TECHNICAL BRIEF

Federal Highway Administration

Manual on Uniform Traffic Control Devices for Streets and Highways: Termination of Interim Approval No. 5, Clearview Font for Positive Contrast Legends on Guide Signs

Introduction: On January 25, 2016, the FHWA published a notice in the Federal Register[1] terminating the use of an alternative letter style, Clearview™, on traffic control devices. The use of this alternative letter style was authorized under the provisions of the *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD) for Interim Approval. Agencies wishing to use the alternative letter style were required to request approval from FHWA. The alternative letter style has not been adopted in the MUTCD.

Research History and Implementation: Initial studies evaluated only one letter form type of the provisional letter style with two different intercharacter spacing criteria. These are now known as 5-W and 5-W-R, the latter of which has a compressed intercharacter spacing so that the length of a word would approximate that of the same word composed of the FHWA Standard Alphabet Series E(modified). This compressed version was found to provide no improvement over Series E(modified). These studies did not evaluate numerals for legibility or recognition. The narrower letter forms of the provisional letter style (designated as 1-W, 2-W, 3-W, and 4-W) were also not evaluated for legibility in these studies.

The study[2] on which the Interim Approval was primarily based found that changing the type of retroreflective sheeting alone resulted in a 6% improvement in legibility to the FHWA Standard Alphabet Series E(modified). However, this quantitative result was not otherwise reported as a major finding. The practical difference attributed to the letter style was characterized as "modest" and the apparent improvement of the provisional letter style could be "partly attributed to [its] increased size." Because of the narrowly focused research statement, which examined the cumulative effect of a change to two variables, the study recommended that the sponsoring agency adopt a new standard to change both the retroreflective sheeting to microprismatic and the letter style to 5-W [3]. The fact that the sponsoring agency already owned 100 licenses of the design and fabrication software for the provisional letter style and had furnished one licensed copy to a sign fabricator was also noted in the recommendation.

Subsequent testing[4, 5] showed that FHWA Standard Alphabet Series D resulted in longer legibility distances than the 3-W letter style of the alternative alphabet.

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[1] *Federal Register*, Vol. 81, No. 15. 81 FR 4083. National Archives and Records Administration, January 25, 2016.

[2] Carlson, P. J. *Evaluation of Clearview Alphabet with Microprismatic Retroreflective Sheetings*, Report No. FHWA/TX-02/4049-1. Texas Transportation Institute, August 2001, resubmitted October 2001.

[3] The sponsoring State agency adopted this recommendation, but substituted 5-W-R for 5-W as its standard.

[4] Chrysler, S. T., P. J. Carlson, and H. G. Hawkins. *Nighttime Legibility of Ground-Mounted Traffic Signs as a Function of Font, Color, and Retroreflective Sheeting Type*, Report No. FHWA/TX-03/1796-2. Texas Transportation Institute, September 2002.

[5] Holick, A. and P. J. Carlson. *Nighttime Sign Legibility as a Function of Various Combinations of Retroreflective Sheeting and Font*, Report No. FHWA/TX-04/1796-4. Texas Transportation Institute, September 2003.

Legibility and recognition deficiencies with numerals of the provisional style were reported in a field experiment as early as 2009. A formal evaluation[6] later confirmed that the numerals of the Standard Alphabets exhibited superior performance when compared with those of the provisional lettering style.

A 2014 study[7] found that there is no practical difference between Series E(modified) of the Standard Alphabets and 5-W of the provisional letter style when tested in positive-contrast color orientations.

Explorations of the provisional letter style in negative-contrast color orientations[8] revealed that the provisional letter style actually reduced the nighttime legibility when compared with the Standard Alphabets.

Recognition vs. Pure Legibility

Research has focused primarily on the legibility of one letter style compared to another. One of the studies acknowledged the fact that the excessively long legibility distances reported in some of the earlier work were actually the result of recognition, rather than legibility, due to learning effects by the participants among the set of test words. These research evaluations did not necessarily simulate the actual process of reading a sign: detection, recognition, and reaction via multiple glances. While legibility alone might be considered a valid surrogate measure for the entire process of interpreting a highway sign, marginally differing results do not necessarily indicate a practical significance that can justify an institutional or systematic change.

Degradation of Consistency in Signing Layouts

The presence and availability of two separate letter styles with differing criteria have resulted in significant confusion and inconsistency in the highway sign design and fabrication processes. Although the terms of the FHWA's 2004 Interim Approval are explicit, misunderstandings and misapplications of the provisional letter style have resulted. In 2011, the FHWA issued a *Design and Use Policy*[9] on this topic that included explicit criteria in question-answer format with photographic examples to illustrate acceptable and unacceptable practices. This additional guidance has failed to allay these practices. The following are representative examples of ways in which these concerns have manifested themselves:

- Sign Design. Poor sign design practices are becoming unduly institutionalized. This phenomenon appears to have coincided with the provisional allowance of an alternative lettering style due to a lack of consistent implementation and inaccurate presumptions

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[6] Miles, J., B. Kotwal, S. Hammond, and F. Ye. *Evaluation of Guide Sign Fonts*, Report No. MN/RC 2014-11. Texas A&M Transportation Institute, February 2014.

[7] Ibid.

[8] Holick, A., S. T. Chrysler, E. Park, and P. J. Carlson. *Evaluation of the Clearview™ Font for Negative Contrast Traffic Signs*, Report No. FHWA/TX-06/0-4984-1. Texas Transportation Institute, January 2006, resubmitted April 2006.

[9] http://mutcd.fhwa.dot.gov/resources/clearviewdesignfaqs/index.htm

that lesser sign design criteria, such as reduced interline and edge spacing, are broadly acceptable.

- Incorrect Applications of the Provisional Letter Style. Many agencies erroneously believed that the alternative lettering style should be used in all applications and that all lettering should be displayed in upper- and lower-case lettering, regardless of the type of message. While there is evidence of this phenomenon occurring at State levels, these misunderstandings have metastasized at the local levels, in part, due to inaccurate or incomplete reports published in news media and trade journals, and promotional efforts of commercial entities, including some associated with the early development of the provisional letter style. There is also considerable confusion that the requirement of the MUTCD to display destination and street names in upper- and lower-case lettering equates to the use of the provisional lettering style rather than the Standard Alphabets. In actuality, there is no interdependency between letter style and case.
- Negative-Contrast Applications of the Provisional Letter Style. Commercial availability and promotion of the alternative letter style for negative-contrast color orientations—which was not part of the Interim Approval—have also resulted in confusion among agencies and sign manufacturers. Regulatory and warning signs, including some as basic as the standard Speed Limit sign, have been observed using the alternative lettering style that has not been approved for use due to its inferiority to the Standard Alphabets in negative-contrast color orientations[10].

Conclusions of Research Evaluations

A significant number of research studies have been performed in pursuit of an alternative letter style. However, inconsistent or counterintuitive conclusions have been drawn from the results as reported to support or promote use and/or further study of an alternative letter style. The following examples illustrate this concern:

- Sign Size. The impetus reported for pursuing an alternative letter style was to avoid the need for larger lettering, thereby avoiding larger sized signs. With the standard spacing of 5-W lettering, the word lengths are typically longer than with Series E(modified), resulting in a larger sign.
- Increase in Letter Height to Accommodate an Alternative Letter Style. A 2003 study[11] concluded that 3-W lettering of the provisional style in a larger letter height produces longer legibility distances than Series D in a smaller letter height. The researchers recommended that 8-inch 3-W lettering be used to replace all signs that used 6-inch Series D lettering. While increases in letter heights in this range can result in increased legibility distances independent of letter style, they will also result in larger signs, including with this scenario. The additional costs associated with larger sign sizes appear not to have been considered in making this recommendation. The recommendation to increase the letter height by 2 inches in order to justify the use of the alternative letter style on conventional roadways contravenes the original premise of considering an alternative letter style: improve legibility without costly increases in sign sizes. Following such a recommendation would result in an 80% increase in the

[10] Holick et al. *Evaluation of the Clearview™ Font for Negative Contrast Traffic Signs.*

[11] Holick and Carlson. *Nighttime Sign Legibility.*

area for a typical one-line Destination sign. The increase in area for a three-line Destination sign typically used at conventional road junctions would be 95%.

- Compressed Intercharacter Spacing. To mitigate the issue of larger signs, which would often necessitate replacement of the supporting structure, compressed intercharacter spacing criteria were developed for the provisional 5-W letter forms, referred to as 5-W-R. The use of 5-W-R is restricted to retrofits where an existing sign support structure that is still in serviceable condition does not have the capacity to accommodate a larger sign. It was expected that these cases would be relatively rare. However, some agencies have specified the compressed intercharacter spacing of 5-W-R as their default standard for all new signs, including those installed on new support structures, resulting in no net improvement over the Standard Alphabets that these signs replaced.

- Comprehensive vs. Incremental Analysis of Results. While the most recent study suggested that there is no practical advantage to using the alternative lettering style over the Standard Alphabets because of the lack of consistent improvement in the legibility index, it questioned whether it is possible to achieve additional improvements in legibility. Instead, the researchers recommended that any future research on letter style focus on improvements that would reduce the cost of signs without affecting their safety performance. This recommendation did not consider the inconsistencies that have arisen due to the presence of two different lettering styles and criteria.

- Specific Focus of Research Evaluations. Early research made iterative revisions to letter forms, size, and spacing of an alternative letter style until what appeared to be a statistically significant improvement resulted, but only for the alternative letter forms. Development of an alternative letter style eventually became self-propagating, excluding any consideration of optimizing the established Standard Alphabet letter forms and other criteria such as stroke width, loop height, or intercharacter spacing. This process unnecessarily presumed a fundamental dysfunction with the existing practice that could not be rectified. One study[12] in which "no conclusion can be drawn about the relative legibility" based its recommendation for letter style on a different study rather than the one conducted.

- Interline Spacing. The closed-course research evaluations did not use signs with multiple lines of legend that would simulate actual highway signing. Because the interline spacing is customarily based on the initial upper-case letter height, and the lower-case loop and rising stem heights of the provisional style are larger than those of the Standard Alphabets, the resulting space between lines of legend is reduced. The effect of this apparent reduced interline spacing was not measured. Reports of signs whose legends appear crowded are likely attributable to this effect.

- In-Service Performance and Comparison. A recent field evaluation[13] observed no statistically significant difference between new signs that used the provisional 5-W lettering and a combination of new and existing signs that used Series E(modified).

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[12] Smiley, A., C. Courage, T. Smahel, G. Fitch, and M. Currie. *Required Letter Height for Street Name Signs: An On-Road Study*, Paper No. 01-2225. Human Factors North and Toronto Transportation, 2001.

[13] Mahmassani, H. S., C. W. Frei, and M. Saberi. *Clearview™ Font in Illinois: Assessing IDOT Experiences and Needs*, Report No. FHWA-ICT-13-003. Northwestern University Transportation Center, January 2013.

The recommendation of this study was to continue using Clearview for positive-contrast signs based on the fact that it had been implemented and there was no difference or negative reaction reported. Though, there appeared to be no consideration of the need to continue to use the Standard Alphabets in the majority of signing applications. This evaluation concluded that retroreflective sheeting materials might affect legibility, regardless of the letter style, corroborating past evidence. Additionally, it was reported in this evaluation that the intercharacter spacing of Clearview was often "manually adjusted" to avoid increasing the size of signs.

- Practical Significance. The 2014 study[14] evaluated a modification of the Standard Alphabets, using larger lower-case letters and a lesser stroke width based on Series E(modified). Based on a comparison between the comparable alternative alphabets and the Standard Alphabets, there was no statistically significant difference in the legibility and/or recognition that could justify further exploration of any one of the letter styles over another. Further, legibility and recognition of numerals of the alternative alphabet were found to be inferior to those of the Standard Alphabets.

Implementation

Interestingly, a number of agencies are now using 20-inch leading upper-case letters with either 5-W or 5-W-R of the provisional lettering style. However, there is not necessarily a proportional increase in legibility or recognition with increases in letter height[15, 16]. The basic premise of the development of an alternative letter style was to address a generalized hypothesis[17] that letter heights of 20 inches would be needed to address the needs of older drivers, partly due to irradiation that can occur with different combinations of high-brightness retroreflective materials. This conclusion was extrapolated from a laboratory simulation and came during the infancy of higher-brightness retroreflective background sheeting on highway guide signs. It was intended to address a more practical visual acuity that would represent a broader cross-section of drivers and was at best, an approximation, as the actual Standard Alphabets were not used in this simulation. The research on an alternative lettering style was promoted largely as a means to avoid unnecessarily enlarging signs to meet this recommendation (cited in various articles as anywhere between a 20% increase to as much as a 33% increase), thereby sparing transportation agencies those additional costs while gaining the benefit of improved effectiveness. The presumption was that letter forms completely different from those of the Standard Alphabets would be the solution and did not examine modification to or optimization of the established Standard Alphabet letter forms. In fact, even the early research[18] had determined that it was the relative contrast of the level of retroreflectivity used for the legend and background that was the critical factor in the legibility and that high-contrast brightness combinations should be avoided.

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[14] Miles et al. *Evaluation of Guide Sign Fonts*.

[15] Mace, D. J., P. M. Garvey, and R. F. Heckard. *Relative Visibility of Increased Legend Size vs. Brighter Materials for Traffic Signs*, Report No. FHWA-RD-94-035. Federal Highway Administration, 1994.

[16] Garvey, P. M. and D. J. Mace. *Changeable Message Sign Visibility*, Report No. FHWA-RD-94-077. Federal Highway Administration, April 1996.

[17] Staplin, L. K., K. Lococo, and J. Sim. *Traffic Control Design Elements for Accommodating Drivers with Diminished Capacity*, Report No. FHWA-RD-90-055. Federal Highway Administration, 1990.

[18] Mace et al. *Relative Visibility*.