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1. INTRODUCTION

1.1 Background

This Traffic Guide Sign Design Manual has been developed to provide training on the design of guide signs. Participants will learn the fundamentals needed to design guide signs. The software package SignCAD® will be used to demonstrate design elements and to develop guide sign examples.

To achieve this goal, this Manual has been divided into five chapters as follows:

- Chapter 1 is the Introduction to the course.
- Chapter 2 presents Basic Information and some background information on guide signs.
- Chapter 3 covers Sign Components including panel sizes, radii, borders, margins, colors, letter sizes, fonts, horizontal and vertical lines, route markers, arrows, fractions, and abbreviations.
- Chapter 4 includes the Example Problems.
- Chapter 5 is the Appendix with Font Spacing Charts, References, List of Definitions, and the Index.

1.2 Acknowledgments

The development of this Traffic Guide Sign Design Manual has been a result of the combined efforts of the MnDOT Office of Traffic, Security and Technology, and Albeck + Associates. The contributions by Heather Lott, Rick Sunstrom, and Eric Peterson are gratefully acknowledged.

1.3 Disclaimer

This Manual is disseminated under the sponsorship of MnDOT, Office of Traffic, Security and Technology. MnDOT and Albeck + Associates, assume no liability for its contents or use thereof.

MnDOT does not endorse products or manufacturers. Trademarks of manufacturers’ names may appear herein only because they are considered essential to the purpose of this manual.

The contents of this manual reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein.

This manual addresses the design layout of guide sign panels only and does not address related guide sign topics such as sign structure design, sign location and placement, or sign message content.

The purpose of this Traffic Guide Sign Design Manual is to present the fundamental concepts of traffic guide sign design and to use these basics to develop signs using the SignCAD® software.

Mere possession of this manual does not qualify an individual to design traffic guide signs. Designing traffic guide signs is an integrated process that requires a solid understanding of signing fundamentals.
1.4 MnDOT OTST Website

The MnDOT Office of Traffic, Safety and Technology website (see Exhibit 1-1) includes a wide variety of traffic engineering information, including signing. The website can be visited by going to: www.dot.state.mn.us/trafficeng/index.html.

Click on the links on the right side to proceed to the appropriate Traffic Engineering Site.

Exhibit 1-1  MnDOT OTST Website

1.5 Written Communications Policy

To request this document in an alternative format, please contact the Affirmative Action Office at 651-366-4723 or 1-800-657-3774 (Greater Minnesota); 711 or 1-800-627-3529 (Minnesota Relay). You may also send an e-mail to ADArequest.dot@state.mn.us. (Please request at least one week in advance).
2. BASIC INFORMATION / BACKGROUND

There are several basic provisions for regulating, warning, and guiding traffic. For signing to be effective it should meet the following five basic requirements:

- Fulfill a need
- Command attention
- Convey a clear, simple meaning
- Command respect of road users
- Give adequate time for proper response

The purpose of this Manual is to develop the knowledge and tools needed so that traffic guide signs are properly designed prior to implementation to ensure maximum effectiveness and driver understanding.

2.1 Historical Perspectives

This section provides some historical perspective on guide sign development.

2.1.1 Guide Signs

Excerpts are taken from 'Traffic Control Devices: Historical Aspects Thereof' by Gordon M. Sessions.

When Minnesota established its trunk highway system in 1921, it made prompt plans for full-scale marking and signing. It adopted a star-shaped design, with lemon yellow and black as the color combination for all official route signs placed by the state along a trunk highway, and suggested white and black for signs erected by other jurisdictions.

Then, in the fall of 1922, three men took a trip that became the first solid impetus toward standardization. As recalled by the late Walter F. Rosenwald, maintenance engineer (later traffic engineer) for the Minnesota Department of Highways:

"At the invitation of Mr. J.T. Donaghey of Wisconsin, the writer and Mr. A.H. Hinkle, the superintendent of maintenance of the Indiana highway commission, joined in a trip through several states to try to work out some uniformity or standardization in the marking of highways.

"At first, it appeared rather hopeless, but it finally was agreed that there was possibility of standardizing shapes and classifying signs with a different shape for each group. The underlying thought was that, if each shape had a definite meaning, it would be a great advantage for night driving as undoubtedly the shape could be distinguished long before the words could be."

The committee reported its findings to the Mississippi Valley Association of State Highway Departments; and that body, at its annual meeting in Chicago in January 1923, agreed on a signing and marking plan which was destined to become the basis of the national standards agreed upon two years later.

The plan's basic contribution was the classification of the more important types of signs, and the assignment of distinctive shapes to them. Its plan called for all signs to have white background with letters and/or symbols in black:

1. Round signs, to be used only as warnings of railroad crossings.
2. Octagonal signs, always signifying “Stop”.
3. Square signs with diagonal vertical (diamond-shaped) for "slow" warnings.
4. Square signs with sides vertical for caution or "attention" signs.
5. Rectangular signs for directional and regulatory information.

6. Route markers of some characteristic or conventional shape different from the above.

The Mississippi Valley Association passed its recommendations along to AASHO.

Without waiting for further guidance, the Minnesota Highway Department on April 1, 1923, published what is believed to have been the first state Manual of Markers and Signs.

The manual provided: "Markers and signs will generally consist of black letters and figures on a lemon yellow field surrounded by a narrow black border..." The existing trunk highway marker was retained: a lemon yellow star on a black circular field, with the route number in black within the star.

Shapes followed the recommendations of the Mississippi Valley Association. The yellow background was new.

In 1924 further work on this topic concluded that "Distance and direction signs should be black and white."

The recommendation as to directional and distance signs:

"No road can be considered satisfactorily equipped with signs unless it has direction and distance signs containing sufficient information in legible form to permit a traveler to go anywhere he desires without the aid of maps or keys. To this end, black and white signboards of adequate size should be placed at every cross-road and function setting forth clearly the information as to direction and distance."

Finally, in 1927 exceptions to black and white guide signs were provided as: “A unique place in the color scheme was provided for one sign in the direction-information-restriction classification. All were to be black-on-white except "....Rest Station is white on a green background" and thus is the origin of the white lettering on green background.

2.1.2 Lettering Style and Size

Information that follows was assembled by Mike Weiss, MnDOT.

Highway signs were first standardized on a national basis in the late 1920's. Standard alphabets for highway signs at that time consisted of mechanical, rectangular characters. These alphabets remained a national standard until 1945. In 1945, the Standard Alphabets for Highway Signs, designed by the U.S. Public Roads Administration, was issued. The new style of alphabets contained in this document were approved by the Joint Committee on Uniform Traffic Control Devices and its constituent agencies, the American Association of State Highway Officials, the Institute of Traffic Engineers and the National Conference on Street and Highway Safety. The new "rounded" style of capital letter alphabets, designated as Series A, B, C, D, E and F not only had a more pleasing appearance than the old alphabets, but also were shown to be consistently more legible based on extensive testing. The letter width varies from the slender Series B through the thicker (bolder) letters provided in Series F.

The 1966 Edition of the Standard Alphabets for Highway Signs, A Reference Guide for the Standardization of Letters and numerals on Highway Signs specified in the Manual on Uniform Traffic Control Devices for Streets and Highways, was issued by the U.S. Department of Commerce, Bureau of Public Roads. This document eliminated the Series A alphabet since it was no longer acceptable for use on highway signs. In addition, the standard lower case alphabet was issued in this document. This lower case alphabet, based on the research and development of the California Division of Highway, is the approved standard for directional signs on the National System of Interstate and Defense Highways. It was recommended that the
initial capitals and numerals used with these lower case letters be Series E uppercase, with the stroke width modified to approximately one-fifth of letter height.

The 1977 Metric Edition of the Standard Alphabets for Highway Signs and Pavement Markings included Series E modified capital letters and numerals to be used as initial capitals and numerals with the lower case alphabet series. These capitals and numerals were the same dimensions as the Series E uppercase, except that the stroke width was widened to approximately one-fifth of the letter heights (as referenced in the 1966 Edition).

In general, both sign and letter size have been established for all regulatory and warning signs. The Federal Manual on Uniform Traffic Control Devices sets forth criteria establishing the series of letters to be used and the spacing between letters for these two classifications of signs.

Only minimum sizes have been established for guide signs. The letter size needed to give motorists ample opportunity to read a sign easily at normal approach speed will, in general, determine the size of sign needed. Sign design is dependent upon many variables:

1. The sign reading behavior of drivers is a highly adaptive process - the manner in which a driver obtains information from a sign heavily depends on the following factors:
   a. Visual loads on the driver's visual information acquisition and processing functions
   b. Driver's informational need
      i. type of informational need
      ii. urgency associated in obtaining information
      iii. driver's familiarity with the route
   c. Size of letters displaying information on the sign
   d. Amount of message displayed on the signs and its relevancy to driver's informational need
   e. Driver's visual capabilities
   f. Vehicle velocity
   g. Location of the sign with respect to the path of the driver

2. Drivers do not concentrate on a sign until they obtain the required information from the sign - they share their time between the sign, objects on the road and performing other driving tasks
2.2 MnDOT Specific Guidance for Traffic Signs

2.2.1 Basic Considerations for Installation of Traffic Signs
As stated in the Minnesota Manual of Uniform Traffic Control Devices (MN MUTCD), five basic considerations are employed to ensure that the basic requirements identified previously are met. These considerations are:

1. **Design**: the combination of physical features such as size, colors, and shape needed to command attention and convey a clear message.

2. **Placement**: the installation of devices should assure that they are within the viewer's cone of vision, so they will command attention and allow time for response. A 20 degree cone of vision should be used for placement of signs. Signs must remain within this cone of vision to be read.

3. **Operation**: the application of devices so that they meet traffic requirements in a uniform and consistent manner, fulfill a need, command respect, and allow time for response.

4. **Maintenance**: the upkeep of devices to retain legibility and visibility, or the removal of devices if not needed, to aid in commanding respect and attention while fulfilling the needs of users.

5. **Uniformity**: the uniform application of similar devices for similar situations so that they fulfill the needs of users and command their respect. THE IMPORTANCE OF UNIFORMITY IN SIGNING CANNOT BE OVEREMPHASIZED.

2.2.2 Functional Classifications of Traffic Signs
The MN MUTCD classifies signs by their functional usage as follows:

1. **Regulatory signs** inform road users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent.

2. **Warning signs** are used to call attention to unexpected conditions on or adjacent to a highway, street or private road open to public travel and to situations that would not be readily apparent to the motorist.

3. **Guide signs** are used to provide directions to motorists, informing them of intersecting routes, directing them to cities and other important destinations, and guiding them to available services, points of interest, and other geographic, recreational, or cultural sites.

Further, guide signs for expressways and freeways have two (2) sub-classifications:

1. **Primary guide signs** consist of advance junction signing, exit directional signs, exit gore signs and destination signs. On interstate freeways, exit numbers are included. Distance signs are also primary guide signs.

2. **Supplemental guide signs** further provide the driver geographic orientation and secondary destinations at certain interchanges. Destinations include cities, motorist services, or traffic generators.
2.2.3 Department Classification by Sign Design Type

While the previous sign classifications describe general functions, MnDOT has further classified signs by “design” type.

Type A signs are large breakaway guide, directional, or informational signs normally installed on mainline freeways, expressways, and occasionally on conventional roads. They are supported on wide-flange steel posts.

Type C signs are primarily regulatory, warning, route marker assemblies, and auxiliaries, as found in the Standard Signs Manual. They are the most common sign type and typically installed on driven U posts or square tube posts.

Type D signs are the smaller guide, destination, or informational signs. They are supported on driven U posts or mounted on overhead structures with punching and stringer spacing as indicated in the Standard Signs Manual.
**Type OH** signs are large overhead guide, directional, or informational signs, either spanning a roadway, cantilevered over the roadway/shoulder, or bridge-mounted. The requirements of the structural support system generally require installation or maintenance by contract. There are three kinds of Type OH signs: sign supports which include no walkway or sign lighting, trusses which may or may not include walkway and sign lighting, and bridge-mounted structures which may or may not include walkway and sign lighting.

Type OH Sign – Cantilever (Design A Truss)  
Type OH Sign – Cantilever (Design B Truss)  
Type OH Sign – Sign Bridge (Design C Truss)

Type OH signs are necessary where ground-mounted signs are not deemed effective. Applications include, but are not limited to the following:

1. Freeway signing where space is not available for ground mounted signs or where there are three or more lanes of travel.
2. Guide and/or lane use control signing approaching intersections in urban areas.
3. Approach warning sign/flasher for mid-block pedestrian crosswalks.
4. Locations with restricted sight distance (may be coupled with other factors cited).
**Type OH** – Sign Support

**Type OH Sign** – Bridge Mounted

**Type EA** signs are exit number panels attached with U-posts to Type A sign panels.

**Type EO** signs are exit number panels attached with U-posts to Type OH sign panels.
2.2.4 MnDOT Conventional Roads and Expressway Guide Sign Types

In addition to sign design type, MnDOT considers the facility the guide sign will serve. Guide signs designed for conventional roads and expressways typically are designed in the same manner.

- **Conventional Road (Single Lane)** – A two-lane, two-way roadway
- **Conventional Road (Multilane)** – An undivided or divided roadway with more than one lane in each direction of travel and having a posted speed less than 55 mph.
- **Expressway** – A high speed, divided, multi-lane highway which is generally an arterial road with a posted speed of 55 mph and greater. Most intersections are at grade, although grade separated interchanges may exist.

**Destination** signs typically have a destination(s) with an accompanying arrow(s) indicating direction. Normally only one destination per route or direction should be identified. No more than three city names should be on a sign. A few exceptions have been made where multiple routes intersect at junctions.

![Destination Signs](image)

**Distance** signs typically have a destination(s) with mileage(s) indicating the distance from the sign location. No more than three city names should be on a sign. A few exceptions have been made where multiple routes intersect at junctions.

![Distance Signs](image)

**Junction** signs indicate the intersection of two or more routes.

![Junction Signs](image)
**Directional** signs typically have a route marker(s), possibly city or street names, and an arrow(s) indicating turning direction.

Supplemental signs show secondary destinations such as airports or tourist attractions. Under MnDOT policy supplemental signs may be provided for the following:

1. National Parks
2. National monuments
3. State parks, with certain amenities
4. Airports
5. Educational institutions
6. Traffic generator signing

Street name signs are normally mounted only on mast arms.

Specific service signs(D9-X6).
2.2.5 Supplemental and Motorist Services Signs

Numbered Interchanges

Unnumbered Interchanges

2.2.6 MnDOT Freeway and Expressway Guide Sign Types

Distance (Sign Type A or OH)

Advance Guide

Numbered

Unnumbered
Exit Directional Guide

Sign Type A

Sign Type OH

Exit Panel (Sign Type EA or EO)

Exit Panel (Sign Type EA or EO)

Supplemental Guide (Sign Type A or OH)

Supplemental Guide (Sign Type A or OH)
3. SIGN COMPONENTS

In this Chapter you will be introduced to some of the basic background information related to traffic sign design and practice. The items covered include:

- Panel Size, Radii, Borders, Margins
- Colors
- Font Styles and Font Sizes
- Horizontal and Vertical Lines
- Route Markers
- Arrows
- Fractions
- Abbreviations

3.1 Panel Size, Radii, Borders and Margins

The panel size (typically derived from the sign components) will dictate the radii, borders and margins.

3.1.1 Panel Size

Panels for guide signs are sized in 6" increments in all cases. Sign panel sizes are always listed with the horizontal dimension first; e.g., a 96" x 48" sign is 96" wide by 48" high. Panel size is typically determined by the spacing and the final components.

3.1.2 Radii

Generally, guide signs do not have radiused corners. The border will be radiused, but the panel will not be. If there is a concern that a pedestrian may be injured by a sharp sign corner then the panel should be radiused.

3.1.3 Borders

Unless specifically stated otherwise, each sign illustrated herein shall have a border of the same color as the legend. The corners of the sign border shall be rounded (radiused), except for stop signs. A dark border on a light background should be set in from the edge, creating a margin between the border and panel edge, while a light border on a dark background should extend to the edge of the panel (no margin).

3.1.4 Margins

The widths of the margins listed in the following tables are based on the length of the SHORTEST sign panel side. To determine whether or not to use a margin follow this rule: If the border and legend have a brighter reflectivity than the background of the sign, DON'T use a margin. If the background is brighter, DO use a margin.
3.1.5 Standard Corner Radii, Margin, and Border for Non-Guide Signs

The following dimensions shall be used for trimming corners and for application of borders on standard sign blanks. Where a complete sign is furnished the radius, margin, and border dimensions shall be as shown on the standard sign drawing.

Exhibit 3-1 Standard Corner Radii, Margin, and Border for Non-Guide Signs

<table>
<thead>
<tr>
<th>Length of Shortest Side</th>
<th>Radius</th>
<th>Margin</th>
<th>Border</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 24”</td>
<td>1.5”</td>
<td>.38”</td>
<td>.38”</td>
</tr>
<tr>
<td>24”</td>
<td>1.5”</td>
<td>.38”</td>
<td>.63”</td>
</tr>
<tr>
<td>30”</td>
<td>1.88”</td>
<td>.5”</td>
<td>.75”</td>
</tr>
<tr>
<td>36”</td>
<td>2.25”</td>
<td>.63”</td>
<td>.88”</td>
</tr>
<tr>
<td>42”</td>
<td>2.25”</td>
<td>.63”</td>
<td>.88”</td>
</tr>
<tr>
<td>48” – 60”</td>
<td>3”</td>
<td>.75”</td>
<td>1.25”</td>
</tr>
</tbody>
</table>

Exhibit 3-2 Guide Sign Border and Radii

<table>
<thead>
<tr>
<th>Length of Shortest Side</th>
<th>Border Width</th>
<th>Border Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 36”</td>
<td>1”</td>
<td>3”</td>
</tr>
<tr>
<td>42” – 60”</td>
<td>1.25”</td>
<td>6”</td>
</tr>
<tr>
<td>66” – 84”</td>
<td>1.5”</td>
<td>9”</td>
</tr>
<tr>
<td>≥ 90”</td>
<td>2”</td>
<td>12”</td>
</tr>
</tbody>
</table>

Exceptions for MnDOT Signs:

1. A sign having 20” legend shall use a 3” border width and a border radius based on the above table.
2. 16”-12” or 13.3”-10” legend on Type “A” or Type “OH” signs shall use a 2” border width and a border radius based on the above table.
3.2 Colors

3.2.1 General Provisions

**Black:** Used as legend color for signs with orange, white or yellow backgrounds. Black also is used as the background color for some regulatory signs.

**Blue:** Indicates services available to road users. It is used as the background color in motorist information signs, interstate, Minnesota, and county route markers, and auxiliary markers. Blue is not used as a legend color except on Adopt-a-Highway signing.

**Brown:** Indicates recreational and cultural facilities. It is used only as the background color in recreational and cultural interest signs. It is not used as a legend color.

**Green:** Indicates movement permitted or gives directional guidance. It is used as the background color in guide signs and as the legend color in permissive parking signs.

**Orange:** Warns of temporary traffic conditions with a higher than normal potential hazard level. It is used as the background color in temporary traffic control signs and is most commonly seen in construction zones. It is not used as a legend color.

**Red:** Indicates right-of-way control, prohibition or exclusion. It is used as the background color for STOP, DO NOT ENTER, WRONG WAY, and interstate route marker signs and as the legend color for YIELD, parking prohibition and prohibitory (circular with slash) signs.

**White:** White either indicates a law, regulation or legal requirement in effect at or near the sign or provides directional guidance. It is used as the background color for regulatory signs, route markers and route marker auxiliaries. It also is used as the legend color for signs with a black, blue, brown, green or red background.

**Yellow:** Warns of a potential hazard. It is used as the background color for warning signs and as the legend color for county route marker signs.

**Fluorescent-Yellow Green:** Designated for use as background color for warning signs and their supplemental plaques associated with pedestrians, bicyclists, playgrounds and schools. SCHOOL plaque is also included.

**Fluorescent Pink:** Incident Management

**Purple:** Electronic Toll Accounts (ETC) such as Minnesota’s MnPASS lanes.

More details on color usage can be found in the MN MUTCD Section 2F.3.
3.3 Word Messages

Except as provided in Section 2A.6 of the MN MUTCD, all word messages shall use standard wording and letters as shown in this Manual, the Mn/DOT “Standard Signs Manual”, and the Federal "Standard Highway Signs and Markings" book.

Word messages should be as brief as possible and the lettering should be large enough to provide the necessary legibility distance. A minimum ratio of 1 inch of letter height per 30 feet of legibility distance should be used.

Abbreviations should be kept to a minimum.

Word messages should not contain periods, apostrophes, question marks, or other punctuation or characters that are not letters, numerals, or hyphens unless necessary to avoid confusion.

The solidus (slanted line or forward slash) is intended to be used for fractions only and should not be used to separate words on the same line of legend. Instead, a hyphen should be used for this purpose, such as "TRUCKS - BUSES."

Fractions shall be displayed with the numerator and denominator diagonally arranged about the solidus (slanted line or forward slash). The overall height of the fraction is measured from the top of the numerator to the bottom of the denominator, each of which is vertically aligned with the upper and lower ends of the solidus. The overall height of the fraction shall be determined by the height of the numerals within the fraction, and shall be 1.5 times the height of an individual numeral within the fraction.

3.3.1 Font Styles

All sign lettering shall be in upper-case letters as provided in the MnDOT "Standard Signs Manual" and the Federal "Standard Highway Signs and Markings" book (see Section 1A.11 of the MN MUTCD), unless otherwise provided in the MN MUTCD for a particular sign or type of message.

The sign lettering for names of places, streets, and highways shall be composed of a combination of lower-case letters with initial upper-case letters.

Use of the Series B alphabet is restricted to street-name signs, parking signs, and other similar signs where limited breadth and stroke widths are required for design purposes.

As a guide to choice of alphabets, tests have shown that, for any given legend, better legibility can be obtained by using a relatively wide spacing between letters than by using wider and taller letters with a cramped space.

Available letter series are B, C, D, E, F, D modified, and E modified as illustrated in the following graphic:
3.3.2 Font Sizes

MnDOT uses highway gothic font styles on all MnDOT highway signs. These range from B to F Series (F Series is only used on "EXIT" panels). As you progress alphabetically through the font series the letters widen and the stroke widths thicken. Two of the series have lower-case lettering - D and E Modified Series. D Series lower-case is typically used on temporary (construction) or unique interest signing (Adopt-A-Highway signing, for example).

With all fonts it should be noted that all characters rounded at the top ("2"), bottom ("U"), or both top and bottom ("S") are slightly taller than the straight characters (See above). This becomes important when fabricating a sign to correctly position the text base line.

**Letters and numerals used on guide signs are the E modified font style.** This font has a lower-case height which is ¾ of the upper-case (capital) height. If the upper-case height is 8” the lower-case will be 6”. This particular size is referred to as 8”-6” E Modified. Approved upper-lower letter heights, in inches, are as follows: 4-3, 6-4.5, 8-6, 10.67-8, 13.33-10, 16-12, 20-15.

Proper names are spelled out in upper-lower case, while generic names and other messages use upper-case lettering only. Upper case lettering is also used with cardinal directions: NORTH, SOUTH, EAST, and WEST with the first letter larger. See the MN MUTCD Section 2D.15 and Exhibit 3-3 and Exhibit 3-4 of the manual for guidance.

Lettering sizes for specific signs are based on the characteristics of the roadway: facility type, speed, and number of lanes. The exhibits included here give details of preferred design standards.

Construction, regulatory, and warning signs are designed more often by panel shapes and size restrictions than by the parameters used for guide signs. Hence, narrower and smaller letters are sometimes employed to “squeeze” a message onto these panels. An extreme example of this is an urban parking restriction sign, 12” x 18”, which may have letters as small and narrow as 2” B on it.

**In all cases, reducing spacing between letters (within words) should be avoided, as that will severely diminish legibility. In addition, font sizes should not be reduced.**
### Exhibit 3-3 Guidelines for Guide Sign (Non-Freeway) Font Size

<table>
<thead>
<tr>
<th>Sign Type</th>
<th>Conventional Roads</th>
<th>Expressway*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;45mph 45-60 mph 45-50 mph 55 mph 55 - 60 mph 65 mph</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single Lane and Multilane Single Lane Multilane Undivided Multilane Divided Multilane Divided Multilane</td>
<td></td>
</tr>
<tr>
<td>Destination</td>
<td>City/Street Name</td>
<td>6-4.5 8-6 10.7-8 10.7-8 10.7-8 13.3-10</td>
</tr>
<tr>
<td>Arrow Size</td>
<td>3 or 13 head</td>
<td>5 or 14 head 6 or 15 head 6 or 15 head 6 or 15 head 7 or 16 head</td>
</tr>
<tr>
<td>Numerals</td>
<td>6 8 10.7 10.7 10.7 13.3</td>
<td></td>
</tr>
<tr>
<td>Cardinal Direction</td>
<td>First Letter</td>
<td>6 6 7 7 7 12</td>
</tr>
<tr>
<td>Rest of word</td>
<td>5 5 6 6 6 10</td>
<td></td>
</tr>
<tr>
<td>Route Marker</td>
<td>2 Digit</td>
<td>18 x 18 18 x 18 24 x 24 24 x 24 24 x 24 24 x 24</td>
</tr>
<tr>
<td></td>
<td>3 Digit</td>
<td>22.5 x 18 22.5 x 18 30 x 24 30 x 24 30 x 24 30 x 24</td>
</tr>
<tr>
<td>City/Street Name</td>
<td>6-4.5 6-4.5 8-6 8-6 8-6 10.7-8</td>
<td></td>
</tr>
<tr>
<td>Numerals</td>
<td>6 6 8 8 8 10.7</td>
<td></td>
</tr>
<tr>
<td>Fraction Numerals</td>
<td>4 4 6 6 6 8</td>
<td></td>
</tr>
<tr>
<td>Junction</td>
<td>ICT</td>
<td>8 8 8 8 8 10</td>
</tr>
<tr>
<td>Cardinal Direction</td>
<td>First Letter</td>
<td>7 7 10 10 10 10</td>
</tr>
<tr>
<td>Rest of word</td>
<td>6 6 8 8 8 8</td>
<td></td>
</tr>
<tr>
<td>Route Marker</td>
<td>24 24 24 24 24 24</td>
<td></td>
</tr>
<tr>
<td>Word</td>
<td>8 8 8 8 8 10</td>
<td></td>
</tr>
<tr>
<td>Numerals</td>
<td>12 12 12 12 12 15</td>
<td></td>
</tr>
<tr>
<td>Fraction Numerals</td>
<td>8 8 8 8 8 10</td>
<td></td>
</tr>
<tr>
<td>Directional</td>
<td>Cardinal Direction</td>
<td>7 7 10 10 10 10</td>
</tr>
<tr>
<td>Rest of word</td>
<td>6 6 8 8 8 8</td>
<td></td>
</tr>
<tr>
<td>Route Marker</td>
<td>2 Digit</td>
<td>18 x 18 24 x 24 24 x 24 24 x 24 24 x 24 24 x 24</td>
</tr>
<tr>
<td></td>
<td>3 Digit</td>
<td>22.5 x 18 30 x 24 30 x 24 30 x 24 30 x 24 30 x 24</td>
</tr>
<tr>
<td>City/Street Name</td>
<td>6-4.5 8-6 10.7-8 10.7-8 10.7-8 10.7-8</td>
<td></td>
</tr>
<tr>
<td>Arrow Size</td>
<td>with City/Street Name</td>
<td>3 or 13 head 5 or 14 head 6 or 15 head 6 or 15 head 6 or 15 head 6 or 15 head</td>
</tr>
<tr>
<td>without City/Street Name</td>
<td>3 or 13 head 5 or 14 head 6 or 15 head 6 or 15 head 6 or 15 head 6 or 15 head</td>
<td></td>
</tr>
<tr>
<td>Generic</td>
<td>6 6 8 8 8 8</td>
<td></td>
</tr>
<tr>
<td>Proper Name</td>
<td>6-4.5 6-4.5 8-6 8-6 8-6 10.7-8</td>
<td></td>
</tr>
<tr>
<td>Action Message</td>
<td>5 5 6 6 6 8</td>
<td></td>
</tr>
<tr>
<td>Arrow Size</td>
<td>3 or 13 head 3 or 13 head 5 or 14 head 5 or 14 head 5 or 14 head 6 or 15 head</td>
<td></td>
</tr>
<tr>
<td>Supplemental</td>
<td>Cardinal Direction</td>
<td>7 7 10 10</td>
</tr>
<tr>
<td>Rest of word</td>
<td>6 6 6 6</td>
<td></td>
</tr>
<tr>
<td>Route Marker</td>
<td>2 Digit</td>
<td>24 x 24 24 x 24 24 x 24 24 x 24 24 x 24 24 x 24</td>
</tr>
<tr>
<td></td>
<td>3 Digit</td>
<td>30 x 24 30 x 24 30 x 24 30 x 24 30 x 24 30 x 24</td>
</tr>
<tr>
<td>City/Street Name</td>
<td>8-6 8-6 8-6 8-6 8-6 8-6</td>
<td></td>
</tr>
<tr>
<td>Arrow Size</td>
<td>5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head</td>
<td></td>
</tr>
<tr>
<td>Signal Mast Arm</td>
<td>Cardinal Direction</td>
<td>7 7 10 10</td>
</tr>
<tr>
<td>Rest of word</td>
<td>6 6 8 8</td>
<td></td>
</tr>
<tr>
<td>Route Marker</td>
<td>2 Digit</td>
<td>24 x 24 24 x 24 24 x 24 24 x 24 24 x 24 24 x 24</td>
</tr>
<tr>
<td></td>
<td>3 Digit</td>
<td>30 x 24 30 x 24 30 x 24 30 x 24 30 x 24 30 x 24</td>
</tr>
<tr>
<td>City/Street Name</td>
<td>8-6 8-6 10.7-8 10.7-8 10.7-8 10.7-8</td>
<td></td>
</tr>
<tr>
<td>Arrow Size</td>
<td>5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head</td>
<td></td>
</tr>
<tr>
<td>Other Overheads</td>
<td>Cardinal Direction</td>
<td>7 7 10 10</td>
</tr>
<tr>
<td>Rest of word</td>
<td>6 6 8 8</td>
<td></td>
</tr>
<tr>
<td>Route Marker</td>
<td>2 Digit</td>
<td>24 x 24 24 x 24 24 x 24 24 x 24 24 x 24 24 x 24</td>
</tr>
<tr>
<td></td>
<td>3 Digit</td>
<td>30 x 24 30 x 24 30 x 24 30 x 24 30 x 24 30 x 24</td>
</tr>
<tr>
<td>City/Street Name</td>
<td>8-6 8-6 10.7-8 10.7-8 10.7-8 10.7-8</td>
<td></td>
</tr>
<tr>
<td>Arrow Size</td>
<td>5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head 5 or 14 head</td>
<td></td>
</tr>
</tbody>
</table>
Notes:
OL = Overlay

1. Letter fonts are E Modified unless otherwise noted.

2. In urban areas there may be limited horizontal space in which to place a sign. It is then permissible to reduce the size of the letters of a sign by one step. D Modified cardinal directions may be used on mast arm signs if load restrictions exist.

3. These minimum and recommended sizes are shown in inches.

4. For signing on freeway and expressway ramps use the sizes shown under the speed 45-60 mph, single lane heading.

5. When a sign includes both destination and supplemental information, and letter sizes stipulated above are different for each, upsize the supplemental legend to the destination legend size.

6. Overhead mounted signs on high speed expressways shall use Freeway font size Exhibit 3-4.
### Exhibit 3-4  Guidelines for Guide Sign (Freeway) Font Size

<table>
<thead>
<tr>
<th>Sign Type</th>
<th>Freeway Signs</th>
<th>Overhead</th>
<th>Ground Mounted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance Guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exit Direction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead Guide Signs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cardinal Direction</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>First Letter</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Rest of word</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Aux/Alt Route Legend</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Route Marker</td>
<td>36 x 36</td>
<td>36 x 36</td>
</tr>
<tr>
<td></td>
<td>2 Digit</td>
<td>45 x 36</td>
<td>45 x 36</td>
</tr>
<tr>
<td></td>
<td>3 Digit</td>
<td>16-12</td>
<td>20-15</td>
</tr>
<tr>
<td></td>
<td>Arrow Size</td>
<td>17-36</td>
<td>17-36</td>
</tr>
<tr>
<td></td>
<td>EXIT ONLY</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Diagonal Upward Pointing Arrow</td>
<td>8-25</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Down Arrow</td>
<td>22-32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distance</td>
<td>Numeral</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Fraction Numerals</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Word</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cardinal Direction</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>First Letter</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Rest of word</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Route Marker</td>
<td>24 x 24</td>
<td>24 x 24</td>
</tr>
<tr>
<td></td>
<td>2 Digit</td>
<td>30 x 24</td>
<td>30 x 24</td>
</tr>
<tr>
<td></td>
<td>City/Street Name</td>
<td>13.3-10</td>
<td>13.3-10</td>
</tr>
<tr>
<td></td>
<td>Numerals</td>
<td>13.3</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td>Fraction Numerals</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Supplemental</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Proper Name</td>
<td>13.3-10</td>
<td>13.3-10</td>
</tr>
<tr>
<td></td>
<td>Action Message</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Word</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Numeral</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Exit Panel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Word</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Numeral</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Letter</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

**Notes:**
*For further guidelines see MMUTCD, Section 2-E*

### 3.3.3 Abbreviations Used on Traffic Control Devices

When the word messages shown in Exhibit 3-5 need to be abbreviated in connection with traffic control devices, the abbreviations shown in Exhibit 3-5 shall be used.

When the word messages shown in Exhibit 3-6 need to be abbreviated on a portable changeable message sign, the abbreviations shown in Exhibit 3-6 shall be used. Unless indicated by an asterisk, these abbreviations shall only be used on portable changeable message signs.
## Exhibit 3-5 Acceptable Abbreviations

<table>
<thead>
<tr>
<th>Word Message</th>
<th>Standard Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afternoon / Evening</td>
<td>PM</td>
</tr>
<tr>
<td>Alternate</td>
<td>ALT</td>
</tr>
<tr>
<td>AM radio</td>
<td>AM</td>
</tr>
<tr>
<td>Avenue</td>
<td>AVE, AV</td>
</tr>
<tr>
<td>Bicycle</td>
<td>BIKE</td>
</tr>
<tr>
<td>Boulevard</td>
<td>BLVD*</td>
</tr>
<tr>
<td>Bridge</td>
<td>(See Table 1A-2)</td>
</tr>
<tr>
<td>CB Radio</td>
<td>CB</td>
</tr>
<tr>
<td>Center (as part of a place name)</td>
<td>CTR</td>
</tr>
<tr>
<td>Circle</td>
<td>CIR*</td>
</tr>
<tr>
<td>Civil Defense</td>
<td>CD</td>
</tr>
<tr>
<td>Compressed Natural Gas</td>
<td>CNG</td>
</tr>
<tr>
<td>Court</td>
<td>CT*</td>
</tr>
<tr>
<td>Crossing (other than highway-rail)</td>
<td>X-ING</td>
</tr>
<tr>
<td>Drive</td>
<td>DR*</td>
</tr>
<tr>
<td>East</td>
<td>E</td>
</tr>
<tr>
<td>Electric Vehicle</td>
<td>EV</td>
</tr>
<tr>
<td>Expressway</td>
<td>EXPWY*</td>
</tr>
<tr>
<td>Feet</td>
<td>FT</td>
</tr>
<tr>
<td>FM Radio</td>
<td>FM</td>
</tr>
<tr>
<td>Freeway</td>
<td>FRWY, FWY*</td>
</tr>
<tr>
<td>Friday</td>
<td>FRI</td>
</tr>
<tr>
<td>Hazardous Material</td>
<td>HAZMAT</td>
</tr>
<tr>
<td>High Occupancy Vehicle</td>
<td>HOV</td>
</tr>
<tr>
<td>Highway</td>
<td>HWY*</td>
</tr>
<tr>
<td>Hospital</td>
<td>HOSP</td>
</tr>
<tr>
<td>Hour(s)</td>
<td>HR, HRS</td>
</tr>
<tr>
<td>Information</td>
<td>INFO</td>
</tr>
<tr>
<td>Inherently Low Emission Vehicle</td>
<td>ILEV</td>
</tr>
<tr>
<td>International</td>
<td>INTL</td>
</tr>
<tr>
<td>Interstate</td>
<td>(See Table 1A-2)</td>
</tr>
<tr>
<td>Junction/Intersection</td>
<td>JCT</td>
</tr>
<tr>
<td>Lane</td>
<td>(See Table 1A-2)</td>
</tr>
<tr>
<td>Miles Per Hour</td>
<td>MPH</td>
</tr>
<tr>
<td>Liquid Propane Gas</td>
<td>LP-GAS</td>
</tr>
<tr>
<td>Maximum</td>
<td>MAX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Word Message</th>
<th>Standard Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mile(s)</td>
<td>MI</td>
</tr>
<tr>
<td>Miles Per Hour</td>
<td>MPH</td>
</tr>
<tr>
<td>Minimum</td>
<td>MIN</td>
</tr>
<tr>
<td>Minute(s)</td>
<td>MIN</td>
</tr>
<tr>
<td>Monday</td>
<td>MON</td>
</tr>
<tr>
<td>Morning / Late Night</td>
<td>AM</td>
</tr>
<tr>
<td>Mount</td>
<td>MT</td>
</tr>
<tr>
<td>Mountain</td>
<td>MTN</td>
</tr>
<tr>
<td>National</td>
<td>NATL</td>
</tr>
<tr>
<td>North</td>
<td>N</td>
</tr>
<tr>
<td>Parkway</td>
<td>PKWY*</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>PED</td>
</tr>
<tr>
<td>Place</td>
<td>PL*</td>
</tr>
<tr>
<td>Pounds</td>
<td>LBS</td>
</tr>
<tr>
<td>Road</td>
<td>RD*</td>
</tr>
<tr>
<td>Saint</td>
<td>ST</td>
</tr>
<tr>
<td>Saturday</td>
<td>SAT</td>
</tr>
<tr>
<td>South</td>
<td>S</td>
</tr>
<tr>
<td>State, county, or other non-US or</td>
<td>(See Table 1A-2)</td>
</tr>
<tr>
<td>non-Interstate numbered route</td>
<td></td>
</tr>
<tr>
<td>Street</td>
<td>ST*</td>
</tr>
<tr>
<td>Sunday</td>
<td>SUN</td>
</tr>
<tr>
<td>Telephone</td>
<td>PHONE</td>
</tr>
<tr>
<td>Temporary</td>
<td>TEMP</td>
</tr>
<tr>
<td>Terrace</td>
<td>TER*</td>
</tr>
<tr>
<td>Thursday</td>
<td>THUR</td>
</tr>
<tr>
<td>Thruway</td>
<td>THWY*</td>
</tr>
<tr>
<td>Tons of Weight</td>
<td>T</td>
</tr>
<tr>
<td>Trail</td>
<td>TR*</td>
</tr>
<tr>
<td>Tuesday</td>
<td>TUE</td>
</tr>
<tr>
<td>Turnpike</td>
<td>TPK*</td>
</tr>
<tr>
<td>Two-Way Intersection</td>
<td>2-WAY</td>
</tr>
<tr>
<td>US Numbered Route</td>
<td>(See Table 1A-2)</td>
</tr>
<tr>
<td>Wednesday</td>
<td>WED</td>
</tr>
<tr>
<td>West</td>
<td>W</td>
</tr>
</tbody>
</table>

* This abbreviation shall not be used for any application other than the name of a roadway
### Exhibit 3-6  Abbreviations That Are Acceptable Only with a Prompt Word

<table>
<thead>
<tr>
<th>Word Message</th>
<th>Standard Abbreviation</th>
<th>Prompt Word that should Precede the Abbreviation</th>
<th>Prompt Word that should Follow the Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>ACCS</td>
<td>----</td>
<td>Road</td>
</tr>
<tr>
<td>Ahead</td>
<td>AHD</td>
<td>Fog</td>
<td>----</td>
</tr>
<tr>
<td>Blocked</td>
<td>BLKD</td>
<td>Lane</td>
<td>----</td>
</tr>
<tr>
<td>Bridge</td>
<td>BRDG</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Cannot</td>
<td>CANT</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Center</td>
<td>CNTR</td>
<td>----</td>
<td>Lane</td>
</tr>
<tr>
<td>Chemical</td>
<td>CHEM</td>
<td>----</td>
<td>Spill</td>
</tr>
<tr>
<td>Condition</td>
<td>COND</td>
<td>Traffic</td>
<td>----</td>
</tr>
<tr>
<td>Congested</td>
<td>CONG</td>
<td>Traffic</td>
<td>----</td>
</tr>
<tr>
<td>Construction</td>
<td>CONST</td>
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</tr>
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<td>----</td>
<td>----</td>
</tr>
<tr>
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<td>----</td>
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</tr>
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<td>----</td>
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<td>----</td>
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<td>Next</td>
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</tr>
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<td>I-*</td>
<td>----</td>
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<td>ITS</td>
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</tr>
<tr>
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<td>LN</td>
<td>(Roadway Name)*, Right, Left, Center</td>
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</tr>
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<td>----</td>
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</tr>
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<td>----</td>
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<td>LWR</td>
<td>----</td>
<td>Level</td>
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<td>----</td>
<td>----</td>
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<td>MAJ</td>
<td>----</td>
<td>Accident</td>
</tr>
<tr>
<td>Minor</td>
<td>MNR</td>
<td>----</td>
<td>Accident</td>
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<td>----</td>
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<td>Wet</td>
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<td>PREP</td>
<td>----</td>
<td>To Stop</td>
</tr>
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<td>QLTY</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Right</td>
<td>RT</td>
<td>Keep, Next</td>
<td>----</td>
</tr>
<tr>
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<td>RT</td>
<td>----</td>
<td>Lane</td>
</tr>
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<td>RDWK</td>
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<td>Ahead (Distance)</td>
</tr>
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<td>----</td>
<td>----</td>
</tr>
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<td>----</td>
<td>----</td>
</tr>
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<td>SLIP</td>
<td>----</td>
<td>----</td>
</tr>
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<td>S-BND</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Speed</td>
<td>SPD</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>State, county, or other non-US or non-Interstate numbered route</td>
<td>(Route Abbreviation determined by highway agency)*</td>
<td>----</td>
<td>(Number)**</td>
</tr>
<tr>
<td>Tires With Lugs</td>
<td>LUGS</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
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<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Travelers</td>
<td>TRVLR5</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Two-Wheeled Vehicles</td>
<td>CYCLES</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Upper</td>
<td>UPR</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>US Numbered Routs</td>
<td>US</td>
<td>Level</td>
<td>(Number) **</td>
</tr>
<tr>
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<td>VEH, VEHS</td>
<td>----</td>
<td>----</td>
</tr>
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<td>WARN</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
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<td>W-BND</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Will Not</td>
<td>WONT</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

* This abbreviation when accompanied by the prompt word, may be used on traffic control devices other than portable changeable message signs.

** A space and no dash shall be placed between the abbreviation and the number of the route.
3.4 Horizontal Spacing

Spacing between words and symbols and within words is just as important as the font size itself. If interested in the requirements and guidelines for spacing within words and between words and symbols, see Appendix A for the appropriate charts based on font.

Horizontal spacing between objects is typically equal to the font size. An exception is with city names such as La Crosse or Le Roy, where 60% of the font size is used between the two parts of the name. This 60% spacing has been programmed into SignCAD®, so no special spacing need be created.

Spacing between objects and borders is between ½ and ¾ of the font size. Distance signs, where the spacing between objects and borders is 13” (constant value).

When designing freeway distance signs, a minimum of 21” space is required between a destination and its corresponding mileage, while a minimum of 18” horizontal space is maintained between the longest destination line and the longest mileage.
3.5 Vertical Spacing for Freeway Distance Signs

Special vertical spacing for Freeway Distance Signs has been developed by MnDOT and is summarized in Exhibit 3-7.

Exhibit Key: Combinations – Tallest component on each horizontal line.

1 = 3 overlays  
2 = 3 fonts  
3 = 3 fractions  
4 = 2 fonts, 1 overlay  
5 = 2 fractions, 1 overlay  
6 = 2 overlays, 1 font  
7 = 2 overlays, 1 fraction  
8 = 1 overlay, 1 font, 1 fraction  
9 = 2 fonts, 1 fraction  
10 = 2 fractions, 1 font

Exhibit 3-7 Combinations for Freeway Distance Signs

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<th>Combination</th>
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<th>3</th>
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<td>9</td>
<td>9</td>
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<td>9</td>
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<td>8.5</td>
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<td>24</td>
<td>13.3</td>
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<td>24</td>
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<td>90‖</td>
<td>84‖</td>
<td>84‖</td>
<td>84‖</td>
</tr>
</tbody>
</table>

Notes:

1. All dimensions are in inches.
2. All signs will have 2" borders.
3. All signs of this category have three lines of legend.
4. Components of three different heights may be used: Route markers (24”), standard fonts (13.33”), and fractions (15”). This results in 10 combinations. When taking into account the order from top to bottom of the line possibilities, this is expanded to 27.
3.6 Horizontal and Vertical Lines

Horizontal lines, border to border, are used to separate independent subjects on a single sign panel. Horizontal lines are used primarily on destination signing. The examples below are the only instances where a horizontal line is needed on a two-destination sign panel.

On destination signs with three or more lines of legend a horizontal line is needed if two lines share an arrow. Again, the line is border to border. Examples of this follow.
Indented horizontal lines are used on panels with more than one message about a single subject. They may act as a form of punctuation, separating phrases to avoid confusion.

Vertical lines separate different directional movements and subjects to prevent confusion.
3.7 Route Markers and Sizes

The route markers are listed in the M series of the Standard Signs Manual and the Standard Signs Summary. One or two digit route markers will have the same width and height dimensions, but three digit markers have a width that is 25 percent greater than their height. Route markers attached to the surface of a guide sign panel are referred to as overlays.

On a sign panel containing two or more route marker overlays the more important route marker is placed on the left side in accordance with the MN MUTCD. Interstate routes are the most important, with U.S., state, county, and township in descending order of importance. Where route markers are of equal importance the lowest number will be on the left side. However, arrow placement overrides these rules.

Cardinal directions are always to the right of Route Markers and Top justified unless on Distance signs, where they are center justified.
3.8 Arrows

Arrows for guide signs are divided into several types:

- **Straight**
- **Down**
- **Double Head**
- **Circular Intersection**
- **90 Degree Double Head**
- **45 Degree Advance Turn**
- **90 Degree Advanced Arrow**
- **Curved-Stem Arrow**

Straight arrows can be installed at different angles, from 0 to 180 degrees, with 0 degrees designated right, 90 degrees straight up, and 180 degrees left.

Specifically, 60 degree arrows are used for exit ramps, and 45 degree arrows for exit loops.

Down arrows shall be used only on overhead guide signs that restrict the use of specific lanes to traffic bound for the destination(s) and/or route(s) indicated by these arrows. Down arrows shall not be used unless an arrow can be located over and pointed to the approximate center of each lane that can be used to reach the destination displayed on the sign.

If down arrows are used, having more than one down arrow pointing to the same lane on a single overhead sign (or on multiple signs on the same overhead sign structure) shall not be permitted.

The 90 degree double head, 45 degree advance turn, and 90 degree advance turn arrows are designated left or right.

If used, the Directional Arrow auxiliary sign shall be mounted below the route sign and any other auxiliary signs in Directional assemblies (see Section 2D.32), and displays a single- or double-headed arrow pointing in the general direction that the route follows.

A Directional Arrow auxiliary sign that displays a doubleheaded arrow shall not be mounted in any Directional assembly in advance of or at a circular intersection.

When more than one arrow is used on a sign, the arrows, with corresponding legends, are to be placed in the order specified below:
These alignments override route marker placements.

The information on arrow dimensions and the corresponding legends is found on the next page. The legend size can be matched to the appropriate arrow size by using that table.
Exhibit 3-8  Straight Arrows

### TABLE 1 - SHORT SHAFT ARROWS

<table>
<thead>
<tr>
<th>Head</th>
<th>Matching Letter Size</th>
<th>Standard Length L</th>
<th>Dimensions in Inches</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td></td>
<td>a</td>
</tr>
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<td>6&quot;</td>
<td>5.58</td>
</tr>
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<td>8&quot;</td>
<td>7.06</td>
</tr>
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</table>

### TABLE 2 - LONG SHAFT ARROWS

<table>
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<th>Standard Length L</th>
<th>Dimensions in Inches</th>
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<td>36°</td>
<td>38&quot;</td>
<td>26.18</td>
</tr>
<tr>
<td>20</td>
<td>42°</td>
<td>42&quot;</td>
<td>26.18</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Arrow Code: First number specifies the head to be used. Second number specifies the length L. Thus, a 5-13 arrow has head #5 and length 13".
2. For each legend size there is a corresponding short shaft and long shaft arrow.

**OVERHEAD SIGNS ONLY**

<table>
<thead>
<tr>
<th>Arrow</th>
<th>Matching Letter Size</th>
<th>Dimensions in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>16&quot;</td>
<td>13.33-10&quot;, 10&quot; &amp; less</td>
<td>24.0 12.0 4.88 2.25 16.5 .76</td>
</tr>
<tr>
<td>22&quot;</td>
<td>18-12&quot;, 12&quot; &amp; greater</td>
<td>32.0 16.0 6.5 3.0 22.0 1.00</td>
</tr>
</tbody>
</table>

**ARROW SELECTION:**
- Adjacent to one line of legend - use Table 1 for vertical, horizontal, or diagonal arrow.
- Adjacent to two or more lines of legend - use Table 2 for vertical or diagonal arrow; Table 1 for horizontal arrow.
- Beneath one or more lines of legend - use Table 2 for horizontal or diagonal arrow ≤ 45°; Table 1 for vertical or diagonal arrow > 45°.
- ALL FREEWAY SIGNS & EXPRESSWAY INTERCHANGE SIGNS - use Table 2.

**ARROW SIZE:**
Arrow head numbers determine which straight arrow corresponds with which advance turn, double head, and double head 90° arrows and legend.
For example, a 5-13 arrow and a 5-24 double head arrow (both have #5 heads) would be appropriate arrows to use with an 8-6" legend.
### DOUBLE HEAD ARROWS

<table>
<thead>
<tr>
<th>Arrow Designation</th>
<th>1 Head</th>
<th>3 Head</th>
<th>5 Head</th>
<th>6 Head</th>
<th>7 Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>6.58</td>
<td>8.35</td>
<td>11.16</td>
<td>15.09</td>
<td>17.72</td>
</tr>
<tr>
<td>L - Minimum</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
</tr>
</tbody>
</table>

### DOUBLE HEAD 90 DEGREE ARROWS

<table>
<thead>
<tr>
<th>Arrow Designation</th>
<th>1-11</th>
<th>3-16</th>
<th>5-22</th>
<th>6-29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>10.5</td>
<td>15.75</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Length</td>
<td>11</td>
<td>16.5</td>
<td>22</td>
<td>29.5</td>
</tr>
</tbody>
</table>

### 45 DEGREE ADVANCE TURN ARROWS

<table>
<thead>
<tr>
<th>Arrow Designation</th>
<th>6 X 8</th>
<th>9 X 12</th>
<th>12 X 16</th>
<th>15 X 20</th>
<th>17 X 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrow head</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Height</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Length</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>17</td>
</tr>
</tbody>
</table>

### 90 DEGREE ADVANCE TURN ARROWS

<table>
<thead>
<tr>
<th>Arrow Designation</th>
<th>8 X 6.5</th>
<th>12 X 10</th>
<th>16 X 13</th>
<th>18 X 16</th>
<th>22 X 18</th>
<th>25 X 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrow head</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>14</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Height</td>
<td>6.5</td>
<td>10</td>
<td>13</td>
<td>18</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Length</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>18</td>
<td>22</td>
<td>25</td>
</tr>
</tbody>
</table>
3.9 Fractions

A fraction is always 1.5 times the height of the numerals used in it. When using a whole number with a fraction see Exhibit 3-10 below for the correct numeral height. Alignment is shown below. Note that the fraction is centered vertically on the numeral.

If a fraction is used on a line with additional legend (as in “1/2 MILE ON RIGHT”) the fraction numerals should be the same height as the legend letter height, as shown below.

<table>
<thead>
<tr>
<th>Fraction Height</th>
<th>Preceding Whole Number Height</th>
<th>Numeral Height in Fraction</th>
<th>Space From Whole Number 1 to Fraction</th>
<th>Space From Whole Numbers 2 - 9 to Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>6&quot;</td>
<td>4&quot;</td>
<td>2.5&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>9&quot;</td>
<td>8&quot;</td>
<td>6&quot;</td>
<td>3&quot;</td>
<td>2.5&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>10.67&quot;*</td>
<td>8&quot;</td>
<td>4.5&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>12&quot;</td>
<td>8&quot;</td>
<td>5&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>13.33&quot;*</td>
<td>10&quot;</td>
<td>5&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>15&quot;</td>
<td>10&quot;</td>
<td>6&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>18&quot;</td>
<td>12&quot;</td>
<td>7&quot;</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

*On distance signs
3.10 Legend/Layout Justifications

Along with Arrow placements (Section 3.8 on page 3-16) the wording on a panel is aligned, or justified, left, center, or right. Various suggested layouts are illustrated on the following pages.

- A single subject center justified on itself.

- Arrow + Arboretum is the longest line and is centered on panel.

- Two subjects left aligned on arrow side.

- Arrow and subject right justified.

- Arrow + Long Prairie is the longest line and is centered on panel.

- Arrow and subject left justified.

- Two subjects right aligned on arrow side.

- Arrow + Long Prairie is the longest line and is centered on panel.
**Guide Sign Design Course Manual**

**Sign Components**

Vertical and left arrows centered on each other.

**Two subjects**
left aligned on arrow side.

Horizontal arrow and Pipestone protrude the most on each side and are spaced the same to the border.

---

Arrow and subject right justified.

**Arrow + Redwood Falls** is the longest line and is centered on panel.

---

Two subjects left aligned on arrow side.

Arrow and subject left justified.

Vertical arrow + Wabasso is the longest line and is centered on panel. Because of horizontal bar it is not necessary to center arrows on each other.
3.11 Typical Freeway Signs

3.11.1 Freeway Advance Guide Type A Signs

There are two formats to this classification, one or two city names. The border shall be three inches wide due to the use of 20-15” legend (complies with Exhibit 3-2, Note 1). The spacing is standardized, as follows:

* City names shall appear in the same order as those on the ramp destination guide sign.
3.11.2 Freeway Exit Direction Type A Signs

There are two formats to this classification, one or two city names. The border shall be three inches wide due to the use of 20-15” legend (complies with Exhibit 3-2, Note 1). The spacing is standardized, as follows:

* City names shall appear in the same order as those on the ramp destination guide sign.
3.12 U-Post and Post Spacing

3.12.1 U-Post Structure Charts for Ground Mounted Signs

The following charts determine the number of posts and knee braces needed to erect a sign panel so the sign and structure can adequately resist wind loads. Note the Type “A” sign areas that require I-beam sign posts which are installed under contract.

While adhering to the required letter height for a sign panel, it is desirable to stay within the U-post area of the tables due to cost and ease of installation and maintenance. This may be possible by simply designing the sign panel with a greater width, which can create horizontal space for an additional U-post. For example, a 102” x 84” sign panel (on the 2 ½ #/ft chart), which is more square footage than a 90” x 84” sign panel, can be installed on U-posts, while the smaller area sign panel becomes a Type “A” sign on I-beam sign posts.

Signs designed for signing contracts use 2.5 #/ft sign structures.
Exhibit 3-11  U-Post Structure Chart

LEGEND
90 mph wind with gusts = 23 psf
2.5 pound post = 0.341 in
SM = 0.341 in
Typical foot below sign to ground
U = Vertical U-post
A = Knee Brace

TYPE "A" SIGNS with Breakaway I-Beams

PANEL LENGTH (WIDTH)

APPROVED
1/1/96

DATE OF REV.

U-POST STRUCTURE CHART FOR GROUND MOUNTED SIGNS 2.5 LB. POSTS

PAGE NUMBER
3.12.2 Sign Post Spacing Chart

Proper U-post spacing is essential for sign structures to meet FHWA breakaway requirements. It is also important when redesigning a sign panel to determine if the existing U-post sign structure will be reused. For example, an existing 2 post (54” spacing) sign structure with an 84” x 48” sign panel could accommodate a 78”, 84”, 90” or 96” sign panel that is 48 inches high on the existing sign structure without moving the vertical posts.

See Exhibit 3-12 for proper sign post spacing.

Exhibit 3-12 Sign Post Spacing Chart

<table>
<thead>
<tr>
<th>Panel Length</th>
<th>Post Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 Posts</td>
</tr>
<tr>
<td>36</td>
<td>24</td>
</tr>
<tr>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>48</td>
<td>30</td>
</tr>
<tr>
<td>54</td>
<td>30</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
</tr>
<tr>
<td>66</td>
<td>42</td>
</tr>
<tr>
<td>72</td>
<td>42</td>
</tr>
<tr>
<td>78</td>
<td>54</td>
</tr>
<tr>
<td>84</td>
<td>54</td>
</tr>
<tr>
<td>90</td>
<td>54</td>
</tr>
<tr>
<td>96</td>
<td>54</td>
</tr>
<tr>
<td>102</td>
<td>60</td>
</tr>
<tr>
<td>108</td>
<td>66</td>
</tr>
<tr>
<td>114</td>
<td>66</td>
</tr>
<tr>
<td>120</td>
<td>72</td>
</tr>
<tr>
<td>126</td>
<td>78</td>
</tr>
<tr>
<td>132</td>
<td>78</td>
</tr>
<tr>
<td>138</td>
<td>78</td>
</tr>
<tr>
<td>144</td>
<td>90</td>
</tr>
<tr>
<td>150</td>
<td>90</td>
</tr>
<tr>
<td>156</td>
<td>90</td>
</tr>
<tr>
<td>162</td>
<td>96</td>
</tr>
<tr>
<td>168</td>
<td>96</td>
</tr>
<tr>
<td>174</td>
<td>102</td>
</tr>
<tr>
<td>180</td>
<td>108</td>
</tr>
</tbody>
</table>

Notes:

1. All dimensions are in inches.
2. Use this chart only if punch codes can't be found in the Standard Signs Manual.
Sign Post Spacing Chart for Exit Panels (Type EA and EO)

Use Exhibit 3-13 mounting exit panels to the upper edges of Type A signs and Type OH signs.

### Exhibit 3-13  Sign Post Spacing Chart for Exit Panels

<table>
<thead>
<tr>
<th>Panel Length (inches)</th>
<th>Post Spacing (inches)</th>
<th>2 Posts</th>
<th>3 Posts</th>
<th>4 Posts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td></td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td></td>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>108</td>
<td></td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>114</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>126</td>
<td></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>132</td>
<td></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>138</td>
<td></td>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>144</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>156</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>162</td>
<td></td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>168</td>
<td></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>174</td>
<td></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. DESIGN PROCESS & EXAMPLE PROBLEMS

4.1 Guide Sign Basics

The following guidelines are simply that – guidelines. Engineering judgment should be used for unique situations based on these guidelines.

1. First, use the guidelines for Font Sizes (Section 3.3.2 on page 3-5) to determine correct letter size and overlay size, based on speed, number of lanes, and roadway type (freeway or non-freeway).

2. The matching arrow size can be found in Section 3.8 on page 3-16.

3. Vertical spacing between lines: ½ to ¾ of letter height. This requirement may not be feasible with all overheads due to restrictions caused by existing mounting structures.


5. Horizontal spacing between objects (fractions, overlays, arrows): ¾ to full letter height.

6. Horizontal spacing between text and inside of border: ½ to ¾ of letter height.

7. The appropriate arrow will be larger than the matching font height, and spacing around it will be less than the vertical spacing between lines (¾ to ¾ letter height). Due to the shapes of arrows, compressing space around them doesn't make them appear crowded.

8. Vertical spacing around fractions can be compressed somewhat because fractions are much taller than the rest of the legend on the same line.

9. Whenever possible, allow no more than three destinations or street names on a guide sign.

4.2 Basic Guide Sign Design Examples

4.2.1 Calculating the vertical size of the sign panel

Use the following formulas and equivalents to determine the specific dimension:

\[ A = \text{Letter height} \]

\[ B = \text{Vertical spacing from text to text, or from text to inside border} \ (½ A \text{ to } ¾ A) \]

\[ C = \text{Arrow/fraction height} \]

\[ D = \text{Horizontal spacing from inside border to legend} \ (½ \text{ to } ¾ A) \]

\[ E = \text{Vertical spacing from arrow to wording, or from arrow to inside border} \ (\text{less than } B) \]

1. Add the heights of all objects in the sign, including border thicknesses. The border thickness may have to be estimated if the length of the panel’s shortest side – height or width – is not known (typical borders widths are summarized in Exhibit 3-2). Add the thickness of horizontal lines, which will be the same as the value given for border thickness. On signs with Font size combinations on the same line, use the largest size when determining component spacing.

2. Add the heights of the spaces between legend lines as well as the spaces between legend lines and borders.
3. Add the two totals from Steps 1 and 2, rounding to the nearest number divisible by 6 (6” increments). This figure is the panel height. Bear in mind that an adjustment may have to be made in border and horizontal line thickness to achieve the right size.

4. Because of the rounding of the panel height in Step 3, spacing likely will need to be adjusted. To do this, find the difference between the rounded panel height and the actual total from Step 3. Then distribute this difference between the spaces on the panel, ensuring to keep ‘B’ measurements equivalent, ‘D’ measurements equivalent, and ‘E’ measurements equivalent. Exceptions to this rule may be necessary in some cases to account for words containing low-hanging letters, such as g, j, p, q, and y, or in other situations.

4.2.2 Calculating the horizontal size of the panel

Horizontal spacing is fairly automatic in most cases. Primarily, it involves maintaining proper spacing from borders to legend and from legend to vertical lines. The example problems illustrate this in more detail. In the few complicated instances instructions are given as to how horizontal spacing can be done. Spacings from legends to borders and vertical lines should be between ½ and ¾ letter height in most cases.

4.2.3 Review vertical and horizontal spacing on the panel

Sign panel design is an iterative process. Even after performing the calculations to solve for vertical and horizontal spacing, the panel may not be complete. Once the values are entered into SignCAD, it may become apparent that there is too much space on the panel. Likewise, the panel may appear cramped by not having enough space between components.

This can happen because of the range of values possible for variables B, E, and D. If the panel appears too spacious, try recalculating these values starting with a smaller B or D space. Likewise, start with larger values if the panel appears cramped. Doing so can make the difference of 6” or even a full foot in total panel size.

4.2.4 Review Panel Structure for Proper Supports

Once the panel has been sized using vertical and horizontal spacing guidelines refer to section 3.12.1 on page 3-25 to ensure U-Posts will be used versus I-beams.
4.3 Example #1, Supplemental Guide Sign

Purpose of Example:

- Color selection
- Font type and letter height selection
- Horizontal and vertical spacing

Given Conditions:

- Posted speed limit = 35 mph
- Number of basic lanes = 4 lanes
- Non-Freeway

Example Task:

- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD, paying particular attention to component location, justification, and spacing. Exhibit 3-3 provides the components to use.

Object and spacing values for this example:

A = Letter height

B = Vertical spacing from text to text, or from text to inside border (½ A to ¾ A)

C = Arrow height

D = Horizontal spacing from inside border to text (½ A to ¾ A)

E = Vertical spacing from arrow to text, or from arrow to inside border (less than B).
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white

2. Install components into panel one at a time

3. Text tool –
   - Type the two lines of text (use the enter key to get to the second line)
   - Font - E modified
   - Size - 6-4.5
   - Proper name - Upper-lower case

4. Arrow tool -
   - Angle - 0 degrees
   - Arrowhead - 13 (13-14 arrow)

5. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B and E

6. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for D
Final Sign Panel

3.0" Radius, 1.0" Border, White on Green;
“Walker” E Mod; “High School” E Mod; Arrow 13 - 14.0" 0°;

Typical Mistakes

• Vertical spacing - kept as automatic spacing
• Horizontal spacing - Legend not centered
Example #1, Supplemental Guide Sign Calculations

Vertical Size of Panel and Line Spacing

Given:
- 3 rows of components: 2 text, 1 arrow
- Font size (Exhibit 3-3) = 6-4.5, based on speed and number of lanes
- Arrow size (Exhibit 3-3 & Exhibit 3-8) = 13-14, based on speed, number of lanes, and sign layout

1. Assume border = 1” (Exhibit 3-2)
   From top to bottom:
   - 1”-top border
   - 6”-top row of text
   - 6”-second line of text
   - 8.56” arrow height
   - 1”-bottom border
   
   total of 22.56” of space needed for objects

2. Four spaces exist:
   Two text spaces (B) @ ½ to ¾ of font size (6”), between 3” and 4.5”, use 4”
   - 2 (4”) = 8” of space required
   Two arrow spaces (E), less than B = 3.5”
   - 2 (3.5”) = 7” of space required
   
   8” + 7” = 15”

3. 22.56” + 15” = 37.56”
   - 37.56” is between 36” and 42” (valid panel sizes), closest to 36”

4. Spacing Adjustments:
   - Rounded Panel Height (36”) - Step 3 totals (37.56”) = -1.56”
   - Therefore, we need to remove 1.56” of spacing from the sign.
   - There are multiple ways to accomplish this by keeping each B measurement equal as well as each E measurement equal. For this example, the chosen method was to remove 0.5” from each B measurement, and 0.26” from each E measurement.
5. Final vertical spacing summary:
   
   - 1” border
   - 3.5” space
   - 6” text
   - 3.5” space
   - 6” text
   - 3.22” space
   - 8.56” arrow
   - 3.22” space
   - 1” border

   sums to 36”

**Horizontal Size of Panel and Spacing**

Once the vertical spacing is determined, the horizontal spacing is based on the longest object.

Use between ½ and ¾ of the font size as horizontal spacing between inside of border and legend. Remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The High School line is the longest object; Horizontal spacing defaults to 6” (font size) between the objects. 

1” (border) + 4” (D space) + 20.3” (High) + 6” (space) + 29.9” (School) + 4.5” (D space) + 1” (border) ➞ 66.2”. Round this down to 66” by removing at least 0.1” from each horizontal space around the High School text, bringing them to less than 3.9” each.

**Key Placement Issues**

- Arrow centered
- All text centered
This page is intentionally left blank
4.4 Example #2, Destination Guide Sign With Tabular Arrangement

Purpose of Example:
- Font and arrow selection
- Using tabular arrangements
- Left and right justification
- Horizontal and vertical spacing

Given Conditions:
- Posted speed limit = 55 mph
- Number of basic lanes = Undivided Multilane
- Non-Freeway

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD, paying particular attention to component location, justification, and spacing. Exhibit 3-3 provides the components to use.
Object and spacing values for this example:

A = Letter height
B = Vertical spacing from text to text, or from wording to inside border (½ A to ¾ A)
C₁ = Vertical arrow height
C₂ = Horizontal arrow height
D₁ = Horizontal spacing from inside border to text (½ A to ¾ A)
D₂ = Horizontal spacing from horizontal arrow to text (A)
E₁ = Vertical spacing from vertical arrow to text, or from arrow to border
E₂ = Vertical spacing from horizontal arrow to text, or from arrow to border
Guide Sign Design Course Manual

SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white

2. Text tool –
   - Create three separate lines of text
   - Font - E modified, Size – 10.7-8
   - Proper name - Upper-lower case

3. Arrow tool –
   - Create three arrows
   - Angles – 90 degrees, 180 degrees, and 0 degrees
   - Arrowhead - 6 (6-17 arrow)

4. Open arrangement tool
   - Select tabular and create a 2 column, 2 row arrangement
   - Install top two city names and arrows into arrangement
   - Edit tabular arrangement data to show horizontal lines, set minimum space to zero
   - Drag the tabular arrangement to the panel

5. Drag last city name and arrow to the bottom of the panel
   - Right align the bottom line – right click the arrow, select Object Align, choose Right

6. Horizontal line tool –
   - Add a horizontal line between the tabular arrangement and the bottom city name, setting the spacing to zero

7. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B, E₁, and E₂

8. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for D₁ and D₂

Typical Mistakes

✓ Vertical spacing - Left to run automatically, spacing around arrows incorrect
✓ Horizontal spacing – spacing between arrows and text incorrect
✓ Alignment – Top two cities not in tabular arrangement or left aligned, bottom arrow not right aligned
Final Sign Panel

Handout

Guide Sign Design Course Manual

9.0” Radius, 1.5” Border, White on Green; Arrow 6 - 17.0” 90°; "Marshall" E Mod; Arrow 6 - 17.0” 180°; “Balaton” E Mod; “Tracy” E Mod; Arrow 6 - 17.0” 0°;

Alternative Panel Design
Example #2, Destination Guide Sign With Tabular Arrangement Calculations

Vertical Size of Panel and Line Spacing

Given:

- 3 rows of components: 3 object/text
- Font size (Exhibit 3-3) = 10.7-8, based on speed and number of lanes
- Arrow size (Exhibit 3-3 & 6) = 5-13, based on speed, number of lanes, and sign layout

1. Assume border = 1.5” (Exhibit 3-2)

   From top to bottom:
   - 1.5”- top border
   - 17”- top arrow (the arrow is taller than the font size)
   - 1.5” – first horizontal line
   - 15.09” – middle arrow (the arrow is taller than the font size)
   - 1.5” – second horizontal line
   - 15.09” – bottom arrow (the arrow is taller than the font size)
   - 1.5”- bottom border

   total of 53.18” needed for components

2. Six spaces exist:

   All will be controlled by objects arrows when performing object spacing in SignCAD, so we need spacings $E_1$ and $E_2$. First, we need to make sure that each of the three sections of the panel will be the same size, accomplished by having equal spacing on each side of all text. Therefore, we will need to calculate space $B$ before finding $E_1$ and $E_2$.

   Space $B$ is only relevant while summing the vertical text components and lines/borders as follows:

   $1.5” + 10.67” + 1.5” + 10.67” + 1.5” + 10.67” + 1.5” = 38.01” needed for components

   $B @ \frac{1}{2} A$ to $\frac{3}{4} A = 5.34”$ to $8”$, use $6”$ (trying to keep the panel smaller since there are 6 of these spaces)

   $6 (6”) = 36”$ of space required

3. $38.01”$ (from Step 2) + $36” = 74.01”

   $74.01”$ is between $72”$ and $78”$ (valid panel sizes), closest to $72”$

4. Spacing Adjustments:

   Rounded Panel Height ($72”$) - Step 3 totals ($74.01”$) = $-2.01”
Therefore, we need to remove 2.01” from the sign. This should be done by removing 0.335” from each of the B measurements, bringing B to 5.665.”

Now, we can calculate $E_1$ and $E_2$. Since each of the three sections of the panel have the same B measurement and text height, they will be equal heights. Therefore, the distance between the borders will be equal to $5.665” (B) + 10.67” (A) + 5.665” (B) = 22”$. Calculate $E_1$ by subtracting the vertical arrow height (17”) from 22” to get a green space measurement of 5”. There are two $E_1$ spaces, so divide by two to get $E_1 = 2.5”$. Similarly, $E_2$ is calculated to be 3.455”. Use these spacing values as the object spacing for the arrows, leaving the object spacing for the text at zero.

5. Final vertical spacing summary:

- 1.5” border
- 2.5” space
- 17” arrow
- 2.5” space
- 1.5” horizontal line
- 3.455” space
- 15.09” arrow
- 3.455” space
- 1.5” horizontal line
- 3.455” space
- 15.09” arrow
- 3.455” space
- 1.5” border

sums to 72”

**Horizontal Size of Panel and Spacing**

Use between ½ and ¾ of the font size as horizontal spacing between inside of border and text/objects. Remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The top line (up arrow and Marshall) is the longest, but use the width of the second line’s horizontal arrow instead of the up arrow, because it is longer. $1.5” (border) + 6” (D_1 \text{ space}) + 17” (horizontal arrow) + 10.67” (space) + 70.5” (Marshall) + 6” (D_1 \text{ space}) + 1.5” (border) \rightarrow 113.17”$. Round to the closest 6” increment, which is 114”. Along with the rounding, center-aligning the top/middle arrow and right-aligning the bottom arrow will automatically adjust the spaces to 6.41”.

**Key Placement Issues**

Top and middle arrow centered, bottom arrow right-aligned, top and middle text left-aligned
4.5 Example #3, Destination Sign (Freeway)

Purpose of Example:

- Selection of freeway sign components
- Placement and spacing of overlays
- Placement of fractions
- Horizontal and vertical spacing of fractions

Given Conditions:

- Posted speed limit = 65 mph
- Number of basic lanes = Multilane
- Freeway, ground mounted

Example Task:

- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.
Object and spacing values for this example:

A₁ = Destination letter height

A₂ = Distance word letter height

B = Vertical spacing from text/overlay to text, or from text/overlay to inside border (½ A₁ to ¾ A₁)

C = Distance fraction height

D₁ = Horizontal spacing from inside border to text (½ A₁ to ¾ A₁)

D₂ = Horizontal spacing from overlay to overlay (approximately ¾ A₁)

D₃ = Horizontal spacing from distance fraction to distance word (average of A₂ & C)

E = Vertical spacing from object to inside border (less than B)
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white

2. Install legend and object components into panel one at a time
   - Consider the fraction to be an object, separate from other text on the same line

3. Adjust vertical spacing
   - Object spacing for the fraction will control over the MILE text because it is taller
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B and E

4. Adjust horizontal spacing
   - Spacing near the fraction and overlays will likely need to be adjusted from the default
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for $D_1$, $D_2$, and $D_3$

Typical Mistakes

- Fraction not formatted correctly, is wrong size, or spacing between it and MILE is incorrect
- MILE is incorrectly placed with the same font size as the distance numeral/fraction.
Final Sign Panel

Jasper Pipestone
3/4 MILE

12.0" Radius, 3.0" Border, White on Green; “Jasper” E Mod; “Pipestone” E Mod; 3/4 E Mod; "MILE" E Mod;

Alternative Panel Design
4.5.1 Example #3, Destination Sign (Freeway) Calculations

Vertical Size of Panel and Line Spacing

Given:

- 4 rows of components: 1 object, 2 text, 1 object/text
- Overlay size = 36”
- Destination font size (**Exhibit 3-4** = 20-15, based on speed and number of lanes)
- Distance (fraction) font size (**Exhibit 3-4**) = 18
- Distance (word) font size (**Exhibit 3-4**) = 12

1. Assume border = 3” (**Exhibit 3-2**)

   From top to bottom:
   - 3” – top border
   - 36” – overlays
   - 20” – first line of text
   - 20” – second line of text
   - 18” – distance fraction
   - 3” – bottom border

   Total of 100” needed for components

2. Five spaces exist:

   Three text/marker spaces (B) @ ½ to ¾ of font size (20”), between 10” and 15”, use 10”
   - 3 (10”) = 30” of space required

   Two fraction spaces (E), less than B = 9”
   - 2 (9”) = 18” of space required

   30” + 18” = 48”

3. 100” + 48” = 148”

   148” is between 144” and 150” (valid panel sizes), round up to 150”

4. Spacing adjustments

   Rounded Panel Height (150”) - Step 3 totals (148”) = 2”

   Therefore, we need to add an additional 2” inches of spacing into the sign.
There are several ways to accomplish this. For this example, the chosen solution is to add the extra 2” by splitting them evenly among the two E measurements. This will make each of the B and E measurements equivalent.

An alternative design involves making the B space above the overlay smaller by 1”, and relocating this toward the center of the sign, further separating the two city names.

5. Final vertical spacing summary:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3” border</td>
<td></td>
</tr>
<tr>
<td>10” space</td>
<td>10” space</td>
</tr>
<tr>
<td>36” overlay</td>
<td>10” space</td>
</tr>
<tr>
<td>20” text</td>
<td>20” text</td>
</tr>
<tr>
<td>18” fraction</td>
<td>10” space</td>
</tr>
<tr>
<td>3” border</td>
<td></td>
</tr>
</tbody>
</table>

sums to 150”

**Horizontal Size of Panel and Spacing**

Use between ½ and ¾ of the font size as horizontal spacing between inside of border and legend/objects. Remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The second text line (Pipestone) is the longest; horizontal spacing defaults to 20” (font size). 3” (border) + 14” (D₁ space) + 150.6” (Pipestone) + 14” (D₁ space) + 3” (border) → 184.6”. Round up to the closest 6” increment, which is 186”. SignCAD will automatically round the panel and force the D₁ spaces to 14.7”.

Spacing between the fraction (3/4) and the text (MILE) should be the average of the two font sizes (18” and 12”, respectively). This leads to a spacing of 15”. Spacing between the overlays should be approximately ¾ font size, or 15”.

**Key Placement Issues**

- ¾ and MILE are both horizontally and vertically centered on their line.
4.6 Example #4, Supplemental Guide Sign (Freeway)

Purpose of Example:
- Font and letter height selection
- Color Selection

Given Conditions:
- Freeway supplemental sign
- Ground mounted

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.
Object and spacing values for this example:

A₁ = Letter height for destination
A₂ = Letter height for EXIT numeral
A₃ = Letter height for EXIT word
B = Vertical spacing from text to text, or from text to inside border (½ A to ¾ A)
D₁ = Horizontal spacing from inside border to text (½ A to ¾ A)
D₂ = Horizontal spacing between the EXIT text and EXIT number (average of A₂ and A₃)
E = Vertical spacing from EXIT numeral to text, or from EXIT numeral to inside border (less than B)
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - brown
   - Border color - white

2. Install components into panel one at a time

3. Text tool –
   - Type the two lines of text (use the enter key to get to the second line)
   - Enter EXIT and 147 separately using the text tool. This provides the ability to size and space these components separately. (Alternatively, you may place them as one object, making sure to change text height to 12.5 after the exit word, add a space, and then change the text height to 15 for the exit numeral.)
   - Font – E modified
   - Size – 13.3-10 for first 2 lines, 10 for EXIT and 15 for 147
   - Proper name - Upper-lower case
   - EXIT is capitalized

4. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B and E

5. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for $D_1$ and $D_2$

Typical Mistakes

- Vertical spacing - Left to run automatically
- Horizontal spacing - Legend not centered
- Not using correct font sizes or spacing between different fonts on the same line
Final Sign Panel

Wild River State Park
EXIT 147

9.0" Radius, 1.5" Border, White on Brown;
“Wild River” E Mod; “State Park” E Mod;
“EXIT” E Mod; “147” E Mod;
4.6.1 Example #4, Supplemental Guide Sign (Freeway) Calculations

Vertical Size of Panel and Line Spacing

Given:

- 3 rows of components: all text
- Destination name font size (Exhibit 3-4) = 13.3-10
- Exit number font size (Exhibit 3-4) = 10 (word); 15 (exit number)

1. Assume border = 1.5"

   From top to bottom:
   - 1.5" - top border
   - 13.33" - top row of text
   - 13.33" - middle line of text
   - 15" - bottom line of text
   - 1.5" - bottom border

   total of 44.67" of space needed for components

2. Four spaces exist

   Two text spaces (B) @ ½ to ¾ of font size (13.33"), between 6.65" and 10", use 9"
   - 2 (9") = 18" of space required

   Two exit numeral spaces (E), less than B = 8"
   - 2 (8") = 16" of space required

   18" + 16" = 34"

3. 44.67" + 34" = 78.67"

   78.67" is between 78" and 84" (valid panel sizes), round down to 78"

4. Spacing adjustments

   Rounded Panel Height (78") - Step 3 totals (78.67") = -0.67"

   Therefore, we need to remove 0.67" of spacing from the sign.

   This can be done by removing 0.34" from each of the B space values.
5. Final vertical spacing summary:
   
   1.5” border
   8.66” space
   13.33” text line
   8.66” space
   13.33” text line
   8” space
   15” text line
   8” space
   1.5” border
   
   sums to 78”

**Horizontal Size of Panel and Spacing**

Once the vertical spacing is determined the horizontal spacing is based on the longest object.

Use between ½ and ¾ of the font size as horizontal spacing between inside of border and text, remember that panels are sized in 6” increments.

The State Park line is the longest object; horizontal spacing defaults to 13.3” (font size) between the objects. 1.5” (border) + 8.33” (space) + 53.97” (State) + 13.33” (space) + 45.79” (Park) + 8.33” (space) + 1.5” border → 132.75”, round to closest 6” increment which is 132”. Decrease the spaces on each side of State Park by 0.38” each to reach this panel size.

**Key Placement Issues**

- None
4.7 Example #5, Advanced Street Name Sign with Directional Arrow

Purpose of Example:
- Text and double headed arrow selection

Given Conditions:
- Posted speed limit = 55 mph
- Number of basic lanes = Undivided Multilane
- Non-Freeway, ground mounted

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.

Object and spacing values for this example:

A = Letter height
B = Vertical spacing from text to text, or from text to inside border (½ A to ¾ A)
C = Arrow height
D = Horizontal spacing from inside border to text (½ A to ¾ A)
E = Vertical spacing from arrow to text, or from arrow to inside border (less than B)
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white

2. Install components into panel one at a time

3. Text tool -
   - Font – E modified
   - Size – 10.7-8
   - Proper name - Upper-lower case

4. Arrow tool –
   - Angle – 0 degrees
   - Arrowhead - 6 (6-42 arrow)

5. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B and E

6. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for D

Typical Mistakes

- Wrong arrow selection
Final Sign Panel

6.0" Radius, 1.3" Border, White on Green;
“182nd Ave” E Mod;
Double Headed Arrow 6 - 42.0" 0°;

Alternative Panel Design
4.7.1 Example #5, Advanced Street Name Sign with Directional Arrow Calculation

Vertical Size of Panel and Line Spacing

Given:

- 2 rows of components: 1 object, 1 text
- Font size (Exhibit 3-3) = 10.7-8
- Arrow size (Exhibit 3-3 & Exhibit 3-8) = 6-42

1. Assume border = 1.25"
   From top to bottom:
   
   1.25” - top border
   10.67” - text height
   15.09” – arrow height
   1.25” - bottom border
   
   total of 28.26” of space needed for components.

2. Three spaces exist:
   One text space (B) @ ½ to ¾ of font size (10.67”), between 5.34” and 8”, use 7”
   
   1 (7”) = 7” of space required
   
   Two object (arrow to border) spaces (E), less than B = 6”
   
   2 (6”) = 12” of space required
   
   7” + 12” = 19” of space required

3. 28.26” + 19” = 47.26”
   
   47.26” is not divisible by 6, round to closest, use 48” ➔ valid panel size

4. Spacing adjustments
   
   Rounded Panel Height (48”) - Step 3 totals (47.26”) = 0.74”
   
   Therefore, we need to add 0.74” of spacing to the sign.
   
   This can be done by adding 0.37” to each of the arrow spacing values (E).

   Alternative methods may be to add the full 0.74” to the top arrow spacing value, or to split it among both arrow spacings, with most of the additional spacing going to the top spacing. Both of these alternative methods serve the purpose of further separating the arrow from the street name.
5. Final vertical spacing summary:

- 1.25” border
- 7” space
- 10.67” arrow
- 6.37” space
- 15.09” arrow
- 6.37” space
- 1.25” border

sums to 48”

**Horizontal Size of Panel and Spacing**

Once the vertical spacing is determined the horizontal spacing is based on the longest object.

Use ½ to ¾ of the font size as horizontal spacing between inside of border and legend, remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The 182nd Ave line is the longest; horizontal spacing defaults to 10.67” (font size) on both sides. 1.25” (border) + 6” (space) + 46.9” (182nd) + 10.67” (space) + 29.5” (Ave) + 6” (space) + 1.25” (border) → 101.57”. The closest valid panel size is 102”, but we will not need to modify the 6” spacings because SignCAD will automatically increase them to 6.215” each when rounding up to 102”.

**Key Placement Issues**

- None
4.8 Example #6, Directional Sign

Purpose of Example:

- *This is a standardized format. Use SignCAD guide sign templates and customize rather than designing the panel from scratch.*

Given Conditions:

- Posted speed limit = 45 mph
- Number of basic lanes = 4 lanes
- Non-Freeway

Example Task:

- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.

Object and spacing values for this example:

A = Letter height

B = Vertical spacing from wording to wording, or from wording to inside border

C1 = Arrow height of a vertical (90 degree) arrow.

C2 = Object height of a horizontal (0 degree) arrow.

D = Horizontal spacing from inside border to legend

E1 = Vertical spacing from arrow to wording, or from arrow to inside border

E2 = Vertical spacing from arrow to wording, or from arrow to inside border

This example is intended to be a short exercise that cannot be fully described in the course. The solution is based on engineering judgment and many years of experience in sign design.
SignCAD Methods:
1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white
2. Install lines
3. Right mouse click on line
   - Select edit
   - Choose Indent: Radius
4. Install remaining components, NOTE: Use 5-13 arrow since only text on sign is 8”.
5. Zero out object spacing of lines and vertical spacing of arrows
6. Adjust NORTH, SOUTH, and overlay vertical object spacing
7. Adjust horizontal spacing so top and bottom legends are centered on panel (standardized format)

Final Sign Panel
4.8.1 Example #6, Directional Sign Calculations

Vertical Size of Panel and Line Spacing

Given:

- 5 rows of components: 2 arrows, 1 overlay, 2 horizontal lines
- Overlay (Exhibit 3-3) = 24 OL, based on roadway, speed and number of lanes
- Cardinal Direction font size (Exhibit 3-3) = 8, based on roadway, speed and number of lanes
- Arrow size (Exhibit 3-3 & Exhibit 3-8) = 5-13, Exhibit 3-3 would indicate use of a 6 or 15 head arrow, this example demonstrates a standardized sign that varies slightly from the established tables.
  Note that the only text on sign is 8”, therefore the arrow used is a 5 head.

1. Border = 1.5” (This is a standardized 78” x 78” panel layout, so border size is known)
   From top to bottom:
   - 1.5”-top border
   - 8” - font size
   - 1.5”-horizontal line
   - 24”-overlay
   - 1.5”-horizontal line
   - 8” - font size
   - 1.5”-bottom border
   - total of 46” of space needed for objects

2. Six spaces exist (5 objects) @ ½ to ¾ of font size (8”) = 4” - 6”, use 5”
   6 (5”) = 30” of space required

3. 46” + 30” = 76”
   76” is not divisible by 6, round to closest, use 78” ➔ valid panel side

4. No border thickness adjustment is necessary, as it is already known

5. Panel height (78”) – Object space requirements (46”) = Vertical spacing amount (32”)
   32”/ 6 spaces = 5.33”, use 5.3” per vertical space

6. To calculate the correct arrow spacing:
E = B - \frac{1}{2} (C - A) or the arrow vertical spacing is equal to the standard spacing (5.3”, from 5 above) minus \frac{1}{2} of the difference between the exact arrow height (13” for a 5-13 arrow) and the font size.

Arrow spacing (upper vertical) = 5.3 - \frac{1}{2}(13-8) = 2.8”. Arrow spacing (lower horizontal) = 5.3 - \frac{1}{2}(11.16-8) = 3.7”

7. Final vertical spacing summary:

<table>
<thead>
<tr>
<th>Calculated</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5” border</td>
<td></td>
</tr>
<tr>
<td>5.3” space</td>
<td></td>
</tr>
<tr>
<td>8” NORTH</td>
<td></td>
</tr>
<tr>
<td>5.3” space</td>
<td>5.4”</td>
</tr>
<tr>
<td>1.5” horizontal line</td>
<td></td>
</tr>
<tr>
<td>5.3” space</td>
<td></td>
</tr>
<tr>
<td>24” overlay</td>
<td></td>
</tr>
<tr>
<td>5.3” space</td>
<td></td>
</tr>
<tr>
<td>1.5” horizontal line</td>
<td></td>
</tr>
<tr>
<td>5.3” space</td>
<td></td>
</tr>
<tr>
<td>8” SOUTH</td>
<td></td>
</tr>
<tr>
<td>5.3” space</td>
<td>5.4”</td>
</tr>
<tr>
<td>1.5” border</td>
<td></td>
</tr>
</tbody>
</table>

Sums to 77.8”        Sums to 78”
An alternative spacing method decreases the vertical spacing between the horizontal bars and the overlay, putting the excess in the top and bottom areas which appear more crowded. This also has the effect of rounding the spacings to ½” increments.

<table>
<thead>
<tr>
<th>Calculated</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5” border</td>
<td></td>
</tr>
<tr>
<td>5.5” space</td>
<td></td>
</tr>
<tr>
<td>8” NORTH</td>
<td></td>
</tr>
<tr>
<td>5.5” space</td>
<td></td>
</tr>
<tr>
<td>1.5” horizontal line</td>
<td></td>
</tr>
<tr>
<td>5.0” space</td>
<td></td>
</tr>
<tr>
<td>24” overlay</td>
<td></td>
</tr>
<tr>
<td>5.0” space</td>
<td></td>
</tr>
<tr>
<td>1.5” horizontal line</td>
<td></td>
</tr>
<tr>
<td>5.5” space</td>
<td></td>
</tr>
<tr>
<td>8” SOUTH</td>
<td></td>
</tr>
<tr>
<td>5.5” space</td>
<td></td>
</tr>
<tr>
<td>1.5” border</td>
<td></td>
</tr>
</tbody>
</table>

sums to 78”

**Horizontal Size of Panel and Spacing**

Once the vertical spacing is determined the horizontal spacing is based on the longest horizontal object line. Ignore the indented horizontal lines, as they do not control panel length, but in fact automatically adjust to panel size.

Use approximately ¾ of the font size as horizontal spacing between inside of border and legend, remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

SOUTH = 40.6”, arrow = 13”, 8” space between, 2-spaces (~ ¾ font size), 3” in border ➔ 76.6”. The right and left side spacings are adjusted equally until 78” is reached.

**Key Placement Issues**

- Cardinal directions are centered vertically on arrows
- Overlay is centered
- Maintaining 78” x 78” panel size

NOTE: The vertical spacing of this sign may be computed by alternately zeroing out the NORTH and SOUTH and using the arrow heights. In this case use formulas $E1 = B - ½ (C1 - A)$ and $E2 = B - ½ (C2 - A)$
This page is intentionally left blank
4.9 Example #7, Three Line Distance Sign

Purpose of Example:
- Typical distance sign
- Alignment features and horizontal spacing

Given Conditions:
- Posted speed limit = 55 mph
- Number of basic lanes = 2 lanes
- Non-Freeway

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.

Object and spacing values for this example:
- \( A \) = Letter height
- \( B \) = Vertical spacing from text to text, or from text to inside border (½ \( A \) to ¾ \( A \))
- \( D_1 \) = Horizontal spacing from inside border to text (¾ \( A \) to \( A \); ideally \( D_1 = A - \) border)
- \( D_2 \) = Shortest same-line horizontal spacing from destination name to distance (min. approx. 1.5\( A \))
- \( D_3 \) = Shortest different-line horizontal spacing from destination name to distance (min. larger than \( A \))

![Diagram of a three line distance sign with measurements labeled: D1, D2, D3.](diagram)
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white

2. Text tool –
   - Create individual text entries for cities and distances
   - Font - E modified
   - Size – 8-6

3. Install city names and distances into panel, one by one

4. Right mouse click on each item
   - Align Left (cities) and Align Right (distances)

5. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B

6. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for D₁, D₂, and D₃

Typical Mistakes

- Cities and mileages not justified correctly
- D₂ and D₃ spaces do not meet minimum requirements
- D₁ space + border is larger than A
Final Sign Panel

Hastings 13
Red Wing 42
Winona 104

6.0" Radius, 1.3" Border, White on Green;
"Hastings" E Mod; "13" E Mod; "Red Wing" E Mod; "42" E Mod;
"Winona" E Mod; "104" E Mod;

Alternative Panel Design

Hastings 13
Red Wing 42
Winona 104
4.9.1 Example #7, Three Line Distance Sign Calculations

Vertical Size of Panel and Line Spacing

Given:

- 3 rows of components: all text
- Font size (Exhibit 3-3) = 8-6

1. Assume border (Exhibit 3-2) = 1.25”

   From top to bottom:
   
   1.25” - top border
   8” - text
   8” - text
   8” - text
   1.25” - bottom border

   total of 26.5” of space needed for components

2. Four spaces exist (B) @ ½ to ¾ of font size (8”) = 4”- 6”, use 5”

   4 (5”) = 20” of space required

3. 26.5” + 20” = 46.5”

   46.5” is not divisible by 6, round to closest, use 48” ➔ valid panel size

4. Spacing adjustments

   Rounded Panel Height (48”) - Step 3 totals (46.5”) = 1.5”

   Therefore, we need to add 1.5” of spacing into the sign.

   This can be done by adding 0.375” to each of the spacing values (B).

Alternatively, one may choose to keep the measurements between text and from text to the panel edges at half-inch increments. This can be done by increasing the vertical spacing around the middle object to 5.5” and the spacing from text to the inside borders to 5.25”. The vertical space between the border and text is not as critical as from text to text.
5. Final vertical spacing summary:
   - 1.25” border
   - 5.375” space
   - 8” text
   - 5.375” space
   - 8” text
   - 5.375” space
   - 8” text
   - 5.375” space
   - 1.25” border
   sums to 48”

**Horizontal Size of Panel and Spacing**

Begin with between 75% and 100% of the font size as horizontal spacing between inside of border and text, remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

Starting with 7” horizontal spacing to the borders, the panel width will likely be 102”. Set the left object spacing for the mileages to the minimum of 1.5A, or 12”. We need to check that the spacing between the longest city name (Red Wing) and the longest distance (104) is a minimum of 1.1A, or 8.8”. To check this, find the difference between the sums of the text string lengths, ignoring the space between the city name and distance: [20.7” (Red) + 8” (space) + 28” (Wing) + 15.9” (42)] – [43.4” (Winona) + 21” (104)] = 8.2”. This is less than the minimum requirement, so we need to increase it by 0.6” to hit the minimum.

Horizontal objects and spacings are now: 1.25” (border) + 7” (D₁ space) + 20.7” (Red) + 8” (space) + 28” (Wing) + 12.6” (D₂ space) + 15.9” (42) + 7” (D₁ space) + 1.25” (border) = 101.7”. This rounds the panel to 102”, automatically increasing the outer spacings to approximately 7.15” each.

Keep in mind that we want the D₁ space + border width to be approximately text height (8”). Currently, we have 7.15” + 1.25” = 8.4”. Therefore, we want to remove 0.4 inches from each side by decreasing each of our D₁ spacings from 7” to 6.6”, while reallocating this combined 0.8” to make D₂ = 13.4”.

**Key Placement Issues**

- Left justified cities
- Right justified mileages
- Minimum horizontal spaces between cities and distances, along same and different lines
4.10 Example #8, Three Line Distance Sign (Freeway)

Purpose of Example:
- Illustrates a typical freeway distance sign, incorporating overlays, fractions and whole numbers.

Given Conditions:
- Freeway distance sign

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.

Object and spacing values for this example:
A = Letter height
B<sub>1</sub> = Distance from top border to first line text/overlay (Exhibit 3-7)
B<sub>2</sub> = Distance from first line text/overlay to second line text/overlay (Exhibit 3-7)
B<sub>3</sub> = Distance from second line text/overlay to third line text/overlay (Exhibit 3-7)
B<sub>4</sub> = Distance from bottom border to third line text/overlay (Exhibit 3-7)
D<sub>1</sub> = Horizontal spacing from inside border to text (13” for all freeway distance signs; D<sub>1</sub> + border = 15”)
D<sub>2</sub> = Shortest same-line horizontal spacing from destination name to distance (ideally 24”, +/- 3”)
D<sub>3</sub> = Shortest different-line horizontal spacing from destination name to distance (minimum 18”)

[D<sub>3</sub> is not applicable in this example problem]

---

Example Diagram:

```
\begin{center}
\includegraphics[width=\textwidth]{example_diagram.png}
\end{center}
```
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white

2. Install sign components as individual entries (so that they can be aligned later), keep in mind the number preceding the fraction is 13.3” (Exhibit 3-7) and the fractions are 15”.

3. Right mouse click on each item
   - Select Object Align Left (destinations) or Right (distances)

4. Adjust vertical spacing

5. Adjust horizontal spacing
   - Move excess space from edges by adjusting $D_2$ within its acceptable range of values

Typical Mistakes

- Not following the freeway distance sign layout combinations listed in Exhibit 3-7
- The font size for the 1 in the Normandale distance is the wrong size
- Spacing between 1 and ½ for Normandale distance not chosen correctly (Exhibit 3-10)
- Not adjusting the $D_2$ spacing correctly, causing the $D_1 +$ border measurement to not equal 15”
Final Sign Panel

4.10.1 Example #8, Three Line Distance Sign (Freeway) Calculations

Vertical Size of Panel and Line Spacing

Given:

- 3 rows of components: 2 object/text, 1 text
- Overlay (∏hibit 3-4) = 24 OL, based on Freeway application
- Font size (∏hibit 3-4) = 13.3-10, based on Freeway application
- Follow Exhibit 3-7 in Section 3.5 for the vertical spacing requirements (this is a standard sign application), and Exhibit 3-10 in Section 3.9 for fraction horizontal spacing requirement.

According to Exhibit 3-7, Combination #6, the following object and spacing requirements exist:

From top to bottom:

- 2” - top border
- 7” - space
- 24” - overlay
- 6” - space
- 24” - overlay
- 7.67” - space
- 13.33” - text
- 10” - space
- 2” - bottom border

sums to 96”
**Horizontal Size of Panel and Spacing**

The left horizontal spaces for the left aligned components and the right horizontal spaces for the right aligned components will be set equally to 13”. Excess amounts on the right and left are added to the horizontal space between left and right legend columns. A minimum of 24” space is required between a destination and its corresponding mileage, while a minimum of 20” horizontal space is maintained between the longest destination line and the longest mileage.

\[
2” \text{ (border)} + 13” \text{ (D}_1 \text{ space)} + 30” \text{ (overlay)} + 13.33” \text{ (space)} + 124.48” \text{ (Normandale)} + 13.33” \text{ (space)} + 43.02” \text{ (Blvd)} + 24” \text{ (D}_2 \text{ space)} + 3.96” \text{ (1)} + 5” \text{ (space)} + 20.90” \text{ (½)} + 13” \text{ (D}_1 \text{ space)} + 2” \text{ (border)} = 308.02”.
\]

Round down to a 306” panel by subtracting 2.1” (greater than 2.02”) from the D\(_2\) spacing.

**Key Placement Issues**

- Mileage entered as separate objects so they can be justified
- Text is left justified and distances are right justified; overlays are middle justified on text
- Follow standard vertical spacing table and fraction font size table
4.11 Example #9, Vertical Split Panel Directional Sign

Purpose of Example:

- Illustrates use of tabular arrangement
- Illustrates vertical and horizontal spacing in this type of sign

Given Conditions:

- Signal mast arm mounted sign

Example Task:

- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.
Object and spacing values for this example:

- $A_1 =$ Letter height for cardinal direction, first letter
- $A_2 =$ Letter height for cardinal direction, rest of word
- $B =$ Vertical spacing from text to overlay, or from text to inside border ($\frac{1}{2} A$ to $\frac{3}{4} A$)
- $C_1 =$ Vertical arrow height
- $C_2 =$ Horizontal arrow height
- $D =$ Horizontal spacing from overlay to borders (overlay text height = approx. 40% of overlay height)
- $E =$ Vertical spacing from vertical arrow to overlay, or from vertical arrow to inside border (less than $B$)
Guide Sign Design Course Manual

SignCAD Methods:
1. Panel tool -
   - Sign type - guide
   - Panel color - green
   - Border color - white
2. Create tabular arrangement - 2 Columns, 3 Rows
3. Install all components in arrangement
4. Move whole arrangement into panel
5. Double click or right click/edit on dashed lines created by arrangement
   - Minimum Space - Change all values to 0
   - Lines - Check Show Vertical Lines
6. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B and E
7. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for D
   All components should be aligned to the center of each column. Adjust horizontal spacing, aiming to have the overlay centered within each column. Each column's width on the sign panel will be determined by the overlay size. This is done easiest by zeroing out the horizontal spacing for the cardinal directions, and applying even spacing on each side of the overlays.

Typical Mistakes
- Arrow size choice incorrect for layout
- Panel sections are different sizes (spacing based on cardinal text, not overlays)
Final Sign Panel

9.0” Radius, 1.5” Border, White on Green:
“SOUTH” E Mod; “WEST” E Mod; Arrow 5 - 13.0” 90°;
Arrow 14 - 18.0” 0°;

Alternative Panel Design
4.11.1 Example #9, Vertical Split Panel Directional Sign Calculations

Vertical Size of Panel and Line Spacing

Given:

- 3 rows of components: 1 text, 2 objects
- Overlay (Exhibit 3-3) = 24 OL, based on mounting
- Cardinal direction font height (Exhibit 3-3) = 7 first letter /6 other letters, based on mounting
- Arrows (Exhibit 3-3 & Exhibit 3-8) = 5-13 for vertical and 14-18 for horizontal, based on layout and mounting

1. Assume border = 1.5”

   From top to bottom:
   - 1.5” - top border
   - 7” - text (first letter controls)
   - 24” - overlay
   - 13” - arrow (tallest arrow in row)
   - 1.5” - bottom border

   total of 47” of space needed for objects

2. Four spaces exist:

   Two text spaces (B) @ ½ to ¾ of font size (7”), between 3.5” and 5.25”, use 4.5”
   - 2 (4.5”) = 9” of space required

   Two vertical arrow spaces (E), less than B, use 4”
   - 2 (4”) = 8” of space required

   9” + 8” = 17” of space required

3. 47” + 17” = 64”

   64” is not divisible by 6, round up to 66” → valid panel side

4. Spacing adjustments

   Rounded Panel Height (66”) - Step 3 totals (64”) = 2”

   Therefore, we need to add an additional 2” inches of spacing into the sign.

   We can do this by adding 0.75” to each of the B spacings, bringing B to the maximum ¾ of font size, 5.25”. Then split the remaining 0.5” among the two E spacing measurements.
5. Final vertical spacing summary:

   1.5” border
   5.25” space
   7” text
   5.25” space
   24” overlay
   4.25” space
   13” arrow
   4.25” space
   1.5” border

   sums to 66”

**Horizontal Size of Panel and Spacing**

Horizontal spacing for this sign is determined only by the overlays and border widths. There are four D spacings, two on each side of the two overlays. Each will be equally sized and equal to the text height used on the overlays, or approximately 40% of the overlay height.

To determine the spacing, add the widths of the objects along the middle row: 1.5” (border) + 10” (D space) + 24” (overlay) + 10” (D space) + 1.5” (border) + 10” (D space) + 24” (overlay) = 92.5”. Round this value down to 90” (a valid panel size) by removing 2.5” of space from the panel. Divide this equally into the four spacing values to result in 9.375” on each side of the overlays.

**Placement Issues**

- Use a 2 column and 3 row tabular arrangement to place objects in, and then place matrix on panel
- Equal spacing between overlays and borders
4.12 Example #10, Split Panel Two Color Destination Sign

Purpose of Example:

- Incorporating different colored panels into the same sign

Given Conditions:

- Posted speed limit = 40 mph
- Number of basic lanes = 2 lanes
- Non-Freeway

Example Task:

- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.
Object and spacing values for this example:

$A_1, A_2$ = Letter height for proper names and distance numeral

$A_3$ = Letter height for distance word

$B_1, B_2$ = Vertical spacing from text to text, or from text to inside border (⅛ A to ⅜ A)

$C_1, C_2$ = Horizontal arrow height

$D_1, D_2$ = Horizontal spacing arrow to text ($A_1, A_2$)

$D_3$ = Horizontal spacing from inside border to text (approximately ¾ A)

$D_4$ = Horizontal spacing between distance numeral and distance word (average of $A_2$ and $A_3$)

$E_1, E_2$ = Vertical spacing from arrow to text, or from arrow to inside border = less than B
**SignCAD Methods:**

1. **Panel tool** -
   - Sign type - guide
   - Panel color – green (college) and brown (history center), create one panel of each
   - Border color – white

2. Install components in the two panels

3. Double click on green panel
   - Border
   - Custom - Check Square Corner: Bottom Left, Bottom Right

4. Double click on brown panel
   - Border
   - Custom - Uncheck Display Border: Top

5. Place the panels next to each other, brown bottom to green top (this enables the multipanel functions)

6. Open each panel edit
   - General
     - Edit multipanel – Check Dimension as unit
   - Size
     - Enlarge to Fit when in Multipanel – Check Column width

7. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for $B_1$, $B_2$, $E_1$, and $E_2$

8. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for $D_1$, $D_2$, and $D_3$

**Typical Mistakes**

- Not squaring the bottom corners of the top panel
- Not hiding the top border for the bottom panel
- The distance numeral and text are entered as the same text height, and the space between them ($D_4$) is incorrect
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EXAMPLE #10: 6.0" Radius, 1.3" Border, White on Green;
“Bemidji State” E Mod; Arrow 3 - 10.0" 180°; “University” E Mod;
6.0" Radius, 1.3" Border, White on Brown;
“Forest” E Mod; “History Center” E Mod; Arrow 3 - 10.0" 180°; “3 MILES” E Mod;
Example #10, Split Panel Two Color Destination Sign Calculations

Vertical Size of Panel and Line Spacing

Given:
- 5 rows of components: 3 text, 2 object/text
- Font size (Exhibit 3-3) = 6-4.5, based on roadway, speed and number of lanes
- Arrow (Exhibit 3-3 & Exhibit 3-8) = 3-10 for horizontal arrows

Each panel needs to be designed separately:

**Top (Green) Panel**

1. Assume border = 1.25”
   - From top to bottom:
     - 1.25” - border
     - 6” - text
     - 8.35” - arrow
     - 1.25” - border
   - total of 16.85” for components

2. Three spaces exist:
   - One text space (B₁) @ ½ to ¾ of font size (6”) = 3”- 4.5”, use 4.5”
     - 1 (4.5”) = 4.5” of space required
   - Two arrow spaces (E₁) = less than B
     - Use E = 4”
     - 2 (4”) = 8” of space required
     - 4.5” + 8” = 12.5” of space required
   - 16.85” + 12.5” = 29.35”
   - 29.35” is not divisible by 6, round to closest, use 30” → valid panel size

**Bottom (Brown) Panel**

1. Assume no top border
   - From top to bottom:
     - 6” - text
     - 8.35” - arrow
     - 1.25” - border
   - total of 21.6” for components

2. Three spaces exist:
   - Two text spaces (B₂) @ ½ to ¾ of font size (6”) = 3”- 4.5”, use 4.5”
     - 2 (4.5”) = 9” of space required
   - Two arrow spaces (E₂) = less than B
     - Use E = 4”
     - 2 (4”) = 8” of space required
     - 9” + 8” = 17” of space required
   - 21.6” + 17” = 38.6”
   - 38.6” is not divisible by 6, round to closest, use 36” → valid panel size
4. Spacing adjustments

Rounded Panel Height (30") - Step 3 totals
(29.35") = 0.65”

Therefore, add 0.65” inches of spacing.
Add 0.5” to B₁ and 0.075” to each E₁ measurement.

Rounded Panel Height (36") - Step 3 totals
(38.6") = -2.6”

Therefore, subtract 2.6” inches of spacing from the sign. Accomplish this by subtracting 0.5” from each B₂ measurement, and by removing 0.8” from each of the E₂ measurements.

4. Spacing adjustments

5. Final vertical spacing summary:

<table>
<thead>
<tr>
<th>Top (Green) Panel</th>
<th>Bottom (Brown) Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25” border</td>
<td>No border</td>
</tr>
<tr>
<td>5” space</td>
<td>4” space</td>
</tr>
<tr>
<td>6” text</td>
<td>6” text</td>
</tr>
<tr>
<td>4.075” space</td>
<td>4” space</td>
</tr>
<tr>
<td>8.35” horizontal arrow</td>
<td>6” text</td>
</tr>
<tr>
<td>4.075” space</td>
<td>3.2” space</td>
</tr>
<tr>
<td>1.25” border</td>
<td>8.35” horizontal arrow</td>
</tr>
<tr>
<td></td>
<td>3.2” space</td>
</tr>
<tr>
<td></td>
<td>1.25” border</td>
</tr>
</tbody>
</table>

Subtotal of 30”                          Subtotal of 36”

Attach the sign panels to reach a combined panel height of 66”

**Horizontal Size of Panel and Spacing**

Use ½ to ¾ font size as horizontal spacing between inside of border and text, remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The History Center line is the longest component. 1.25” (border) + 4” (D₁ space) + 33.9” (History) + 6” (space) + 30.9” (Center) + 4” (D₂ space) + 1.25” (border) ➔ 81.3”, use 84”. This will automatically increase the outer spaces by 1.35” each.

Horizontal spacing from the arrows to the text should be text size (6”). Spacing between distance numeral and distance word is the average of the two text sizes.
Key Placement Issues

- Create two panels and design their vertical spacing separately instead of together as one sign.
- Make sure that the green bottom corners are squared, and the top of the brown panel has no border displayed.
- Join the two signs and under Edit Multipanel, check Dimension as Unit.
4.13 Example #11, Junction with Fraction Sign

Purpose of Example:

- This is a standardized format. Use SignCAD guide sign templates and customize rather than designing the panel from scratch.

Given Conditions:

- Posted speed limit = 55 mph
- Number of basic lanes = 2 lanes
- Non-Freeway

Example Task:

- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.

Object and spacing values for this example:

A = Letter height
B = Vertical spacing from text to overlay, or text to inside border (½ A to ¾ A)
C = Distance fraction height (1.5 A)
D₁ = Horizontal spacing from inside border to legend (½ A to ¾ A)
D₂ = Horizontal spacing from distance fraction to distance word (average of A and C)
E = Vertical spacing from fraction to overlay, or from fraction to inside border (less than B)
SignCAD Methods:

1. Panel tool -
   - Sign type - guide
   - Panel color – green
   - Border color – white

2. Install components (JCT text and overlay)

3. Install ¼ MILE text
   - Select text tool
   - Adjust height – Fraction is 1.5 times larger than the numerals within it and also 1.5 times larger than MILE.
   - Typing a space, then 1/4, and another space will create the fraction. Delete initial spaces after the fraction is created
   - Adjust height back to 8” before typing MILE. Use the text tool to change the space after the fraction to the average of the two font sizes.

Typical Mistakes

- Incorrect fraction design
Final Sign Panel

Example #11:
9.0" Radius, 1.5" Border, White on Green;
"JCT" E Mod; "1/4 MILE" E Mod;

Alternative Panel Design
4.13.1 Example #11, Junction with Fraction Sign Calculations

Vertical Size of Panel and Line Spacing

Given:

- 3 rows of objects (1 text, 1 overlay, 1 object/text)
- Font size (Exhibit 3-3) = 8, based on roadway, speed and number of lanes
- Overlay (Exhibit 3-3) = 24, based on roadway, speed and number of lanes

1. Assume border = 1.5”
   From top to bottom:
   1.5” - top border
   8” - text
   24” - overlay
   12” - distance fraction
   1.5” - bottom border
   total of 47” of space needed for components

2. Four spaces exist:
   Two text spaces (B) @ ½ to ¾ of font size (8”), between 4” and 6”, use 5”
   2 (5”) = 10” of space required
   Two fraction spaces (E), less than B, use 4”
   2 (4”) = 8” of space required
   10” + 8” = 18” of space required

3. 47” + 18” = 65”
   65” is not divisible by 6, round to closest, use 66” ➔ valid panel size

4. Spacing adjustments
   Rounded Panel Height (66”) - Step 3 totals (65”) = 1”
   Therefore, we need to add an additional 1” of spacing into the sign.
   We can do this by adding 0.5” to each of the E spacings.

   Alternatively, one may choose to add the whole 1” to the bottom E space, further separating the line from the bottom border.
5. Final vertical spacing summary:

- 1.5” border
- 5” space
- 8” text
- 5” space
- 24” overlay
- 4.5” space
- 12” fraction
- 4.5” space
- 1.5” border

sums to 66”

**Horizontal Size of Panel and Spacing**

Once the vertical spacing is determined the horizontal spacing is based on the longest object.

Use between ½ and ¾ of the font size as horizontal spacing between inside of border and text, remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The ¼ MILE is the longest object and determines the width of the sign. 1.5” (border) + 7” (D₁ space) + 15.8” (¼) + 10” (D₂ space) + 28” (MILE) + 7” (D₁ space) + 1.5” (border) \(\Rightarrow 70.8”\), round to 72”. SignCAD automatically will round up to 72” by increasing each D₁ space to 7.6”.

**Key Placement Issues**

- Spaces used on each side of 1/4 to create correct fraction design
- Fraction is coded with a font size of 12”
4.14 Example #12, Freeway Overhead Sign

Purpose of Example:
- Freeway example
- Diagonal arrow

Given Conditions:
- Overhead mounted
- Freeway 60 mph
- 4 lanes
- Ramp

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.
Object and spacing values for this example:

- \( A_1 \) = City name letter height
- \( A_2 \) = Cardinal direction letter height, first letter
- \( A_3 \) = Cardinal direction letter height, rest of word
- \( B \) = Vertical spacing from text to border, text to overlay, or from overlay to inside border (\( \frac{1}{2} A_1 \) to \( \frac{3}{4} A_1 \))
- \( C \) = Horizontal width of diagonal arrow
- \( D_1 \) = Horizontal spacing from inside border to text, or from text to diagonal arrow (approximately \( \frac{3}{4} A_1 \))
- \( D_2 \) = Horizontal spacing from overlay to cardinal direction (\( \frac{1}{2} A_1 \) to \( \frac{3}{4} A_1 \))
- \( D_3 \) = Horizontal spacing from inside border to diagonal arrow (approximately \( \frac{3}{4} A_1 \))
SignCAD Methods:

1. Panel tool –
   - Sign type – guide
   - Panel color – green
   - Border color - white

2. Text tool –
   - Font – E modified
   - Size – 15 E modified for EAST first letter, 12 other letters; 16-12 E modified for Stillwater
   - Proper name – Upper-lower case

3. Arrow tool –
   - Angle – 60 degrees
   - Arrowhead – 17 (17-36 arrow)

4. Install components into panel one at a time with the arrow last

5. Right justify arrow

6. Top align EAST – Right/click, object align top

7. Baseline align EAST – Right/click, text align baseline

8. Adjust vertical spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for B

9. Adjust horizontal spacing
   - Right mouse click on object to be spaced - select object spacing (left click)
   - Enter calculated values for \( D_1 \), \( D_2 \), and \( D_3 \)

Typical Mistakes

- Arrow angle incorrect
- Cardinal direction not top aligned on overlay
- Cardinal direction not text-aligned baseline
Final Sign Panel

![Final Sign Panel Diagram]

12.0" Radius, 2.0" Border, White on Green;
“EAST” E Mod; “Stillwater” E Mod; Arrow 17 - 36.0" 60°;

Alternative Panel Design

![Alternative Panel Design Diagram]
4.14.1 Example #12, Freeway Overhead Sign Calculations

Vertical Size of Panel and Line Spacing

Given:

- 2 rows of components: 1 object/text , 1 text
- Overlay (Exhibit 3-4) = 36, based on freeway and overhead position
- Font size (Exhibit 3-4) = 16-12, based on freeway and overhead position
- Cardinal Direction Font Size (Exhibit 3-4) = 15 first letter / 12 other letters
- Arrow (Exhibit 3-4) = 17-36, based on roadway and sign type

1. Assume border = 2”
   From top to bottom:
   - 2” - top border
   - 36” - overlay
   - 16” - legend
   - 2” - bottom border
   total of 56” of space needed for objects

2. Three spaces exist @ ½ to ¾ of font size (16”) = 8” to 12”, use 11”
   3 (11) = 33” of space required

3. 56” + 33” = 89”
   89” is not divisible by 6, round to closest, use 90” ➔ valid panel size

4. Spacing adjustments
   Rounded Panel Height (90”) - Step 3 totals (89”) = 1”
   Therefore, we need to add 1” of spacing into the sign.
   This should be done by adding 0.33” to each of the spacing values (B).

   Alternatively, one may choose to add 0.5” to each top and bottom B spacing values.
5. Final vertical spacing summary:

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” border</td>
<td></td>
</tr>
<tr>
<td>11.33” space</td>
<td></td>
</tr>
<tr>
<td>36” overlay</td>
<td></td>
</tr>
<tr>
<td>11.33” space</td>
<td></td>
</tr>
<tr>
<td>16” text</td>
<td></td>
</tr>
<tr>
<td>11.33” space</td>
<td></td>
</tr>
<tr>
<td>2” border</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>90”</td>
</tr>
</tbody>
</table>

**Horizontal Size of Panel and Spacing**

Once the vertical spacing is determined the horizontal spacing is based on the longest object. The arrow is spaced 12” from inside the right border. Use approximately between \( \frac{1}{2} \) and \( \frac{3}{4} \) of the font size (16”) as horizontal spacing on either side of the city name, remember that panels are sized in 6” increments.

Stillwater and the arrow are the longest objects across the panel. 2” (border) + 10” (D₁ space) + 124.4” (Stillwater) + 10” (D₁ space) + 22.9” (arrow) + 12” (D₂ space) + 2” (border) = 183.3” => 186” used. Add an extra 1.35” into each D₁ space to get 11.35”.

**Key Placement Issues**

- Sequence of installing components: Arrow installed last
- Fixing arrow position to right side
- EAST is top and baseline aligned
4.15 Example #13, Freeway OH Exit Direction Sign w/ Exit Panel

Purpose of Example:
- Freeway design
- Exit only, split panel

Given Conditions:
- Overhead mounted
- Freeway

Example Task:
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.
Object and spacing values for this example:

A₁ = Street name letter height
A₂ = EXIT ONLY letter height
B₁ = Vertical spacing from overlay to text, or from overlay to inside border (½ A₁ to ¾ A₁)
B₂ = Vertical spacing from text to text, or from text to inside border (½ A₁ to ¾ A₁)
C = Arrow height
D₁ = Horizontal spacing from inside border to text (approximately ¾ A₁)
D₂ = Horizontal spacing from arrow to text (A₂)
D₃ = Horizontal spacing from inside border to text
E = Vertical spacing from arrow to inside border
SignCAD Methods:
1. Panel tool -
   - Sign type - guide
   - Panel color – green (guide section) and yellow (exit only section), create one panel of each
   - Border color – white (for the green panel) and black (for the yellow panel)
2. Install components in the two panels
3. Double click on green panel
   - Border
     - Custom - Check Square Corner: Bottom Left, Bottom Right
     - Custom – Uncheck Display Border: Bottom
4. Double click on yellow panel
   - Border
     - Custom - Uncheck Display Border: Top
5. Place the panels next to each other, yellow bottom to green top (this enables the multipanel functions)
6. Open each panel edit
   - General
     - Edit multipanel – Check Dimension as unit
     - Size
       - Enlarge to Fit when in Multipanel – Check Column width
   9. Adjust vertical spacing
      - Right mouse click on object to be spaced - select object spacing (left click)
      - Enter calculated values for \( B_1 \), \( B_2 \), and \( E \)
10. Adjust horizontal spacing
    - Right mouse click on object to be spaced - select object spacing (left click)
    - Enter calculated values for \( D_1 \) and \( D_2 \); \( D_3 \) should be automatic with centering of line

Typical Mistakes
- Panel calculations done as one panel instead of two separate panels
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Final Sign Panel

12.00" Radius, 2.00" Border, White on Green;
“Mesaba Ave” E Mod; “Superior St” E Mod;
12.00" Radius, 2.00" Border, Black on Yellow;
“EXIT” E Mod: Arrow 8 - 25.00" 60°; “ONLY” E Mod:
4.15.1 Example #13, Freeway Exit OH Direction Sign w/ Exit Panel Calculations

Given:
- 4 rows of components: 1 object, 2 text, 1 object/text
- Font size (Exhibit 3-4) = 16-12, based on roadway, speed and number of lanes
- Arrow (Exhibit 3-4) = 3-10 for horizontal arrows

Each panel needs to be designed separately:

<table>
<thead>
<tr>
<th>Top (Green) Panel</th>
<th>Bottom (Yellow) Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assume no bottom border</td>
<td>1. Assume no top border</td>
</tr>
<tr>
<td>From top to bottom:</td>
<td>From top to bottom:</td>
</tr>
<tr>
<td>2” - border</td>
<td>23.48” - diagonal arrow</td>
</tr>
<tr>
<td>36” - overlay</td>
<td>2” - bottom border</td>
</tr>
<tr>
<td>16” - text</td>
<td></td>
</tr>
<tr>
<td>16” - text</td>
<td></td>
</tr>
<tr>
<td>total of 70” for components</td>
<td>total of 25.48” for components</td>
</tr>
</tbody>
</table>

2. Four spaces exist:
   - Two overlay spaces ($B_1$) @ ½ to ¾ of font size (16”) = 8”- 12”, use 10”
     - $2 (10”) = 20” of space required$
   - Two text spaces ($B_2$) = @ ½ to ¾ of font size (16”) = 8”- 12”, use 10”
     - $2 (10”) = 20” of space required$
   - $20” + 20” = 40” of space required$

3. $70” + 40” = 110”$
   - 110” is not divisible by 6, round to closest, use 108” ➔ valid panel size

2. Two spaces exist:
   - Two arrow spaces ($E_2$) = less than B
   - We don’t have a B space for this part of the sign, but assume ½ to ¾ of A₂ (12”) = 6” - 9”, use 7”
   - Use $E = 6”$

3. $25.48” + 12” = 37.48”$
   - 37.48” is not divisible by 6, round to closest, use 36” ➔ valid panel size
4. Spacing adjustments

Rounded Panel Height (108") - Step 3 totals (110") = -2.0"

Therefore, subtract 2" of spacing from the sign by removing 1" from each $B_1$ measurement. (Space around text is more important than space around overlays for legibility reasons, so $B_2$ should remain the same.)

Rounded Panel Height (36") - Step 3 totals (37.4") = -1.48"

Therefore, subtract 1.48" inches of spacing from the sign. Accomplish this by subtracting 0.74" from each $E$ measurement. (SignCAD’s default object spacing of 4” around the arrow will actually achieve the correct panel height in this case.)

5. Final vertical spacing summary:

6. Final vertical spacing summary:

<table>
<thead>
<tr>
<th>Top (Green) Panel</th>
<th>Bottom (Yellow) Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” border</td>
<td>No border</td>
</tr>
<tr>
<td>9” space</td>
<td>5.26” space</td>
</tr>
<tr>
<td>36” overlay</td>
<td>23.48” arrow</td>
</tr>
<tr>
<td>9” space</td>
<td>5.26” space</td>
</tr>
<tr>
<td>16” text</td>
<td>2” border</td>
</tr>
<tr>
<td>10” space</td>
<td></td>
</tr>
<tr>
<td>16” text</td>
<td></td>
</tr>
<tr>
<td>10” space</td>
<td></td>
</tr>
<tr>
<td>No border</td>
<td></td>
</tr>
</tbody>
</table>

Subtotal of 108”  Subtotal of 36”

Attach the sign panels to reach a combined panel height of 144”

**Horizontal Size of Panel and Spacing**
**Horizontal Size of Panel and Spacing**

Use approximately between ⅓ and ⅔ font size as horizontal spacing between inside of border and text, remember that panels are sized in 6” increments. Additionally, be sure to check panel size against U-Post Spacing charts to verify desirable installation on a new or existing structure.

The Mesaba Ave line is the longest component; horizontal spacing on either side of this should be used to determine panel width. 2” (border) + 10” (D₁ space) + 88.4” (Mesaba) + 16” (space) + 44.2” (Ave) + 10” (D₁ space) + 2” (border) ⇒ 172.6”, round to 174”. The panel will automatically round up to this size and increase the outer spaces by 0.7” each.

The width of the EXIT ONLY panel will match that of the top panel once attached. Set the D₂ spacing values equal to the A₂ text height, (12”). By default, the text and arrow will be centered on the panel, allowing the horizontal spacing from the text to inside border (D₃) to be automatically set.

**Key Placement Issues**

Create two panels and design their vertical spacing separately instead of together as one sign.
5. APPENDIX

5.1 Font Spacing Charts

LETTER & NUMERAL WIDTHS and SPACE between letters and numerals

To determine the proper SPACES between letters or numerals obtain the code number from table 1 or 2 and enter table 8 for that code number to the desired letter or numeral height.

### TABLE 1
LETTER TO LETTER CODE NUMBER

<table>
<thead>
<tr>
<th>Preceding Letter</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>O</th>
<th>X</th>
<th>AJT</th>
<th>V</th>
<th>W</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### TABLE 2
NUMERAL TO NUMERAL CODE NUMBER

<table>
<thead>
<tr>
<th>Preceding Letter</th>
<th>15</th>
<th>236</th>
<th>890</th>
<th>47</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
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<tr>
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<td>2</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 3
WIDTH OF STROKE

<table>
<thead>
<tr>
<th>Letter or Numerical Height</th>
<th>Stroke Width in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1.00</td>
</tr>
<tr>
<td>10.87</td>
<td>2.13</td>
</tr>
<tr>
<td>13.33</td>
<td>2.87</td>
</tr>
<tr>
<td>16</td>
<td>3.20</td>
</tr>
<tr>
<td>20</td>
<td>4.00</td>
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</tbody>
</table>

### TABLE 4
WIDTH OF LETTER in Inches

<table>
<thead>
<tr>
<th>Letter Height</th>
<th>8</th>
<th>10.67</th>
<th>13.33</th>
<th>16</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.00</td>
<td>10.67</td>
<td>13.33</td>
<td>16.00</td>
<td>20.00</td>
</tr>
<tr>
<td>B</td>
<td>8.38</td>
<td>8.60</td>
<td>10.62</td>
<td>12.75</td>
<td>15.94</td>
</tr>
<tr>
<td>C</td>
<td>8.38</td>
<td>8.50</td>
<td>10.62</td>
<td>12.75</td>
<td>15.94</td>
</tr>
<tr>
<td>D</td>
<td>8.38</td>
<td>8.50</td>
<td>10.62</td>
<td>12.75</td>
<td>15.94</td>
</tr>
<tr>
<td>E</td>
<td>8.54</td>
<td>7.82</td>
<td>9.80</td>
<td>11.88</td>
<td>14.85</td>
</tr>
<tr>
<td>F</td>
<td>8.54</td>
<td>7.82</td>
<td>9.80</td>
<td>11.88</td>
<td>14.85</td>
</tr>
<tr>
<td>G</td>
<td>8.38</td>
<td>8.50</td>
<td>10.62</td>
<td>12.75</td>
<td>15.94</td>
</tr>
<tr>
<td>H</td>
<td>8.38</td>
<td>8.50</td>
<td>10.62</td>
<td>12.75</td>
<td>15.94</td>
</tr>
<tr>
<td>I</td>
<td>1.60</td>
<td>2.13</td>
<td>2.87</td>
<td>3.20</td>
<td>4.00</td>
</tr>
<tr>
<td>J</td>
<td>0.60</td>
<td>0.80</td>
<td>1.00</td>
<td>1.23</td>
<td>1.62</td>
</tr>
<tr>
<td>K</td>
<td>5.50</td>
<td>8.67</td>
<td>10.63</td>
<td>15.00</td>
<td>15.25</td>
</tr>
<tr>
<td>L</td>
<td>5.50</td>
<td>7.82</td>
<td>9.80</td>
<td>11.88</td>
<td>14.85</td>
</tr>
<tr>
<td>M</td>
<td>7.88</td>
<td>9.84</td>
<td>12.29</td>
<td>14.75</td>
<td>18.44</td>
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<td>N</td>
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<td>8.50</td>
<td>10.62</td>
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<td>15.94</td>
</tr>
<tr>
<td>O</td>
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WIDTH OF NUMERAL in Inches

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SPACE: In inches measured horizontally from the extreme right edge of the preceding letter (or numeral) to the extreme left edge of the following letter (or numeral).

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## LETTER WIDTHS FOR LOWER CASE E MODIFIED SERIES

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**Series E Modified Lower Case Spacing**
8-6, 10.67-8, 13.33-10

**Following Letter**

**Appendix**
Each spacing is the distance measured from the extreme right edge of the preceding letter to the extreme left edge of the following letter.

**SERIES E MODIFIED LOWER CASE SPACING**

16-12, 20-15

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</table>
5.2 Glossary of Sign Terms

Cone of Vision - A fan-shaped field of view extending in front of a vehicle operator.

Conventional Road (Single Lane) - A two-lane, two-way section of highway.

Conventional Road (Multilane) - An undivided or divided roadway with more than one lane in each direction of travel and having a posted speed less than 55 mph.

Demountable Legend - Non-adhesive backed character affixed to the sign face material by fasteners, usually pop-rivets.

Expressway - A high speed, divided, multi-lane highway which is generally an arterial road with a posted speed of 55 mph and greater. Most intersections are at grade, although grade separated interchanges may exist.

Highway - a general term for denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Legend - The message on the face of a sign panel. It includes all alpha-numeric text, arrows, route markers, and special symbols. Legends are made of retroreflective materials except where opaque black paints are prescribed for text on certain signs.

Legend - Direct Applied - Adhesive-backed pressure sensitive characters.

Logo - A single or multicolored symbolic design unique to a product, a business or a service facility; a national, regional or local commercially recognized pictorial reference to a specific product, service or business used as a means of identification of a company's products, services or business.

Overlay - A thin, flat aluminum sheet with sign face material applied, which is bolted or pop-rivetted to a sign panel.

Primary Guide Signs (Freeways only) - These signs consist of advance junction signing, exit directional signs, exit gore signs and destination signs. On interstate freeways, exit numbers are included. Distance signs are also primary guide signs.

Sheeting - Encapsulated Lens Retroreflective - A material utilizing retroreflective spherical lens elements adhered to a synthetic resin and covered by a smooth plastic surface (commonly referred to as "High Intensity").

Sheeting - Enclosed Lens Retroreflective - A material utilizing retroreflective spherical lens elements embedded within a smooth plastic film (commonly referred to as "Engineering Grade"). MnDOT no longer uses this material.

Sheeting - Pressure Sensitive - Reflective or non-reflective sheeting which has an adhesive backing that permits application of the sheeting to the substrate by pressure, and requires no heat, solvent, or other preparation for adhesion to smooth, clean surfaces.

Sheeting - Wide Angle Prismatic Retroreflective for Visual Impact Performance (VIP) - A material utilizing prismatic lenses formed in a transparent, synthetic resin, sealed and backed with a pressure sensitive adhesive and blue poly liner. This sheeting material has optimum performance over a broad range of observation angles.

Sign Base Material or Sign Blank (Substrate) - Sheet aluminum joined by backup splice plates, or extruded sections bolted together to form a flat surface.

Sign Face Material - Reflectorized or non-reflectorized sheeting material applied to the sign substrate.
Supplemental Guide Signs - Guide signs which further orient the driver to geographical identification and secondary destinations. Destinations include cities, motorist services, and state parks.
5.3 Index

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6. HANDOUTS