

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 upon highway safety and ITS design. Human Factors research products include highway system design tools, guidelines and handbooks based upon empirical human performance data collected in the laboratory and in controlled on-the-road assessments.



U.S. Department of Transportation
Federal Highway Administration

Research and Development
Turner-Fairbank Highway
Research Center
6300 Georgetown Pike
McLean, VA 22101-2296

FHWA Design-by-Blur Software System A Windows™ Program for Symbol Sign Optimization

The *recursive-blur technique* is a method for improving the legibility distance of graphical symbols used in highway signs and related signing systems. The *recursive-blur technique* was pioneered by FHWA research efforts intent upon developing an approach to improve the visibility of highway signs for older drivers [see *Symbol Signing for Older Drivers*, Publication No. FHWA-RD-98-000]. The *FHWA Design-by-Blur* system provides an integrated software environment for using the *recursive-blur technique* for optimizing the legibility distance of existing as well as novel graphic symbols. The software runs on generic desktop computers under the Windows™ operating system.

Background

Unlike text-based highway signs that are composed of a finite set of alphanumeric elements (i.e., 26 letters and 10 numerals), symbol signs can assume countless shapes and permutations. As a result, specific rules and guidelines for optimizing their legibility have proved to be elusive. However, recent research has demonstrated that graphic symbols whose recognition is maintained under increasing levels of optical blur also tend to be legible at very great viewing distances.

The *recursive-blur technique* provides the graphics designer with a development tool that leverages this relationship between legibility distance and a symbol sign's resistance to blur degradation. Application of the *recursive-blur technique* requires a set of graphics tools and image processing procedures that enable the graphics designer to modify a symbol sign in such a manner as to systematically increase its resistance to blur degradation; and, at the same time, increase the legibility distance afforded by the revised symbol design. The *FHWA Design-by-Blur* software provides a complete set of graphics tools needed to implement the *recursive-blur technique*. An example of how the technique is applied toward the optimization of symbol highway signs is schematically presented on the reverse side of this document.

Issued March 1998

Publication No. FHWA-RD-98-000

Recursive-Blur Technique for Optimizing Symbol Sign Legibility

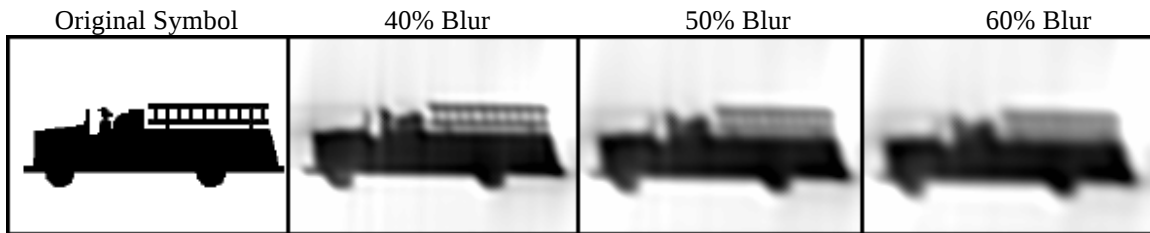


Figure 1.

Step 1. The level of blur was progressively increased until some critical detail in the original symbol became “unrecognizable”. An example of this progressive blur operation is depicted in Figure 1. The Fire Station symbol sign was blurred at the 40, 50 and 60 percent levels. The ladder -- a critical detail necessary for the identification of the symbol as a fire truck -- has become unrecognizable at both the 50 and 60 percent blur levels.

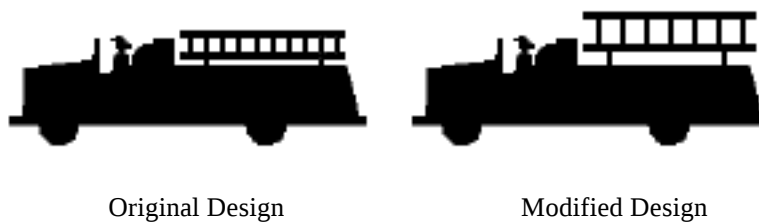


Figure 2.

Step 2. Using the graphics tools provided (e.g., paint brush, eraser, etc.), the designer has modified the symbol under optimization with the aim of making it more resistant to the blur degradation effects observed in Figure 1 (above). In this case, the overall size of the “ladder” element is increased while some of the “rungs” of the ladder are eliminated.

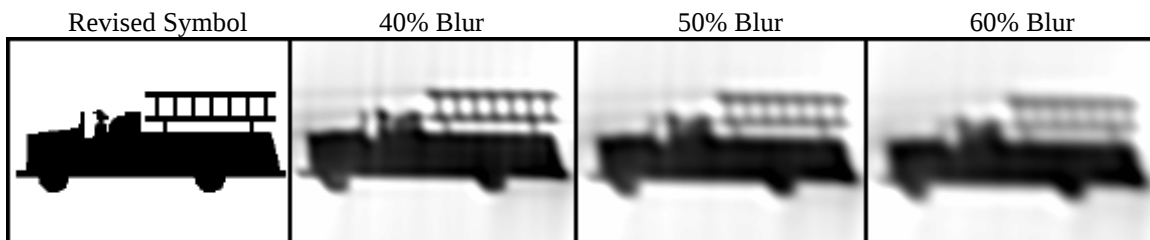


Figure 3.

Step 3. The modified (or revised) version of the symbol was then progressively blurred to determine whether or not the new design was recognizable under higher levels of blur than the original version of the symbol. Comparisons of the progressive blur series in Figures 1 versus 3 (above) demonstrates that the modified version of the symbol has become more resistant to blur degradation -- the revised version of the symbol remains recognizable at blur levels where the original symbol design was significantly degraded.

Step 4. The “blur-modify-blur-inspect” cycle described in Steps 1-3 is repeated in an attempt to render the symbol recognizable under higher and higher levels of blur. FHWA sponsored research (cited above) has demonstrated significant improvements in the legibility distances afforded by highway sign symbols that have been optimized using this “recursive-blur technique”.

The *Design-by-Blur* graphics optimization system was developed under contract to FHWA by the Dakota Research Company, Vermillion, South Dakota. For more information about the system contact Ms. Elizabeth Alicandri, Manager, Human Factors Laboratory, HSR-30, (703) 285-2415
Email address: beth.alicandri@fhwa.dot.gov