in the FHWA Guidebook to Measuring Multimodal Network Connectivity. Add text to reflect the understanding that a shared-use path or trail may serve as major route for through pedestrian/bicyclist flow.
4D.02	NO	YES	N/A	Page 423 line 19: Remove the requirement of an engineering study to install an APS. The ADA addresses rights under federal law that are not subject to assessment of requests or volumes and jurisdictions have ADA Transition Plans to guide decisions. If an agency's policy is to install APS, it should not be required to complete an engineering study. This also appears to preempt the draft PROWAG that requires APS wherever new pedestrian signals are installed.
4D.02	N/A			Page 423 line 41: Delete the first part of the sentence so that the text reads, "Pedestrians should be provided with sufficient time to cross the roadway by adjusting the traffic control signal operation and timing to provide sufficient crossing time every cycle or by providing pedestrian detectors."
4D.02	NO	NO	YES	Page 423 lines 16-29: Change the text to read "Pedestrian signal heads shall always be used in conjunction with vehicular traffic control signals unless the crossing is prohibited." delete all other text.
4D.03	NO	YES	N/A	Page 423: Concur with option to allow bicycle signal faces to be used where it is desired to provide separate signal indications to control bicycle movements at a traffic control signal as this change is in line with increasing bicycle activity and infrastructure throughout the country. Note, some states allow bicyclists to treat a signal like a stop sign

				where bicyclist can proceed through a red indication after stopping if traffic is clear. Propose additional language to clarify how the proposed meaning of the red bicycle signal indications would be handled.
4D.08	NO	NO	YES	Page 428, Lines 43-47: Maximum display heights needs to remain a standard, as there are frequently issues with displays being too high and too close to a stop line, such that no driver at the stop line can see a display without leaning forward over the steering wheel and looking up – particularly in smaller cars. Similar issues for motorcycles and bicycles, requiring them to look so high up that they cannot keep an adequate view of the intersection.
4E.01	NO	YES	NO	Page 431, Lines 18-20: Recommend deleting the term “dual-arrow”, as it sounds like an arrow display with two heads, rather than a bi-modal (two available colors) display. Otherwise, an alternate term such as “dual-color” or “two-mode” may be more appropriate.
4F	NO	YES	N/A	Page 436 and below: Discussion of steady, flashing, and permissive/protective for signals directed at drivers needs to be reviewed against bicycle traffic signals discussion in 4H for consistency. Most people who bicycle also drive and meanings of signals should be consistent across modes. In addition, both pedestrians and bicyclists may have signal heads separate from the motor vehicle heads or may be present in a crosswalk; references to both together are most appropriate in defining who a motorist yields to or who may have a permissive or protected phase.
4F.01	NO	YES	N/A	Page 436, lines 13 and 50: Add so text reads "except pedestrians directed by a pedestrian signal head or bicyclists directed by a bicycle traffic signal" here and any other locations that have the "except pedestrians directed…" language. (No others found but if that language is added elsewhere in modifications, stay consistent.)
4F.01	NO	YES	N/A	Page 438: Flashing Yellow Arrow signal needs to provide for "shall not be displayed" pre-emption by a pedestrian pushbutton with Standard like that on Page. 436, lines 22-25 under steady yellow arrow. This was implemented in Idaho after a pedestrian fatality: https://www.ktvb.com/article/news/local/achd-new-uPagerades-will-make-left-turns-safer-for-pedestrians-drivers/277-23d9c51a-6a90-4b0e-80cc-c8055a672628
4F.01	NO	YES	N/A	Page 437, line 6: Add to text so it reads "after yielding to pedestrians or bicyclists, if any Page. 438, line 10: Add to text so it reads "after yielding to pedestrians or bicyclists, if any…"
4F.02	N/A			Page 440 line 4: Add to text so it reads "after yielding to pedestrians or bicyclists, if any…"
4F.09	N/A			Page 447 line 4: Add to text so it reads "after yielding to pedestrians or bicyclists, if any…"
4F.19	NO	NO	YES	Page 459, Lines 36-38: Revise Item C to “shall not be permitted”. Shortening or omitting a pedestrian change interval when a pedestrian is present does not remove the pedestrian from the intersection, unnecessarily introduces the risk of a pedestrian still being in a crossing when a conflicting vehicle movement is present and poses a significant and potentially lethal hazard for non-visual users in particular. Allowing this is likely to result in a fatality.
4H.01	NO	YES	N/A	Page 464 lines 32-37: Modify the Option to allow permissive turns across two-way separated bike lanes based on engineering judgment. This scenario is not meaningfully different than a side path, which does not have a similar restriction on permissive turns. This should also be an option when drivers are shown a flashing red arrow, which would provide drivers with more time to check for oncoming bicycle traffic. The decision whether signal phase separation is needed should be made based on context.

4H.01	NO	YES	N/A	Page 464 Line 12: Change "counter-flow" to "contra-flow" per other comments on this usage. Add additional Options to the list on lines 8-15 as follows: "To provide a fully separated bicycle signal phase." " To provide for the movement of bicyclists on a separated bike lane or side path that goes through an intersection".
4H.02	NO	NO	YES	Page 465 lines 1-2: Remove prohibition on use of bicycle signal face at PHB. There is no research basis for this prohibition; practitioners have been using bicycle signals in conjunction with Pedestrian Hybrid Beacons without incident in Phoenix and Tucson. In the absence of evidence that this operation is problematic, use of bicycle signals with PHBs should be based on engineering judgment. The benefit would be to allow a shorter crossing clearance time when the signal is used only by bicyclists; additionally, there could be some added uniformity based on context of the local bicycle network, which aligns with the Guidance in 4H.01.
4H.03	NO	NO	YES	Page 465: Remove Section 4H.03; the text is confusing ("new designs"?) and may be interpreted to mean that a bicycle signal requires a specific warrant in and of itself. Move Guidance and Support for the decision to install bicycle signals to Section 4H.01 "Use of Bicycle Signal Faces". Their use should be considered an element of bicycle facilities network connectivity, which is captured to some extent under the Support language concerning a retrofit "where such a determination is not required through an engineering study"..
4H.04	NO	NO	YES	Page 465, Lines 25-26: Why? Signs should be optional unless there is a demonstrated need, such as non-obvious receiving paths or movements that must be controlled separately.
4H.06	NO	NO	YES	Page 465, Lines 46-47: References the wrong sign numbers, doesn't reference enough signs (see 4H.04), and the statement regarding the signs should only apply when the signs are present.
4H.04	NO	YES	N/A	Page 465: Change the Standard to a Guidance statement. The necessity of a sign accompanying a bicycle signal indication should be left to engineering judgment based on the context. FHWA needs to consider options for practitioners to change the signal backplate to integrate word messages and/or colors to differentiate bicycle signals from motor vehicle signals. The reality is that urban corridors are constrained, and more tools are needed to distinguish the two signals than just a regulatory sign. The bicycle signals in Long Beach, CA are an example of an option that should be available (https://www.flickr.com/photos/army_arch/11667800784/).
4H.05	NO	YES	N/A	Page 465: Mirror Section 4H.05 to how Section 4F.01 combines and lays out "Application of Steady and Flashing Signal Indications "during Steady (Stop-and-Go) Operation". As proposed, practitioners are allowed to use steady GREEN BICYCLE and flashing YELLOW BICYCLE indications in the same scenario, where permissive turns are permitted across a bicycle facility at a signalized intersection. The steady GREEN BICYCLE and flashing YELLOW BICYCLE should not have the same meaning and should not be used interchangeably; this is counter to the meanings of signals in general. The use of a flashing YELLOW BICYCLE should be better reserved for situations when the traffic control signal is operated in flashing mode, as described in 4H.06. As recommended by NCRHP Report #273, research is needed to determine guidance on ways to communicate with a person on a bicycle that their movement is protected or permissive and whether it conflicts with other road users. If a well-researched method for

				communicating this was available, a corridor with both permissive and protected movements would by necessity have some inconsistency in bicycle signal indications but would be more consistent in communicating the signalized crossing to people on bicycles.
4H.06	NO	NO	YES	Page 468 Line 8 sets the Standard yellow change interval for bicycle signal faces at "shall be 3 seconds." This is shorter than the intervals provided in 4F.17 Guidance for motorists, who would often be moving faster than a bicyclist and be able to clear the intersection more quickly. Change Standard to Guidance and remove text "except that the minimum duration of the yellow change interval shall be 3 seconds." The Support statement that follows that the red clearance interval is the time during which bicyclists are expected to clear the intersection is not consistent with the use of a red signal. That may be how the timing is set but it should not be defined as the intended meaning of the red; this is the function of the yellow interval, which needs more time to work as intended and which should be adjusted for overall roadway width in a given context (and potentially topography--longer in an uphill direction where the climb slows average pace).
4I.01	NO	NO	YES	Page 469: Add Standard that an APS shall be installed whenever a pedestrian signal head is installed. Remove the requirement of an engineering study to install an APS. The ADA addresses rights under federal law that are not subject to assessment of requests or volumes. This also appears to preempt the draft PROWAG that requires APS wherever new pedestrian signals are installed; do not create unnecessary conflict with a rule that at some point will be forthcoming from another federal agency.
4I.04	NO	YES	N/A	Page 471 line 2: Move the existing text, "Where countdown pedestrian signals are used, the countdown shall always be displayed simultaneously with the flashing UPRAISED HAND..." from the Standard section into the Guidance section to avoid creating conflict with laws in some states that permit a pedestrian to encounter the crosswalk if the countdown indicates sufficient time for them to cross. It needs to be possible to provide the countdown information to pedestrians decoupled from the DON'T WALK flashing hand.
4I.05	NO	YES	N/A	Page 471 Line 46 add text, "The intent is to place pedestrian pushbuttons where pedestrians using wheelchairs or other mobility aids can readily actuate the pushbutton and quickly reach the access ramp. These provisions place the pedestrian pushbutton close to the crosswalk where a pedestrian is more likely to use the pushbutton"
4I.05	NO	YES	N/A	Page 472 line 3: Define the reach requirement in 4I.05.A in this document rather than referring to two separate external sources. Also consider referring to PROWAG reach dimensions, preferably those in the draft awaiting approval.
4I.05	NO	YES	N/A	Page 472 line 11: Change 4I.05.D to "Immediately adjacent to a level landing at the top of the curb ramp". A push button placed up to 10' from a curb ramp is not helpful for users with disabilities. A user with a vision disability cannot effectively use a push button to provide a crossing direction cue when the push button is not aligned with the truncated domes. A user in a wheelchair will have difficulty bracing their chair on a grade while pushing the APS button. One example of this placement requirement can be found in the Minnesota DOT's "Curb Ramp Guidelines" - https://www.dot.state.mn.us/ada/pdf/curbramp.pdf, see pages 23-25.

4I.05	NO	YES	N/A	Page 472 line 46: Line 46 add text, "The intent is to place pedestrian pushbuttons where pedestrians using wheelchairs or other mobility aids can readily actuate the pushbutton and quickly reach the access ramp. These provisions place the pedestrian pushbutton close to the crosswalk where a pedestrian is more likely to use the pushbutton"
4I.06	NO	YES	NO	Page 473, Lines 32-35: Revise to allow either flashing or steady red signal indication for conflicting vehicle movements. Omission of the flashing red portion needs to be an option where there are issues with conflicts during the pedestrian clearance phase, such as second pedestrian from opposite direction ('second train' problem).
4I.06	N/A			Page 474 lines 25-26: Option language: "If pedestrian volumes and characteristics do not require a 7-second walk interval, walk intervals as short as 4 seconds may be used." This doesn't seem to have a lot of guidance for when a 7-second interval would not be required, nor does it account for crossings providing improved network connectivity that will lead to projected increases in pedestrian volumes if the crossing actually does improve the network by allowing sufficient crossing time. If you assume 3.5 feet per second, this is enough time to travel 14 feet--how many roads have two 7-foot travel lanes?
4I.06	NO	YES	NO	Page 475, Lines 25-27: Recommend revising to read: "At locations where a leading pedestrian interval is used without accessible pedestrian signals, the WALKING PERSON (symbolizing WALK) shall be displayed for the full minimum required time for the Walk Interval in addition to the time provided for the leading pedestrian interval."
4I.06	N/A			Page 475 line 6: Revise the text to read, "At intersections with high conflicting turning vehicle volumes, a brief leading pedestrian interval..." If pedestrian volumes must be used include projected or planned as well as actual volumes. (Which is done all the time for driving signal warrants)
4J.01	NO	YES	N/A	Page 476 lines 23-42, delete existing text and insert, "Use the FHWA Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations to determine when a pedestrian hybrid beacon is the best treatment for pedestrian safety. Do not use pedestrian or bicyclist volume warrants to determine need for a pedestrian hybrid beacon especially where pedestrians or bicyclists would experience excessive stress or delay. Consider the density and proximity of homes and other pedestrian and bicycle traffic generators such as schools, transit stops, rail, parks, and commercial development to determine when a pedestrian crossing is needed." Delete Figures 4J-1 and 4J-2 and all reference to them. For lines 43-45 change the text to read, "Where there is a divided street having a median of sufficient width for pedestrians or bicyclists to wait, the criteria for the major-street traffic volume shown in Figure 4J-1 need only be met for one side for it to be applied to both sides.
4J.02	NO	YES	NO	Page 477, Line 25: Recommend revising "signal system" to read "signalized corridor" or comparable term for nearby signals. Signal system sounds like part of a conventional traffic signal system.
4J.02	NO	NO	YES	Page 478 line 6: Change the text to read, "Bicycle signal faces (see Chapter 4H) may be used..." Bike signal might be important for complete streets treatments.
4J.03	NO	NO	YES	Add option to allow omission of flashing circular red phase. Allows means to prevent vehicles from invading pedestrian clearance phase where conflicts are discovered.
4J.03	NO	NO	YES	Page 478, lines 28-31: Revise to allow for any PHB pedestrian signal heads to rest in dark, not just the one installation case

				discussed. There are many locations where outside of peak vehicle periods, there is no need for pedestrians to have to wait to activate a PHB system, and this will allow them to cross legally without waiting for the system to cycle, reducing delay for both the pedestrian(s) and any vehicles that show up partway through the cycle.
4J.03	NO	NO	YES	Page 478 lines 39-42: Delete the option section that would allow the pedestrian hybrid beacon to remain in dark condition after a pedestrian actuation until the minimum dark time has been provided. This allows more flexibility.
4K.03	NO	NO	YES	Page 482, Lines 14-20: Percussive tones should not be mandatory, and an entire intersection should use the same indications (percussive tones or speech messages) for consistency and to meet user expectations. Using speech messages on one corner and percussive tones on the receiving corner is confusing at best.
4L.01				Page 488, lines 38-39; Clarification on the use of audible information devices for RRFB activation push buttons (locator tones). It's unclear if push button locator tones can be used without the audible message "Yellow lights are flashing" reference on Page 489, lines 40-44
4L.02	NO	YES	NO	Page 488, Lines 41-42: RRFB units should be permitted to be installed directly above or below the overhead sign. Above the sign in all cases reduces the risk of being blinded by the strobe when trying to read the sign and identify the pedestrian, as the strobe is farther from the expected area of visual focus.
4L.02	NO	YES	N/A	Page 488 line 47: Change guidance to standard, change text to read, "An audible information device with a locator tone shall be used with RRFBs to assist pedestrians with vision disabilities."
4L.02	NO	YES	NO	Page 488, line 186: Need to finalize reference paragraph (currently reads "paragraph X").
4L.03	NO	NO	YES	Page 489, Lines 43-44: Speech warning message should be revised to "Warning lights should be on – cross with caution." Stating that "yellow lights are flashing" may not be true if there is an error in the system resulting in the lights not flashing, and there is no backup control for vehicular traffic like there is with a traffic signal system.
4L.03	NO	YES	N/A	Page 489 lines 40-41: The use of an audible information device in conjunction with RRFB needs to be made standard. The Standard as written reads "if" such a device is used. The ADA is not optional; use of the audible information device needs to be required. Change sentence on lines 40-41 to read: "~~If~~ Use an audible information device ~~is used~~ in conjunction with an RRFB~~;~~, the audible information device shall not use vibrotactile indications or percussive indications." Make the same type of change on line 43 to drop the "if" and make it a straight requirement.
4P	NO	NO	YES	I only have one request regarding the Executive Summary # 435 of the FHWA Summary, cut and pasted below for reference. To remove and rewrite Section 4(I) now become proposed 4(P) in its entirety. This Summary appears to justify the Official Ruling No. 4(09)-6(I). The Ruling and the Summary were based on lose ground, which requires the ramp meter to meet all requirements of a conventional traffic signal, i.e., intersection control signal, with few exceptions. It should be the other way around that the meter shall only meet few minimum requirements of traffic signal in term of display color, physical dimensions, and appearance, specifically 8" or 12" lens, red, yellow, green indication arranged from top to bottom. Other than that, everything else are different.

				Reasons: 1- Except for the flashing beacon as warning signal, **all requirements in Chapter 4 pertain to using signal indicators to assign right of way for conflicting movements.** 2- Ramp metering does not assign any right of way, hence do not have to meet strict rules in term of intersection clearance, conflict monitoring, minimum clearance interval, minimum time, minimum sight distance, redundance dual display, etcetera. **Ramp meter simply regulates the concurrent movement,** merging ramp traffic into mainline traffic. With or without the ramp meter, the concurrent flow still happens, safely. WSDOT strongly suggests the FHWA remove 4(I), put a place holder on 4(P) and have an emergency meeting with the States to simplify the Ramp Meter signal section.
4P.02	NO	NO	YES	Page 495, Lines 36-40: Revise current text to apply only to ground mounted signals for two lanes and allow alternative of one display per lane when installed overhead. There are many locations with two controlled lanes where it is not possible to install ground mounted posts on both sides of the ramp. Single overhead displays for two separately controlled lanes have also been adequate and functional in many states for many years.
4S.03	NO	NO	YES	Page 503, Lines 14-16: Speech warning message should be revised to “Warning lights should be on – cross with caution.” Stating that “yellow lights are flashing” may not be true if there is an error in the system resulting in the lights not flashing, and there is no backup control for vehicular traffic like there is with a traffic signal system.
4S.04	NO	NO	YES	Delete the proposed Standard which would prevent the use of LEDs within the border of a Speed Limit sign to indicate the speed limit is in effect.
4U.01	N/A			Page 508 line 7: Change text to read, "...includes situations warning of marked school crosswalks, trail crossings..."
4U.02	NO	YES	N/A	Page 509 lines 24-38: Concur with the proposed change; however, - "Yellow lights are flashing" suggested message language does not allow flexibility. "WAIT FOR TRAFFIC TO STOP THEN CROSS WITH CAUTION" is one option sometimes used. Suggest greater flexibility in audible warning message.
4U.02	NO	NO	YES	Page 509, Lines 36-38: Speech warning message should be revised to “Warning lights should be on – cross with caution.” Stating that “yellow lights are flashing” may not be true if there is an error in the system resulting in the lights not flashing, and there is no backup control for vehicular traffic like there is with a traffic signal system.
Part 5 – Automated Vehicles General Comments	NO	NO	YES	In general, I think all of Part 5 should be removed, and the relevant recommendations included in their respective original sections instead. It’s all guidance and support anyway, so I think that Part 5 will be ignored by most, and that the one Standard in 5B.04 will be missed regularly. Inserting it into the respective original sections would help it to be seen regularly and actually get non- Cooperative Automated Transportation (CAT) / Connected and Automated Vehicle (CAV) people thinking about it more.
Part 5 – Automated Vehicles General Comments	NO	NO	YES	The purpose and scope of this chapter is too focused on accommodating Automated Vehicles without consideration for the negative consequences to other modes such as bicycles and pedestrians. Further-more, given that almost everything in this chapter is a support or guidance statement perhaps the timing isn’t right to introduce this type of chapter into the MUTCD. Support and

				guidance statements offer little and/or miss-leading value in today's resource constrained environment. If something is worth doing it should be a standard, and also included within other parts of the manual.
5	NO	NO	YES	Recommend deleting all of Part 5. It is not appropriate to add statements, even if they are Guidance statements, to the Manual for technology that is in its infancy and does not have sufficient research to support statements, particularly with respect to whether the Standard, Guidance, Option, or Support is sufficient for safety and mobility of people outside the vehicle. To prepare for the possibility of widespread use of CAVs, FHWA should focus on standardizing consistent and intuitive access for pedestrians, bicyclists, and other vulnerable road users. This will improve functioning of roads for today's users as well as tomorrow's and provide more information to all so CAVs can adapt to the environments they are likely to encounter in a wide variety of roadway contexts. If Part 5 is not deleted, omit comments on specific segments are provided as well.
5A.02	NO	YES	NO	"AVs are vehicles in which at least one element of vehicle control (e.g., steering, speed control, braking) occurs without direct driver input." This is probably broader than FHWA/NHTSA policy, which usually makes a distinction between Advanced Driver Assistance Systems (level 1-2 SAE automation) and Automated Driving Systems (level 3-5 SAE automation).
5A.04 Traffic	YES	NO	NO	"Agencies should adopt traffic control device maintenance policies and or practices with consideration to both the human vehicle operator and DAS technology needs"
5A.04 Traffic	YES	NO	NO	"Established maintenance policies that incorporate effective practices to ensure the clear message intended to the road user on traffic control devices reaching the end of their useful life, or are damaged or otherwise no longer serviceable, be identified, fixed or replaced in a timely manner." I like this, makes me think of "fix it first" policy asks.
5A.04	NO	NO	YES	"D. Removal of extraneous devices that are no longer necessary or that provide limited benefit to vehicle operation or navigation." I'm worried that this only mentions vehicle operation and does not consider people walking.
5A.04	NO	NO	YES	Page 512 line 13: Change the text to read, "Agencies should adopt traffic control device maintenance policies and or practices with consideration to both the human vehicle operator and DAS technology needs, with a primary concern for the safety of roadway users outside the vehicle..." Without this addition, all CAV policies center on those inside the vehicle. Roadway operations are to be managed for all users.
5A.04	NO	YES	N/A	Page 512 line 30: Make sure that this sentence is in other parts of the MUTCD, "Established maintenance policies that incorporate effective practices to ensure the clear message intended to the road user on traffic control devices reaching the end of their useful life, or are damaged or otherwise no longer serviceable, be identified, fixed or replaced in a timely manner." This is true regardless of the presence or absence of CAV technology. It belongs in other chapters because it isn't specifically about new technology.
5A.04	NO	NO	YES	Page 512 line 36: Delete or rephrase text "D. Removal of extraneous devices that are no longer necessary or that provide limited benefit to vehicle operation or navigation." This implies that devices that provide benefit to other users of the roadway should be removed. Decisions about devices and benefits need to be made with engineering judgment considering the needs of all roadway users, not only those in vehicles.

5B.01	NO	NO	YES	Page 513 Line 17: Issues with limiting LED refresh rates to greater than 200Hz: If manufacturers are willing to adopt it, for new installations, it would be fine. I would not require this, nor do I see any need to. The information should be conveyed to computerized systems through other means (radio signals), rather than continuing to rely on optical based systems trying to read devices which agencies nationwide will never be consistent on, nor could they ever afford to. To the best of my knowledge, LEDs have a refresh rate of either 60 Hz (baseline) or 120 Hz (typical 2x multiplier to prevent human perception of refresh), and there is little to no incentive to increase the refresh rate beyond human perception. Higher rates are only useful for displaying movement, which we do not allow on DMS or traffic signal displays. And road authorities certainly are not going to encourage changes that increase costs to them, and increased refresh rates are expensive (go look up TV or computer monitor refresh rates and costs).
5B.02	NO	NO	YES	"The following should be considered to better accommodate machine vision used to support the automation of vehicles: I. Avoidance of decorative elements in crosswalks." Is this evidence-based or just a way to embed the anti-fun policies of engineers prioritizing speed?
5B.02	NO	NO	YES	Page 513 Lines 29-44: Guidance Statements: First and foremost. Guidance statements add limited value. If action is desired and needed to save lives and improve visibility than these statements (Lines 29-44) should all be standard statements. In addition, Pavement Marking should be focused on the needs of human drivers, machine vision systems need to adapt and be developed to align with what works best for humans. Furthermore 6-inch-wide markings isn't a one-size fits all solution. Recommend offering alternatives for wet/dry locations. For example, WSDOTs current Pavement Marking Recommendations that work for both Human and Machine Vision Systems at both wet and dry locations are as follows: Pavement Markings: Wet Locations • 4 inch-wide High Build (thicker) paint improves composite bead adhesion while bead optics allow for wet night retro-reflectivity. • Recommended Application for Wet locations: Standard 4-inch-wide marking, 22.5 mil high build paint, 8 lbs/gal all weather bead mix (approx. 70% standard 1.5 bead, 30% composite bead) • Note: 6-inch-wide marking at the standard 15mil thickness with the standard bead would provide little to no-increase in nighttime retro-reflectivity during wet conditions. Pavement Markings: Dry Locations • Wider 6-inch lane and edge lines provide increased visibility and contrast over traditional 4-inch lines during day and dry night conditions. • Recommended Application for Dry locations: Wider 6-inch lines, 15 mil paint, 7 lbs/gal standard 1.5 glass beads.
5B.02	NO	NO	YES	Page 513 Regarding lines 32 and 33: this is an expensive change in condition from the existing MUTCD which defines normal width as 4 inches. This is an effort to improve contrast for both drivers and AV systems to reduce crashes on the nation's journey to Target Zero. Lines 42 and 43 continue the philosophy seeking more contrast but instead of stripe width, they suggest color contrast and stripe length. The theme is clear – more contrast however, for both human and machine sensing, it needs to be noted that there are

				other and at times, more effective means of attaining greater contrast than simply providing wider or longer lines. If we look at run off the road serious and fatal crash data for Washington, we find a significant number occurring at night and under wet road conditions. As the industry is well aware, conventional 4- or 6-inch-wide lines with 1.5 IR glass beads struggle to aid drivers or machines when they are wet. In Washington, roads on the west side of the state are wet a lot during the long dark northern latitude cold months (6 months of the year). As such, it should not be assumed by the MUTCD that the only or best way to improve contrast is with wider or longer lines. In addition to wider or longer lines, brighter lines play a role in providing contrast and that is why our paint specifications have for years, included ASTMs for retro reflectivity and colorfastness. For colorfast, if white lines are allowed to turn gray or yellow lines are allowed to fade to white, less contrast is available. Similarly, if it rains, both white and yellow line retro reflectivity can go all the way to zero resulting in suboptimal wayfinding – the link between run off the road crashes and wayfinding is clear. This brief background in all-weather / all conditions wayfinding is necessary so that I can suggest that the MUTCD allow states to define the manner and method of achieving the greatest contrast for drivers and AV systems as our budgets, equipment, and staffing allow. In Washington with our very diverse climate, we may find locationally better ways of providing improved contrast than simply applying wider or longer lines. We may find, for example, that providing brighter lines that work when wet is a much larger leap forward in wayfinding than wider or longer lines that aren't much more helpful than today's lines when they're wet. The MUTCD needs to consider something other than a one size fits all solution to a very diverse transportation system.
5B.02	NO	NO	YES	Page 513 line 44: Delete the following text, "I. Avoidance of decorative elements in crosswalks". See discussion of decorative treatments in crosswalks under 3H.03 above. Primary concerns for crosswalk treatments should be suitability for persons with disabilities and conspicuity for drivers to see and stop in time. "Machine vision" needs to be as good as or better than human vision to be acceptable if it is genuinely going to improve safety for all roadway users. This manual should be written in the context of all types of roadways including those where pedestrian movements are the primary mode.
Section 5B.03 Highway Traffic Signals	NO	NO	YES	Page 514 Lines 8-9: Issues with limiting LED refresh rates to greater than 200Hz (Sames comments as for 5B.01 Signs): If manufacturers are willing to adopt it, for new installations, it would be fine. I would not require this, nor do I see any need to. The information should be conveyed to computerized systems through other means (radio signals), rather than continuing to rely on optical based systems trying to read devices which agencies nationwide will never be consistent on, nor could they ever afford to. To the best of my knowledge, LEDs have a refresh rate of either 60 Hz (baseline) or 120 Hz (typical 2x multiplier to prevent human perception of refresh), and there is little to no incentive to increase the refresh rate beyond human perception. Higher rates are only useful for displaying movement, which we do not allow on DMS or

				traffic signal displays. And road authorities certainly are not going to encourage changes that increase costs to them, and increased refresh rates are expensive (go look up TV or computer monitor refresh rates and costs).
Section 5B.04 Temporary Traffic Control	NO	YES	NO	Page 514 Lines 25-36 Standard Language: They should add something about …weather permitting. It is not always possible to apply or keep these materials on the pavement during work zone events and if speeds are kept low enough, segments that have less than perfect delineation and markings could still be traversed safely in certain conditions – as has been the case since road construction first began over 100 years ago.
Section 5B.04 Temporary Traffic Control	NO	YES	NO	Page 514 Lines 23-24: End Road Work signs in part 6 are shown as optional on some of the typical applications (or not shown at all on some) and language on use of these signs is “when use...” they should be placed near the end of the termination area.... Part 5B uses language implying stronger consideration in all applications (even though it is in a guidance statement). This could be an interpretation issue for the use of the signs depending on the section you are reading... On our construction projects, we usually use post mounted “road work ahead” / “end road work” signs at the project limits for the duration of the project. For daily/nightly operations within the project limits “end road work” signs are not used (like for a mile long lane closure in the middle of a 10-mile-long project). Maintenance operations per the M54-44 - WSDOTs Work Zone Traffic Control Guidelines for Maintenance Operations” - do not use the end road work signs. Work Zone Traffic Control Guidelines M 54-44 (wa.gov).
Section 5B.04 Temporary Traffic Control	NO	YES	NO	Page 514 Lines 25-36: Standard Language: This appears to be the same language that is in the 2009 part 6F.77 and is carried over into the 11th edition part 6J.01 except that the first two sentences in second paragraph are being shown as a “standard changed to a guidance”. So, they should be revised to match. For daily/nightly operation, pavement markings are superseded by drums/cones along with signs. On paving a chip seal projects, temporary edge lines are not used, just lane/center lines until the permanent markings are installed.
Section 5B.04 Temporary Traffic Control	NO	NO	YES	Page 514 Lines 38-41: Guidance Statements: Where did the 8-inch width come from? Perhaps it is a reference to square inches of sheeting material? WSDOT will not use 8-inch-wide tubular markers or guideposts. Something isn’t right here. See language in Part 3. https://mutcd.fhwa.dot.gov/htm/2003r1r2/part3/part3f.htm
5B.06	NO	NO	YES	Page 515 Lines 12-13: Remove proposed text concerning bikeway type. This Manual explicitly states that it does not provide information concerning physical barriers, yet here it recommends them--but for the sake of the CAV's processors, not for the safety of the people on bicycles. The type of bicycle facility should be selected based on context, including the volumes and speeds of drivers, and not based on the existing technological limitations of CAVs. Bicycle facility selection is discussed extensively in FHWA's own document, the Bikeway Selection Guide, and will be further addressed in the forthcoming AASHTO Bike Guide.
Section 5B.06 Traffic Control for	NO	NO	YES	"To better accommodate machine vision used to support the automation of vehicles, bicycle facilities should be segregated from other vehicle traffic using physical barriers where practicable. Road markings should indicate the end of a bike lane that is merged with

Bicycle Facilities				other traffic." This is interesting, I've seen a lot of skepticism about it. I wonder if this is evidence-based and where that evidence came from. I'm not sure what road markings they are thinking indicate the end of a bike lane. I'm not sure why pedestrian crossings or other markings are not addressed.
Section 5B.06 Traffic Control for Bicycle Facilities	NO	NO	YES	Guidance statement indicating that physical separation between motor vehicle traffic and bicycle facilities is desired. Remove this proposed text. The type of bicycle facility should be selected based on the volumes and speeds of motor vehicles on a street, and not based on the existing technological limitations of CAVs. Bicycle facility selection is discussed extensively in FHWA's own document, the Bikeway Selection Guide, and the forthcoming AASHTO Bike Guide
6A.02	NO	YES	N/A	Page 519 line 46: Replace the term "reasonably safe" with "...passage maintaining a similar facility or level of separation from motorists through the TTC zone."
6A.02	NO	YES	N/A	Page 520 line 6: Change the text to read, "This includes providing information about the TTC zone in usable formats for pedestrians with visual disabilities."
6B.01	NO	NO	YES	Page 524 lines 42-47: Keep the text, "Provisions for effective continuity of accessible circulation paths for pedestrians should be incorporated into the TTC plan. Where existing pedestrian routes are blocked or detoured…"; this information needs to be included in this sub-section of the document. A search did not find redundant text elsewhere in the section. Change the word "should" to "shall".
6B.01	NO	NO	YES	Page 525 Lines 14-15 delete the text, "Reduced speed zoning (lowering the regulatory speed limit) should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so." The choice to lower vehicle speeds for safety in TTC should not be determined by driver preference. Drivers are not capable of determining safe driving speeds for those outside of the vehicle. Line 18-19 delete the text, "A TTC plan should be designed so that vehicles can travel through the TTC zone with a speed limit reduction of no more than 10 mph." Engineering judgement should be used to determine the appropriate speed through a TTC zone. Lines 20-21, delete the text, "A reduction of more than 10 mph in the speed limit should be used only when required by restrictive features in the TTC zone." Change the text on line 21-22 to read, "Where a speed reduction of more than 10 mph is used, additional driver notification should be provided." This is especially important where people walking, biking and working are in or near the TTC zone even when there are no restrictive features being used. Line 25, change the text to read, "Research has demonstrated that large reductions in the speed limit, such as a 30-mph reduction, increase speed variance. While there will be no change to the crash potential for drivers that travel the changed posted speed, motorists that break the law and exceed the speed limit through a work zone will have an increased crash potential. Changes to the speed limit that are accompanied by speed management techniques have been shown to be more effective than speed limit signs alone."
6B.09	N/A			Page 530 line 5: Add a sentence at the end of the guidance section, "Plan detours so that bicyclists and pedestrians, especially those with a disability, will not have to retrace their steps or add significant out-of-the-way travel to get through the TTC zone to a destination.
6C.02	N/A			Page 531 line 20: Change the text to read, "Unless the TTC zone is on a limited access facility or where pedestrians are prohibited, adequate pedestrian access and walkways shall be provided, and

				accessibility and detectability shall be maintained along the alternate pedestrian route."
6C.02	NO	YES	N/A	Request keeping the Standard text, "Advance notification of sidewalk closures shall be provided…" Add guidance for emergency situations where it is not possible to provide advance notification.
6C.03	N/A			Page 534 line 8: Correct publication numbers in this sentence - "Additional information on the design and construction of accessible temporary facilities is found in publications listed in Section 1A.05 (see Publications 12, 38, 39, and 42)."
6C.03	N/A			Page 534 line 42: Change the text to read, "...pushbutton shall be equipped with a locator tone...
6C.03	NO	YES	N/A	Page 534 lines 9-12: Change the text to read, "Standard: Adequate provisions shall be made for pedestrians with disabilities." ADA accessibility needs to be a Standard, not guidance, for temporary pedestrian facilities. An engineer cannot be expected to know the disability status of every pedestrian who may pass through a given location.
6D.02	NO	NO	YES	The stop/slow paddle W20-8 deleted details should remain in this manual. Flaggers using this manual may not have a copy of the signs and markings book.
6L.02	NO	NO	YES	States AFADs are to be crashworthy, but most are trailer mounded like temporary signals, PCMS and Arrow Boards that do not include the same statement about being crashworthy.
6L.07	NO	YES	NO	In the first standard on warning lights, attachment to signs and channelizing devices should be per the manufactures crashworthy approved recommendations.
6L.08	NO	NO	YES	Are these devices (flag Trees) to be crashworthy?
6M.02	NO	YES	NO	In Paragraph 01, add “or engineering judgement” to the first sentence.
6N.04	NO	YES	N/A	Page 595 line 41: Delete the words, "if practical" at the end of the sentence.
6N.04	NO	YES	N/A	Page 595 line 45: Change the text to read, "...equal to 30 miles per hour) where there would be..."
6N.04	NO	YES	N/A	Page 596 line: Add sentence following existing proposed text, "Bicyclist pathways are subject to ADA requirements; do not assume that the bicyclists will have the ability to dismount and walk a bicycle or tricycle through the detour."
6N.04	NO	YES	N/A	Page 596 lines 18-19: Change the text to read, "...and construction activities reduce the lane width(s) refer to section 9E.09 for direction regarding how to accommodate bicyclists in travel lanes." Or match the text to criteria shown in Figure 6P-47
6N.11	NO	NO	YES	Change the Standard to Guidance for “When only the left-hand lane is closed on undivided roads, channelization devices shall be placed along the center line as well as along the adjacent lane”. The existing centerline already delineates this for oncoming traffic—installing channelization devices in additional should be supplemental, not required.
Figures 6P	NO	YES	NO	Add “(optional)” to all END ROAD WORK signs in all Typical Applications.
Figure 6P-5	NO	YES	NO	The first sign spacing dimension is missing. Should be A, B, C for the three warning signs shown.
Figure 6P-22	NO	YES	NO	Delete the arrow board in front of the work area as this could direct drivers coming thru the intersection in the left lane to move left again. Maybe use an R4-8 instead. The arrow board listed as optional addresses the lane closure.
Figure 6P-23	NO	YES	NO	Move the arrow board into the lane closure taper, delete the left R3-7 and use am R4-7 in front of the work area.

Figure 6P-24	NO	YES	NO	Place a R4-8 in front of the work area for traffic moving up the plan.
Figure 6P-24	NO	NO	YES	Going in the “up” direction, there’s no guidance for the shift from the coming left lane on the opposite side of the intersection. Recommend using a W6-3 (12”x18”) in place of the R4-7C shown wi on the right side of the contraflow lane). 
Figure 6P-27	NO	YES	NO	Show flagger stations.
Notes for Figure 6P-28	NO	YES	NO	Modify “12:1 (8%)” to “12:1 (8.33%)”.
Figure 6P-28	NO	YES	NO	The minimum temporary sidewalk width is 48” per PROWAG (unless the length exceeds 200’—then a 60”x60” area is needed). Suggest using 48” MIN with an asterisk noting 60” MIN for distances over 200’.
Figure 6P-28	NO	YES	N/A	Suggest rewording to notes 5 and 6 so it is similar to that proposed in Section 6A.02, P03.3.B, as follows: "When SIDEWALK CLOSED CROSS HERE signs are used, the information shall also be provided in a format usable ~~shall include audible information devices to provide adequate communication~~ to pedestrians with visual disabilities." and: "Information in a format useable for pedestrians with visual disabilities shall be provided ~~where~~ at midblock closings and changed crosswalk areas ~~cause inadequate communication. to pedestrians who have visual disabilities~~."
Figures 6P-28 & 6-29	NO	YES	NO	In the sidewalk detour view, show a symbol for the pedestrian channelizing device across the entire sidewalk.
Notes for Figure 6P-29	NO	YES	NO	Consider adding pedestrian detour signage at the turns to delineate the TPAR (temporary pedestrian access route).
Figure 6P-29	NO	YES	N/A	Suggest rewording to notes 5 and 6 so it is similar to that proposed in Section 6A.02, P03.3.B, as follows: "When SIDEWALK CLOSED CROSS HERE signs are used, the information shall also be provided in a format usable ~~shall include audible information devices to provide adequate communication~~ to pedestrians with visual disabilities." and: "Information in a format useable for pedestrians with visual disabilities shall be provided ~~where~~ at midblock closings and changed crosswalk areas ~~cause inadequate communication. to pedestrians who have visual disabilities~~."
Figure 6P-35	NO	YES	NO	Show Shadow Vehicle 2 having a “LEFT LANE CLOSED AHEAD” sign or a PCMS that alternates between “LEFT LANE CLOSURE” “(arrow mode” phases
Notes for Figure 6P-36	NO	YES	NO	Standard Note 5: This standard statement conflicts when the work zone already has temporary barrier installed prior to the lane shifts—which would require the temp. barrier to be placed along the shifting taper.
Figure 6P-39	NO	YES	NO	In the “up” traffic, the gated DO NOT ENTER signs could be confusing to drivers approaching the median shift back to the right. Seems R4-7C is sufficient. If used, I’d recommend the DO NOT ENTER signs be moved back away from the median shift at least “A” distance. Let drivers get pass the median shift before seeing the DO NOT ENTER signage

				(perhaps place them at the end of the oncoming left lane closure taper.
Figure 6P-40	NO	YES	NO	The 250' distance for the centerline channelizing devices is too short as a temporary acceleration lane would need to be at least this length. L distance for taper needed.
Figure 6P-40	NO	YES	NO	The 100' ramp opening is pretty short for freeway speeds
Figures 6P-40 & 6- 44	NO	YES	NO	Regarding the on-ramp acceleration tangent and merge taper: In TA-40, the entire on-ramp tangent & merge taper is less than the 250' callout (between W4-1R and the end of the merge taper). This conflicts with TA-44 which calls out a "L" on-ramp merge taper length.
Notes for Figure 6P-41	NO	YES	NO	Standard Note 6: A minimum height distance of 5 feet (instead of 7' specified) is sufficient to raise the EXIT sign up above any channelization devices. Please revise to "…minimum of 5 feet"
Figure 6P-42	NO	YES	NO	Most exit-ramp tapers are 20:1, roughly L/3. Using a "L" exit-ramp taper results in a taper far exceeding the permanent condition. A 100' opening is very minimal. Recommend increasing to 240' (At 20:1 exit-ramp taper, matching permanent tapers, this allows a 12' exit-ramp lane. Move "EXIT OPEN" sign up to the beginning of the temporary exit-ramp (especially on left figure). Having it roughly 500' prior to the exit-ramp is too far back—it invites motorists to pull into the work area too early. Instead of a 1000' tangent between lane closure taper and beginning of exit-ramp, reduce to 500' which is more than sufficient.
Notes for Figure 6P-42	NO	YES	NO	Standard Note 4: A minimum height distance of 5 feet (instead of 7' specified) is sufficient to raise the EXIT sign up above any channelization devices. Please revise to "…minimum of 5 feet"
Notes for Figure 6P-44	NO	YES	NO	Standard Note 2: Change to Guidance statement instead of Standard. In congested, urban areas—traffic needs to merge into the mainline at the highest speed possible. Making on-ramp traffic stop and then merging only serves to farther increase the speed differential—thus, we ask for this to be reduced to a Guidance statement so it can be implemented in more rural areas (where gaps are available), but not required in congested, urban areas.
Notes for Figure 6P-48	NO	YES	NO	Standard Note 4: Change to Option statement instead of Standard. Generic bicycle detour routes will be sufficient in many situations; thus, route-specific bicycle detours are rarely needed.
Notes for Figure 6P-50	NO	YES	NO	Standard Note 4: Change to Option statement instead of Standard. Generic bicycle detour routes will be sufficient in many situations; thus, route-specific bicycle detours are rarely needed.
Figure 6P-53	NO	YES	NO	On the bottom leg, the "A" dimension lines are needed. The cardinal approach directions could be confusing when the application is applied.
Figure 6P-54	NO	YES	NO	The dimension line separating L from the buffer space is needed on three approaches. Is the "lane ends merge left" sign necessary, four signs may be tough to fit in many urban areas.

Figure 6P-42	NO	YES	NO	Most exit-ramp tapers are 20:1, roughly L/3. Using a "L" exit-ramp taper results in a taper far exceeding the permanent condition. A 100' opening is very minimal. Recommend increasing to 240' (At 20:1 exit-ramp taper, matching permanent tapers, this allows a 12' exit-ramp lane. Move "EXIT OPEN" sign up to the beginning of the temporary exit-ramp (especially on left figure). Having it roughly 500' prior to the exit-ramp is too far back—it invites motorists to pull into the work area too early. Instead of a 1000' tangent between lane closure taper and beginning of exit-ramp, reduce to 500' which is more than sufficient.
Notes for Figure 6P-42	NO	YES	NO	Standard Note 4: A minimum height distance of 5 feet (instead of 7' specified) is sufficient to raise the EXIT sign up above any channelization devices. Please revise to "…minimum of 5 feet"
Notes for Figure 6P-44	NO	YES	NO	Standard Note 2: Change to Guidance statement instead of Standard. In congested, urban areas—traffic needs to merge into the mainline at the highest speed possible. Making on-ramp traffic stop and then merging only serves to farther increase the speed differential—thus, we ask for this to be reduced to a Guidance statement so it can be implemented in more rural areas (where gaps are available), but not required in congested, urban areas.
Notes for Figure 6P-48	NO	YES	NO	Standard Note 4: Change to Option statement instead of Standard. Generic bicycle detour routes will be sufficient in many situations; thus, route-specific bicycle detours are rarely needed.
Notes for Figure 6P-50	NO	YES	NO	Standard Note 4: Change to Option statement instead of Standard. Generic bicycle detour routes will be sufficient in many situations; thus, route-specific bicycle detours are rarely needed.
Figure 6P-53	NO	YES	NO	On the bottom leg, the "A" dimension lines are needed. The cardinal approach directions could be confusing when the application is applied.
Figure 6P-54	NO	YES	NO	The dimension line separating L from the buffer space is needed on three approaches. Is the "lane ends merge left" sign necessary, four signs may be tough to fit in many urban areas.
7A.02	N/A			Page 668 Line 27 add "and bike" to the text so that it reads, "..., establish school walk and bike routes, ..." and on line 34 so that it reads, "... school walk and bike routes might make it necessary for children to walk or bike an indirect route to an established school crossing location where there is existing traffic control ..." Following this sentence add text, "However, this should be the exception, wherever possible provide/request crossing treatments along the direct route so that children will not have to go out of their way." It is widely accepted that best practice is to design and install crossings to match desire paths as people will continue to cross where it makes sense for them. The existing MUTCD acknowledges this in section 7A.03 with the statement "students might become impatient and endanger themselves by attempting to cross the street during an inadequate gap". Add text to end of the first Guidance statement (line 38) so that it reads, "...take advantage of existing traffic controls until additional crossing treatments can be provided."

				Delete item B. on line 43 "The number of students using the crossing", this is especially true for roads that are 30mph or higher, where the stress of crossing would discourage crossings. Add the first three sentences in the support language from section 7A.03 to the end of this section, "The frequency of gaps... accommodate the crossing demand." This will acknowledge the consequences that the lack of sufficient gaps, both in frequency and duration, can have on school children given their lack of decision-making skills.
7B.03	NO	YES	N/A	Page 673 line 10: Change the guidance so that the school crossing assembly can be installed on an approach controlled by a YIELD sign.
7B.06	NO	NO	YES	Page 675 lines 4, 5: Recommend removing proposed Guidance sentence providing a maximum distance for school zones. The dimensions of school properties can vary significantly, this dimension should not be a fixed number.
7C.01	N/A			Page 677 line 9: Delete the text, "Crosswalk lines should not be used indiscriminately."
8A.12	N/A			Page 687 and others: First appearance of "highway vehicles" is in 8A.12. The term is used 47 times. As noted above, throughout the document "driver" or "motor vehicle operator" is a preferred term over "vehicle" when referring to the person making operational decisions. If a "highway vehicle" is a particular type of vehicle or operated by a particular type of human, that needs to be defined.
8A.12	YES	NO	NO	In its entirety
8D.13	NO	NO	YES	Page 722, Lines 21-24: Why is a circular green indication prohibited at a queue cutter signal? This does not seem justified.
8E.06	NO	YES	N/A	Page 733 line 12: Change text to read, "Where used, maze fencing or pedestrian barriers need to be designed to permit the passage of wheelchairs and power-assisted mobility devices, and if bicycles are permitted, to permit the passage of bicyclists including tandem bicycles, bicycles with trailers or cargo bikes. ADA accommodation for bicyclists must be provided, including for bicyclists that are not able to dismount and walk-bike.
8E.06	NO	YES	N/A	Fig 8E-8 indicates for pedestrian only but also says to design to fit pathway users. The alignment of the path with gates needs to serve people biking, including people with disabilities using adaptive bicycles or tricycles.
8B.08	NO	YES	N/A	Page 698, Lines 10 – 12. Since the installation of the W10-5 has a compliance date, recommend changing this Guidance Statement to a Standard statement.
8E.06	NO	YES	N/A	Fig 8E-8 indicates for pedestrian only but also says to design to fit pathway users. The alignment of the path with gates needs to serve people biking, including people with disabilities using adaptive bicycles or tricycles.
9A.01	NO	NO	YES	Page 739 lines 15-21: Remove both paragraphs. For the first paragraph, state laws vary regarding bicyclists on sidewalks. The MUTCD should not attempt to characterize bicycle law across all states. Individual state laws will already be considered in the development of bicycle facilities. The second paragraph reiterates language from part 1 and is not similarly reiterated for design of bicycle lanes.
9A.02	NO	NO	YES	Page 740 lines 11-14: Remove paragraph. Purpose of MUTCD already conveyed in part 1.
9A.03	NO	YES	N/A	Page 741 line 29: Remove the words: "that must be visible at night". Retroreflectivity is important during times of low light, not just at night, and should be required for bicycle facilities.
9B.01	NO	YES	N/A	Page 743 line 16: More guidance needed for higher volume regional trails intersecting high volume roadways. RRFB or other enhancements should be called out here. Some regional trails

				intersect higher volume (or low volume, high speed) roadways. Are there additional warning devices (particularly for the motorists) that should be highlighted in these contexts? Concern is for conspicuity since trails do not tend to "bulb out" at their intersection with roadways.
9B.01	NO	YES	N/A	Page 743: Consider adding guidance for the type of signalized intersection at which the bicyclist movement does not have any conflicting movements with driver movements, e.g., a T intersection with a bike lane at the top of the T that continues across the intersection. (Pavement markings for a bike lane in this configuration should fit the Standard for travel lane markings found in 3B.11, Page. 349, lines 24-26.) In this type of configuration, a bicyclist should be able to continue, similar to the condition present for a pedestrian on a sidewalk paralleling that same bike lane or a rider on a separated shared-use path, if this does not set up a conflict with pedestrian movement in a crosswalk. Subject to engineering judgment a STOP or YIELD sign rather than a bicycle signal, or no regulatory control, may be appropriate as the set-up facing the bicyclist.
9B.02	NO	YES	N/A	Change R3-7bP by replacing the words BICYCLES with a bicycle symbol. Rationale: A bicycle symbol, rather than the words BICYCLIST OR BICYCLE is easier to recognize quickly and should be used whenever possible.
9B.02	NO	YES	N/A	Provide guidance/example situations where "except bicycles" should apply and include "other" as an option. Rationale: The guidance that states: "Where an engineering study demonstrates that it is appropriate to exempt bicyclists from the provisions of a regulatory sign, the Except Bicycles plaque (R3-7bP) should be used" may cause engineers to error on the side of always including bicyclists unless guidance is supplied.
9B.03	NO	YES	N/A	Page 744 line 34: Delete text "Counter-flow bicycle lanes shall not be displayed on Advance Intersection Lane Control signs." Contra-flow bicycle lanes, which are less common, seem very appropriate for advance cues. Same comment on the physically separated bikeways advance signage. Refer to comment under 1C.02, Definitions, about changing "counter-flow" to "contra-flow" when referring to these bike lanes.
9B.03	NO	YES	N/A	Page 744 lines 22-34: Provide graphics to illustrate the range of what would be acceptable in terms of separate signage. Rationale: Separate signs are easier to process, but application scenarios are difficult to visualize. Specifically, it is not clear how many separate signs would be too many. It is also unclear why some of the specific restrictions, such as for contraflow bike lanes (Line 34), are needed. Visuals may help here.
9B.03	NO	YES	N/A	Page 744: "Physically separated" is not defined in the manual although it is used in several places; refer to comments provided under 1C.02, Definitions. Since the Option statement allows this sign to be installed on intersection approaches with separated bike lanes (which is a desired use of this sign), additional clarification as to what constitutes physical separation in this context is needed.
9B.04	NO	YES	N/A	Figure 9B-4 shows yield markings at various distances ahead of the crosswalk and the text does not make it clear why the distances would vary in each of these scenarios. For instance, in Figure 9B-4D it appears that the yield markings are 20-40', matching the requirement for a mid-block crosswalk; this distance is excessive when considering the speed of bicyclists. Revise the Figure and corresponding Support statement in Section 9B.12 to make it clear the location is per engineering judgment.

9B.10	NO	YES	N/A	Page 746: In addition to discussing back-in angled parking in the bike section, this general treatment has benefits beyond accommodating safer bike lanes. It could be wholly located in a more general section that describes all of its applications/design considerations/benefits, or the general application could be located elsewhere, and this would be a discussion of how it works with bike lanes.
9B.11	NO	YES	N/A	Page 747 lines 6 and 7: A version of the R10-15 that has both the pedestrian and bicyclist is appropriate for the scenario described in the Support statement here; the R10-15 with just the pedestrian symbol does not provide awareness that bicyclists may also be located to the right, as in the case of a shared use path or a separated bike lane. R10-12b "turning traffic yield to bikes" sign will be installed almost all the time at locations which also will benefit from an R10-15a sign. This will result in a doubling of signs at an intersection. Add a version of the R10-15 with the bike symbol to the Manual and reference here. Similarly, the new R10-12b does not address the possible presence of pedestrians (as in a shared use path or bike lane + sidewalk) and again leads to installation of additional signage. The modified R10-15 with both the pedestrian and bicycle symbol applies to both scenarios. Remove the new R10-12b sign until/unless evidence is provided to support improved outcomes.
9B.12	NO	YES	N/A	Page 747: In previous edition of the manual, the R9-6 sign was predominantly used in areas where shared use paths entered congested zones. The way this sign is used in the NPA is nearly the same as how the R1-5 is used for motor vehicles. A version of this sign must address "STOP FOR" states in the same manner as the R1-5a. Figure 9B-4D, when considering a "STOP FOR" state, makes it clear why another version is necessary. Add a second version of this sign.
9B.14	NO	YES	N/A	Page 748 lines 1-5: A version of the R10-15 that has both the pedestrian and bicyclist is appropriate for the scenario described in the Support statement here; the R10-15 with just the pedestrian symbol does not provide awareness that bicyclists may also be located to the right, as in the case of a shared use path or a separated bike lane. R10-12b "turning traffic yield to bikes" sign will be installed almost all the time at locations which also will benefit from an R10-15a sign. This will result in a doubling of signs at an intersection. Add a version of the R10-15 with the bike symbol to the Manual and reference here. Similarly, the new R10-12b does not address the possible presence of pedestrians (as in a shared use path or bike lane + sidewalk) and again leads to installation of additional signage. The modified R10-15 with both the pedestrian and bicycle symbol applies to both scenarios. Remove the new R10-12b sign until/unless evidence is provided to support improved outcomes. Lines 5 and 7: Do not change "bicyclists" to "bicycles".
9B.14 and elsewhere	NO	YES	N/A	Page 747: Change the sign number from R4-11 to R9-20 to match the proposed changes to Figure 9B-1. Make similar changes to Part 2 and 6, as appropriate.
9B.19	NO	NO	NO	Could not find graphics of R9-24 through R9-27.
9B.20 and in part 2	NO	NO	YES	Sign R10-25: The presence of a RRFB does not change the assignment of right-of-way at a marked crosswalk, which should follow state law. The proposed addition of "await gap in traffic" is not consistent with all state laws and should be removed from the sign.

9B.21	NO	NO	YES	Page 750: The new R10-12b does not address the possible presence of pedestrians (as in a shared use path or bike lane + sidewalk) and leads to installation of additional signage. The modified R10-15 with both the pedestrian and bicycle symbol applies to both scenarios. Remove the new R10-12b sign until/unless evidence is provided to support improved outcomes. Refer to similar comment under 9B.11.
9B.22	NO	YES	NO	As written, these signs are going to introduce confusion on protected vs. permitted movements.
9B.15	NO	NO	YES	Page 748 lines 20-21: No restrictions should be imposed on use of this sign. States should have the flexibility to post the signs where needed. A pass with 3-foot law, or similar, also applies to drivers passing bicyclists within bike lanes or on shoulders; whether a driver is required to adjust lane position is based on distance away from the rider in most states, not the presence or absence of a bike lane. Often riders on shoulders hug the inside of a fog line to avoid debris or broken pavement, but they still need motorists to leave adequate passing space. Also, riders in most states are to remain as far to the right of travel lanes as is safe, with no requirement or presumption that they must be in a shoulder or bike lane when it is available. In Washington riders are not legally required to use bike lanes and state law requires moving over an entire lane if possible.
9B.18	NO	YES	N/A	Page 749 lines 14-16: Item C in the Standard is too vague to have meaning. Change the text of item C to "Characteristics of the roadway approach to the intersection (volume, speed, number of lanes, width, presence of rail tracks, etc.) make it practical to provide an alternative so that bicyclists do not have to use the same lane as motor vehicle traffic to facilitate turns." Recommend removing the standard that requires the R9-23 sign from the two-stage left turn box, except when right turns are made from that same bike lane. Or add text to caution that the use of the sign should not indicate to bicyclists turning right that they must make their turn from the bike lane".
Figure 9B-2	NO	YES	N/A	In this example, among turn restrictions - it eliminates the conflict between left turning vehicles and oncoming traffic. However, the Except Bicycles sign would allow bicycles to make that left turn against oncoming traffic (since left turn box is optional). I presume that sign is intended to restrict bicycles also since a two-stage turn box is provided. Consider revising the figure to restrict right turns rather than all turns.
9B-3	NO	YES	N/A	This figure shows two ADA parking stalls without adjacent access aisles. Each ADA parking spot is required to have an access aisle adjacent to the parking spot. Revise figure to show access aisle. Note that whether the access aisle is to the right or left of the back in parking stall is a question that has been up for debate. It can sometimes affect whether drivers park head-in or back-in. See 2010 ADA Standards, 502.2 (also in PROWAG R309.3)
Figure 9B-5				Add Sign Fabrication Numbers to Figure.
Figure 9B-7				Add Sign Fabrication Numbers to Figure.
Figure 9B-7-2				Add Sign Fabrication Numbers to Figure.
9C.04	NO	YES	N/A	Page 752 line 35: In Paragraph 2, remove the word "unconventional" from the proposed Support statement. These signs are frequently used on very conventional facilities, e.g., shared use paths.
9C.05	NO	YES	N/A	Page 753: A bicycle symbol, rather than the words BICYCLIST OR BICYCLE, should be used whenever possible. Change W16-20P by replacing the words BICYCLES with a bicycle symbol.

9C.06	NO	YES	N/A	Page 753: A bicycle symbol, rather than the words BICYCLIST OR BICYCLE, should be used whenever possible. Change W16-21P by replacing the words 2-WAY BICYCLE CROSS TRAFFIC with a bicycle symbol and two arrows.
9C.06	NO	YES	N/A	Consider text allowing the sign be used at driveways, where STOP signs are unlikely
9C.07	NO	YES	N/A	Keep the bicycle merging sign as an option. Remove the text that would restrict the use of these signs at intersection approaches where the bike lane ends and bicyclists must merge with traffic.
9C.08	NO	YES	N/A	Provide more text for when IN ROAD sign should be used.
9C.08	NO	YES	N/A	Figure 9C-1 has not been modified to match the new text. Remove and replace the "SHARE THE ROAD" plaque with the "IN ROAD" plaque to match the proposed text.
9D.01	NO	NO	YES	Page 756: Remove the Guidance statement which states that travel times should not be used on Bicycle Destination signs; reasons provided for its inclusion are not supported by research. A 2018 Study at the Pennsylvania State University showed that people frequently overestimate the time it takes to bicycle a known distance. For this reason, travel times on bicycle wayfinding signs can be useful. In urban environments, the travel time is unlikely to vary much between users due to the shorter blocks and signalized intersections; especially when tourists are the intended audience, time can be more useful than distance. The Support statement should be phrased in terms of the benefits the signs provide to bicyclists, not by emphasizing that the signs should be small to keep them away from motorists.
9D.02	NO	YES	N/A	Page 756 lines 41-42: Do not limit the use of travel times on single destination Bike Route guide signs; reasons provided for this exclusion are not supported by research. As noted in comment on 9D.01, a 2018 Study at the Pennsylvania State University showed that people frequently overestimate the time it takes to bicycle a known distance. For this reason, travel times on bicycle wayfinding signs can be useful and their use should not be restricted.
9D.02	N/A			Many of the proposed signs are not shown in figures and therefore cannot be reviewed. For example, D11-1d, D11-1e, D11-1f, and D11-1g appear in the text and tables but do not appear in the proposed figures.
9D.03	NO	YES	N/A	Page 757: Remove the new Standard prohibiting the use of a bicycle symbol on a Street Name sign. Rationale: There is no research/evidence that this practice decreases safety or efficiency of the roadway network for bicyclists or other roadway users and the treatment is successfully used in some jurisdictions. The bicycle symbol may help alert motorists to the presence of bicyclists on streets that cross bicycle boulevards. Use of the bicycle symbol on street name signs should be an option subject to engineering judgment.
9D.04	NO	YES	N/A	Page 757 lines 31-33: End the sentence after "upon recommendations of State highway organizations. “The rest of the sentence is inaccurate and unnecessary. Text reading "the respective States own these systems" with respect to the US Bicycle Route system is incorrect. A USBR may be designated that uses portions of state routes, regional trails, county roads, and local streets. The state does not "own" every portion of the system; it holds the responsibility for the process that leads to the AASHTO recommendations.
9D.04	NO	YES	N/A	Page 757 lines 35-38: A series of text changes are needed for lines 35-38. For lines 35/36, remove the text: "Bicycle routes are designated under the presumption that extensive pre-trip planning is done by the bicyclist." In line 36 change the text that states, "Sign

				systems can therefore be limited to" to "Sign systems should always include junctions, accomplishing turns, the beginning of routes, and route termination points." In lines 37/38 remove the text that states "and still achieve the same navigational benefits and advantages. Extensive use of reassurance markers are typically not needed." Add the text: "Engineering judgment should be used to determine if additional route signage might be helpful." Rationale: We do not assume other roadway users do extensive pre-trip planning. There may be valid reasons for posting additional signage that confirms that the bicycle rider is still on their intended route especially where a route takes a rider far from services. We cannot assume that bicyclists have cell phones, and in rural locations cell phone connectivity may be absent.
9D.06	NO	NO	YES	Page 759: Change Standard to Guidance. There is no research-based reason to propose a new Standard that limits the flexibility of practitioners to design bicycle wayfinding signs that reflect community uniqueness. Bicycle wayfinding does not require the same standards as highway signs read at higher speeds. Many signs with background colors and borders different from the proposed language are already in use with no evidence of safety concerns; the creation of a new Standard puts those signs out of compliance and creates a cost burden to change them. Without evidence to support the new Standard, FHWA should change this to a Guidance statement.
9D.08	NO	YES	N/A	Page 760: Do not prohibit posting bicycle route signs in the same assembly with other route markers. This is a common, practical approach, and there is no research indicating that this causes problems. There should be an option to post with vehicular route markers.
9D.12	NO	YES	N/A	Change Standard to Guidance to be consistent with section 2D.55 Community Wayfinding. Rationale: Destination guide signs that create a "continuous system of signs that direct tourists and other road users to key [destinations]" are just as meaniful for a bicyclist network as a motorist network. Research does not support limiting the flexibility of practitioners to design bicyclist wayfinding signs that reflect community uniqueness. Imposing a more restrictive Standard on bicyclist signage than on motorist signage is inconsistent.
9D.13	NO	YES	N/A	Page 76 line 33: This standard requires the use of sign D11-20 that says bikes "may use turn box" without excluding the condition described in section 9B.18 when a two-stage turn is required and uses sign R9-23b. I suggest revising Standard "Where a two-stage turn box is provided AND USING THE TURN BOX IS OPTIONAL, the..."
9E.01	NO	NO	YES	Page 767: Line 35 is incorrect. A shoulder is not a travel way. Suggest: "a portion of the right of way shall not be established as both a shoulder and bicycle lane". Line 39 message is unclear. Suggest two signs: "No Shoulder Driving" and "Bicycles Allowed" Rationale: The statement "Bicycles use shoulder only" appears to restrict bicyclists from using the travel lane, which they may be legally allowed to use. The intent is to restrict motorists from operating in the shoulder, not to require bicyclists to be there.
9E.01	NO	YES	N/A	Discussion of shoulder needs to match definition in 1C.02 and needs to refer to bicyclist use. Wording provided in comment under 1C.02: "Shoulder---a longitudinal area contiguous with the traveled way that is primarily for may accommodate stopped vehicles for emergency use; bicyclist travel; transit or school bus stops; and pedestrian use in some locations. A shoulder provides and for lateral support of base and surface courses, and that is graded for

				emergency stopping. A shoulder might be paved or unpaved. A paved shoulder might be opened to part-time travel by some or all vehicles and is generally open to full-time use for bicyclists where bicycle use is not otherwise prohibited on limited access highways."
9E.02	NO	YES	N/A	Page 768 line 32: The phrase "controlled by a traffic signal that displays bicycle signal indications" may be misconstrued to mean a bicycle traffic signal is required. Change to read: "A through bicycle lane may be positioned to the right of a right-turn only lane or to the left of a left-turn only lane provided that the bicycle lane through movement is separated from the general turning movement by a traffic signal".
9E.02	NO	YES	N/A	Page 769: Guidance statement on line 22 is not best practice and is a design question. Research shows safety benefit with a shift of less than 6 feet. The design issues depend on posted speed, traffic volume, other considerations. AASHTO Bike Guide can address this. This appears to refer to a Bend-Out: Shift the bike lane away from the motor vehicle traffic, which results in turning motorists having exited the through travel lane prior to crossing the bike lane, slowing their speed and approaching the crossing at closer to a 90-degree angle. The design commonly known as a "protected intersection" is a type of bend-out design. Vehicles turning at 90 degrees can better see bicyclists. The requirement for a vehicle length offset is not based in research. These issues are more appropriately addressed in other guidance documents.
9E.02	NO	YES	N/A	Two conditions are described but only one is illustrated in Figure 9E-7D. Add a second figure illustrating a separated bike lane shifting away from the travel lane to align with text.
9E.02	NO	YES	N/A	Page 770 lines 1-4: More guidance is needed regarding mixing zones. Also, the phrase in line 3 "outside of crossing points at intersections and driveways" should be in parentheses to make the sentence clearer. The statement "it is important to consider the use of mixing zones in the context of a bicycle facility that is otherwise free of general traffic outside of crossing points at intersections and driveways," is not as clear as it could be, but also lacks further guidance about what a traffic engineer should consider instead. Sometimes mixing zone treatments are a part of higher volume, higher speed arterials where it would be very difficult for drivers to pay attention to bicyclists as they execute lane changes and attempt to access mixing zones. Research indicates that mixing zones reduce bicyclist level of comfort (http://www.nyc.gov/html/dot/downloads/pdf/cycling-at-a-crossroads-2018.pdf). Keep guidance for providing a bicycle lane through intersections with turn lanes. Remove the text on lines 23-25 "A buffer-separated or separated bicycle lane should not be shifted away from the adjacent general-purpose lane at an intersection unless there is sufficient space for a vehicle to queue between the general-purpose lane and the extension of the bicycle lane." The decision for treatments to serve bicyclists through an intersection should be determined by engineering judgement based on the road characteristics and the priority design vehicle. The proposed guidance about bend-in and bend-out configurations at intersection would prohibit a bike lane to be buffered at an intersection unless the width of that buffer meets the bend-out criteria. That's not practical for most buffered or separated bike lanes.
9E.02	NO	YES	N/A	Page 769 line 35: Revise the Support statement starting on line 35, to read: "Where a bicycle lane needs to be dropped to accommodate a general-purpose turn lane ahead of an intersection, the general-purpose turn lane may accommodate both through bicyclists and turning general traffic. Ahead of the approach, a

				mixing zone may be established to indicate the preferred path of bicyclists making the through movement." Rationale: The current statement is confusing regarding what a mixing zone is and where it is located relative to the general roadway, an intersection approach, and the intersection.
9E.02	NO	YES	N/A	Page 769 line 41: Revise statement in line 41 to read: "Mixing zones WITH YIELDING AREA shall have yield markings..." to align with Figure 9E-05A.
9E.02	NO	YES	N/A	Page 769 Revise statement in line 43 to read: "Mixing zones WITHOUT A YIELDING AREA shall have shared lane markings and turn arrows in the turn lane". This standard statement suggests that the bicycle lane continues to the intersection, which would negate the need for a mixing zone.
9E.03	NO	YES	N/A	Page 770: While the practice of marking bicycle lane extensions through intersections may be a good idea to help roadway users understand the path of travel of all modes through an intersection, add to Support to discuss the goals of marking lane extensions for bicyclists by default, but not for other vehicle lanes.
9E.03	NO	YES	N/A	Page 770: Add "lane extension markings" through the intersection in Figure 9E-6 to align with text; the markings illustrated are only shown through driveways. Change text to allow for bicycle lane markings to be connected to crosswalk markings so that it reads: "The transverse line establishing one side of the crosswalk, or the limit of a high-visibility crosswalk pattern (see Section 3C.05) that does not employ a transverse line, may be used to demarcate one side of the bicycle lane extension." It is a common practice that one side of a bike lane coincides with continental crosswalk markings. The proposed language requires that there is separation between the two, and that an outside extension line is always present. There is no practical reason why this would be necessary and when the space is not available, the outside extension line should simply be dropped rather than narrow the bicycle crossing. This will also reduce the cost of installation and maintenance by simplifying the marking layout. FHWA should make allowances for known situations where the available width is restricted, rather than ignore this context altogether.
9E.04	NO	NO	YES	Page 771: Rotated bicycle symbols are not referenced anywhere else in the manual. Remove the word "rotated".
9E.05	NO	NO	YES	Page 771: Recommend deleting the sentence, "The "Guide for the Development of Bicycle Facilities" authored by the American Association of State Highway and Transportation Officials (see Section 1A.05) contains information on designing for bicycles on the sidewalk in lieu of, or in addition to, using shared-lane markings in the circular roadway of the intersection." The draft bike guide will provide other options, distinguishes shared use paths rather than sidewalks, and does not imply that bikes on sidewalks are the preferred option. See comment for 3D/9E.05/9E1.0
9E.06	NO	YES	N/A	Page 771: Provide guidance to readers (Use FHWA Bikeway Selection Guide recommendations, Fig 9, page 23) for when to consider buffered bike lanes based on speed and volume. Practitioners often consider conventional bike lanes on higher speed facilities but change their recommendation after considering the more recent FHWA guidance. 30 mph does not seem like a high speed with respect to driving, so the practitioner may not recognize the value of buffer separation at that speed without further guidance.
9E.06	NO	YES	N/A	Page 772: Revise Option statement to read: "Where a buffer space is less than four feet wide, one-directional diagonal markings may be used". Follow with a Standard statement: "Where a buffer space

				is four feet or wider, one-directional diagonal or chevron markings shall be used". Rationale: There are conflicting statements about chevron markings and diagonal markings and when they may be used. Where buffer space is less than two feet wide, no markings are required. Where buffer space is two to four feet wide, diagonal markings are optional. Where buffer space is greater than four feet wide, diagonal or chevron markings are required.
9E.07	NO	YES	N/A	Page 772: Clearly distinguish between Barrier Protected Bike lanes (a design treatment) and Barrier Separated Bike Lanes (which can be accomplished with traffic control treatment). Also, provide guidance to readers (Use FHWA Bikeway Selection Guide recommendations, Fig 9, page 23) for when to consider separated bike lanes based on speed and volume. For the first point, there is often confusion between the terms “separation” and “protection”. By definition, a bike lane is a space separated from traffic and a buffered bike lane represents even greater separation. Here, it seems that separation does not mean laterally, but vertically and with a barrier and so the terms should reflect this. In addition, there appear to be two types of barrier separation. One provides physical protection if a driver leaves the travel lane, the other merely reinforces the separation. Practitioners choosing the appropriate level of marking and vertical control need to recognize that Barrier Protected Bike lane suggests a facility suitable for most ages and abilities. Barrier Separated Bike lane suggests an improved buffered bike lane where incursions by motorists are more strongly discouraged, but not physically prevented. Make sure the width of the gap recommended is the same as the gap width from 9E.06.
9E.07	NO	YES	N/A	Page 773 lines 10-13: Remove text "Information regarding the design requirements for pedestrians who would interact with a separated bicycle lane can be found in the". Rationale: The ADAAG and PROWAG do not contain any reference to separated bicycle lanes so referring to them for design requirements related to pedestrian interaction with SBL is inappropriate. The reference included in Section 1A.05 to these documents is sufficient.
9E.07	NO	YES	N/A	Page 773 lines 21, 22: Add statement that left turns on red shall also be prohibited across separated bicycle lanes (applicable to one-way streets).
9E.07	NO	YES	N/A	Page 773: Remove the Guidance starting on line 27. 4H.01 allows permissive conflict by using a green ball and flashing yellow arrow; this section seems contradictory and is out of context here (why in markings section?)
9E.07	NO	YES	N/A	Page 773 lines 32-35: Remove the Standard starting on line 32. Rationale: The decision whether signal phase separation for a two-way separated bike lane is required at a signalized intersection should be based on engineering judgment. From an operational standpoint a two-way separated bicycle lane is not different from a side path, which does not require any signal phase separation. Two-way separated bike lanes have been installed in a number of locations across the country with permissive motor vehicle turns without safety issues. There is ongoing research on this subject; FHWA should await findings before establishing Standards.
9E.07	NO	YES	N/A	Page 773 lines 7-9: This includes a reference to AASHTO bike guide; why not refer to the bike guide for other design questions rather than set up as standards throughout?
9E.07	NO	YES	N/A	Page 773: Change the proposed Standard to Guidance. Engineering judgment should be used to determine the necessity and function of a buffer adjacent to a parking lane. Remove the second sentence in the Support; decision making regarding selecting a one-way versus two-way separated bike lane is context

				specific and better discussed in existing guidance documents. The existing AASHTO Guide for the Development of Bicycle Facilities does not contain any information on separated bicycle lanes; refer instead to FHWA Bikeway Selection Guide, then update when the new AASHTO Bike Guide comes out.
9E.07b	NO	YES	N/A	The figure notes that parking is permitted in the buffer space. This is incorrect; the buffer space is the area adjacent to the bike lane. Recommend that this figure calls out the parking lane.
9E.07d	NO	YES	N/A	Proposed text in 9E.02 describe two conditions; only one is illustrated in 9E.07. Recommend adding a figure to illustrate a buffered or separated bicycle lane shifting away from the travel lane. Match terminology between text and figures here and elsewhere in document concerning whether reference is to shift to/away from curb or to/away from travel lane.
9E.08	NO	NO	YES	Page 774 lines 22-23: "Shall not" language not necessary; treatment may be suitable on low-volume streets and this should be left to engineering judgment. There are many places in the US where contra-flow bike lanes exist between a travel lane and a parking lane and function with no known safety issues. There is no research to suggest that this practice is unsafe. Remove this standard statement. Provide guidance on applicable traffic control; if driver has to cross a double yellow line to go across bike lane and access curbside parking, should that be a dashed yellow?
9E.08	NO	YES	N/A	Page 774: Provide guidance for when to consider various levels of separation/protection based on speed and volume (Use FHWA Bikeway Selection Guide recommendations, Fig 9, page 23). Contra-flow bike lanes are essentially buffered bike lanes, with further emphasis given by yellow versus white paint. FHWA guidance recommends buffered bike lanes at 30 mph and 3K+ AADT. At 35 mph and 7k+ AADT barrier protected bike lanes are recommended. Also, there should be an option to use ONE WAY signs in lieu of, or in addition to, no left turn signs. Terminology: Counter-flow lanes are defined in the NPA as opposing-direction lanes "designated for peak direction of travel", which is inappropriate for bicycle facilities. Change to "contra-flow" here and in other parts of the document when referring to these bike lane types and add a definition to Part 1.
9E.09	NO	NO	YES	Page 775 lines 25-26: Per 3H.06, green colored pavement is used to enhance the conspicuity of word, symbol, and/or arrow pavement markings. Many communities throughout the US have use green pavement markings behind shared use lane markings to increase conspicuity of the symbol, especially in the context of bicycle boulevards. Revise to state that green-colored pavement may be used behind shared use lane markings, as an option.
9E.09	NO	NO	YES	Page 775 lines 12-13: Shared lane markings should be limited to locations with posted speeds of 25 mph or less and not where multiple lanes are present. Shared lane symbols are already restricted for multilane roundabouts (9.10). Note: If sharrows are to be retained as a safety tool (I would not recommend this), then the marking should add signage to indicate what a bicyclist is expected to do. The signage might indicate “bicyclists ride in center of sharrow symbol” to educate bicyclists and drivers. In addition, minimum maintenance requirements should be required so that the symbol remains prominent. If a jurisdiction wishes to stop using the treatment, it should be fully removed rather than being allowed to fade and create an ambiguous situation. Note that FHWA guidance (Bikeway Selection Guide, see page 23) recommends protected bike lanes at 35+mph and buffered bike lanes at 30 mph. A

				treatment that indicates a bicyclist should take up the lane where drivers are expecting to travel at 35 or 40 mph is concerning.
9E.09	NO	NO	YES	Page 775 lines 3-9: Revise text regarding how shared lane markings may be used. Add that they should: "Act as wayfinding tools (on bike boulevards, for example) B. Indicate where a brief, perhaps unexpected, sharing situation is present (example mixing zones as proposed in 9E.02)." The function ascribed to shared lane markings (sharrows) is not well understood by bicycle riders or motor vehicle drivers. More recent research has indicated that sharrows may make conditions less safe for bicyclists (Ferenchak, Wesley E. Marshall, 2019) and additional research is needed before it can be determined that sharrows address the functions listed in the MUTCD (lateral positioning with respect to parked cars or in narrow lanes, alerting drivers to expected position of riders, encouraging safe passing, reducing the incidence of wrong way riding). References: (1) Nicholas N. Ferenchak, Wesley E. Marshall, Advancing healthy cities through safer cycling: An examination of shared lane markings, International Journal of Transportation Science and Technology, Volume 8, Issue 2, 2019, Pages 136-145, ISSN 2046-0430, https://doi.org/10.1016/j.ijtst.2018.12.003. (2) Ahmad Feizi, Majid Mastali, Ron Van Houten, Valerian Kwigizile, Jun-Seok Oh, Effects of bicycle passing distance law on drivers' behavior, Transportation Research Part A: Policy and Practice, Volume 145, 2021, Pages 1-16, ISSN 0965-8564, https://doi.org/10.1016/j.tra.2020.12.017 (3) Nicholas Fournier, Sarah Bakhtiari, Krishna Deep Valluru, Nicholas Campbell, Eleni Christofa, Shannon Roberts, Michael Knodler, Accounting for drivers' bicycling frequency and familiarity with bicycle infrastructure treatments when evaluating safety Accident Analysis & Prevention, Volume 137, 2020, 105410, ISSN 0001-4575, https://doi.org/10.1016/j.aap.2019.105410
9E.10	NO	NO	YES	Page 776: Recommend deleting the sentence, "The "Guide for the Development of Bicycle Facilities" authored by the American Association of State Highway and Transportation Officials (see Section 1A.05) contains information on designing for bicycles on the sidewalk in lieu of, or in addition to, using shared-lane markings in the circular roadway of the intersection." The new AASHTO Bike Guide will provide other options, distinguishes shared use paths rather than sidewalks, and does not imply that bikes on sidewalks are the preferred option. Add statement: "If used, shared lane markings should be place in the center of the travel lane in a circular roadway." Conflicts can occur when motorists try to overtake a bicyclist while also needing to exit a circular roadway. Bicyclists should be encouraged to take the lane. Also refer to comments for 3D, 9E.05, 9E1.0.
9E.11	NO	YES	N/A	Page 777 Support statement is written awkwardly. Instead of "that does not require them," use something like "instead of requiring them." In line 10, use "orient" instead of "orientate" to be consistent with the rest of the MUTCD. Lines 39-40 appear to conflict with Line 46 and Figure 9E-10(D). Practitioners need more concrete guidance on the sizing of the symbols within the box; need a fixed set of sizes from which to choose.
9E.12	NO	YES	N/A	g 777 lines 29-34: Remove the proposed Guidance statement on lines 29-34. The MUTCD is not a guidance document and is not equipped to provide meaningful discussion on contextual considerations. The language that is provided is vague; guidance documents can better address what the number of conflicts might mean under various contexts and what treatment might be most appropriate within an overall bikeway network. As written, this

				prioritizes turning movements of drivers over bicyclists, whereas a location with a high number of conflicts might benefit from the application of a bike box to position bicyclists to be more visible. 9E.11 two-stage bicycle turn box has prohibition of turning movements, which is beneficial, and this section has RTOR prohibition where bike box is placed, both of which are improvements this Guidance seems to undercut. The likely effect in many places is that bike boxes won't be created where they would provide the most benefit. The word "discernible" is highly subjective with respect to the number of conflicts and must not be used; the only other places in the document it appears are references to visual indicators where its use is more appropriate. Lines 32-34, "other treatments": This section would benefit from more discussion of other treatments and the use of conflict analysis. Documented conflict analysis, using methods such as video analytics, should be standard practice to evaluate intersections along with consideration of speed and volume. Protected intersections should be listed here as an additional treatment.
9E.13	NO	YES	N/A	Page 778 lines 46-47: Remove reference to "high volume"-- vague.
9E.13	NO	YES	N/A	{g 889" Agree that marking crosswalks for shared use paths should be the default practice and the practitioner should have the burden to demonstrate why a marked crosswalk is not needed, rather than the other way around. Recommend expanding proposed Standard language to consider the types of roads where marked crosswalks shall be marked here and in other relevant sections. As noted in comments on 3C.01 the new Standard proposed in 9E.13 should also be applied to marked crosswalks at signalized intersections. The reasons for marking these two instances are not different. The FHWA STEP guidance provides ample discussion on the situations where a marked crosswalk makes sense based on driver speed and volume. Refer to that resource here and elsewhere.
9E.15	NO	YES	N/A	Operationalize definition of the term "appropriately sized".
Figure 9E-9	NO	YES	NO	In all three examples, there is a shared space element which is fighting the black and white regulatory sign. This needs to consider warning sign or other treatment. Specifically, the R4-4 sign. What about if Buses are permitted to go straight?
Figure 9E-10	NO	YES	N/A	Drawing A – Remove the through and left arrows from the center of the intersection.
Figure 9E-14	NO	NO	YES	The use of Green in road markings is meant for the path users (wayfinding) who already know where they're going (path is well defined). So, this use of green seems Superfluous.
Figure 9E-15	NO	NO	YES	Superfluous use of pavement markings when signs are present induce a potential slippage issue during rain events.
9G	N/A			Section 9G cannot be reviewed as the proposed revisions to the text, figures, and tables in the Manual were not provided for public comment. Remove these proposed revisions from the Manual until a time when they can be properly reviewed and commented on.

TABLE 2. AGREE WITH ANOTHER COMMENTER. If you agree with another commenter, please indicate the commenter with whom you agree with and note any additional information FHWA may find helpful or any exceptions.

Docket Comment Number and/or Commenter Name	Agree with commenter's comments as written	Agree with commenter; with exception(s)	Additional information helpful to FHWA, or exceptions to commenter's comments
Oregon DOT	YES	N/A	1B.02 Agree with Oregon DOT's comments.
NCUTCD – Markings Technical Committee	YES	N/A	Section 3D Roundabout Markings worked through/reached consensus by 5 state DOT's and NC Roundabout Task Force and voted/approved by MTC/Council vote expected. Section 3D, notably 3D.02, 3D.04, 3D.04, & 3D.06