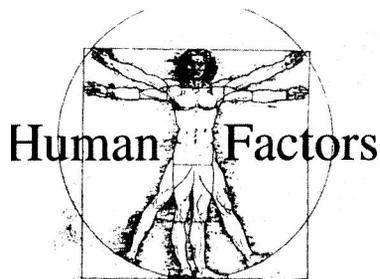


Summary Report



The Human Factors Research Program addresses human performance-related issues that affect highway system design. Current human factors research thrusts are in the areas of Highway Safety and Intelligent Transportation Systems (ITS).

FHWA is placing special emphasis on the U.S. trend toward increasing numbers of older drivers and implications of this trend on highway safety and ITS design. Human factors research products include highway system design guidelines and handbooks based upon empirical human performance data collected in the laboratory and in controlled, on-the-road tests.



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IMPROVEMENTS IN SYMBOL SIGN DESIGN TO AID OLDER DRIVERS

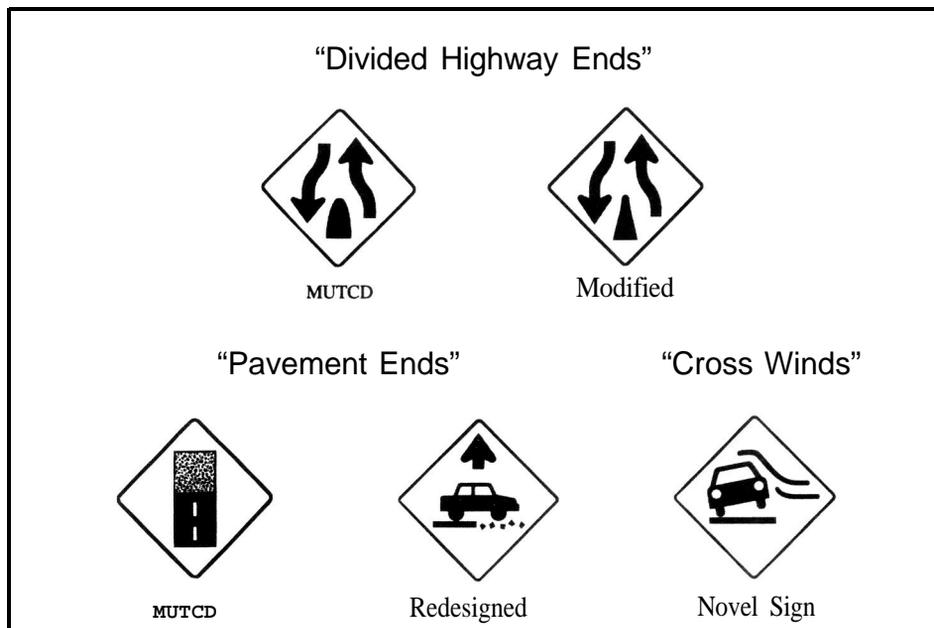


Figure 1. Examples of symbol sign alternatives studied.

The proportion of American adults age 65 and older is expected to comprise 20 percent of the population by the year 2020. Studies have shown that older drivers have higher rates of accidents, injuries, and fatalities on a per-mile-driven basis. A major cause of roadway accidents for older drivers is failure to heed traffic signs.

Previous research found that older drivers have difficulty detecting, reading, understanding, and responding to some symbolic traffic signs. This study had four objectives:

- ◆ Determine the effectiveness of symbol signs in the *Manual on Uniform Traffic Control Devices (MUTCD)*.
- ◆ Develop and test alternative symbol signs to enhance their effectiveness. Alternatives included redesign or modification of *MUTCD* signs, or the creation of novel signs (figure 1).
- ◆ Determine which specific elements of symbol signs are critical to effective sign design.
- ◆ Develop symbol sign design guidelines for current and future signs that are responsive to the sensory and cognitive capabilities of all drivers, including older drivers.

Research Methods

The study was conducted in two phases of laboratory investigations. The first phase assessed daytime visibility and comprehension of all 85 of the symbols in the *MUTCD*. Based on these results, a sample of 18 symbols (6 “best,” 6 “intermediate,” and 6 “worst”) were selected for further testing of glance legibility, reaction time, and conspicuity.

Table 1. Summary of recognition distance improvements for modified, redesigned, and novel designs.

Sign Name	MUTCD Number	Recognition Improved	Distance (m) Standard	Percent Increase
<i>Modified</i>				
Cross Road	W2-1	467	299	56
Right Curve	W1-2R	291	269	8
Hospital	D9-2	265	202	32
Divided Highway Ends	W6-2	206	178	16
Keep Right	R4-7	202	181	12
No Parking	R8-3a	120	116	4
<i>Redesigned</i>				
Advance Flagger	W20-7a	192	173	11
Pavement Ends	W8-3a	107	75	43
Campfire	RA-030	99	80	24
Ranger Station	RG-170	73	58	26
Seat Belt	R16-1	67	57	19
<i>Novel</i>				
Crosswind	None	114		
Horse-Drawn Vehicle	None	108		
Reduced Visibility	None	110		
Truck Entrance	None	96		
School Bus Stop Ahead	None	84		

The second phase investigated comprehension plus daytime and nighttime legibility distance measures for 14 modified and 5 novel symbol signs. The purpose of this phase was to improve visibility, especially for older drivers. Each sign was digitized and its spatial frequency was determined prior to its exposure to a series of computerized filters that model older drivers' loss in contrast sensitivity. Males and females in three age groups: young (18-39 years old), middle-age (40-59 years old), and older (60 years and older) were tested.

Results

Phase I results found: (1) older drivers' comprehension of symbol signs was poorer than both younger and middle-aged drivers; and (2) older drivers' legibility distances were shorter. These findings were especially true of recreational and

cultural signs, where the symbols are ambiguous and background color tends to provide poor conspicuity.

Phase II results from the modified and novel sign studies found that sign modification did little to improve comprehension, which was from 67 to 100 percent across all signs. Table 1 shows Phase II legibility distance results. Overall, the degree of improvement for the redesigned signs was greater than for the modified signs, and the redesign was especially helpful for the least legible signs.

Study Implications

Based on the experimental results and the redesign techniques employed in the study, a number of guidelines have been suggested. These include:

- ◆ Minimize symbol complexity by using very few details.

- ◆ Maximize the distance between symbol sign elements.
- ◆ Use representational rather than abstract symbols.
- ◆ Use solid rather than outline figures for designs.
- ◆ Standardize the design of arrowheads, human figures, and vehicles.
- ◆ Retain maximum contrast between the symbol and the sign background.

For More Information

A full report on symbol sign design is available from the FHWA R&D Report Center, phone no. 703 285-2144.

Title: Symbol Signing for Older Drivers
Publication No. FHWA-RD-94-069

This research was conducted by Swanson Transportation Consultants, Inc. For more information, contact Dr. Truman M. Mast, Human Factors Team Leader, HSR-30, 703 285-2404.