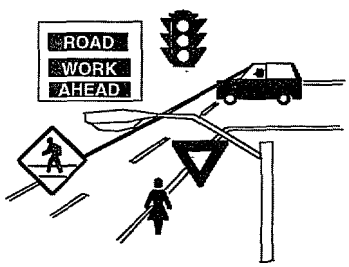
HVH-1 (3)

Summary Report

FHWA
Traffic Safety
Research Program



The FHWA Traffic Safety Research Program addresses the visibility of the roadway and its environment, and traffic control methods and devices to promote the safe and efficient movement of vehicles and pedestrians. The current emphasis areas are: the ITS program on advanced traveler information systems (ATIS), condition-responsive traffic control devices, and improved driver visibility through fluorescent materials and ultraviolet headlighting. Recent research includes recommending guidelines for the retroreflective requirements for traffic signs and pavement markings. The research is to support the programs of the FHWA's Office of Highway Safety and the Manual on Uniform Traffic Control Devices.

US Deportment of Transportation
Federal Highway Administration

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THE VISIBILITY AND COMPREHENSION OF PEDESTRIAN TRAFFIC SIGNALS

The research objectives were to determine performance criteria for acceptable pedestrian signal visibility and to study the comprehension of innovative and standard pedestrian signals.

Two field studies and a video questionnaire were designed and implemented to test the visibility and comprehension of pedestrian signals. The rationale of these studies was threefold: (1) to examine the possible use of innovative symbols and red/green pedestrian signals; (2) to test the use of newer, energy-efficient technologies such as fiber-optics (FO) and light-emitting diodes (LED); and (3) to develop a performance-based visibility standard for pedestrian signals.

Visibility Study

The objective of the visibility study was to test the legibility of 7.6-cm letters and 15.2-cm symbols at distances of 18.3 m and 29.6 m at various luminance settings during the day. Specifically, the study was designed to determine which signals were visible to older pedestrians when the voltages were set at 120 V, 90 V, and 60 V to vary the signal luminance. Measurements of signal intensity in candelas (cd) were obtained to better analyze signal performance of each signal display.

A total of 48 senior citizens, age 62 and older, participated in this study. Test stimuli included several types of commercially available pedestrian signals (incandescent, fiber-optic, and LED), including 22.9-cm (9-in) and 30.5-cm (12-in) rectangular signal housings and two round 29-cm Red/Yellow/Green (RYG) signals with symbol masks. Each subject was asked to identify the signal's location in the test stimuli array, to name the signal's display configuration (WALK, DON'T WALK, walking man, or hand), and to assess the signal's brightness on a five-point scale.

Results

The visibility data were analyzed by calculating the percentage of subjects correctly identifying the message of the signal that was energized. Analyses were also conducted on the percentage of responses where signals were identified as "overbright" or where subjects were "uncertain" of the signal message:

- All signals with intensities of 25 cd or greater resulted in a zero level of uncertainty for the 29.3-m distance, except for the nonstandard white hand at 66 cd and the white WALK at 37 cd that resulted in all correct responses and uncertainty except for one subject. A maximum value of 100 cd would remove many of the overbright signals reported at 29.3 m, while still providing four times the intensity needed for certain recognition by all subjects.

- The orange incandescent DON'T WALK measured at 270 cd and four FO signals operating at more than 100 cd were rated as being overbright.

- There were no meaningful differences between the text and symbol versions of the FO signals. Among the incandescent signals, the symbol versions were below the 25 cd, and had insufficient intensity. Thus, this resulted in more uncertainty for the symbols than for the brighter red text messages.

Walking-Speed Studies

The 48 elderly subjects participating in the pedestrian signal studies were asked to walk 18.3 m along a marked length on an asphalt parking lot. Subjects were asked to walk at a "normal street-crossing speed" and to imagine they were using a crosswalk at a signalized intersection on a five-lane urban street. Each subject was timed individually with a stopwatch.

Results

- The mean walking speed for this group of subjects was 1.45 m/s, which is well above ***the Manual on Uniform Traffic Control Devices*** standard of 1.22 m/s. Only five subjects, or 10 percent, were unable to walk the distance at a rate of 1.22 m/s.

- The 15th percentile walking speed for the older subjects was 1.26 m/s.

Comprehension of Pedestrian Signals

A video questionnaire was used to test pedestrian comprehension of standard and innovative pedestrian signals. Most of the innovative signals were symbolic, and many were presented in nonstandard colors such as green, yellow, and red. Standard signals included text and symbolic messages in orange and white. The symbols used in the study are shown in the figures below:

The 48 elderly subjects who participated in the visibility and walking-speed studies also viewed the video questionnaire. In addition, the video questionnaire study included 43 subjects ranging in age from 11 to 15 years. The 45 flashing and steady test stimuli were shown in intersection and mid-block crossing contexts. Subjects were instructed to provide the meaning of the test stimuli by choosing one of four multiple-choice items on a pencil-and-paper answer sheet.

Results

- At least 90 percent of the subjects gave the most correct answer of "it's okay to cross" for the six green and white signals shown in the steady mode, with 100 percent comprehension for the white WALK, green WALK, and green walking man symbol.

- The yellow steady hand was rated highest of the seven yellow "wait on the curb" stimuli, with only 66 percent correct answers.

- The orange flashing DON'T WALK and the orange flashing hand were the only orange stimuli that had slightly less than 90 percent correct answers.

- The four steady red "wait on the curb" signals had at least 95 percent of the subjects providing correct responses. Of the younger subjects, 100 percent correctly understood the red hand.

- The innovative standing man was the least successful of the symbols.

- The innovative "slash man" performed well with either red or orange, and its comprehension was virtually the same as with the standard hand.

- Virtually no differences were found between green and white or between red and orange when only color was varied and other signal characteristics were held constant.

- Flashing signals were generally less understandable than steady signals.

Reference

Pennak, Sara; Douglas J. Mace; and Mark Finkle. ***Visibility and Comprehension of Pedestrian Traffic Signals,*** Publication No. FHWA-RD-96-187, Federal Highway Administration, Washington, DC, 1997.

For more information:

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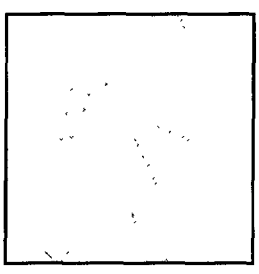

Figure 1. Walking man.

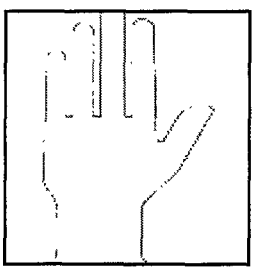

Figure 2. Hand.

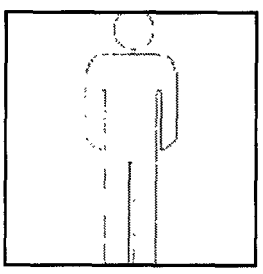

Figure 3. Standing man.

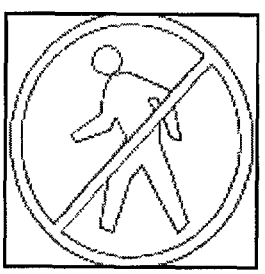

Figure 4. Slash man.

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