

This section describes the principles of signing. Included is information on: message preparation and sign legend content, mounting methods and placement guidelines, material selection, and maintenance procedures. It is important that these guidelines be followed when planning, specifying, and placing signs at Corps projects.

Each sign in this manual has been designed for a specific purpose and is available from approved sources.

All standard identification and directional signs are made to order. They follow specified grids, material specifications, and fabrication techniques. All signs shown in this manual are part of a total Corps of Engineers sign system.

Each type of sign used on a Corps project or facility has been specified in this manual either by function (identification, directional, informational, safety, etc.), or by location (campground, boat ramp, lock, dam, building interior, etc.).

All signs in this manual have been designed around their intended function. For example, signs requiring an immediate response from the viewer are succinctly worded. Signs viewed from moving vehicles are sized larger than signs read by pedestrians. Safety and traffic signs adopt standard colors for maximum recognition. Informational signs placed at recreation areas are designed to be visually harmonious with the environment.

Because of the variety of environmental conditions affecting sign placement, and because of the different legends on signs for specific locations, effective sign program implementation requires a clear understanding of the following principles and guidelines.

Design and installation of directional signs on public roads must be fully coordinated with the local or state highway department.

Questions not answered in this manual should be referred to the district/division Sign Program Manager.

It is important to remember that the principles of signing in this section - and throughout this manual - constitute guidance. With a few exceptions, the guidance in the manual is not mandatory. However, following these principles as much as possible will result in an effective, economical sign program at all Corps facilities.

All signs is designed for the first-time viewer. It is important that sign legends be brief, using as few words as possible to communicate the desired message. Use words or terms that are easy to understand.

All signs, with the exception of directionals, should convey no more than one concept or thought. Two thoughts require two separate signs. For this reason, the Corps Castle should not be placed on signs other than those used specifically for identification and as indicated in this manual.



Incorrect: Use of Corps Mark on directional sign is not acceptable



Correct: No unnecessary information on directional sign

The messages placed on signs should be concise, preferably no more than ten words. If a long legend is required to convey the necessary information, place a short descriptive headline, in larger letters, over the text. This headline gives priority to the information and increases the "glance" legibility of the sign (see page 2.3).



Incorrect: Message long and wordy



Correct: Headline gives priority to most important information

Naturally, signs intended for viewing from a moving vehicle require greater brevity than those viewed by pedestrians.

To decide what words should be placed on a sign, here are some guidelines to follow:

- 1) Legend: Evaluate what information is needed at that specific point.
 - a) Only provide the information necessary to make a decision at that particular location.
 - b) On directional signs, do not anticipate decisions that can be made later; unnecessary information will confuse the viewer.
 - c) Provide a second sign at the next decision point. As the user moves through a project, the information on signs should progress from general to specific.



Most general



More specific

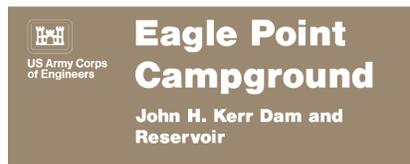


Most specific

2) Sign Type: Define the type of sign that is required at that location to communicate the necessary information. Each sign should have a single purpose. For example, a site identification sign should only identify a site as outlined in Section 5. It should not have other kinds of information on it such as: directional instructions (Section 6), regulatory restrictions (Section 8), or fee symbol (Section 7). A dual-purpose sign dilutes the communicative impact of both messages.



Incorrect: Inappropriate information on an identification sign



Correct: Three signs, each with the appropriate information

3) Language: Use proper and consistent nomenclature. The words used to convey information should be familiar and comfortable to the viewer. The same wording should be used throughout a project.

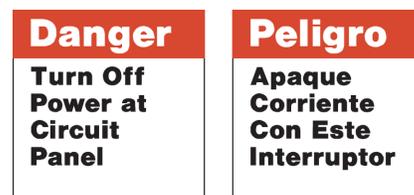


Incorrect: Technical language not obvious to public



Correct: Simplified language

4) Non-English Signs: In areas where a significant percentage of the population speaks primarily in a foreign language, the use of language is essential, two signs - one in each language - should be placed side by side. These signs will follow the same format: same overall size, letter size and style, color, and mounting. Because of variations in dialect, the legends on non-English signs shall be developed at the local level. Two languages should never appear on the same sign.



Correct: Two signs with the same message in English and Spanish

5) Positive Tone: Whenever possible, messages should be presented using positive wording, unless it dilutes the clarity of the thought being communicated.

6) Information Order: Determine the hierarchy of information. Western cultures read line-to-line from top to bottom, left to right. In general, the most important message should appear on the first line.

An effectively designed sign integrates a clear, succinct legend with legible, well-spaced typography. The typography should be sized, spaced, and positioned so that the type does not appear to bleed off the edge.

Following are elements that are to be considered in the design of a sign.

1) Legibility: Typography and panel size must be appropriate for the distance and speed at which a sign is viewed. The qualities of an effective sign should also include the following: pure legibility, glance legibility, target value, and priority value.

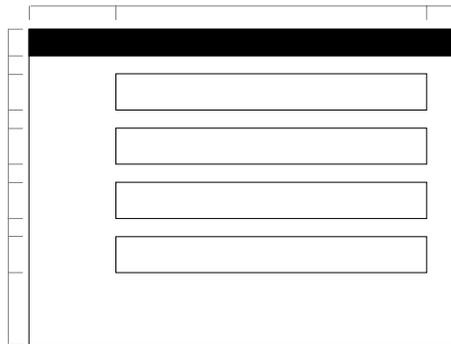
a) Pure legibility is the maximum distance at which sign copy can be read under optimum conditions, i.e., with no distraction and unlimited time.

b) Glance legibility is the distance at which a sign can be read swiftly and accurately, such as when a driver must remain aware of other cars and has only a fleeting glimpse of the sign.

c) Target value is the characteristic by which one sign is seen first from among a number of other similar or identical signs.

2) Sign Format: The philosophy of this manual is that all signs within a recreation area and/or a project should follow a similar format. This continuity of design

will provide a finished look to the area and will assist the visitor to identify quickly the message that is conveyed. The majority of signs used at Corps projects have been standardized. However, some signs may be required for specific purposes not covered in this manual. All special signs should use the grid format for signs of the same functional type as shown in this manual.



Grid format

a) Sign Background: The space on the sign panel around the sign legend is important for the readability of the sign. The border creates a field that separates the sign legend from distracting environmental conditions behind the sign. This increases the target value of the sign and creates a neutral field for the placement of the legend. If the legend is placed too

close to the edge of the sign panel, it may appear to bleed off the edge of the panel when viewed from the targeted distance.



Incorrect: Panel too small for type



Correct: Proper size panel for type

To maximize the target value of a sign, it must have sufficient background area and contrast so that a driver can distinguish it in complex driving environments. There must also be sufficient contrast between the letters and the sign background so that a driver can read the message easily. It is generally recognized that maximizing the background area around the legend will dramatically increase the legibility of the message.

b) Border: The function of the border is that of a “visual container” of the message. It is most effective at night when the border on the top and bottom of the panel is caught and illuminated by headlights, which heightens the target value and signals to the driver the location of the sign. On dark background signs, the border will generally be the same color as the lettering. Contrasting the border with the background heightens the target value of the sign when the color value in the surrounding environment is similar to the value of the sign panel.



Incorrect: Sign without borders



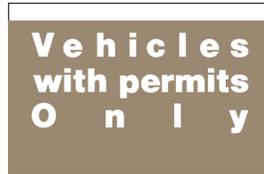
Correct: Sign with borders

c) Flush Left Legends: The legends of most signs shown in this manual use a flush left/rag right format. This means that the legend is aligned flush to the left of the layout grid margin. The look of the unjustified right margin is determined by line-break and legend placement within the format.

This type of layout has greater readability than if the legend is centered or justified. By using this format throughout, visual consistency is added to all types of signs used in the Corps sign system.



Incorrect: Centered type



Incorrect: Justified type



Correct: Flush left type on grid format

d) Legend Line Length: When preparing signs with site-specific legends, visualize the selected message on the sign panel. The look of the sign will be determined in part by the number of words and their layout on the sign panel. How many words, their length, and the length of each line of copy are all factors affecting the look of the sign. The appropriate layout of a sign legend should be carefully designed for: visual balance, legibility, and communicative impact.

It should be noted that words with the same number of letters may have different lengths. The actual length will depend on the letters in each word. For example, the words “campground” and “recreation” each have ten letters. Yet

when set in type, “campground” is longer because it has individual letters that are wider.

A single message on a sign may be placed on two or more lines to maintain the proportions of the sign panel, except where limited by established grids.



Incorrect: Single line creates awkward panel



Incorrect: Line-break good, but panel unnecessarily long



Correct: Proper line-break for visual balance and pleasing panel shape

A two-line message is visually stronger if the first line is slightly longer than the second.

A three-line message generally has greater visual balance if the middle line is slightly longer than the other two. Obviously, some sign legends will not line-break with this visual consistency. However, it is most important that extreme differences in line length should be minimized, if possible.

Line length can be reduced by utilizing commonly recognized abbreviations, such as St. for Saint or Mt. for Mount. Proper names, however, should always be written out in full and placed on one line. Additional examples of proper line-break formats are shown on pages 5.9-11.

The actual length of a legend can be calculated using the method outlined on page D.2.

The Corps sign system uses the Haas Helvetica letter-style for all sign legends. This sans-serif typeface is both highly legible and readily available to manufacturers. Used in the system are three different weights (stroke widths), each for a specific purpose.

The primary weight, Helvetica Bold, is used for all Standard Identification signs and primary legends on most other types of signs specified in this manual.

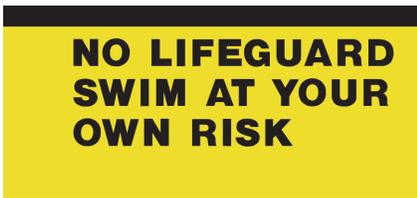
Helvetica Medium is used for the legends of directional signs only.

Helvetica Regular is used for all building interior signs and for selected support legends in combination with the Helvetica Bold typeface.

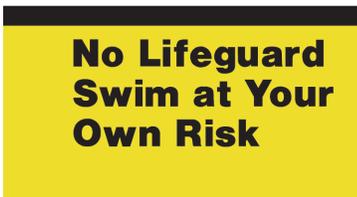
Complete displays of these letter-styles are shown in Appendix D.

The following examples describe the correct use of typography on Corps signs.

1) Upper and Lower Case Legends: For optimum readability, the legends of most signs specified in this manual have upper and lower case legends with initial capital letters. Studies have shown that lower case legends (initial capitals only) are read and understood considerably faster than all upper case sign legends. Upper and lower case words create forms and patterns making each word unique. This increases perceptibility and legibility.



Incorrect: All capital letters



Correct: Initial capital letters

Tests show that legends set in all upper case letters must be read letter for letter, with the exception of only the most common words like LEFT, RIGHT, CAUTION, or STOP, which are read as a form because of a lifetime of conditioning.

2) Letter- and Word-Spacing Typography viewed from a distance, such as on signs, must have more open letter spacing than typography viewed at close proximity. The spacing between letters in words and between words must be correct for optimum readability. To ensure correct letter- and word-spacing for all Corps signs, a spacing guide is provided in Appendix D.

Cordell Hull

Spacing too tight for signs

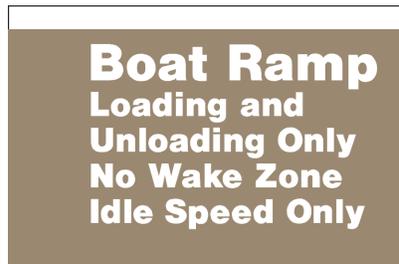
Cordell Hull

Correct spacing for signs

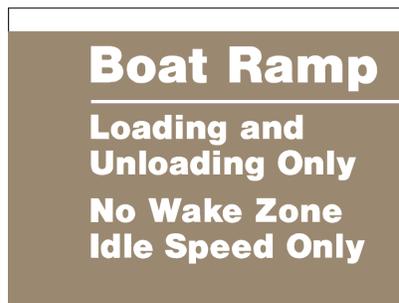
Cordell Hull

Spacing too open for signs

3) Line-Space: The space between multiple-line sign legends is called line-space. The line-space of the examples shown in this manual have been calculated for good legibility and readability. Multiple-line messages are intended to be read as a group without the lines bleeding together when viewed from a distance. Line-space between two different messages is greater than line-space between lines of the same multiple-line message group.



Incorrect: Equal line-spacing between all legend lines



Correct: Line-spacing varies according to the sense of the legend

4) Legend Sizes and Viewing Distance Guidelines: The appropriate size letter is selected for a sign so that the legend will be readable from the viewing distance desired. To that end, most of the signs shown in the manual are available in more than one size so that the properly sized sign can be viewed for the specific location.

Once the appropriate viewing distance has been calculated, use the chart on page 2.6 to determine the appropriate size of the primary legend typography of the sign. All signs in the system will be sized around the capital letter height of the primary legend of the sign.

When measuring the size of a capital letter-form, only use flat letters (A B C D E F H I K L M N P R T V W X Y Z). Round letters (C G J O Q S U) will not give an accurate measurement because they are



Incorrect: Same size round letter looks smaller than flat letter



Correct: Round letter looks the same as smaller flat letter

drawn to extend slightly above and below the base line and height line, respectively. This enlargement compensates for the fact that round shapes appear smaller than square shapes placed in the same size border.

The viewing distance charts below are a guide to sign letter size. Sizes are based on the distance at which a proposed sign is to be viewed. Type sizes are calculated to meet the U.S. Department of Transportation-Federal Highway Administration Standards for visual acuity.

To determine the legend size for signs where reaction time is not a critical factor, use Table A. The capital letter height sizes provided in the second column

correspond to the standard type sizes specified throughout this manual.

To keep standard identification signs from becoming overly large relative to their placement location, use Table A.

Table B is used for signs read from approaching automobiles, and incorporates reaction time and advanced sign placement location into the formula. This is used primarily for directional signs.

All legends use upper and lower case type. The type size is calculated from the height of the initial capital letter. This size is referred to as "A" throughout this manual.

Remember that these charts provide guidelines, not mandatory specifications. However, necessary deviations from the charts shall be documented in the sign plan.

Table A: This table identifies the correct sign legend size as calculated from the proposed viewing distance, for signs read on project roads at slow approach speeds, as viewed by pedestrians, or from slow moving water craft. This chart is applicable for most all signs shown in the manual except where reaction time is a factor.

Legend size calculations for vehicles are shown for low MPH viewing. Adjustments for higher speed reaction times, or viewing from a wider cone of vision are not included in Table A. Letter sizes for these conditions must be calculated on a site-by-site basis, using FHWA Standards or refer to the viewing distance/ reaction time calculations provided in Section 6, pages 6.16-18.

For waterway signs, refer to the sign legend sizes shown to the right. For distance greater than 1,512 feet, the capital letter height of sign legend (A) is calculated by dividing the viewing distance by 28, and rounding up to the nearest inch. For example, a sign viewed from 2,000 feet would require a legend height of 72" ($2,000 \div 28 = 71.428$, and round up to 72"). Sign placement guidelines for waterways are provided in Section 14.

Viewing distance (In feet):	Capital letter height (In inches):	Application:			
0-20	.75				
21-27	1				
28-41	1.5				
42-55	2				
56-83	3				
84-111	4				
112-167	6				
168-251	9				
252-335	12				
336-503	18				
504-671	24				
672-839	30				
840-1007	36				
1008-1175	42				
1176-1343	48				
1344-1512	54				

Table B: This table identifies letter size as a function of viewing distance and reaction time. It describes the location in which the sign is to be placed in advance of the destination when viewed from an approaching vehicle.

This table is only to be used for comparative purposes and general reference. A detailed guideline for determining legend size, sign placement, and required reaction time is provided in Section 6, page 6.16-18.

All letter sizes are calculated for people with a minimum visual acuity of 20/40, in compliance with FHWA standards.

*Operating speed is the 85th percentile speed.

Note: All dimensions have been rounded up to the nearest standard size. All distances have been rounded up to the nearest 100'.

Legend: 200/600 = minimum distance/desired distance.

Operating Speed* (MPH)	Detection & Recognition Time (Seconds)	Viewing Distance (Feet)	Letter Size (Inches)	Sign Placement Distance In Advance of Location	
				Single Lane Approach (Feet)	Multi-Lane Approach (Feet)
0-20	3	90	4	200/600	400/900
21-25	3	110	4	200/600	500/900
26-30	3	135	6	250/600	600/900
31-35	3	155	6	300/600	725/900
36-40	3	180	9	375/1300	875/1300
41-45	3	200	9	475/1300	1000/1300
46-50	3	220	9	500/1300	1100/1300
51-55	3	250	12	575/2600	1250/2600
56-60	3	275	12	650/2600	1400/2600
61-65	3	300	12	725/2600	1550-2600

Viewer response time is a function of target value and legibility. In turn, these factors are dependent on contrast between the legend and background color of the sign and on the contrast between the sign and the environment. The primary factors in obtaining a high target value are size of the panel used and color of the sign background. Of color combinations, black and white combinations offer the greatest color contrast but are the least desirable because of poor contrast with the environment, which is predominantly black, white, and gray. Appropriate colors have been specified for each different type of sign shown in this manual. Three functional criteria are used in the selection of the appropriate color for sign legend and panel combinations. These include: color association, contrast, and target value.

1) Color Association: Many sign types inherit their color standards from other sign color systems. These include the *Manual on Uniform Traffic Control Devices* for traffic signs, and the *Occupational Safety and Health Administration Standards* for safety-related signs. Generally these adopted color systems are quite appropriate for their intended purposes. Viewers are familiar with the coded messages of these color combinations - red and white: danger; yellow and black: caution; etc.

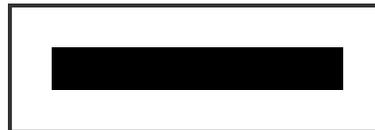
The communicative value of signs with similar functions is heightened by their association with these recognized functional color combinations.

Danger

Caution

Recreation

2) Contrast: The difference in color value (light and dark) between message and background must be great enough for good legibility. Legibility is increased when a light color is used on a dark background. The reverse combination tends to “wash out” the legend because of the diffusion of light from the lighter background.



Dark on light

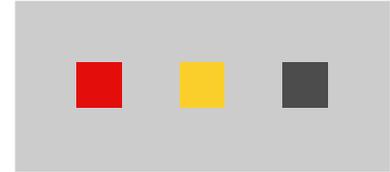


Light on dark



Tone on tone

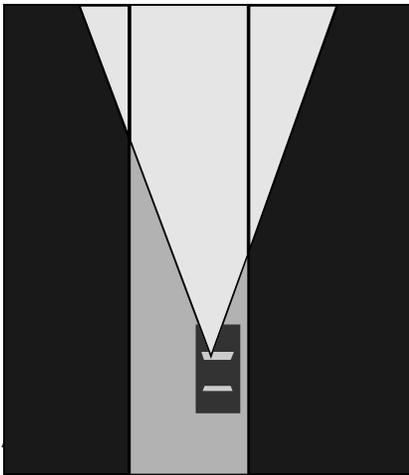
3) Target Value: This characteristic causes a sign to stand out from other signs and objects in the environment. The target value of a sign is increased by size, color contrast to the environment, and sign layout. The signs shown in this manual have been sized and designed for good target value for their functions and intended placement locations.



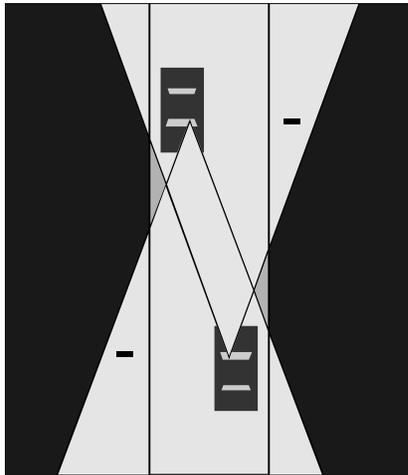
The color of a sign contributes to its target value

The following are general guidelines for placing signs viewed from an approaching vehicle as well as for mounting signs for pedestrian viewing. Guidelines for specific sign types are shown in their respective sections, and general traffic sign placement guidelines are shown on page 9.9.

1) Straight Ahead: Sign placement must be within the approaching driver's immediate cone-of-vision. Drivers cannot be expected to turn their heads to read a sign. Signs mounted more than 40 feet off the roadway because of special circumstances may require use of a larger panel to increase readability because the sign is outside the normal cone-of-vision.

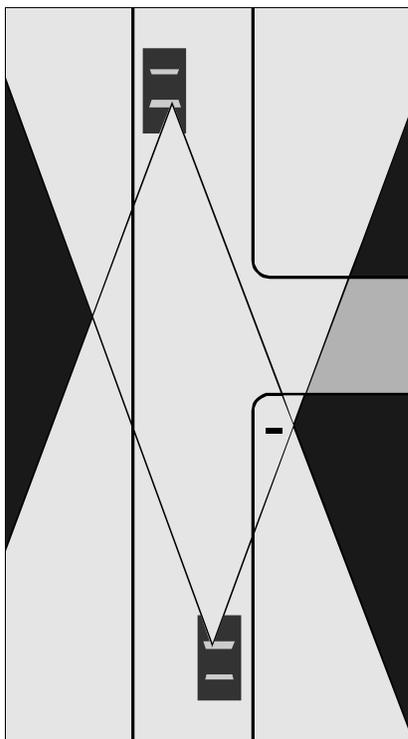


3) Right Side: Place signs on the right side of the roadway whenever possible. Drivers are not conditioned to look to the left side of the road for critical driving information.



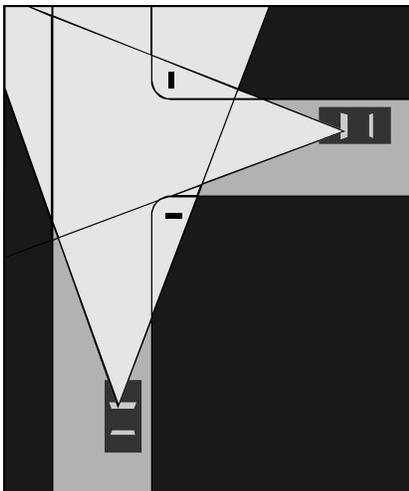
Signs placed on the right-hand side of a roadway

An exception to this rule is the use of a double-face Standard Identification sign mounted perpendicular to a facility entrance roadway. If a double-face sign is used instead of two single-face signs each mounted on the opposite right sides, this sign should be sized and placed with clear target value and readability from both directions.



Double-face Standard Identification sign

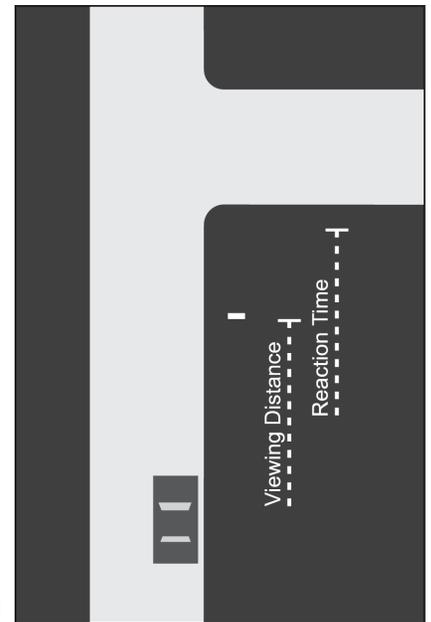
2) Perpendicular: The sign face should be perpendicular to the approaching viewer. Never place a sign parallel to passing traffic.



Signs placed perpendicular to the viewer

4) Distance Legibility: All signs must be clearly legible from the distance at which they are to be read. The viewing distance guide in this section shows the appropriate legend size for each type of sign.

5) Advance Warning: Signs on roadways that communicate a desired reaction, such as "Turn Right at Corner", must be placed in advance of the intersection to afford a safe distance for reaction to and execution of the maneuver.



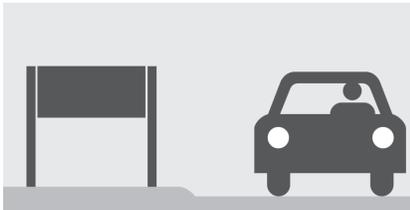
Sign placed well in advance of required action

Refer to Section 14, Lock, Dam and Waterway Signs, for guidelines when placing sign on a waterway to be viewed from both water and land.

6) Viewing Angle: Mount signs at eye level. The height of the average viewer's eye level is 5'6" standing, and 4'6" driving a car. Eye level of a viewer driving a truck or recreational vehicle is higher. Signs placed for viewing from long distances will be mounted higher than those in the immediate foreground. Mounting height requirements are shown in each section for each specific sign type.



Pedestrian viewing



Vehicular viewing

Mounting height is measured from the ground level to the bottom edge of the sign panel. For signs mounted along roadways, the grade of the road is considered ground level. When ground mounted signs on two posts are placed on sloping or inclined grades, adjustments must be made to the post lengths an mounting heights. Extreme differences between post lengths should be minimized whenever possible.

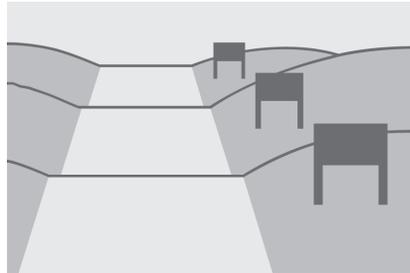


Post lengths adjusted for a grade sloping down from the road



Post lengths adjusted for a grade sloping up from the road

7) Spacing: Signs must be located with respect to other signs. Mounting sites should be carefully selected so that groups of signs are placed without creating a cluttered appearance. Also, drivers must be given time to read and react to one sign before another is presented.



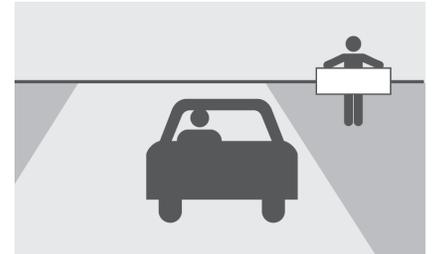
Signs spaced to allow driver to read and react to each one independently

8) Sign Location and Site Preparation: Placement must be carefully considered to ensure that each sign fits its location and achieves optimum visibility. Signs should be placed against a simple uniform background of a building wall, native vegetation or open sky to reduce distraction and visual confusion. Traffic signs and directional signs are normally located along roadways or walkways and should not receive any ornamental landscaping which would distract the viewer or obscure the sign. Avoid excessive clearing or the need for continual grounds maintenance, but it may be necessary to do some site work prior to placing a sign.

Standard Identification sign siting may require special consideration of views or the visual relationship with the named project area or structure. Where possible, an identification sign should be located near the entrance of the facility being signed. Carefully designed landscaping may be permitted around Standard Identification signs only. The siting and landscaping of identification signs should be reviewed by the division/district Sign Program Manager and a division/district landscape architect.

Landscape planting may be permitted with Standard Identification signs. This planting is ideally used to frame the background behind the sign, creating an orderly overall area view. Elaborate, domestic planting around the base of sign is not recommended. A simple use of low growing ground covers around the sign

with shrubs in the background are appropriate. Plants selected should be native or locally naturalized species that blend well with their surroundings and do not visually compete with the sign itself. Effective plant selection should be used to reduce maintenance.



Normally, signs should be placed 14 to 16 feet from the edge of the shoulder but not closer than 6 feet from the edge

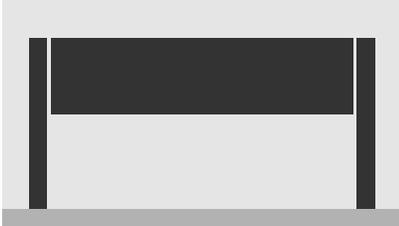
9) Field Test: An effective way to determine a sign placement location is to place the actual sign in the proposed location for verification. This is relatively simple for pedestrian signs; they are viewed from relatively short distances. For signs viewed from a moving vehicle, testing will include driving the approach from which it is viewed to verify the appropriateness of the proposed location. Since sign location plans are usually prepared prior to the ordering of the actual sign, a cardboard or brown paper banner, the same size as the proposed sign, can be used to check placement against the criteria above.

10) Breakaway Posts: Normally, signs should not be closer than 6 feet from the edge of the shoulder. If there is no shoulder, 12 feet from the edge of the traveled way. In areas where sign posts must be placed closer to the road, the posts should be of a suitable breakaway or yielding design. Refer to Appendix B for specifications.

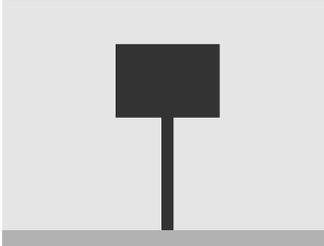
Sign mounting methods have been standardized to create visual uniformity for all signs placed around a facility. Mounting heights and locations have been determined for ease of reading.

There are two principal methods of mounting signs. These are:

1) Ground Mounted: Placing a sign panel on one or more posts fixed in the ground.

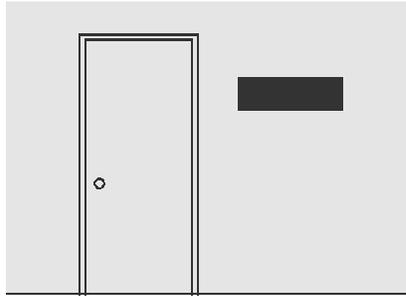


Ground mounted with two posts



Ground mounted with a single post

2) Wall Mounted: Placing a sign on a vertical surface such as the wall or door of a building or fence.

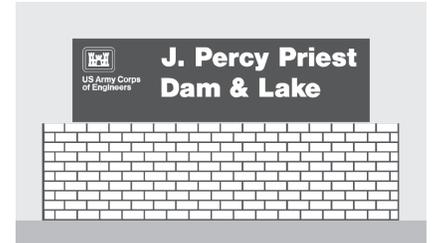


Wall mounted

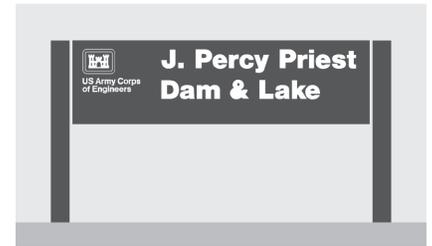
Each type of sign utilizes a mounting method appropriate to the viewing requirements. A sign must be positioned with a clear line-of-sight from the viewing point to the sign face. General sign locations will be established on the sign plan. Specific locations should be drawn on detailed site plans only after the placement location has been field-checked for accuracy.

When a new sign replaces an old sign that does not comply with the standards shown in this manual, the entire sign assembly should be replaced. All old sign bases should be removed and the site cleared prior to the placement of the new sign.

Mount signs using wood posts unless otherwise specified. Wooden signposts used consistently throughout a project are visually more harmonious with the surrounding landscape. They also provide a more finished look to a sign installation than metal posts. The standard for most small signs will be a nominal 4" x 4" redwood post (No. 2 grade or better, well-seasoned, and free from defects). Larger signs may be specified with structural grade posts of other wood types.



Incorrect: New sign panel on old base

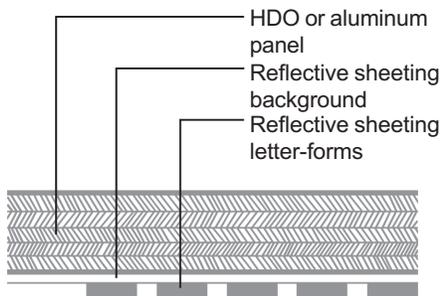


Correct: Appropriate mounting for this sign type

Within each section there are recommendations concerning materials to be used for each category of sign. These materials have been identified because of their proven suitability for these applications. Few of the materials or fabrication techniques identified in this manual are exotic or proprietary, and the majority have been tailored to their respective uses and employ standard industry practices and supplies.

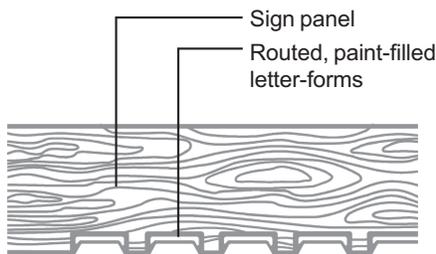
Most of the standard project identification signs and those signs placed in recreation areas and on waterways use the following materials and fabrication processes:

- Plan section through HDO plywood or aluminum sign and post, with applied or screen-printed legend on reflective sheeting background:



(scale of sheeting exaggerated)

- Plan section through a sign with routed and paint-filled legend:



Special-use signs are made from a variety of materials and reproduction processes suited to the requirements of the sign. For example: interpretive signs can be made from porcelain enamel; boundary markers from fiber-reinforced polyester; and building interior signs from injection-molded plastic with screen printed legends.

All of the various alternatives are outlined in the respective sections for each sign type. Assuming that all of the possible materials are equally appropriate, materials selection will be determined by the following criteria:

- 1) Longevity: All of the materials identified have a long life if properly maintained. Redwood signs, if properly maintained, will last 15-20 years.

Reflective sheeting is guaranteed for 5-7 years and will generally last longer. Sign-posts that are not pressure-treated may need to be replaced on a shorter life cycle,

depending on environmental conditions.

Though some signs may have to be replaced due to damage and periodic updating before the projected lifetime of the materials expires, using lower grade materials than those recommended is ultimately more costly. This is because signs made with high grade materials will need replacing less often than signs made with inferior materials which deteriorate faster. The cost difference between the high grade and inferior materials is minimal because labor costs for fabrication and placement account for a significant portion of the overall expense.

- 2) Budget: Generally, the single most expensive sign in an area will be the Standard Identification sign. Because of the impression it will make over its 10-20 year life, this expense is justified.

Signs with custom legends will be more expensive than signs with the standard legends shown in this manual.

The cost of the sign includes not just purchase and installation, but also the cost of maintenance over its lifetime. A sign that costs less to purchase than another may actually be more expensive when refinishing and replacement costs are considered.

- 3) Maintenance Requirements: The maintenance requirements of a sign depend upon the material chosen. Routed signs should be cleaned with a mild soap on a regular basis. Reflective sheeting signs will last between 7-10 years, but need to be cleaned routinely. All recommended materials have been chosen for durability and ease of maintenance, but there are variations. Assess the requirements of each possible material against the maintenance capabilities and costs at a given site. All materials require some maintenance: frequent, scheduled inspections are necessary to ensure that they are in place and undamaged. All of the materials outlined in this manual have been designed to be vandal resistant. Fabrication techniques such as the use of tamper-resistant hardware have been specified. However, no sign is completely vandal-proof. Some materials and methods of construction are more resistant than others. Often a vandalism problem is specific to a location. This includes carving the surface of wood signs, painting, graffiti, or using the signs for target practice. If vandalism is a problem at a given site, the material selected should counter the specific type of damage being incurred.

- 4) Material Legibility: A flat sign face generally is a more legible sign than one with a routed legend. Light creates shadows in routed letter-forms that may distort its legibility. Therefore, signs

requiring a consistently high level of glance legibility (such as highway directional and traffic control signs) should not be fabricated from routed material. On the other hand, routed identification signs may be placed at entrances and within projects where a small percentage of legibility loss may be sacrificed for the harmonious visual effect created by the use of natural materials.

Sign programs at most projects will use a variety of sign materials. The selected material will depend on the intended function of the sign.



- 5) Aesthetics: Regardless of sign material selected, the overall aesthetic effect of total project sign installation is that of looking uniform and tailored. Sign placement should reflect a sense of visual order. Nothing is more visually chaotic than too many signs placed randomly in a small area. Proper sign maintenance is critical to upholding E high aesthetic standard. Finally, mounting materials and heights shall be standardized for visual uniformity.

It is essential to recognize that each sign is part of a family of signs within a Corps facility, and as such the selection of materials for each location should maintain visual continuity.

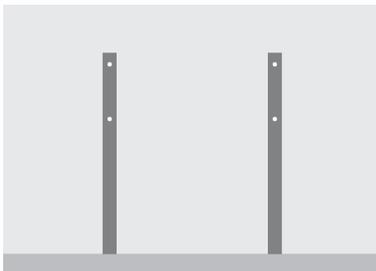
In summary, to evaluate materials: compare the initial costs to material longevity; determine maintenance costs over time; and evaluate the overall visual effect of all signs in the project. Keep in mind that aesthetic quality will depend more on the appropriate use of materials and the proper layout of typography than on the amount of money spent on an individual sign.

- 6) Other Materials: Substrate materials not mentioned in this manual may be considered for use. Check with the Sign Program MCX before using new materials.

The maintenance of signs is an integral part of comprehensive sign program management. This includes inspecting, repairing, replacing, removing, cleaning, and refinishing. The effectiveness of the total sign system is only as good as the maintenance rendered. Missing, broken, or illegible signs cause confusion and accidents and diminish the cumulative effect of the whole sign program. Poor maintenance reflects an attitude of neglect, which in turn can lead to abuse of an area and encourage vandalism.

A maintenance program begins with a comprehensive field inspection of all signs. Use a site plan to locate signs, along with a sign schedule describing the message, materials, mounting methods, and installation dates of each (see Section 3, Planning). Establish a schedule and designate an individual to check each sign on the plan and evaluate the following:

1) Is the sign in place?



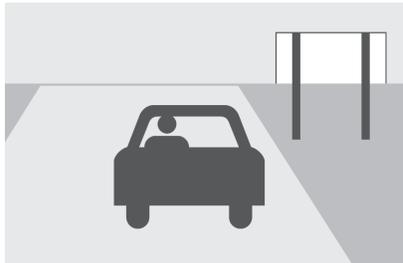
Sign panel missing

2) Is the sign still necessary?



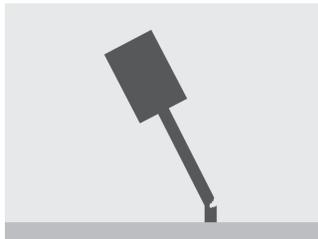
Redundant signs

3) Is the sign upright and facing in the right direction?



Sign facing in wrong direction

4) Are the supports in good condition?



Broken post

5) Is the face in good condition?

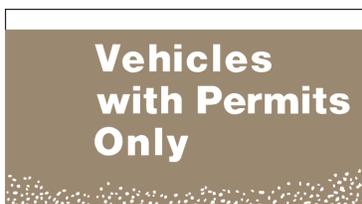


Missing letters



Bent face

6) Is the surface dirty?



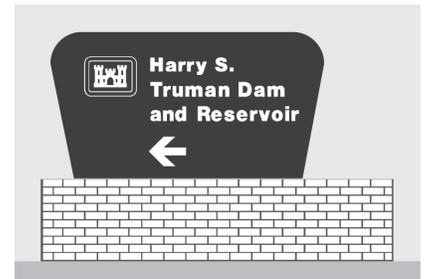
Mildew or fungus

7) Is the sign obscured by foliage?



Leaves in front of sign

8) Is the sign in compliance with this manual?



Sign not in compliance

9) Should maintenance work be requested to correct deficiency?

Following this evaluation, orders for removal, replacement or maintenance should be prepared, and maintenance work done in a systematic manner. It is important that maintenance crews and rangers note damaged signs on maintenance work orders as part of their routine work completed. The frequent scheduled inspections and routine observations are complementary, forming a total maintenance program. Appendix C outlines in detail the procedures necessary for a comprehensive sign maintenance program. This information should be incorporated into the sign plan (see Section 3) so that maintenance and replacement are coordinated.

The appropriate and effective communications of safety-related information is a key component of the Corps Sign Standards Program. Throughout all areas, including recreation facilities, waterways, locks and dams, construction sites, and industrial facilities, safety signs are used to restrict, warn and inform visitors and employees of eminent danger or possible hazardous conditions.

Because of the interrelationship of Corps projects and facilities, two different types of safety signs may be used at the same location. This would be most common in and around a navigation lock where industrial safety signs are used along with standard waterway signs.

The Sign Standards Manual, carefully delineates which types of signs are to be used for each different condition. If you have questions concerning the appropriate type or classification of sign to be used for a particular application, consult your Sign Program Manager for assistance.

Sign Types:

There are two basic types of safety signs used on Corps projects. These include standard industrial safety signs as shown in Section 11 for use in Corps shops and equipment, on a dam, powerhouse or locking device, and around construction activity. The second type are public-oriented safety signs used at recreation projects and along the waterway system as shown in Sections 7 and 14.

The major difference between these two types of signs is the layout grid or graphic format of the sign. Both sign types follow the established color system, i.e., red and white for Danger and Restricted, and yellow or black for Warning and Caution signs. For illustrative purposes, two symbol sign applications that are commonly used are shown as part of this review.

Sign Classifications:

Although all safety signs share a common function, there are differences as to which classifications and types of signs are used for each particular condition. The illustrations shown on the following pages identify both the sign classifications (Danger, Caution, etc.) and the various types of safety signs within a specific classification (recreation, waterway, industrial safety). The determination of the appropriate sign classification will depend on the severity of hazard.

Standardized Safety Sign Legends:

Most commonly used safety-related signs are shown in the appropriate sections throughout the manual. The legends for these signs have been carefully developed so that the signs will communicate the intended message as effectively as possible and maintain a common visual format to increase the recognition value of each individual sign as used throughout Corps facilities.

The Danger, Caution, and Warning safety sign legends appearing in this manual have been approved by HQUSACE, Office of Counsel, and cannot be changed. If the wording of a safety sign is not appropriate to the condition being signed, consult the district Sign Program Manager. Request for modified sign legends or a new sign should be made using the procedure and worksheet on page 1.13.

Legend System:

A safety sign legend is made up of two parts. This includes a banner headline with signal word (Danger, Warning, or Caution) and a specific descriptive legend. Safety signs are placed to warn or instruct viewers and have been worded in such a manner that the viewer is not endangered in a hazardous location.

Signal Word:

The headline banner shows a signal or key word (or words) which designates the degree of hazard and calls attention to the action/emphasis section below the signal word. It is always located in the upper section of the sign panel.

Specific Description:

The action/emphasis section of a sign contains those words which state the appropriate protective action to be taken or clarify the nature of the hazard.

Sign Color:

The sign classifications rely on color associations. This standard system of safety sign colors reflects accepted industry standards and should be maintained as specified in the Sign Standards Manual. It must be emphasized that all Danger signs be white on red and Caution signs be black on yellow to maintain the basic integrity of the safety sign standards. The basic colors for each sign are described in the illustrations contained in this review. Note that on Warning/Caution signs as used on waterways and recreation sites, a chartreuse (ultra-bright retro-reflective lemon-yellow color) is used instead of industrial safety yellow.

Scope:

These standards apply to the design, application and use of signs intended to indicate hazards in the environment and provide information so that injury or property damage resulting from such hazards may be avoided.

Purpose:

It is the purpose of these standards to reduce the proliferation of non-standard signs and the use of a variety of signs to indicate similar hazards.

Sign Plan:

Prior to placing any safety-related signs, they must first be made part of the project sign plan. Legends must be reviewed for consistency and their relationship to all other signs in the project.

Clarity and Legibility:

All signs must adhere to the graphic format and color system specified in this manual. Legends should be brief and use language that is easily understood by the viewing audience. The size of the sign shall be determined by the size of the letters as required for a safe viewing distance and the length of the message.

Posting Policy:

Unless signs are placed on a waterway with a long viewing distance, most safety signs are relatively small and are placed for viewing in close proximity to the condition being identified. If the hazard covers a large area, additional signs should be used. The sign must be readily viewed in relation to the hazard.

Safety-related signs should be placed to alert and inform in sufficient time to avoid hazards or take appropriate action. Signs should be so placed as to be legible, create no distractions or be hazards in themselves. Care should be taken to avoid grouping too many signs together in one location. Do not place signs on movable objects or adjacent to movable objects such as behind a door, which, when moved, can obscure the sign.

Maintenance:

Once a safety sign is installed, it must be properly maintained until the hazard being signed no longer exists, or until a policy decision has been made by the district or division that the warning no longer be used. All safety-related signs must be inspected on a systematic basis and repaired or replaced on a timely basis, as required.

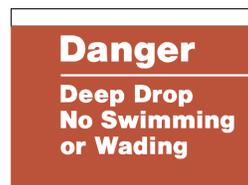
1. Danger/Restricted Signs

These signs indicate immediate and grave danger, a hazard capable of producing irreversible damage or injury and prohibitions against harmful activity.

1.1 *Recreation sites*

To denote a hazard and identify specific prohibitions.

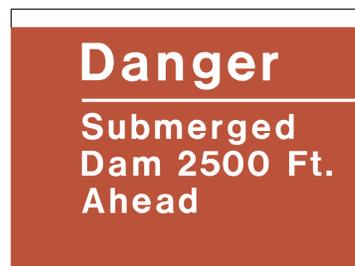
Typeface: *Helvetica Bold*
 Legend color: *White*
 Panel color: *Red*
 Rule/bar: *White*
 Grid format: *1*



1.2 *Waterways*

To indicate entry into a dangerous area as viewed from the water.

Typeface: *Helvetica Medium*
 Legend color: *White*
 Panel color: *Red*
 Rule/bar: *White*
 Grid format: *1*



1.3 *Waterways*

To prohibit watercraft entry into a dangerous area with alternate banner "Restricted".

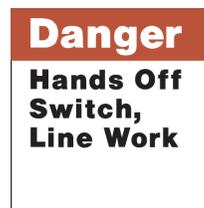
Typeface: *Helvetica Medium*
 Legend color: *White*
 Panel color: *Red*
 Rule/bar: *White*
 Grid format: *1*



1.4 *Industrial Safety*

In shops and around dams to identify hazards.

Typeface: *Helvetica Bold*
 Legend color: *White on red headline and black on white description*
 Panel color: *White*
 Rule/bar: *Safety Red*
 Grid format: *A*



need new graphic

2. Caution/Warning Signs

These signs are used to call attention to a potential danger, or a hazard capable of resulting in moderate to severe injury or damage. In some instances, the hazards may be the same as those associated with Danger signs but are of significantly less magnitude.

2.1 *Recreation sites*

To caution viewers about potential hazardous conditions.

Typeface: *Helvetica Bold*
 Legend color: *Black*
 Panel color: *Lemon-Yellow (chartreuse)*
 Rule/bar: *Black*
 Grid format: *1*



2.2 *Waterways*

To warn boaters approaching a hazardous area.

Typeface: *Helvetica Medium*
 Legend color: *Black*
 Panel color: *Red*
 Rule/bar: *Lemon-Yellow (chartreuse)*
 Grid format: *1*



2.3 *Industrial Safety*

In shops and around dams to warn of hazards.

Typeface: *Helvetica Bold*
 Legend color: *Yellow on black bar, black on yellow panel*
 Panel color: *Safety Yellow*
 Rule/bar: *Black*
 Grid format: *A*



3. Symbol Signs

Within a facility a symbol sign may be used in lieu of a safety sign as a more user friendly method to define specific rules at a location. Used with other symbol signs at the same location, these pictographs rely on a common graphic shorthand for all prohibitions in public areas.

3.1 *Slat System with Prohibition Symbol*

Used at the entry to introduce prohibitions and safety-related information for a facility.

Typeface: *Helvetica Bold*
 Legend color: *White*
 Panel color: *Corps Brown*
 Symbol: *Black*
 Circle/slash: *Red on white background*
 Grid format: *A*



3.2 *Prohibition Symbol*

Used at specific locations where applicable in lieu of a written safety sign.

Typeface: *Helvetica Bold*
 Legend color: *Black*
 Panel color: *White*
 Symbol: *Black*
 Circle/slash: *Red*
 Grid format: *A*



These additional two classifications are used in the industrial safety sign format. They include "Notice" and general "Safety" information informing viewers of general practices, but should not be used in lieu of hazard warnings.

4. Notice Signs

These signs are used to control or define access and circulation. They are used primarily for information and are not placed to identify a hazard.

4.1 Industrial Safety

In shops and around dams to warn of hazards.

Typeface: *Helvetica Bold*
Legend color: *White on Safety Blue header with black on white panel*
Panel color: *White*
Rule/bar: *Safety Blue*
Grid format: *A*



need new graphic

5. General Safety Signs

These signs identify rules and facilities relating to health, first aid, medical equipment, sanitation, housekeeping practice and general safety information.

5.1 Industrial Safety

In shops and around dams to identify safety practices.

Typeface: *Helvetica Bold*
Legend color: *White on Safety Green header with black on white panel*
Panel color: *White*
Rule/bar: *Safety Green*
Grid format: *A*



Foreword

This report provides a guide on letter size and the placement of directional signs on roadways leading to, or in the Corps of Engineers recreation projects.

The primary references utilized in this report include the following:

- *Geometric Design of Highways and Streets, by the American Association of State Highway and Transportation Officials (AASHTO), dated 1984.*
- *Manual on Uniform Traffic Control Devices (MUTCD) Revision 4, by the U.S. Department of Transportation, dated 1986.*

Principals

Careful selection of letter size and sign location will enable the motorist to detect and understand the sign message before passing the sign. There should be time to comfortably react to the sign message after passing the sign. The typical reaction of the motorist would be to slow

from the operating speed and then to turn either right or left at the appropriate crossroad or access road. On multi-lane roadways, the motorist may have to change lane before slowing to the crossroads or access road.

Detection and Recognition Time

The information handling process of a motorist¹ includes time periods for the delay between the time a directional sign is presented and the time the eyes begin to move, the eye fixation, and the recognition or perception of the sign message. These times vary between two-thirds of a second to six seconds² depending on the complexity of the information and whether it is expected or unexpected. A detection and recognition

time of up to three seconds is recommended for signs on road up to 70 miles per hour³ and a 3.0 second time is used for general warning signs⁴.

It is concluded from the information presented by AASHTO and the MUTCD that a three-second detection and recognition time would be appropriate for directional signs on roadways of all speeds.

Viewing Distance

The viewing distance is the distance a motorist travels during the detection and recognition time. This distance must be unobstructed and the directional sign must be within the motorist's cone of vision. The viewing distance in feet is calculated by the following formula:

$$D = 1.47 TV$$

Where: D = viewing distance in feet
 T = detection and recognition time in feet
 V = operating speed in miles per hour

The operating speed is defined as the 85th percentile speed (the speed at or below which 85% of the vehicles are moving).

Letter Size

The size of the upper case letters in the sign message consisting of upper and lower case letters is determined by the motorists ability to read the sign throughout the viewing distance.

Research in 1939⁵ established a viewing standard of 50 feet per inch of letter height for daylight conditions and 40 feet

per inch for nighttime conditions. These values were for a static visual acuity of 20/20 and represented the 80th percentile of the distribution of the observed legibility distances. A 20/40 visual acuity is to be used for design to comply with Federal Highway Administration Standards since drivers licenses are commonly issued with that minimum vision. Therefore, the

¹AASHTO, *Geometric Design of Highways and Streets*, Washington D.C., 1984, p. 146.

²ibid, pp. 42-45

³ibid, p. 147

⁴U.S. Department of Transportation, *Manual on Uniform Traffic Control Devices (MUTCD)*, Revision 4, 1986.

⁵Forbes, T. W. and Holmes, R. S., *Legibility Distances of Highway Destination Signs in Relation to Letter Height, Letter Width and Reflectorization*, H.R.B. Proceedings, Vol. 19, 1939, pp. 321-334.

viewing standard for 20/40 vision would result in a 25 feet per inch of letter height for daylight conditions and 20 feet per inch for nighttime conditions.

The research ophthalmologist working with the Corps of Engineers on this project has established a viewing distance for 28 feet per inch of letter height for Helvetica Medium typeface with upper and lower case letters in the sign message for a visual acuity of 20/40. It is believed that this most recent research is more applicable for this project, but that a slightly larger letter size or smaller viewing standard be used to compensate for nighttime conditions and for a dynamic visual acuity.

Consequently, a standard utilizing a minimum letter height of four inches is

recommended for conditions with operating speeds under 25 miles per hour and a minimum viewing standard of 27.5 feet per inch of letter height. A maximum letter height of 12 inches is recommended for operating speeds of 65 miles per hour and a viewing standard of 25 feet per inch of letter height. The letter height size would increase by one inch for each five miles per hour above 25 miles per hour.

It should be noted that the motorist with 20/20 vision and an unobstructed viewing distance would have twice the time to read the sign message than the motorist with 20/40 vision. Therefore, it is also recommended that directional signs be located where the sight distance would be double the viewing distance.

Sign Placement

The placement of directional signs is to be far enough in advance of the location of the site so that the motorist can react and slow the vehicle or change lanes, if necessary, prior to reaching the appropriate crossroad or access road. In some cases, such as high speed highways, two signs may be necessary.

For conditions on a single lane approach, the minimum sign placement distance is calculated to permit a motorist to comfortably slow the vehicle prior to stopping or turning off the roadway approach. This distance is calculated by the following formula⁶:

$$D = \left(\frac{V2 + V1}{2} \right) \times \left(\frac{V2 - V1}{6} \right) \times 1.47$$

Where D = Distance in feet
 $V2$ = Operating speed in mph roadway
 $V1$ = Final speed in mph at leaving roadway, assumed to be zero

$\frac{V2 + V1}{2}$ = Average speed during deceleration

$\frac{V2 - V1}{6}$ = Time required to comfortably decelerate

However, AASHTO7 has indicated a longer distance traveled during a comfortable deceleration than the formula implies. Because the AASHTO results use longer distances than the calculated results, it is recommended that the

AASHTO results be used for the minimum distance a sign should be placed in advance of the appropriate crossroad or access point.

It is common for some highway departments to locate directional signs on rural highways one-half mile in advance of the appropriate crossroad. This is a desirable condition and not the minimum condition. Therefore, a minimum and desirable location is recommended for the placement of directional signs. The minimum placement would be used only when in urban areas or where the desirable placement is not possible. In no case should the directional sign be placed less than 200 feet or more than 2600 feet from the appropriate crossroad or access road. A secondary directional sign may be necessary if the desired placement is used and the appropriate crossroad cannot be seen by the motorist when approaching the initial directional sign. The secondary sign would be located at the minimum distance to the crossroad.

The minimum distance a sign is to be placed in advance of the crossroad is to be increased on multi-lane roadway approaches. This also allows the motorist time to change lanes. This distance is normally traveled in approximately eight seconds in moderate to heavy traffic. Therefore, it would add approximately 200 feet at operating speeds under 20 miles per hour and 800 feet at operating speeds at 65 miles per hour.

⁶Woods, D. L. and Rowan, N. J., *Street Name Signs for Arterial Streets*, H.R.B. Record 325, 1970, p. 54.
⁷AASHTO, p. 36 and p. 1044.

Recommendations

Table 1 contains the recommended viewing distances, letter sizes, and sign placement for operating speeds up to 65 miles per hour.

The decision to use a particular size sign at a specific location should be made on the basis of a thorough study of the area. Table 1 provides the fundamental criteria for directional sign letter sizing and placement.

Ambiguous and/or complicated situations may require a more indepth analysis performed by a qualified engineer. This assessment is needed to exercise the judgment inherent in the selection of traffic signs just as it is needed to locate and design the roads and streets which the signs complement.

Table 1
Directional sign letter size and placement guide

Operating Speed*	Detection & Recognition Time	Viewing Distance	Letter Size	Sign Placement Distance in Advance of Location	
				Single Lane Approach	Multi Lane Approach
(MPH)	(Seconds)	(Feet)	(Inches)	(Feet)	(Feet)
0-20	3	90	4	200/600	400/900
21-25	3	110	4	200/600	500/900
26-30	3	135	6	250/600	600/900
31-35	3	155	6	300/600	725/900
36-40	3	180	9	375/1300	875/1300
41-45	3	200	9	450/1300	1000/1300
46-50	3	220	9	500/1300	1100/1300
51-55	3	250	12	650/2600	1400/2600
56-60	3	275	12	650/2600	1400/2600
61-65	3	300	12	725/2600	1550/2600

*Operating speed is the 85th percentile speed

Note: All dimensions have been rounded

Legend: 200/600 = minimum distance/desired distance