

Executive Summary

Identification of Pavement Marking Colors SJN: 14733

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The Ohio Department of Transportation (ODOT) is charged with selecting and enforcing color specifications for pavement markings. In recent years, changes in materials have affected the physical appearance of these markings. Even though, at application, the colors meet current federal specifications, the specifications themselves are sketchy and, in some cases, given in terms of the physical properties of the materials rather than appearance. This method is particularly troublesome since the markings are viewed under a variety of lighting conditions and against different colored backgrounds (pavement types). Perhaps more of a problem is that current practice requires only a subjective evaluation of whether colors are within specification. Recently, the ODOT has also been put under a legislative mandate to require that a certain percentage of their contracts contain warranties. This mandate makes it necessary to develop appropriate specifications for acceptable changes in the color of pavement markings over time. Research is needed to develop these specifications with regard to the color appearance properties of markings. They need to be more relevant to the needs of the driver than the current specifications, and guidelines for objective evaluation need to be provided. This research includes a review of current literature on color, perception, and measurement as well as a review of current practices with regard to pavement markings. It also includes an investigation of human perception of the color of pavement markings under a variety of conditions and the development of specifications, tolerances for which procedures for enforcement can be easily applied by the ODOT.

The Commission Internationale de l'Eclairage (CIE), in 1931, developed a method for specifying colors. This method allows for the specification and replication of any color by associating an x and y coordinate with that color. Figure 1 shows such a diagram, which includes an artist's rendering of the approximate colors in various locations. This diagram is used by both the ODOT and the Federal Highway Administration (FHWA) for specifying the color ranges of proposed pavement color specifications and will be used throughout this research. The current pavement marking color specifications are spread through a number of sources. Few of these sources provide information on supporting research. The earliest specifications for pavement marking materials simply required that they be white or yellow, with yellow being reserved to mark no-passing (AASHTO [The American Association of State Highway and Transportation Officials], 1954).

Responses in the color naming experiment were similar for both daytime and nighttime viewing, for older and younger subjects, and for a variety of pavement types. The regions in which test chromaticities met the criteria for color deficient subjects were larger for white and smaller for yellow than for normal vision subjects. These regions were, however, in much the same location. These data indicate that, using color coding, the standards that would be suggested from the color scaling are probably the best that could be established. The only method of improvement would be redundant coding based on some dimension other than color. These results indicate that it is reasonable to establish standards and that these standards can be acceptable across a variety of conditions and for a range of drivers.

The contours that were derived from the color scaling data could reasonably be used for a new standard. The ODOT, however, would prefer standards that allow a worker to easily and quickly determine if a pavement marking being measure in the field conforms. While the established contours can be represented by their four corner points, a determination of whether a measurement falls within the contour is a bit more complex. The proposed standards, on the other hand, are defined by horizontal and vertical lines only, so that there is a range of both x and y values that a color must fall within to meet the standard. The ODOT has indicated that they would prefer a standard of this type. In keeping with that request, boxes of this sort were established to maximize acceptable colors and stay within the contours suggested by the color scaling data. For the white markings, the range of x values is 0.33 ± 0.03 , and the range of y values is 0.34 ± 0.03 . For the yellow markings, the range of x values is 0.47 ± 0.03 and the range of y values is 0.47 ± 0.03 .