

legibility of changeable message signs.<sup>50</sup> The FHWA received one comment from the NCUTCD opposing this change, stating that other units are in use. The FHWA believes that this is a minimum requirement, and the FHWA includes this sentence in this final rule.

Additionally, the FHWA adds to the first GUIDANCE statement that for a trailer or large truck mounted sign, the letter height should be a minimum of 450 mm (18 in). For a service patrol truck mounted sign, the letter height should be a minimum of 250 mm (10 in). The message panel should have adjustable display rates (minimum of 3 seconds per phase) so that the entire message can be read at least twice at the posted speed, the off-peak 85th percentile prior to work starting, or the anticipated operating speed. Because the FHWA is retaining the current guidance that road users should be able to read the entire message twice, there may be a need in some temporary traffic control zones to use more than one Portable Changeable Message sign. The FHWA incorporates these changes in response to research addressing the needs of older road users.<sup>51</sup>

The FHWA received one opposing comment from a traffic engineering consultant suggesting that legibility depends on several factors and that, at a minimum, letter heights on trailer or large truck mounted signs and changeable message signs mounted on service patrol trucks should be the same, at 450 mm (18 in). The Virginia DOT agreed with allowing smaller letter heights for service patrol trucks and also suggested that letter heights for signs used on work vehicles in moving operations could also be smaller. The FHWA received one opposing comment from a traffic control device manufacturer suggesting that letter heights for changeable message signs should be consistent with the size of lettering on static signs. The FHWA disagrees because the sign types are entirely different and need to be treated

separately. The FHWA adopts the letter heights as proposed in the NPA.

The FHWA received one comment from the NCUTCD opposed to the minimum three second per phase recommendation for the adjustable display rates, stating that there was no documentation indicating that three seconds was appropriate. The FHWA disagrees because a minimum display time needs to be specified for each message phase to give road users a reasonable chance to read the message before it goes away and, based on the previously-cited research addressing the needs of older drivers, believes three seconds is sufficient.

Additionally, for clarity, the FHWA moves the GUIDANCE information regarding the factors that agencies should take into account when designing changeable messages from the end of the section to the end of the first GUIDANCE statement.

Additionally, the FHWA changes and relocates from the first GUIDANCE statement to the following OPTION statement (based on the 2000 MUTCD) that smaller letter sizes may be used on a sign mounted on a trailer or large truck provided that the message is legible from a minimum distance of 200 m (650 ft), or a sign mounted on a service patrol truck provided that the message is legible from a minimum distance of 100 m (330 ft). The FHWA received one comment from the NCUTCD opposed to this paragraph, stating that there is not sufficient documentation to justify smaller letter sizes. The FHWA adopts the OPTION as proposed in the NPA, because service patrol trucks are typically small pick-up trucks on which it is not practical to mount large signs.

Additionally, the FHWA adds a fourth paragraph to the second STANDARD statement to clarify that the mounting of Portable Changeable Message signs on a trailer, a large truck, or a service patrol truck shall be such that the bottom of the message sign panel shall be a minimum of 2.1 m (7 ft) above the roadway in urban areas and 1.5 m (5 ft) in rural areas when it is in the operating mode, to correspond with mounting heights for ground-mounted signs. The FHWA received one comment from a traffic engineering consultant opposed to these mounting heights, stating that it is sometimes not practical or necessary to mount the large, heavy signs this high. The commenter suggested that this be changed to a GUIDANCE to give more flexibility. The FHWA retains this as a STANDARD, because the only change from the 2000 MUTCD is to add that these signs may be mounted lower in rural areas, thereby giving agencies

additional flexibility. Any further changes would require notice and public comment in a future rulemaking.

The FHWA also consolidates all of the SUPPORT statements in this section under one heading at the beginning of the section. The FHWA makes this minor editorial change to better organize the section, based on a suggestion from a traffic engineering consultant.

259. In Section 6F.56 Arrow Panels (numbered Section 6F.53 in the NPA), the FHWA adds to the first GUIDANCE statement that an arrow panel in the arrow mode should be used to advise approaching road users of a lane closure along major multi-lane roadways in situations involving heavy traffic volumes, high speeds, and/or limited sight distances, or at other locations and under other conditions where road users are less likely to expect such lane closures. The FHWA received one comment from the City of Tucson, Arizona, in support of this change. The NCUTCD opposed this change suggesting that "Sequential Chevron mode" be added, because chevron mode is also permitted for arrow panels in this case. The FHWA agrees and incorporates this change.

The FHWA also revises the last paragraph of this GUIDANCE statement to clarify that if it is not removed, an arrow panel within the clear zone should be delineated with retroreflective temporary traffic control devices if it is not feasible to shield it with a barrier or crash cushion when it is not in use. The FHWA received one comment from a private citizen opposed to this change, stating that shielding the arrow panel with a barrier or crash cushion is impractical. The FHWA notes that the change proposed in the NPA actually clarified that the shielding only pertains to arrow panels not in use, and that retroreflective delineation is acceptable. The FHWA adopts the change as proposed in the NPA.

The FHWA revises the last paragraph of the sixth STANDARD statement to clarify the language. The FHWA received no comments regarding this change, and adopts this change. However, the FHWA received two comments from the City of Charlotte, North Carolina, and a private citizen regarding the fifth GUIDANCE statement and the last paragraph of the last STANDARD statement concerning the use of the word "shift" as it relates to moving traffic over laterally. Because the intent throughout the MUTCD is that arrow panels are to be used only in merging operations, not to shift traffic laterally, the FHWA revises these statements accordingly. The FHWA makes these changes in the final rule,

<sup>50</sup> "Changeable Message Sign Visibility," Federal Highway Administration publication number FHWA-RD-94-077, by P.M. Garvey and D.J. Mace, 1994, is available from FHWA, Turner-Fairbank Highway Research Center, 6300 Georgetown Pike, McLean, Virginia 22101. It is also available for purchase from The National Technical Information Service, Springfield, Virginia 22161, (703) 605-6000. Internet Web site address at <http://www.ntis.gov>.

<sup>51</sup> Information about this research is summarized on pages 253-263 of the "Highway Design Handbook for Older Drivers and Pedestrians," Report number FHWA-RD-01-103, published by the FHWA Office of Safety Research and Development, 2001. It is available for purchase from The National Technical Information Service, Springfield, Virginia 22161, (703) 605-6000. Internet Web site address at <http://www.ntis.gov>.