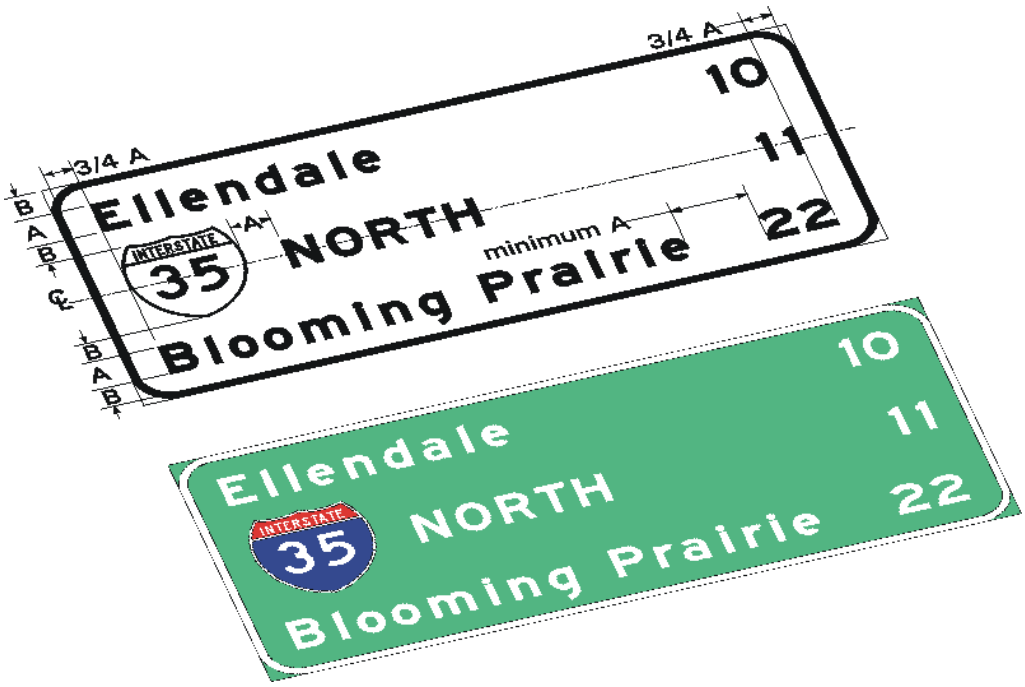
Traffic Guide Sign Design Manual



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MINNESOTA DEPARTMENT OF TRANSPORTATION

Moving Minnesota

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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.

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.

1.2 Course Schedule

Day 1

Time	*Topic*	*Chapter*	*Page #*	*Comments*
7:30	Registration			
8:00	Introduction	1	1-1	
8:15	Basic Information	2	2-1	
	Sign Components	3.1	3-1	Panel Size, Radii, Borders, Margins
9:45	Break			
10:00	Sign Components continued	3.2	3-3	Colors
		3.3	3-3	Font Styles and Font Sizes
		3.4	3-6	Horizontal Spacing
		3.5	3-7	Vertical Spacing for Freeway Distance Signs
		3.6	3-8	Horizontal and Vertical Lines
		3.7	3-9	Route Markers and Sizes
		3.8	3-11	Arrows
		3.9	3-14	Fractions
		3.10	3-15	Abbreviations
		3.11	3-16	Legend/Layout Justifications

		3.12 3.13	3-18 3-20	Typical Freeway Signs U-Post and Post Spacing
12:00	Lunch			
1:00	SignCAD Demonstration			
2:15	Break			
2:30	Example Problem # 2	4.5	4-9	Supplemental Guide Sign (Freeway)
3:15	Example Problem # 3	4.6	4-14	Split Panel Destination Sign
4:00	Adjourn*			

* Note: Instructors will be available after training to answer individual questions.

Day 2

Time	*Topic*	*Chapter*	*Page #*	*Comments*
8:00	Introduction & Recap			
8:15	Example Problem # 4	4.7	4-19	Directional Sign
9:00	Example Problem # 6	4.9	4-28	Three Line Distance Sign (Freeway)
9:45	Break			
10:00	Example Problem # 7	4.10	4-31	Vertical Split Panel Directional Sign
11:30	Example Problem # 8	4.11	4-36	Split Panel Two Color Sign
12:00	Lunch			
12:45	Example Problem # 10	4.13	4-47	Freeway Overhead Sign
2:15	Break			
2:30	Example Problem # 11	4.14	4-52	Freeway Overhead Exit Direction Sign
3:45	Course Wrap-up and Questions			
4:00	Adjourn*			

* Note: Instructors will be available after training to answer individual questions.

1.3 Instructor Information

Jeff Gerken, PE, PTOE will serve as the instructor for the Traffic Guide Sign Design Course. Jeff is a transportation engineer and the manager of Albeck Gerken Traffic Consulting. He has experience on a wide variety of projects including signing plans, traffic signal timing, traffic operations analysis, and corridor studies. Jeff teaches four other traffic engineering courses for the Minnesota Department of Transportation (Mn/DOT).

John Benson will serve as a Mn/DOT technical resource for the course development and course instruction. John has been working in the field of signing for 28 years, primarily on trunk highway (non-contract) and specialty signing projects. John previously served as the liaison with the state sign shop and continues to coordinate with the SignCAD software developers. John has created many standard signs and is in charge of updating the Standard Signs Manual and the Standard Signs Summary.

Rick Sunstrom will serve as a Mn/DOT technical resource for the course development and course instruction. Rick has been working in the field of traffic engineering at Mn/DOT for 36 years. His focus of experience is primarily in the area of freeway and contract signing projects.

1.4 Acknowledgments

The development of this Traffic Guide Sign Design Manual has been a result of the combined efforts of the Mn/DOT Office of Traffic, Security and Operations, and Albeck Gerken Traffic Consulting. The contributions by John Benson, Rick Sunstrom, and Mike Weiss are gratefully acknowledged.

1.5 Disclaimer

This Manual is disseminated under the sponsorship of Mn/DOT, Office of Traffic, Security and Operations. Mn/DOT and Albeck Gerken Traffic Consulting assume no liability for its contents or use thereof.

Mn/DOT does not endorse products or manufacturers. Trademarks of manufacturers' names may appear herein only because they are considered essential to the object 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. The contents do not necessarily reflect the official policy of the Minnesota Department of Transportation.

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.

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.

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, Mn/DOT.

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
      - type of informational need
      - urgency associated in obtaining information
      - 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 Mn/DOT 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 highway 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 hazardous conditions, actual or potential, on or adjacent to a highway or street, 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, Mn/DOT 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 highways. They are supported on I beam 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 are typically installed by Mn/DOT sign crews.

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:

1) sign support (no walkway or sign lighting)

2) truss (may or may not include walkway and sign lighting) and

3) bridge mounted (may or may not include walkway and sign lighting).

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 Mn/DOT Conventional Highway 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 highways and expressways typically are designed in the same manner.

Conventional Highway: a street or highway other than a low-volume road, a freeway, or an expressway.

Expressway: a divided highway with partial control of access.

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.

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.

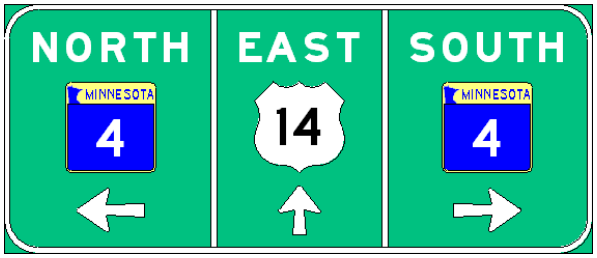
Junction signs indicate the intersection of two or more routes.

Conventional

Conventional

Expressway at grade

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 Mn/DOT 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 Mn/DOT Freeway and Expressway Guide Sign Types

Distance (Sign Type A or OH)

Advance Guide

Freeway

Expressway Interchange

Exit Directional Guide

Sign Type A

Sign Type OH

Exit Panel (Sign Type EA or EO)

Freeway only

Freeway only

Supplemental Guide (Sign Type A or OH)

Freeway

Freeway

Expressway Interchange

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

Guide signs are developed with numerous components, many of which dynamically change based on their inter-relation.

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

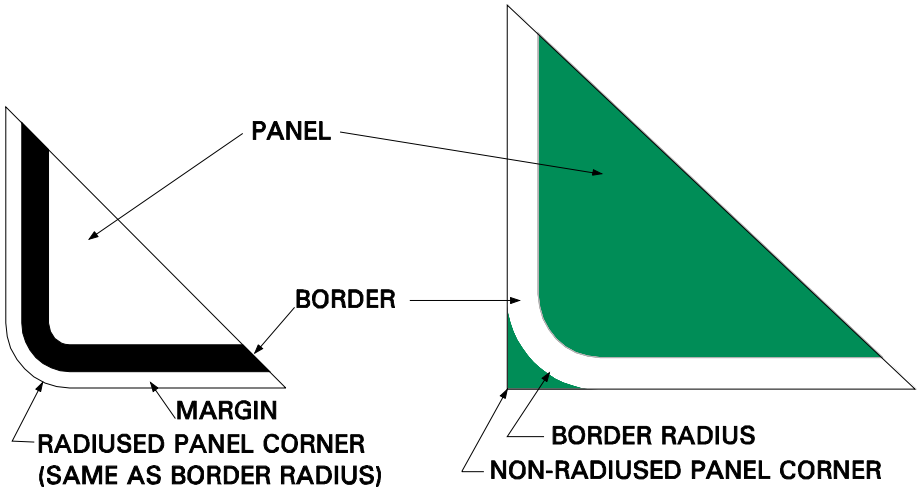
Generally, guide signs do not have radiused corners. The border will be radiused, but the panel will not be. If there is a concern that a pedestrian may be injured by a sharp sign corner then the panel should be radiused.

3.1.3 Borders

Unless specifically stated otherwise, each sign illustrated herein shall have a border of the same color as the legend, at or just inside the panel edge. The corners of the sign border shall be rounded, except for stop signs. A dark border on a light background should be set in from the edge (a margin), 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.



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.

Table 1: Standard Corner Radii, Margin, and Border for Non-Guide Signs

Length of Shortest Side	Radius	Margin	Border
Under 24”	1.5”	.38”	.38”
24”	1.5”	.38”	.63”
30”	1.88”	.5”	.75”
36”	2.25”	.63”	.88”
42”	2.25”	.63”	.88”
48” – 60”	3”	.75”	1.25”

Table 2: Guide Sign Border and Radii*

Length of Shortest Side	Border Width	Border Radius
≤ 36”	1”	3”
42” – 60”	1.25”	6”
66” – 84”	1.5”	9”
≥ 90”	2”	12”

*Exceptions for Mn/DOT Signs:

Notes:

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

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 typical 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 SCHOOL CROSSING, PEDESTRIAN CROSSING and BICYCLE CROSSING and their auxiliary plaques. School plaque is also included.

3.3 Font Styles and Font Sizes

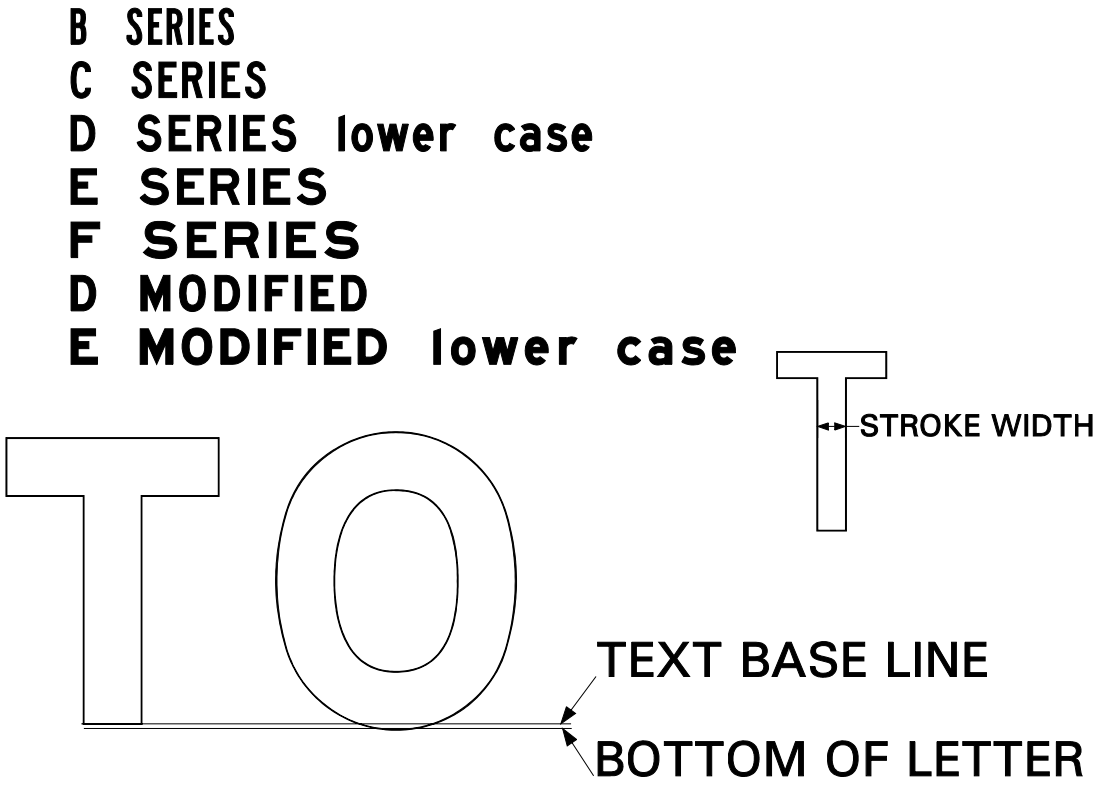
3.3.1 Font Styles

Sign lettering shall be in upper-case letters of the type approved by the Federal Highway Administration (FHWA), except that destination names may be in lower-case lettering with initial upper-case. Standard upper-case and lower-case alphabets have been issued by the FHWA.

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

Mn/DOT uses highway gothic font styles on 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 should be used only on temporary 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. 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 size is referred to as 8”-6” E Modified. Approved letter heights, in inches, for guide signs are as follows: 4-3, 6-4.5, 8-6, 10.67-8, 13.33-10, 16-12, 20-15, 5, 10, 12, 18. The last four sizes are in upper-case only.

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.

Lettering sizes for specific signs are based on the characteristics of the roadway: facility type, speed, and number of lanes. The tables 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. However, the primary consideration of guide sign design should be readability.

Table 3: Guidelines for Guide Sign (Non-Freeway) Font Size

Sign Type		Speed						
		<45 mph		45-50 mph		>50 mph	55 mph	>55 mph
		2 Lane/ 2 Way	4 or More Lanes	2 Lane/ 2 Way	4 or More Lanes	2 Lane/ 2 Way	4 or More Lanes	4 or More Lanes
GROUND MOUNTED:								
Destination	City/Street Name	6-4.5	8-6	8-6	10.7-8	8-6	10.7-8	13.3-10
	Arrow Size	3 or 13 head	5 or 14 head	5 or 14 head	6 or 15 head	5 or 14 head	6 or 15 head	7 or 16 head
Distance	Cardinal Direction	6	6	6	8	6	8	8
	Route Marker	18 OL	18 OL	18 OL	24 OL	18 OL	24 OL	24 OL
	City/Street Name	6-4.5	6-4.5	6-4.5	8-6	6-4.5	8-6	10.7-8
Junction	Cardinal Direction	8	8	8	8	8	10	10
	Route Marker	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL
	Action Message	8	8	8	8	8	10	10
Directional	Cardinal Direction	6	8	8	8	8	8	10
	Route Marker	18 OL	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL
	City/Street Name	6-4.5	8-6	8-6	10.7-8	8-6	10.7-8	13.3-10
	Arrow Size	3 or 13 head	5 or 14 head	5 or 14 head	6 or 15 head	5 or 14 head	6 or 15 head	7 or 16 head
Supplemental	Generic	6	6	6	8	8	8	8
	Proper Name	6-4.5	6-4.5	6-4.5	8-6	8-6	8-6	10.7-8
	Action Message	5	5	5	6	6	6	8
	Arrow Size	3 or 13 head	3 or 13 head	3 or 13 head	5 or 14 head	5 or 14 head	5 or 14 head	6 or 15 head
SIGNAL MAST ARM MOUNTED:	Cardinal Direction	8DM or EM	8DM or EM	8DM or EM	8DM or EM	8DM or EM	8DM or EM	8DM or EM
	Route Marker	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL
	City/Street Name	8-6	8-6	8-6	8-6	8-6	8-6	8-6
	Arrow Size	5 or 14 head	5 or 14 head	5 or 14 head	5 or 14 head	5 or 14 head	5 or 14 head	5 or 14 head
OTHER OVERHEADS:	Cardinal Direction	8	8	8	8	8	8	10
	Route Marker	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL	24 OL
	City/Street Name	8-6	8-6	8-6	10.7-8	8-6	10.7-8	13.3-10
	Arrow Size	5 or 14 head	5 or 14 head	5 or 14 head	6 or 15 head	5 or 14 head	6 or 15 head	7 or 16 head

Notes: OL = Overlay, DM = D Modified letters, EM = E Modified letters

1. Letter fonts are E Modified unless otherwise noted.
2. In urban areas limited horizontal space in which to place a sign can occur. It is then permissible to reduce the size of the letters of a sign by one step (i.e. 6-4.5 to 4-3).
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 >50 mph, 2 lane/2 way heading.

5. Where a sign panel legend consists of a 24" route marker with an arrow on a >55 mph, 4 or more lane roadway, the arrow size shall conform to the 6 or 15 arrow head size.

Table 4: Guidelines for Guide Sign (Freeway) Font Size

Sign Type			Type OH Signs	Ground Mount Signs
Distance	Cardinal		10	10
	Route Marker		24 OL	24 OL
	City/Street Name		13.3-10	13.3-10
	Numeral		13.3	13.3
	Fraction		15	15
Guide	Cardinal		12	12
	Route Marker		36	36
	City/Street Name		16-12	20-15
	Arrow Size		17-36	17-36
	EXIT ONLY		12	--
	Down Arrow Size		22-32	
	Distance	Numeral	15	18
		Fraction	15	18
		Word	10	12
Exit Panel	Word		10	10
	Numeral		15	15
	Letter		15	15
Supplemental Guide	Place/Name		13.3-10	13.3-10
	Word		10	10
	Numeral		15	15

Notes:

*For further guidelines see MMUTCD, Section 2-E

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 and between the objects and borders is usually ¾ of the font size (in some cases ½ of the font size is acceptable). An exception to this rule involves freeway distance signs, where the spacing between objects and borders is equal to font size.

3.5 Vertical Spacing for Freeway Distance Signs

Special vertical spacing for Freeway Distance Signs has been developed by Mn/DOT and is summarized in Table 5.

Table 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

Table 5: Combinations for Freeway Distance Signs

Combination	1	2	3	4	4	4	5	5	5	6	6	6	7	7
Border	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Space	7	10	9	7.5	10	10.4	6.5	9	9	7	9	7.4	7	8.5
Component	24	13.3	15	24	13.3	13.3	24	15	15	24	13.3	24	24	15
Space	6	10	8.5	7	7.6	10.4	6	7	9	6	8.2	8	6	7.5
Component	24	13.3	15	13.3	24	13.3	15	24	15	24	24	13.3	24	24
Space	6	10	8.5	14.4	7.6	7	9.5	7	7	8.2	6	8	7.5	6
Component	24	13.3	15	13.3	13.3	24	15	15	24	13.3	24	24	15	24
Space	7	10	9	14.4	10	7.5	10	9	7	9.5	7.5	7.3	8.5	7
Border	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Panel height	102”	84”	84”	90”	90”	90”	90”	90”	90”	96”	96”	96”	96”	96”

Combination	7	8	8	8	8	8	8	9	9	9	10	10	10	
Border	2	2	2	2	2	2	2	2	2	2	2	2	2	
Space	7	7	9	10	7	9.6	10	9.6	9.5	9.6	9	9.2	9.2	
Component	24	24	15	13.3	24	13.3	15	13.3	15	13.3	15	13.3	15	
Space	7.5	7	7	9.6	7	7	9.6	9.6	9.6	9.6	9.2	9.2	9.2	
Component	15	13.3	24	15	15	24	13.3	13.3	13.3	15	15	15	13.3	
Space	7.5	9.7	7	7	9	7	7	9.6	9.6	9.5	9.2	9.2	9.2	
Component	24	15	13.3	24	13.3	15	24	15	13.3	13.3	13.3	15	15	
Space	7	10	10.6	7	10.6	10	7	9.5	9.6	9.6	9.2	9	9	
Border	2	2	2	2	2	2	2	2	2	2	2	2	2	
Panel height	96”	96”	96”	96”	90”	90”	90”	84”	84”	84”	84”	84”	84”	

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.

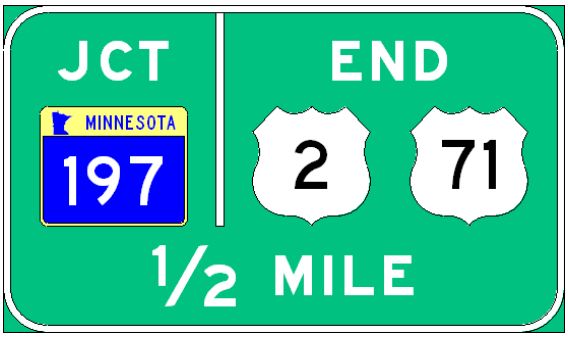
3.6 Horizontal and Vertical Lines

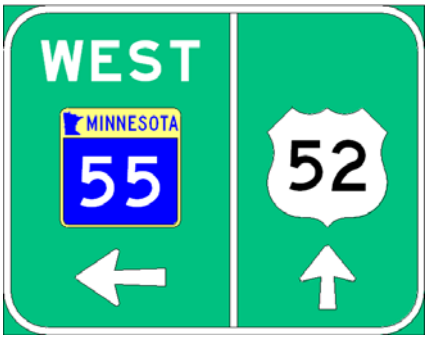
Horizontal lines, border to border, are used to separate independent subjects on a single sign panel. Horizontal lines are used primarily on destination signing. The examples below are the only instances where a horizontal line is needed on a two-destination sign panel.

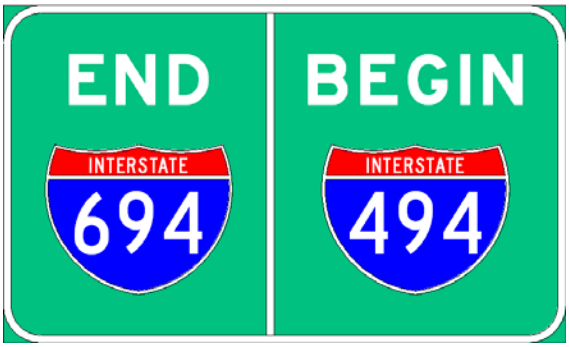
On destination signs with three or more lines of legend a horizontal line is needed if two lines share an arrow. Again, the line is border to border. Examples of this follow.

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.



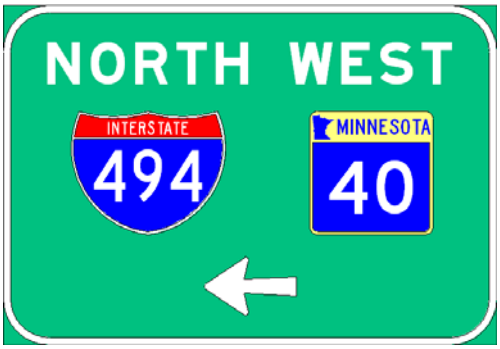




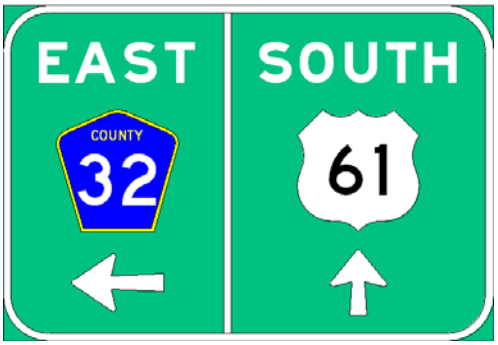
3.7 Route Markers and Sizes

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 this rule.



Important marker first



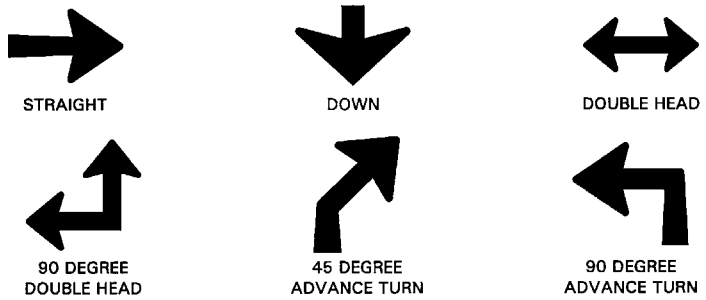
Arrow placement has priority

Like markers – Lowest to the left

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

3.8 Arrows

Arrows for guide signs are divided into several types:



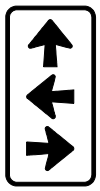
Straight arrows can be installed at different angles, from 0 to 180 degrees, with 0 degrees designated right, 90 degrees straight up, and 180 degrees left.

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

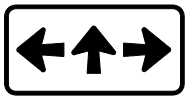
Down arrows can also be installed at different angles, but are used only on overhead signs where they can be centered directly over a specific lane.

The 90 degree double head, 45 degree advance turn, and 90 degree advance turn arrows can be either left or right.

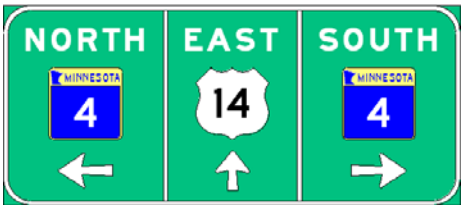
When more than one arrow is used on a sign, the arrows, with corresponding legends, are to be placed in the order specified below:



Vertical Placement



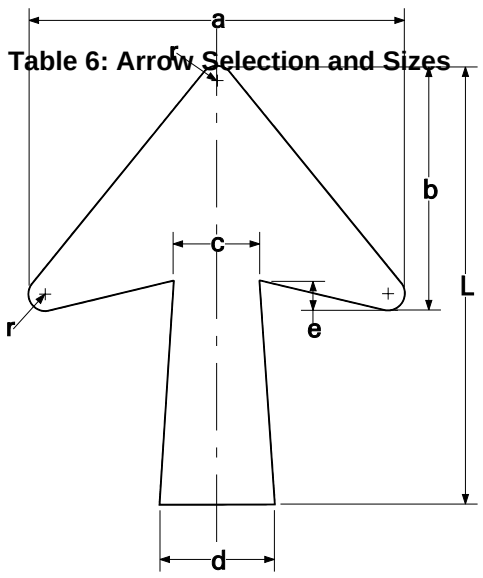
Horizontal Placement



These alignments override route marker placements.

The information on arrow dimensions and the corresponding legends and is found in Table 6. The legend size can be matched to the appropriate arrow size by using that table.

Table 6: Arrow Selection and Sizes



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

Arrow	Letter and Overlay Size	Dimensions in Inches					
		f	g	h	i	L	r
16"	13.33-10", 10" & less	24.0	12.0	4.88	2.25	16.5	.75
22"	16-12", 12" & greater	32.0	16.0	6.5	3.0	22.0	1.00

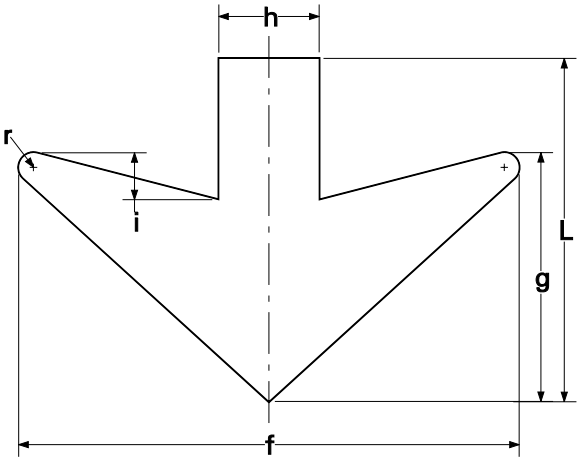


TABLE 1 - SHORT SHAFT ARROWS

Head	Matching Letter Size	Standard Length L	Dimensions in Inches					
			a	b	c	d	e	r
1	4", 4.3"	6"	5.58	3.63	1.28	1.72	.47	.26
2	5"	8"	7.06	4.60	1.61	2.18	.56	.32
3	6", 6-4.5"	10"	8.35	5.44	1.91	2.58	.67	.38
4			9.75	6.35	2.23	3.02	.78	.44
5	8", 8-6"	13"	11.16	7.27	2.55	3.44	.89	.51
6	10", 10.67-8"	17"	15.09	9.83	3.45	4.65	1.21	.69
7	10", 12", 13.33-10"	20"	17.72	11.54	4.05	5.47	1.42	.81
8	16-12"	25"	21.88	14.25	5.00	6.75	1.75	1.00

TABLE 2 - LONG SHAFT ARROWS

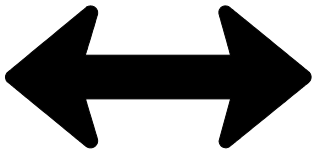
Head	Matching Letter Size	Standard Length L	Dimensions in Inches					
			a	b	c	d	e	r
11	4", 4.3"	9"	5.70	4.36	1.38	1.83	.45	.26
12	5"	12"	7.18	5.48	1.74	2.30	.56	.32
13	6", 6-4.5"	14"	8.56	6.54	2.07	2.74	.67	.38
14	8", 8-6"	18"	11.41	8.72	2.76	3.66	.90	.51
15	10", 10.67-8"	24"	15.14	11.56	3.66	4.85	1.19	.68
16	10", 12", 13.33-10"	29"	18.24	13.93	4.41	5.84	1.43	.82
17	16-12", 20-15"	36"	22.25	17.00	5.38	7.13	1.75	1.00
17		42"	22.25	17.00	5.38	8.39	1.75	1.00
18		36"	26.18	20.00	6.33	7.13	2.06	1.18
18		42"	26.18	20.00	6.33	8.39	2.06	1.18

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.

APPROVED	DATE OF REV.	STRAIGHT ARROWS		PAGE NUMBER
9/1/73	1/1/03			102

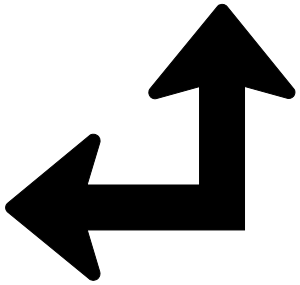
DOUBLE HEAD ARROWS



Arrow Designation	1 Head	3 Head	5 Head	6 Head	7 Head
Height	5.58	8.35	11.16	15.09	17.72
L - Minimum	12	18	24	30	36

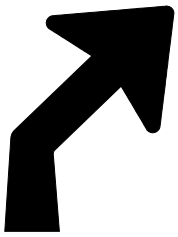
NOTES: 1. All dimensions are in inches.
2. Arrow lengths shall be sized in 6 inch increments.

DOUBLE HEAD 90 DEGREE ARROWS



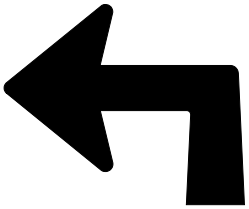
Arrow Designation	1-11	3-16	5-22	6-29
Height	10.5	15.75	21	28
Length	11	16.5	22	29.5

45 DEGREE ADVANCE TURN ARROWS



Arrow Designation	6 X 8	9 X 12	12 X 16	15 X 20	17 X 24
Arrow head	1	3	5	6	7
Height	8	12	16	20	24
Length	6	9	12	15	17

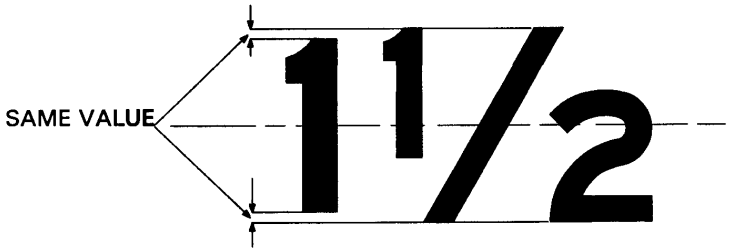
90 DEGREE ADVANCE TURN ARROWS



Arrow Designation	8 X 6.5	12 X 10	16 X 13	18 X 16	22 X 18	25 X 21
Arrow head	1	3	5	14	6	7
Height	6.5	10	13	16	18	21
Length	8	12	16	18	22	25

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 the height of the number should be close to, or the same as, the overall height of the fraction, without being greater. See table below. 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.

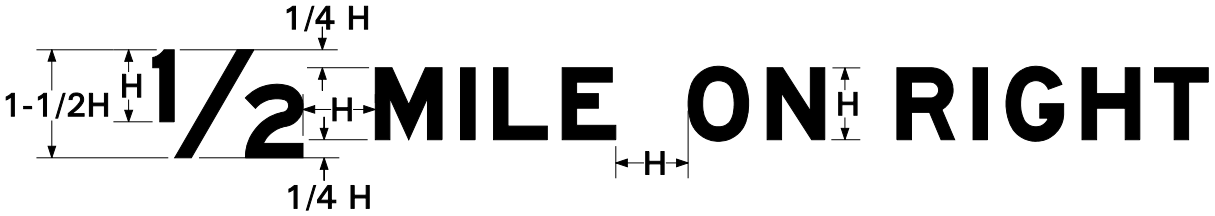


Table 7: Fraction Font Sizes

Fraction Height	Preceding Whole Number Height	Numeral Height in Fraction
6"	6"	4"
9"	8"	6"
12"	10.67"* or 12"	8"
15"	13.33"* or 15"	10"
18"	18"	12"

*On distance signs

3.10 Abbreviations

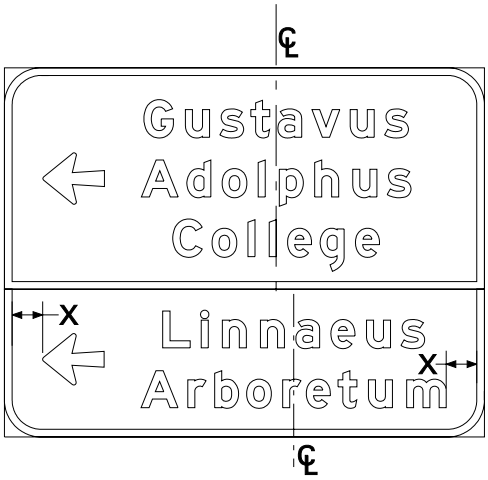
The only approved abbreviations are listed in the following table.

Table 8: List of Abbreviations

Full Word	Abbreviation	Full Word	Abbreviation
Alternate	ALT	Lane	Ln
Avenue	Ave	Mile	Ml
Boulevard	Blvd	North	N
Center	Cntr	Parkway	Pkwy
Circle	Cir	Pedestrian	PED
Court	Ct	Place	Pl
Drive	Dr	Road	Rd
East	E	South	S
Expressway	Expwy	Square	Sq
Feet	FT	Street	St
Freeway	Fwy	Trail	Tr
Highway	Hwy	University	Univ
Junction	JCT	West	W

3.11 Legend/Layout Justifications

Along with Arrow placements (section 3.8) 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.

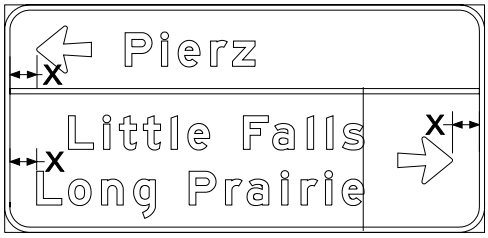
A single subject
center justified on itself.

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.

Vertical and left arrows
centered on each other.

Two subjects
left aligned on arrow side.

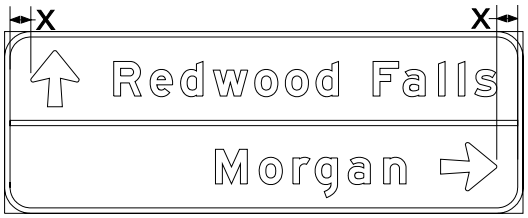
Arrow and subject
right justified.

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

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.

Arrow and subject left justified.

Arrow and subject right justified.

Itasca State Park + arrow is the longest line and is centered on panel.

Two subjects left aligned on arrow side.

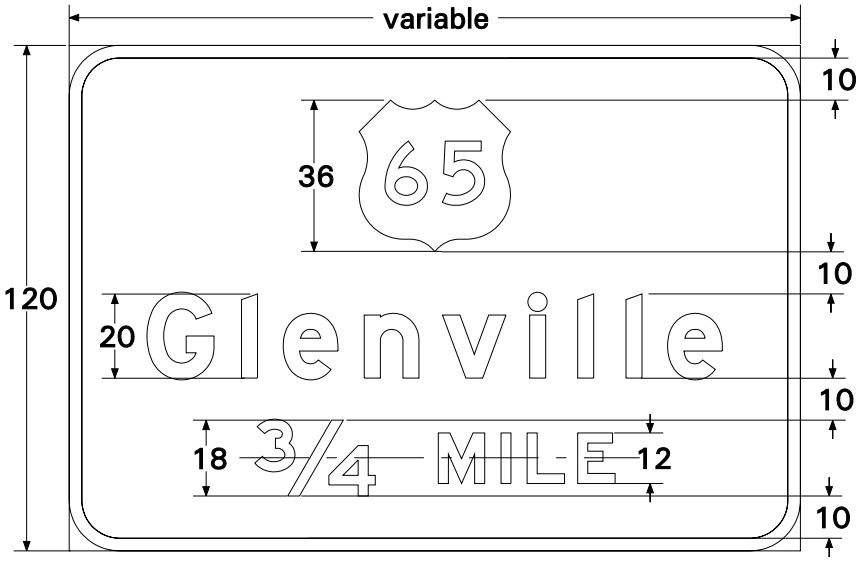
Arrow and subject left justified.

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.

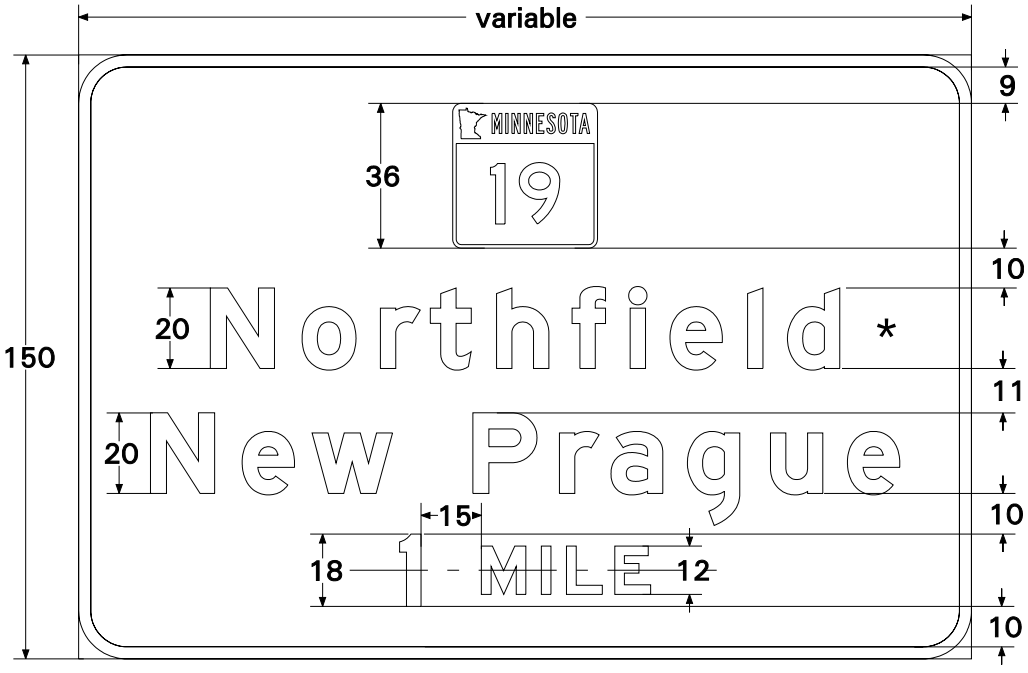
3.12 Typical Freeway Signs

3.12.1 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 Table 2, Note 1). The spacing is standardized, as follows:



12" radius 3" border

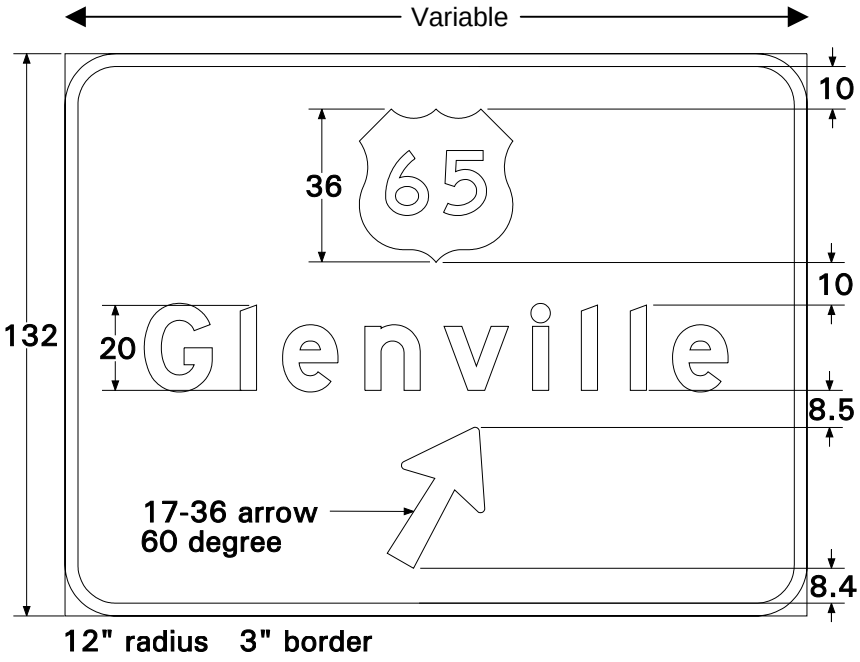


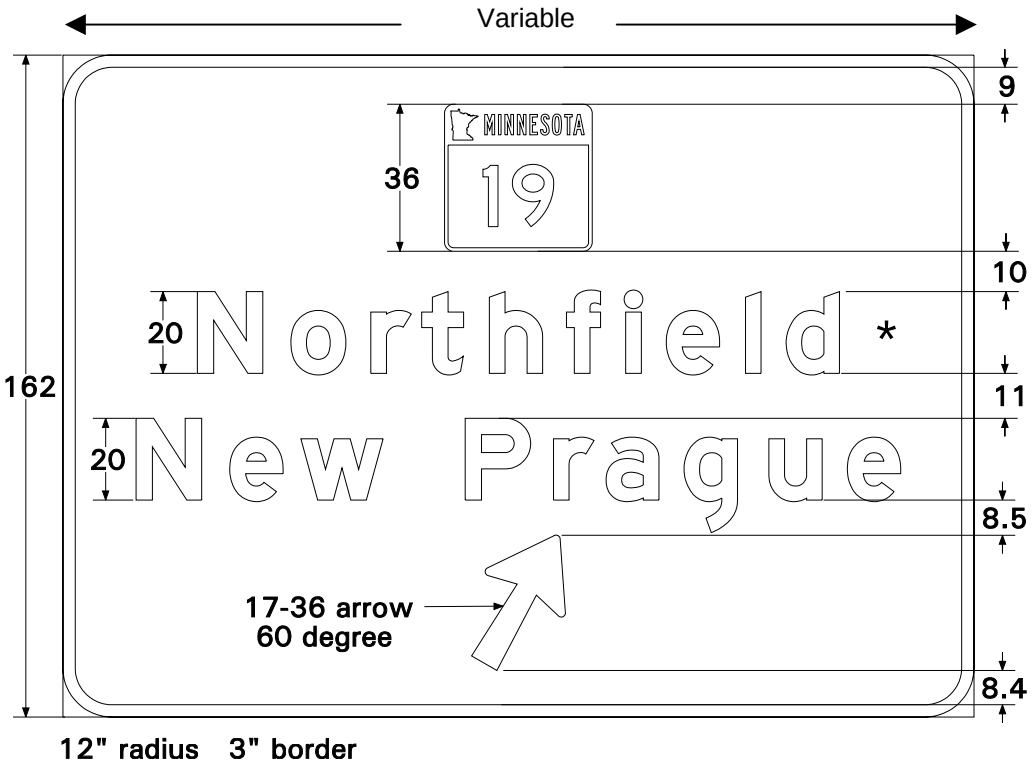
12" radius 3" border

* City names shall appear in the same order as those on the ramp destination guide sign.

3.12.2 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 Table 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.

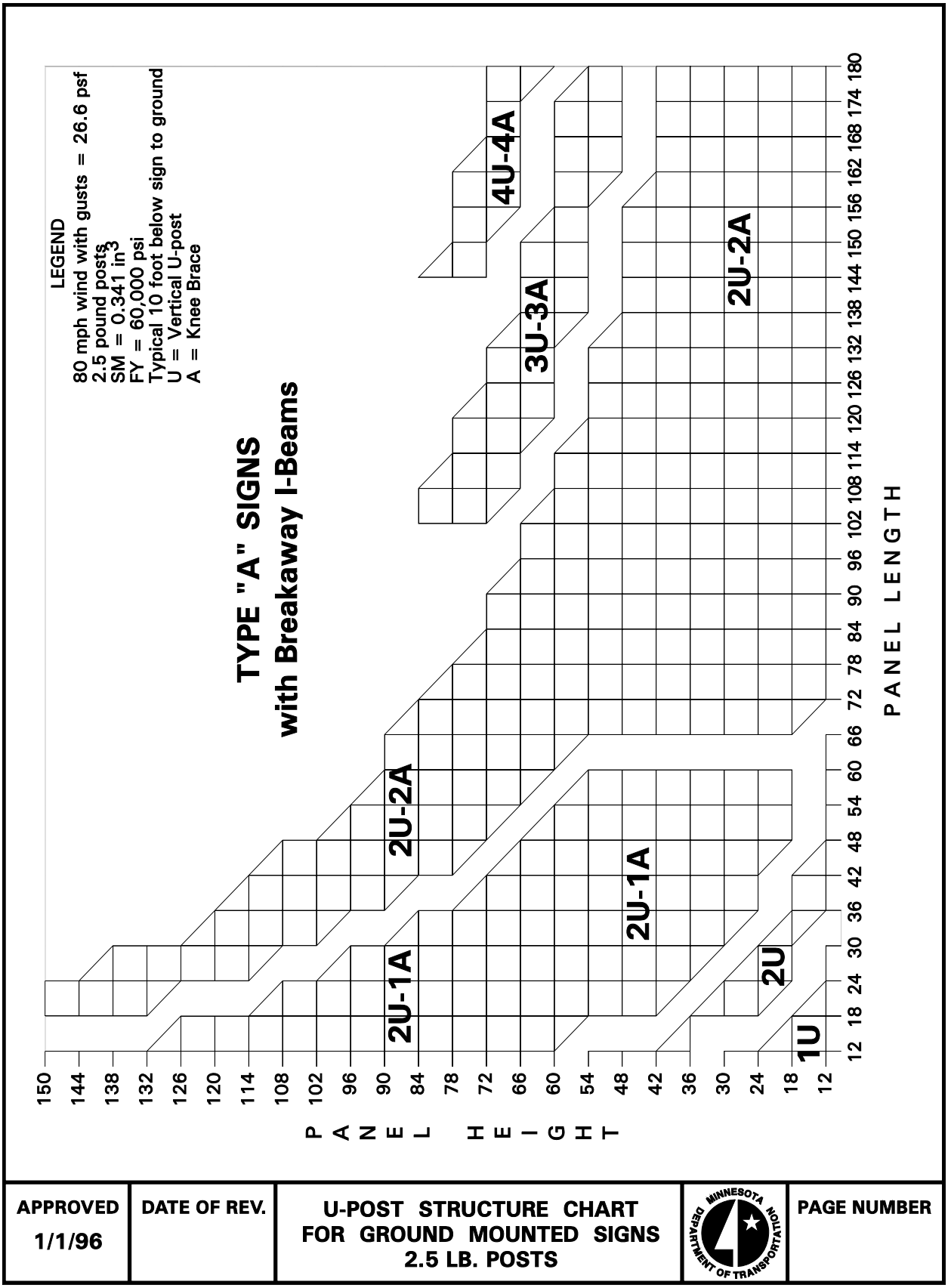
3.13 U-Post and Post Spacing

3.13.1 U-Post Structure Charts for Ground Mounted Signs

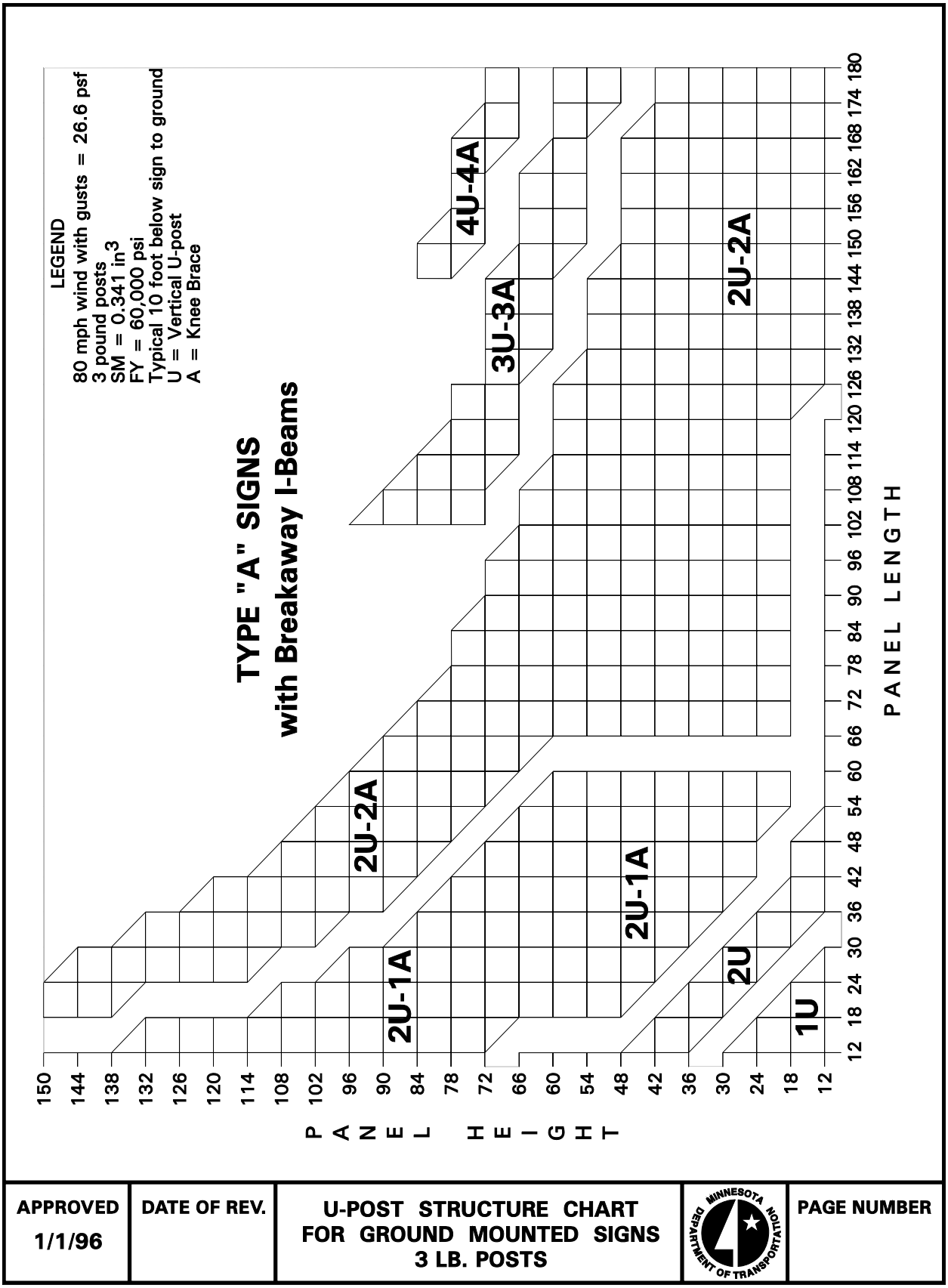
The following charts determine the number of posts and knee braces needed to erect a sign panel so the sign and structure can adequately resist wind loads. Note the Type "A" sign areas that require I-beam sign posts which are installed under contract.

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 3 #/ft sign structures to accommodate the largest sign panel possible on a U-channel sign post structure. Signs designed for installation by Mn/DOT forces may use either 3 #/ft or 2 ½ #/ft risers to which the sign panel is attached. Contact the area sign supervisor to determine which post selection chart to use. More information on sign structures is available in the Traffic Engineering Manual, Figures 6.3A and 6.3B.



APPROVED	DATE OF REV.	U-POST STRUCTURE CHART FOR GROUND MOUNTED SIGNS 2.5 LB. POSTS		PAGE NUMBER
1/1/96				



APPROVED	DATE OF REV.	U-POST STRUCTURE CHART FOR GROUND MOUNTED SIGNS 3 LB. POSTS		PAGE NUMBER
1/1/96				

3.13.2 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 the following chart for proper sign post spacing.

PANEL WIDTH	POST SPACING		
	2 POSTS	3 POSTS	4 POSTS
36	24		
42	30		
48	30		
54	30		
60	36		
66	42		
72	42		
78	54		
84	54		
90	54		
96	54		
102	60	45	
108	66	45	
114	66	45	
120	72	45	
126	78	45	
132	78	45	
138	78	48	
144	90	51	45
150	90	54	45
156	90	54	45
162	96	57	48
168	96	60	48
174	102	63	54
180	108	63	54

1. All dimensions are in inches.
2. Use this chart only if punch codes can't be found in the Standard Signs Manual.

4. 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 (Chapter 3.3.2) to determine correct letter size and route marker size, based on speed, number of lanes, and roadway type (freeway or non-freeway).
2. The matching arrow size can be found in Chapter 3.8.
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.
4. Vertical spacing between legend and inside of border: ½ to ¾ of letter height.
5. Horizontal spacing between objects (words, overlays, arrows, etc.): Letter height.
6. Horizontal spacing between legend and inside of border: Approximately ¾ of letter height. Use no less than ½ of letter height.
7. The appropriate arrow will be larger than the matching font height, but should be considered as font height in calculating vertical spacing. Due to the shapes of arrows compressing space around them doesn't make them appear crowded. There are exceptions to this rule.
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 = Letter height

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

C = Arrow height

D = Horizontal spacing from inside border to legend (approximately ¾ A)

E = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (C - A)

F = Vertical spacing from arrow (a) to arrow (b) = B - ½ (Ca - A) - ½ (Cb - A)

1. Add the heights of all objects in the sign, including border thickness (twice). 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 Table 2). Figure the height of an arrow (C) to be that of the corresponding letter height (A). Route markers, logos, and other graphics should be added at their full height. Also 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, average the component font sizes when determining component spacing.

2. Total the number of spaces between legend lines, including the two spaces from legends to borders. Multiply this by a number that is between ½ and ¾ of letter height. For example, if lettering used is 6", the number could be 4. If lettering is 8", it could be 5.
3. Add the two totals from paragraphs 1 and 2 and round to the nearest number divisible by 6 (6" increment). This figure is the panel height. Bear in mind an adjustment might have to be made in border and horizontal line thickness due to an incorrect estimate of the panel's shortest side.
4. Adjust the paragraph 1 total by any change in border thickness. This difference between the original estimate and the actual figure will be added or subtracted once for the top border, once for the bottom border, and once for each horizontal line, if any, used on the panel.
5. Subtract from the total in paragraph 3 (panel height) the total in paragraph 4. Divide this by the number of spaces from paragraph 2. This gives an exact spacing dimension B.
6. Before applying B to the sign, the additional heights of arrows, which weren't counted in paragraphs 1 and 4, must be subtracted from B. This is done by subtracting letter height (A) from arrow height (C) and dividing by two. This figure is then subtracted from B above and below the arrow.

   [E=B-½ (C-A)]
7. It may be preferable, in some cases, to round spaces to whole or half inch increments to simplify fabrication. If so, any excess amounts may be added to the spacing around arrows.

4.2.2 Calculating the horizontal size of the panel

Horizontal spacing, in most cases, is fairly automatic. 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 approximately ¾ letter height.

4.2.3 Review Panel Structure for Proper Supports

Once the panel has been sized using vertical and horizontal spacing guidelines refer to section 3.13.1 to ensure U-Posts will be used versus I-beams.

4.3 SignCAD Program

4.3.1 To create signs from scratch:

The following paraphrased outline is a suggested order of steps (from SignCAD 4.7 Help Files, Copyright ©1994-2001, SignCAD Systems, Inc):

1. Analyze the sign to determine how it is laid out in rows and columns. You can 'nest' rows of objects within columns, and columns within rows to create complex signs easily.
2. Determine how objects are to be aligned to one another: top, middle or bottom, or left, center or right. Each row and column has its own alignment, unaffected by the alignment of column and row groups within it. You can align the entire grouping on the panel so that you can set exact spacing from the edges.
3. Set preferences: Font, font size, fill colors, spacing. You can also change these at any time.
4. Use the panel tool to place a panel onto the workspace. The panel will recognize objects as they are placed onto it and resize itself and its border to accommodate each new object.
5. Use the toolbar to place objects one by one, onto the panel, adding to existing rows or columns and creating whole new rows and columns.
6. If the panel is complex, use the arrange tool to create simple column or row arrangements of objects.
7. If you want objects to be aligned both vertically and horizontally, create a tabular arrangement.

8. Move objects and arrangements onto the panel.
9. Select the Arrange Tool to show alignments and spacing information.
10. Adjust alignments and spacing, and modify objects or edit text. Adjusting the spacings will almost always be required.
11. Determine which objects (usually only one or two) that control heights of rows or widths of columns.
12. Save and print the sign, or export DXF or HPGL. Copy and paste is another option.

4.3.2 Key Strokes Used in SignCAD

Table 9: Common Key Strokes Used in SignCAD

Key Stroke	Result
Shift + 2	1/2
Shift + 3	1/3
Shift + 4	1/4
Shift + 5	1/5
Shift + 6	2/3
Shift + 8	3/4
Ctrl while dragging mouse over sign panel	will highlight panel and allow moving it
Ctrl + A	will size sign to fill workspace on monitor
F2	will reduce viewing size of sign
F3	will allow magnification
Ctrl + S	text size
Ctrl + F	text font
Ctrl + Z	undo

4.4 Example #1, Supplemental Guide Sign

Purpose of Example:

- Color selection
- Font and letter height selection
- Vertical spacing
- Horizontal 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.

Basic Manual Methods:

Formulas and equivalents for the following example:

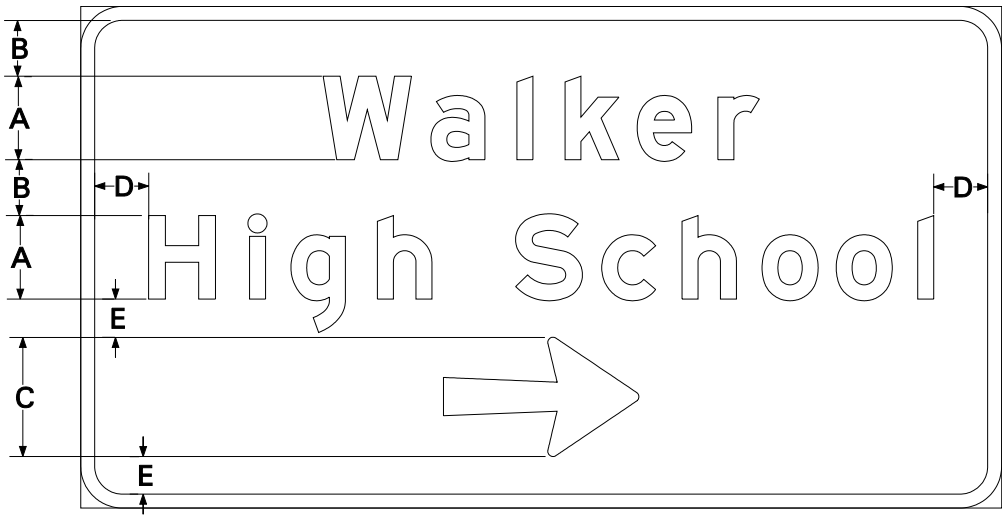
A = Letter height

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

C = Arrow height

D = Horizontal spacing from inside border to legend (approximately ¾ A)

E = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (C - A)



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

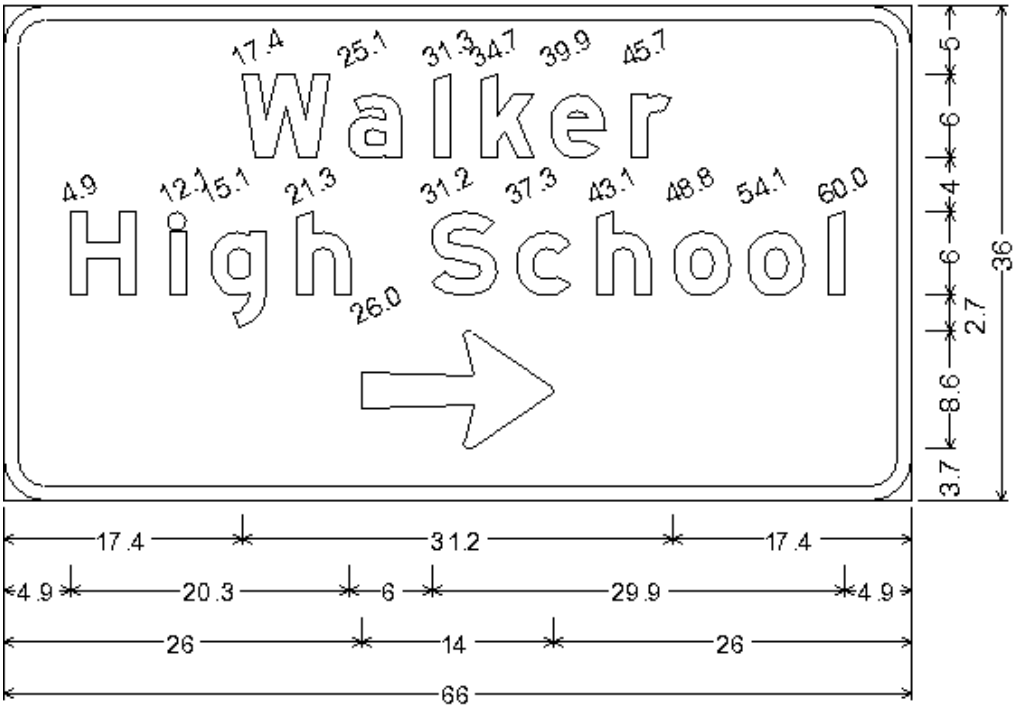
    Arrowhead - 13 (13-14 arrow)

5. Adjust vertical spacing -

    Right mouse click on object to be spaced - select object spacing (left click)

    Aim is ½ to ¾ letter height

6. Adjust horizontal spacing



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 - Left to run automatically
- Horizontal spacing - Legend not centered
- Panel designed without the aid of color - Note color selections in sign description

Final Sign Panel

Example #1, Supplemental Guide Sign

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects, 2 text, 1 arrow

Font size **(Table 3)** = 6-4.5, based on speed and number of lanes

Arrow size **(Tables 3 & 6)** = 13-14, based on speed, number of lanes, and sign layout

1. Assume border = 1" (Table 2)

   From top to bottom:

   1"-top border

   6"-top row of text

   6"-second line of text

   6" arrow height (assumed at this point)

   1"-bottom border

   total of 20" of space needed for objects

2. Four spaces exist (3 objects) @ ½ to ¾ of font size (6") = 3"- 4.5", use 4"

   4 (4") = 16" of space required

3. 20" + 16" = 36"

   36" is divisible by 6 ➔ valid panel side

4. According to border table for Guide Signs, a sign with a short side of $\leq$36" a border of 1" is used

   ➔ no change to assumption in step #1

5. Panel height (36") – Object space requirements (20") = Spacing distance (16")

   16"/ 4 spaces = 4" per vertical space.

6. To calculate the correct arrow spacing:

   E = B- ½ (C-A) or the arrow vertical spacing is equal to the standard spacing (4", from 5 above) minus ½ of the difference between the exact arrow height (8.6" for a 13-14 arrow) and the font size.

   Arrow spacing = 4-½(8.6-6) = 2.7"

7. Final vertical spacing summary:

   1" border

   4" space

   6" text line

4” space

6” text line

2.7” space

8.6” arrow

2.7” space

1” border

sums to 36” (no adjustments)

Horizontal Size of Panel and Spacing

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

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 (Section 3.13) 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. 50.3” of text + 6” space + 2” of borders ➔ 58.3”, add in 2 spaces of 4.5” (¾ letter height) each ➔ 67.3” round to closest 6” increment which is 66”. Forces spaces on either side to be reduced to 3.9”

Key Placement Issues

- Arrow centered
- All text centered

4.5 Example #2, 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.
- Tip: Note the spacing between EXIT and 147: it is halfway between the 10" EXIT and the 15" 147.

Basic Manual Methods:

Formulas and equivalents for the following example:

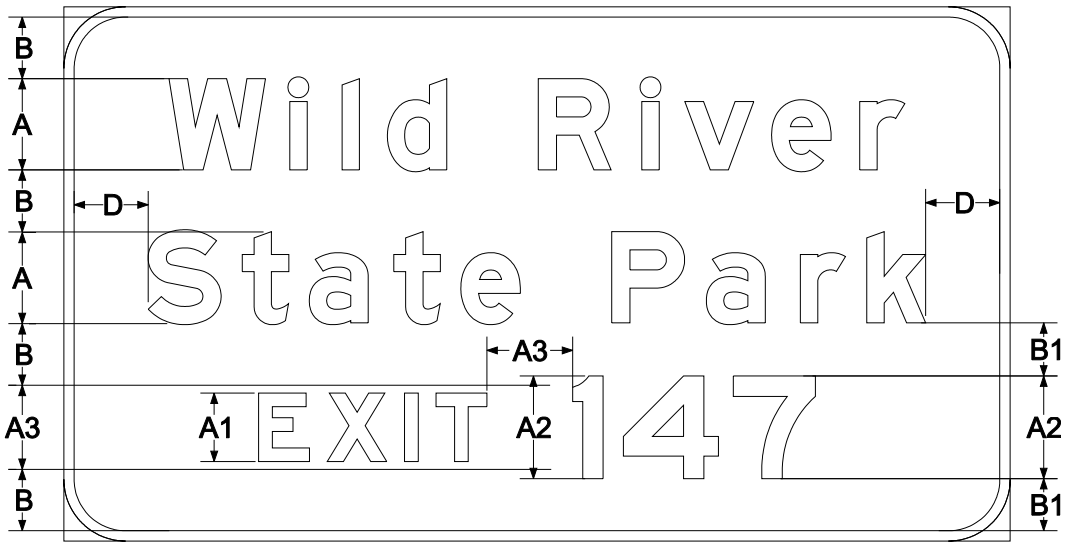
A, A1, A2 = Letter (text) height

A3 = The average of the two letter heights on the action line = (A1 + A2)/2

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

B1 = Vertical spacing above and below the exit number = B – (A2 – A3)/2

D = Horizontal spacing from inside border to legend (approximately ¾ A)



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)

   Font - E modified

   Size – 13.3-10 for first 2 lines, 10 for EXIT and 15 for 147

   Proper name - Upper-lower case

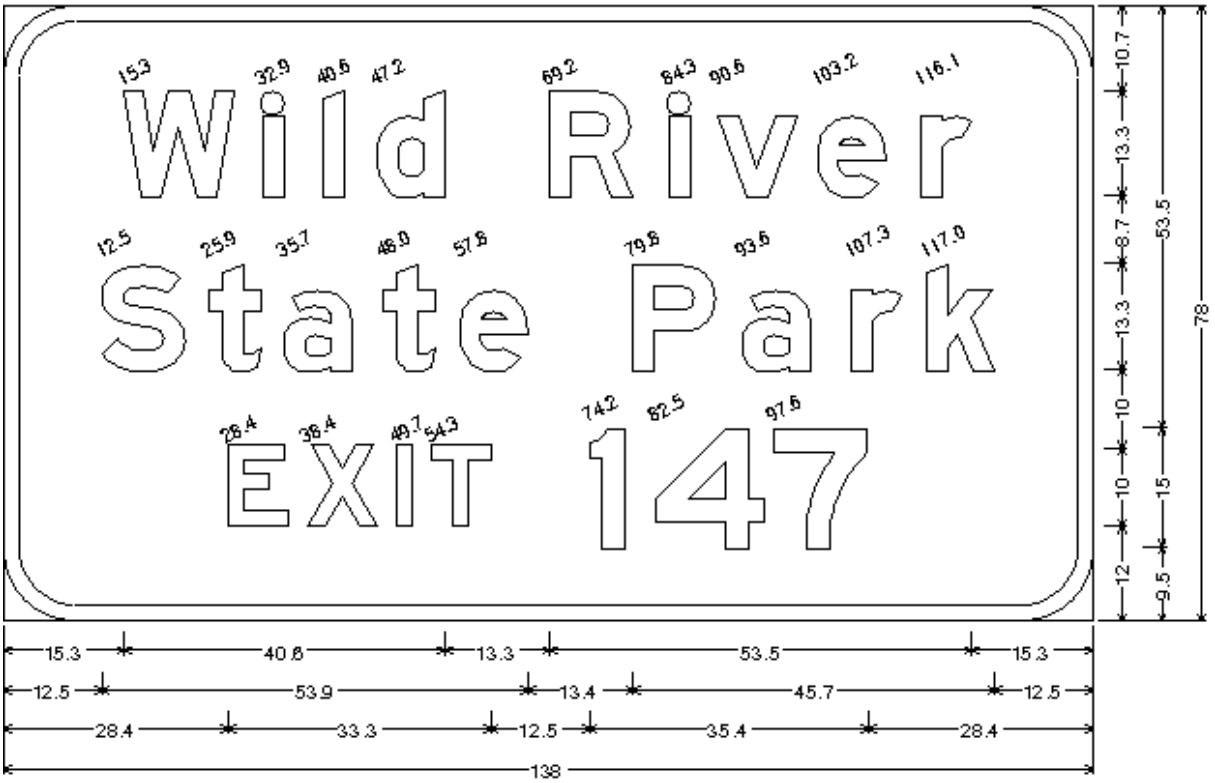
   EXIT is capitalized

4. Adjust vertical spacing -

   Right mouse click on object to be spaced - select object spacing (left click)

   Aim is ½ to ¾ letter height

5. Adjust horizontal spacing



9.0" Radius, 2.0" Border, White on Brown;
"Wild River" E Mod; "State Park" E Mod; "EXIT 147" E Mod 125% spacing;

Typical Mistakes

- Vertical spacing - Left to run automatically
- Horizontal spacing - Legend not centered
- Not using applicable font sizes

Final Sign Panel

Example #2, Supplemental Guide Sign (Freeway)

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects

Font size **(Table 4)** = 13.3-10 for the Place/name, 10 for the word (in this case EXIT), and 15 for the exit number 147. Based on the Freeway Font Sizes Supplemental Guide Sign (Type A).

1. Assume border = 2" **(Table 2, Note 2)**

   From top to bottom:

   2"-top border

   13.3"-top row of text

   13.3"-middle line of text

   12.5"-bottom line of text (average of the 15 and 10 sizes)

   2"-bottom border

   total of 43.1" of space needed for objects

2. Four spaces exist (3 objects) @ ½ to ¾ of font size (13.3") = 6.65"- 9.975", use 8.3" (the average)

   4 (8.3") = 33.2" of space required

3. 43.1" + 33.2" = 76.3"

   76.3" is NOT divisible by 6 ➔ use closest divisible by 6 ➔ 78

4. According to Table 2, Note 2, a Type A sign with 13.3 text uses a border of 2"

   ➔ no change to assumption in step #1

5. Panel height (78") – Object space requirements (43.1") = Spacing distance (34.9")

   34.9"/ 4 spaces = 8.7" per vertical space.

6. To calculate the correct arrow spacing:

   N/A

7. Final vertical spacing summary:

   2" border

   8.7" space

   13.3" text line

   8.7" space

   13.3" text line

7.5” space, B1= 8.7 – (15 – 12.5)/2,

15” text line

7.5” space, B1= 8.7 – (15 – 12.5)/2,

2” border

sums to 78” (no adjustments required)

Horizontal Size of Panel and Spacing

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

Use approximately ¾ of the font size as horizontal spacing between inside of border and legend, 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. 99.6” of text + 13.3” space + 4” of borders ➔ 116.9”, add in 2 spaces of 10” (¾ letter height) each ➔ 136.9” round to closest 6” increment which is 138”. Allows spaces on either side to be increased to 10.5 and 10.6”.

Key Placement Issues

- None

4.6 Example #3, Split Panel Destination Sign

Purpose of Example:

- Use of horizontal line
- Aligning objects
- Arrangement tool – column alignment

Given Conditions:

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

Basic Manual Methods:

Formulas and equivalents for the following example:

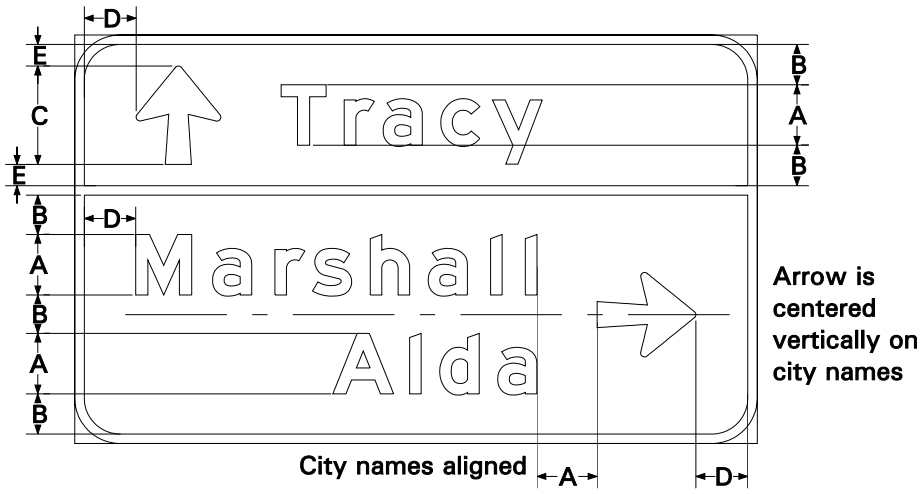
A = Letter height

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

C = Arrow height

D = Horizontal spacing from inside border to legend (approximately ¾ A)

E = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (C - A)



SignCAD Methods:

1. Panel tool -

   Sign type - guide

   Panel color - green

   Border color - white

2. Draw horizontal line – right mouse click on line to show edit features
3. Open arrangement tool

   Select column

   Install Marshall and Alda into column

4. Install remaining components into panel – note how to “grab” column
5. Align components –

   Right mouse click on objects to be aligned – select object align

   Left for vertical arrow

   Right for Alda

6. Vertical spacing –

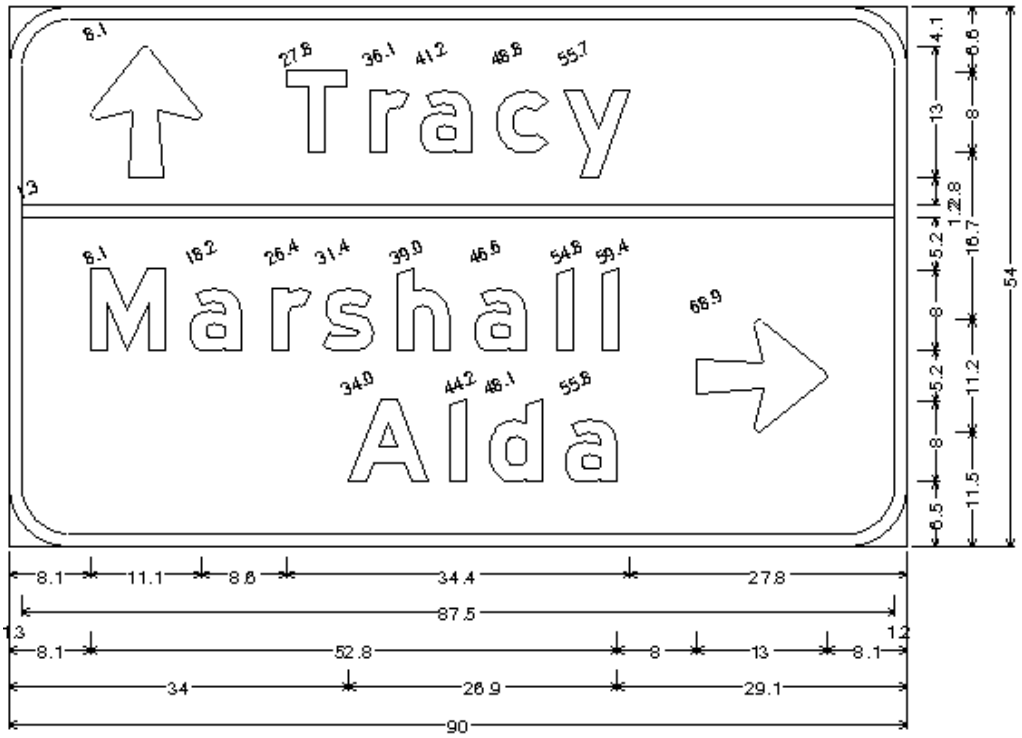
   Deal with tallest objects on lines – Arrow on line with Tracy. Zero out Tracy’s vertical spacing

   Zero out object spacing of horizontal line

   Vertical object spacing of horizontal arrow has no effect on panel height so ignore

   Set vertical spacing for Marshall and Alda

   6. Equalize horizontal spacing of the longest line – Note that default horizontal object spacing of arrow is 4”, while default for text is letter height



6.0" Radius, 1.3" Border, White on Green;
Arrow 5 - 13.0" 90°; "Tracy" E Mod; "Marshall" E Mod; "Alda" E Mod; Arrow 5 - 13.0" 0°;

Typical Mistakes

- Top line not left justified
- Longest line not centered

Final Sign Panel

Example #3, Split Panel Destination Sign

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects; 1 arrow, 2 text

Font size **(Table 3)** = 8-6, based on speed and number of lanes

Arrow size **(Tables 3 & 6)** = 5-13, based on speed, number of lanes and sign layout

1. Assume border = 1.25" (make one border 1.3" and the other 1.2")

   From top to bottom:

   1.3"-top border

   8"-arrow height (assumed at this point)

   1.3"-horizontal line

   8"-row of text

   8"-row of text

   1.2"-bottom border

   total of 27.8" of space needed for objects

2. Five spaces exist (4 objects) @ ½ to ¾ of font size (8") = 4"- 6", use 5"

   5 (5") = 25" of space required

3. 27.8" + 25" = 52.8"

   52.8" is not divisible by 6, round to closest, use 54" ➔ valid panel side

4. According to Table 2, a sign with a short side of 54" a border of 1.25" is used

   ➔ no change to assumption in step #1

5. Panel height (54") – Object space requirements (27.8") = Spacing distance (26.2")

   26.2"/ 5 spaces = 5.24" per vertical space, used 5.2"

6. To calculate the correct arrow spacing:

   E = B-½ (C-A) or the arrow vertical spacing is equal to the standard spacing (5.2", from 5 above) minus ½ of the difference between the exact arrow height (13" for a 5-13 arrow) and the font size.

   Arrow spacing = 5.2-½(13-8) = 2.7".

7. Final vertical spacing summary:

Calculated	Adjustments
1.3” border	
2.7” space	use 2.8”
13” arrow	
2.7” space	use 2.8”
1.3” horizontal line	
5.2” space	
8” text	
5.2” space	
8” text	
5.2” space	
1.2” border	
sums to 53.8” (add 0.1” to the arrow spaces)	sums to 54”

Horizontal Size of Panel and Spacing

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

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 (Section 3.13) to verify desirable installation on a new or existing structure.

The Marshall and arrow line is the longest object; Horizontal spacing defaults to 8” (font size) on both sides of Marshall. The Sign CAD arrow default spacing is 4”. Equalize the left side spacing of Marshall and the right side spacing of the arrow to ¾ letter height (6”). 6” + 52.9” of text + 8” + 13” arrow + 6” + 2.5” borders ➔ 88.4”. Round to nearest 6” increment, which is 90”. Adjust spacings to incorporate extra 1.6”

Key Placement Issues

- Start with horizontal line to divide panel
- Use the arrangement tool to establish a column for the Marshall/Alda text
- Alda should be right justified

4.7 Example #4, Directional Sign

Purpose of Example:

- Use of indented horizontal line
- This is a standardized format

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.

Basic Manual Methods:

Formulas and equivalents for the following example:

A = Letter height

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

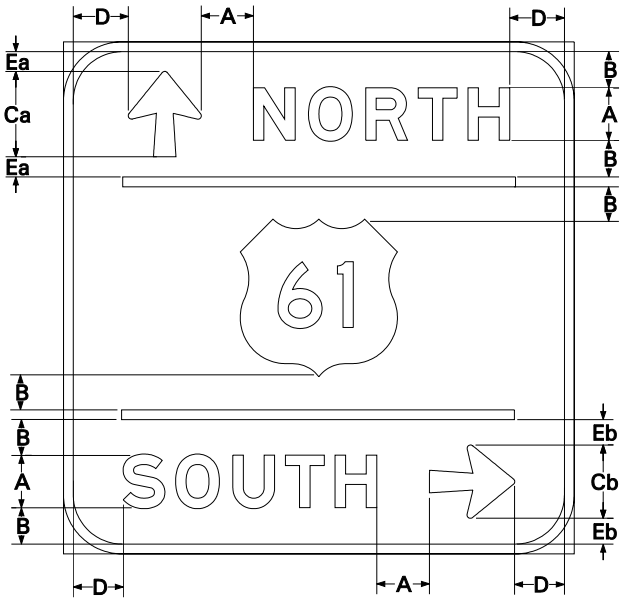
Ca = Arrow height of a vertical (90 degree) arrow.

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

D = Horizontal spacing from inside border to legend (approximately ¾ A)

Ea = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (Ca - A)

Eb = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (Cb - A)



SignCAD Methods:

1. Panel tool -

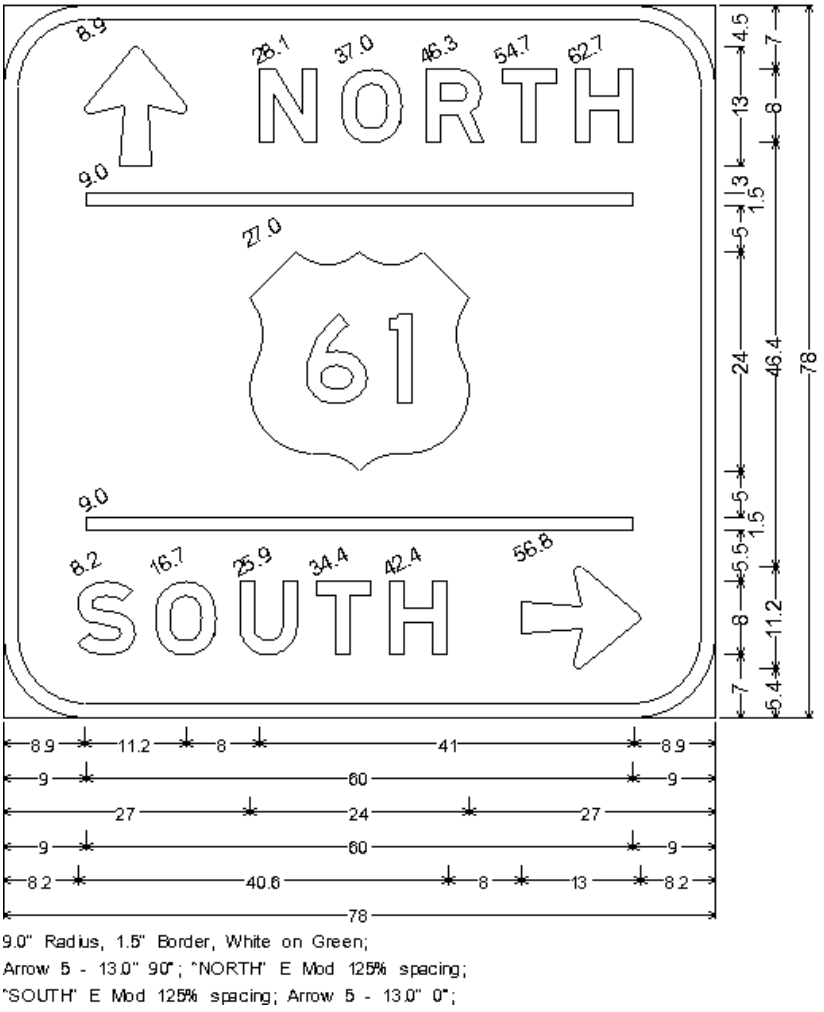
   Sign type - guide

   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 NORTH and SOUTH
6. Adjust arrow and route marker vertical object spacing
7. Adjust horizontal spacing so top and bottom legends are centered on panel



9.0" Radius, 1.5" Border, White on Green;
Arrow 5 - 13.0" 90"; "NORTH" E Mod 125% spacing;
"SOUTH" E Mod 125% spacing; Arrow 5 - 13.0" 0";

Final Sign Panel


NORTH
61
SOUTH

Example #4, Directional Sign

Vertical Size of Panel and Line Spacing

Given:

5 rows of objects, 2 arrows, 1 route marker, 2 horizontal lines

Route marker **(Table 3)** = 24 OL, based on roadway, speed and number of lanes

Cardinal Direction font size **(Table 3)** = 8, based on roadway, speed and number of lanes

Arrow size **(Tables 3 & 6)** = 5-13, Table 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"-arrow height (assumed at this point)

   1.5"-horizontal line

   24"-route marker

   1.5"-horizontal line

   8"-arrow

   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. Not applicable in this case, border thickness is known.

5. Panel height (78") – Object space requirements (46") = Spacing distance (32")

   32"/ 6 spaces = 5.33", use 5.3" per vertical space

6. To calculate the correct arrow spacing:

   E = B-½ (C-A) or the arrow vertical spacing is equal to the standard spacing (5.3", from 5 above) minus ½ of the difference between the exact arrow height (13" for a 5-13 arrow) and the font size.

   Arrow spacing (upper vertical) = 5.3-½(13-8) = 2.8". Arrow spacing (lower horizontal) = 5.3-½(11.16-8) = 3.7"

7. Final vertical spacing summary:

Calculated	Adjustments
1.5” border	
2.8” space	2.9”
13” arrow	
2.8” space	
1.5” horizontal line	
5.3” space	
24” route marker	
5.3” space	
1.5” horizontal line	
3.7” space	
11.2” arrow	
3.7” space	3.8”
1.5” border	
sums to 77.8”	sums to 78”

Horizontal Size of Panel and Spacing

Once the vertical spacing is determined the horizontal spacing is based on the longest object. Ignore the 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 (Section 3.13) to verify desirable installation on a new or existing structure.

SOUTH = 38.8”, arrow = 13”, 8” space between, 2-spaces (~ ¾ font size), 3” in border ➔ 74.8”. Normally, this would round down to the closest 6” increment, 72”. But because this is a standardized panel, 78” is used. The right and left side spacings are adjusted equally until 78” is reached.

Key Placement Issues

- Cardinal directions are centered on arrows
- Route marker is centered
- Maintaining 78” x 78” panel size

4.8 Example #5, Three Line Distance Sign

Purpose of Example:

- Typical distance sign
- Alignment features

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.

Basic Manual Methods:

Formulas and equivalents for the following example:

A = Letter height

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

D = Horizontal spacing from inside border to legend (approximately ¾ A)

SignCAD Methods:

1. Panel tool -

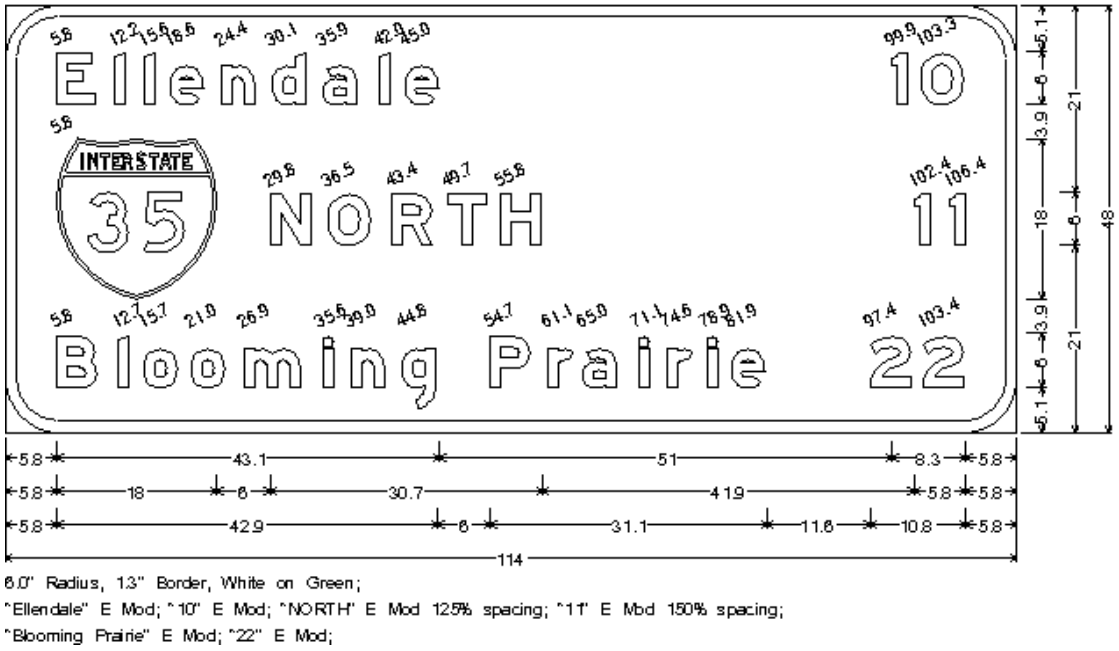
   Sign type - guide

   Panel color - green

Border color - white

2. Install sign components as individual entries (so that they can be aligned later)
3. Right mouse click on each item

   Select Object Align Left or Right
4. Adjust vertical spacing
5. Adjust horizontal spacing
6. Move excess space from edges into middle by adjusting horizontal spacing to the right of “Prairie”



Typical Mistakes

- Cardinal direction top justified, should be middle justified since it’s a Distance Sign

Final Sign Panel

Example #5, Three Line Distance Sign

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects, 1 route marker, 2 text

Route marker **(Table 3)** = 18 OL, based on speed and number of lanes

Font size **(Table 3)** = 6-4.5, based on speed and number of lanes

1. Assume border **(Table 2)** = 1.25" (Make one border 1.3" and the other 1.2")
   From top to bottom:
   1.3"-top border
   6"-text
   18"-route marker
   6" text
   1.2"-bottom border
   total of 32.5" of space needed for objects

2. Four spaces exist (3 objects) @ ½ to ¾ of font size (6") = 3"- 4.5", use 4"
   4 (4") = 16" of space required

3. 32.5" + 16" = 48.5"
   48.5" is not divisible by 6, round to closest, use 48" ➔ valid panel side

4. According to border table for Guide Signs, a sign with a short side of 48" a border of 1.25" is used
   ➔ no change to assumption in step #1

5. Panel height (48") – Object space requirements (32.5") = Spacing distance (15.5")
   15.5"/ 4 spaces = 3.875", use 3.9" per vertical space

6. No arrows

7. Final vertical spacing summary:

Calculated	Adjustments
1.3” border	
3.9” space	3.8”
6” text	
3.9” space	
18” route marker	
3.9” space	
6” text	
3.9” space	
1.2” border	
sums to 48.1” (reduce upper space by 0.1”)	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 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 (Section 3.13) to verify desirable installation on a new or existing structure.

The Blooming Prairie 22 is the longest object; Horizontal distance is based on ¾ 6” (font size) space on both sides. Blooming = 42.9”, one space 6”, Prairie = 31.2”, one 6” space, 22 = 10.8”, 2.5” in border and 9” in outside spaces ➔ 108.4”. A minimum of the font size (6”) shall be used between the city name and the mileage. The horizontal spacings could be adjusted, however in this case the next size panel (114”) is chosen. The excess space (5.6”) is added to the space between the city name and mileage => 11.6”. This number may have to be adjusted further to maintain ¾ spacing on the left and right.

Key Placement Issues

- Cardinal directions are middle justified on Route Markers on Distance Signs
- Cardinal directions are always capitalized
- Mileage entered as separate objects so they can be justified, 11 spacing can be expanded to 150%
- Text is left justified and distances are right justified

4.9 Example #6, Three Line Distance Sign (Freeway Overhead)

Purpose of Example:

- Illustrates a typical freeway distance sign, incorporating route markers, fractions and whole numbers.

Given Conditions:

- Freeway Overhead distance sign

Example Task:

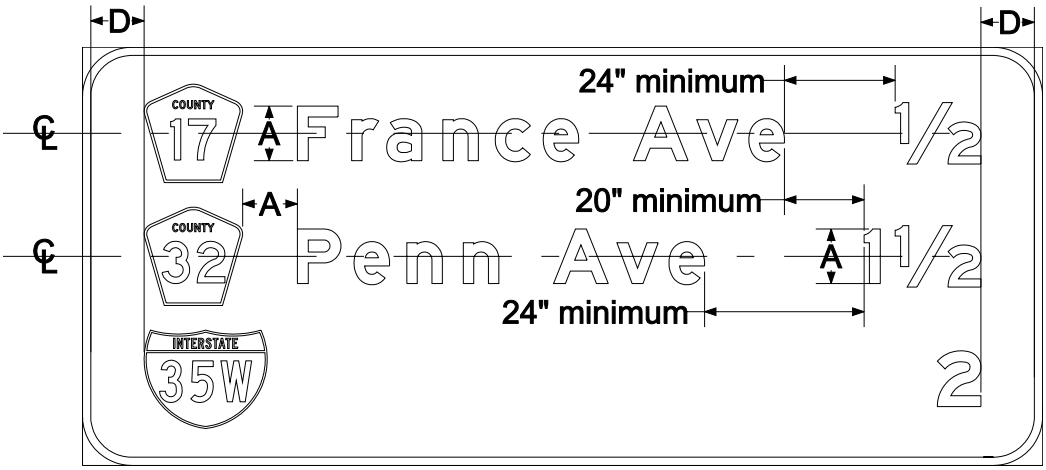
- Using the given conditions listed above and the sign components illustrated below, develop the guide sign using SignCAD paying particular attention to component location, justification, and spacing.

Basic Manual Methods:

Formulas and equivalents for the following example:

A = Letter height

D = Horizontal spacing from inside border to legend (approximately A – See Section 3.4)



SignCAD Methods:

1. Panel tool -

   Sign type - guide

   Panel color - green

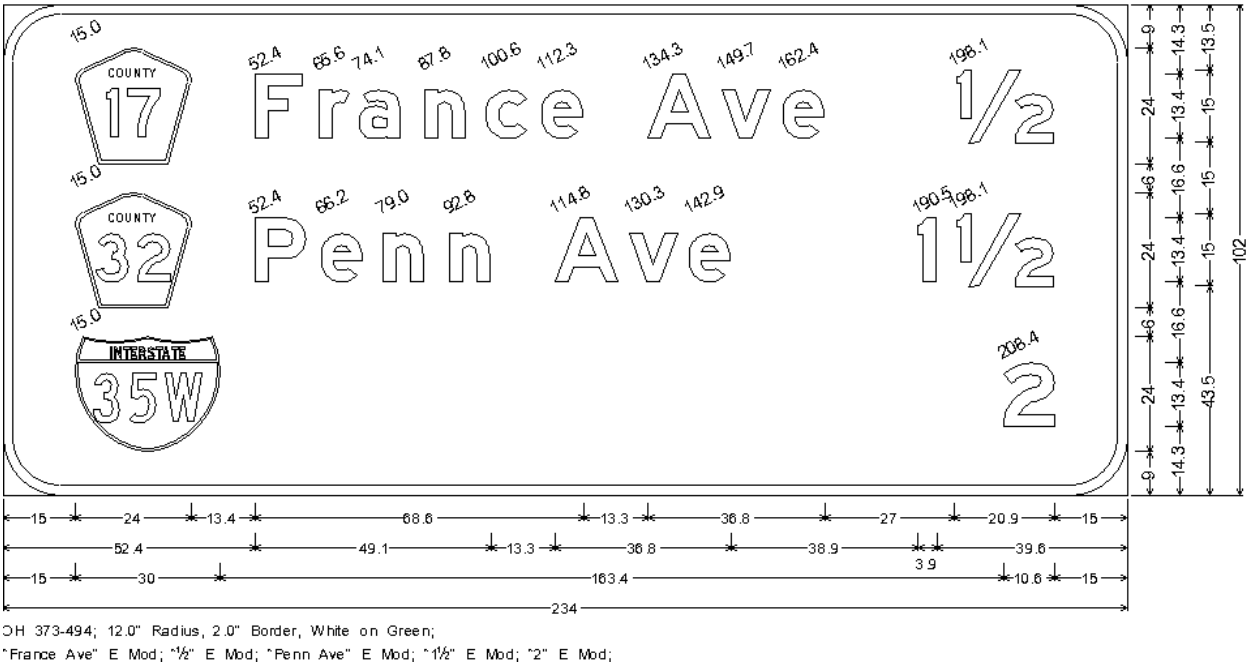
   Border color - white

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” and the fractions are 15”.

3. Right mouse click on each item

   Select Object Align Left or Right

4. Adjust vertical spacing
5. Adjust horizontal spacing
6. Move excess space from edges into middle by adjusting horizontal spacing



OH 373-494; 12.0" Radius, 2.0" Border, White on Green;
"France Ave" E Mod; "½" E Mod; "Penn Ave" E Mod; "1½" E Mod; "2" E Mod;

Typical Mistakes

- A freeway distance sign follows the layout combinations listed in section 3.5.

Final Sign Panel

Example #6, Three Line Distance Sign (Freeway Overhead)

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects, 3 route markers

Route marker **(Table 4)** = 24 OL, based on Freeway application

Font size **(Table 4)** = 13.3-10, based on Freeway application

Follow table in section 3.5 for the spacing requirements (this is a standard sign application)

According to section 3.5, Combination # 1, the following object and spacing requirements exist

From top to bottom:

2”-top border

7” space

24”-route marker

6” space

24”-route marker

6” space

24”-route marker

7” space

2”-bottom border

Vertical panel size is 102”

Horizontal Size of Panel and Spacing

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

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.

Key Placement Issues

- Mileage entered as separate objects so they can be justified
- Text is left justified and distances are right justified
- Route Markers are middle justified on text
- Follow standard vertical spacing tables

4.10 Example #7, 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.

Basic Manual Methods:

Formulas and equivalents for the following example:

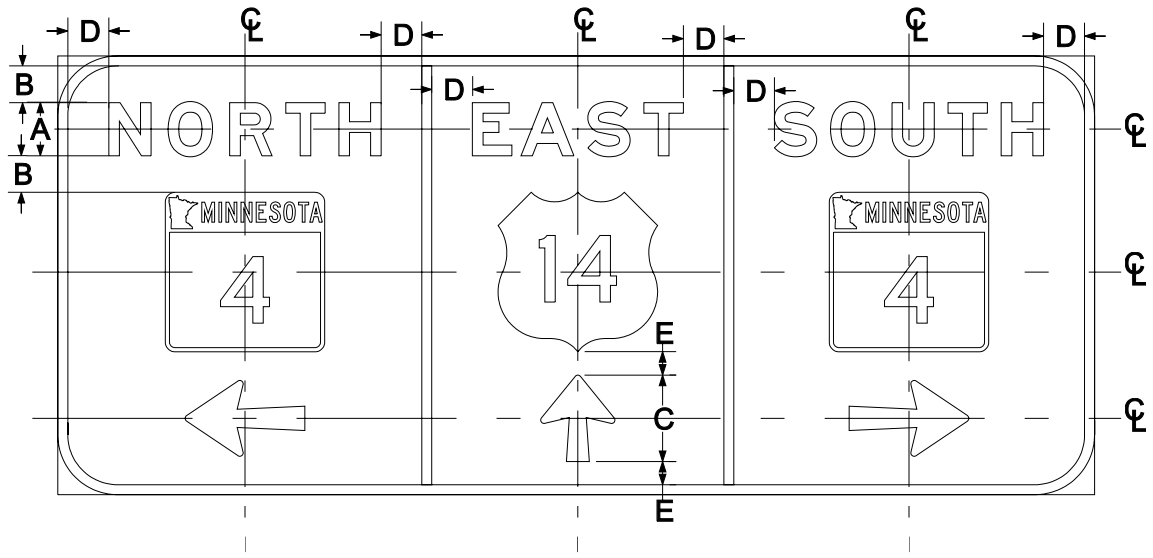
A = Letter height

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

C = Arrow height

D = Horizontal spacing from inside border to legend (approximately ¾ A)

E = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (C - A)



SignCAD Methods:

1. Panel tool -

   Sign type - guide

   Panel color - green

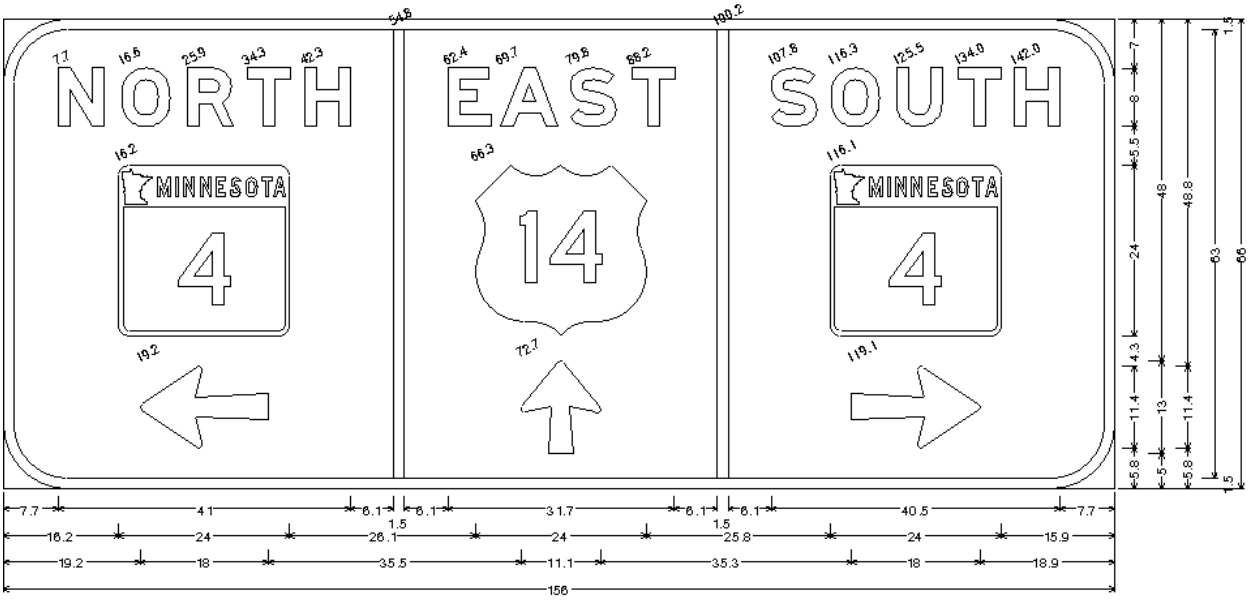
   Border color - white

2. Create tabular arrangement - 3 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

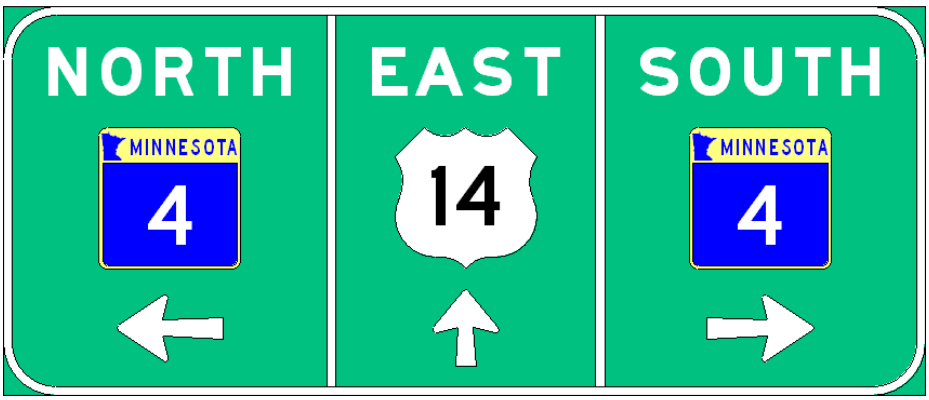
6. Adjust vertical spacing - Panel should be 66” tall. Work with tallest component on each horizontal line. The only item to specifically use is the vertical arrow in the middle. It’s taller than the two horizontal arrows - 13” to 11.4”.
7. Horizontal spacing - Adjust evenly across by adding the longest components, borders, and vertical lines together. Then add to this sum ¾ letter height for each space between legend and border or legend and vertical bars. Round to the nearest 6” increment, and split up difference between spaces. Zero out any horizontal spaces that may interfere with this procedure.



Typical Mistakes

- Arrow size choice incorrect for layout

Final Sign Panel



Example #7, Vertical Split Panel Directional Sign

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects (center column controls), 1 cardinal direction, 1 route marker, 1 arrow

Route marker **(Table 3)** = 24 OL, based on mounting

Cardinal direction **(Table 3)** = 8, based on mounting

Arrows **(Tables 3 & 6)** = 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

   8”-text

   24”-route marker

   8” arrow (assumed at this point)

   1.5”-bottom border

   total of 43” of space needed for objects

2. Four spaces exist (3 objects) @ ½ to ¾ of font size (8”) = 4”- 6”, use 5”

   4 (5”) = 20” of space required

3. 43” + 20” = 63”

   63” is not divisible by 6, round to closest, use 66” ➔ valid panel side

4. According to border table for Guide Signs, a sign with a short side of 66” a border of 1.5” is used

   ➔ no change to assumption in step #1

5. Panel height (66”) – Object space requirements (43”) = Spacing distance (23”)

   23”/ 4 spaces = 5.75”, use 5.7” per vertical space.

6. To calculate the correct arrow spacing:

   E = B- ½ (C-A) or the arrow vertical spacing is equal to the standard spacing (5.7”, from 5 above) minus ½ of the difference between the exact arrow height (13” for a 5-13 arrow) and the font size.

   Arrow spacing (vertical) = 5.7-½(13-8) = 3.2”

7. Final vertical spacing summary:

Calculated	Adjustments
1.5” border	
5.7” space	
8” text	
5.7” space	
24” route marker	
3.2” space	3.3”
13” arrow	
3.2” space	3.3”
1.5” border	
sums to 65.8” (add 0.1” to each arrow space)	Sums to 66”

Horizontal Size of Panel and Spacing

Once the vertical spacing is determined the horizontal spacing is based on the longest objects in each column.

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 (Section 3.13) to verify desirable installation on a new or existing structure.

NORTH, EAST, SOUTH are the longest objects in each column; Horizontal distance is based on ¾ 8” (font size) space = 6” on both sides. 1.5” + 6” + 39.2” (NORTH) + 6” + 1.5” + 6” + 30.7” (EAST) + 6” + 1.5” + 6” + 38.8” (SOUTH) + 6” + 1.5” => 150.7”. Round to the closest 6” increment, use 150”. The 0.7” remainder can be divided up and deducted equally from all six 6” spacings.

Placement Issues

- Use a 3 column and 3 row table to place objects in matrix and then place matrix on panel
- Objects in each row should be horizontally aligned.
- Equal spacing between legend and border and legend and vertical bars

4.11 Example #8, Split Panel Two Color Destination Sign

Purpose of Example:

- Incorporating different colored panels into the same sign

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.

Basic Manual Methods:

Formulas and equivalents for the following example:

A = Letter height

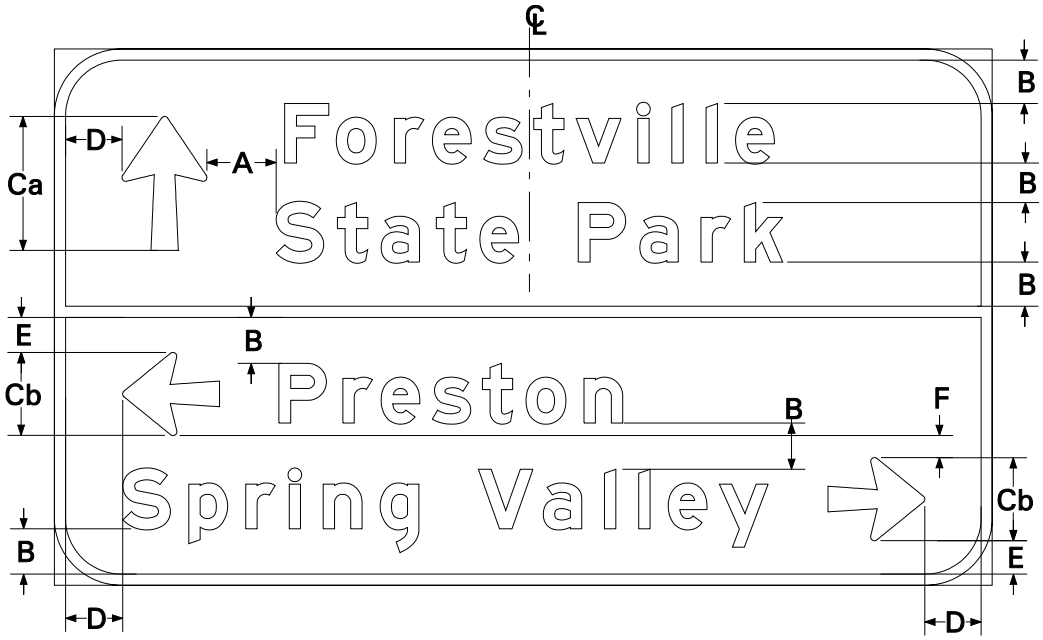
B = Vertical spacing from wording to wording, or from wording to inside border (½ A to ¾ A)

C = Arrow height

D = Horizontal spacing from inside border to legend (approximately ¾ A)

E = Vertical spacing from arrow to wording, or from arrow to inside border = B - ½ (C - A)

F = Vertical spacing from arrow (b) to arrow (b) = B - ½ (Cb - A) - ½ (Cb - A)



* Forestville is centered above State Park

SignCAD Methods:

1. Panel tool -

   Sign type - guide

   Panel color – green (city directions) and brown (recreational), create one panel of each

   Border color – white

2. Install components in the two panels
3. Double click on brown panel

   Border

   Custom - Check Square corner lower left and lower right

4. Double click on green 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

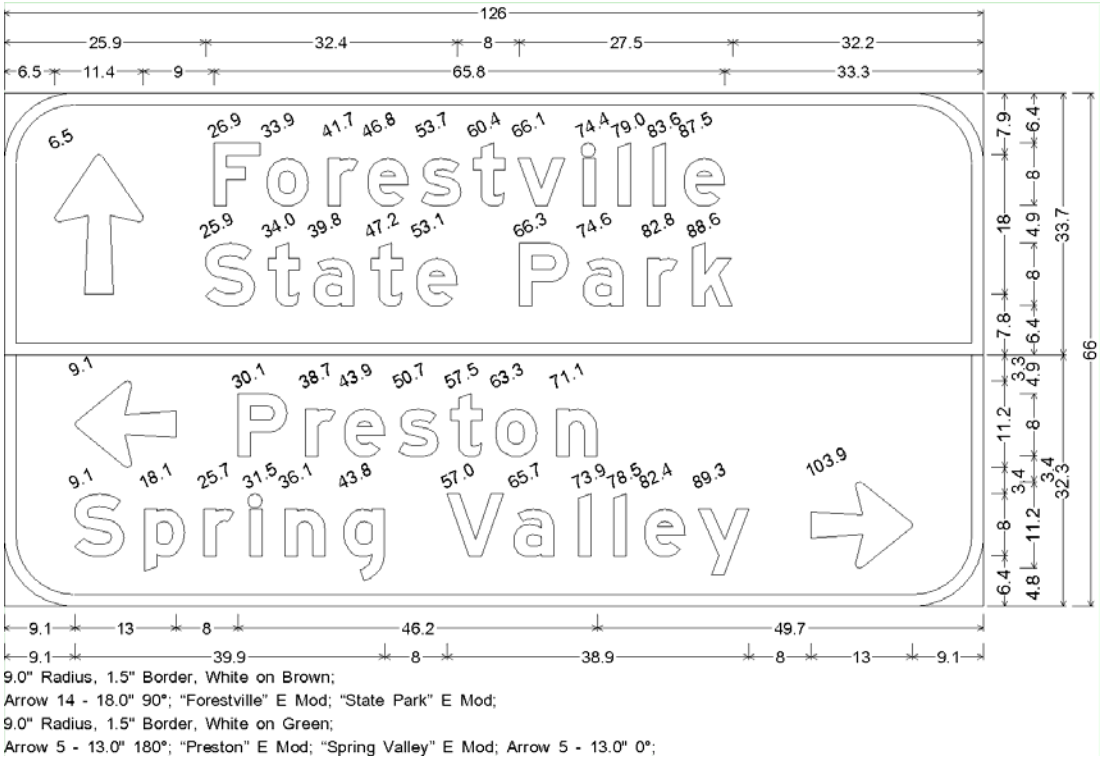
7. Adjust alignment

   Left justify the lower left side arrow by right clicking on each of them –

   Object align left

   Move top arrow and Forestville State Park to left by adjusting left and right object spacing

8. Adjust vertical spacing
9. Adjust horizontal spacing



Typical Mistakes

- Forestville left-justified instead of centered

Final Sign Panel

Example #8, Split Panel Two Color Destination Sign

Vertical Size of Panel and Line Spacing

Given:

4 rows of objects (text on top and arrows on bottom control), 2 lines of text, 2 horizontal arrows

Font size **(Table 3)** = 8-6, based on roadway, speed and number of lanes

Arrow **(Tables 3 & 6)** = 5-13 for horizontal arrows and 14-18 for vertical arrow, based on roadway, speed, and layout

1. Assume border = 1.5"

   From top to bottom:

   1.5"-top border

   8"-text

   8"-text

   1.5"-horizontal bar

   8" arrow (assumed at this point)

   8" arrow (assumed at this point)

   1.5"-bottom border

   total of 36.5" 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. 36.5" + 30" = 66.5"

   66.5" is not divisible by 6, round to closest, use 66" ➔ valid panel side

4. According to border table for Guide Signs, a sign with a short side of 66" a border of 1.5" is used

   ➔ no change to assumption in step #1

5. Panel height (66") – Object space requirements (36.5") = Spacing distance (29.5")

   29.5"/ 6 spaces = 4.917", use 4.9".

6. To calculate the correct arrow spacing:

   E = B-½(C-A) or the arrow vertical spacing is equal to the standard spacing (4.9", from 5 above) minus ½ of the difference between the exact arrow height (11.2" for a 5-13 arrow) and the font size.

   Arrow spacing = 4.9-½(11.2-8) = 3.3". Spacing between Preston and Spring Valley lines is arrow (b) to arrow (b) ➔ B- ½ (Cb-A) – ½ (Cb-A) = 4.9 – ½(11.2-8) – ½(11.2-8) = 1.7".

7. Final vertical spacing summary:

Calculated	Adjustments
1.5” border	
4.9” space	
8” text	
4.9” space	
8” text	
4.9” space	
1.5” horizontal line	
3.3” space	
11.2” horizontal arrow	
1.7” space	1.8”
11.2” horizontal arrow	
3.3” space	
1.5” border	
sums to 65.9” (add 0.1” to space between arrow and arrow).	Sums to 66”

Adjustments now have to be made with the individual panel sections to allow for a 66” overall height. First, add up the total space required for each color.

Brown exact height = 1.5” + 4.9” + 8” + 4.9” + 8” + 4.9” + 1.5” = 33.7”

Green exact height = 3.3” + 11.2” + 1.8” + 11.2” + 3.3” + 1.5” = 32.3”

Open Panel Edit for each border section, select Size, and change the Height Increment and Minimum to the 33.7” for brown and 32.3” for green.

Horizontal Size of Panel and Spacing

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

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 (Section 3.13) to verify desirable installation on a new or existing structure.

The Spring Valley and horizontal arrow is the longest object; Horizontal distance is based on ¾ 8” (font size) space on both sides. Spring = 39.8”, one space 8”, Valley = 38.9”, one 8” space, horizontal arrow = 13”, 3.0” in border and 12” in outside spaces → 122.7”, use 120”, decrease outer spaces by 1.3” and 1.4”.

Key Placement Issues

- Create 2 separate panels, one green, one brown
- Place the Forestville and State Park text lines in a column
- Join the two signs and under Edit multipanel check Dimension as unit.
- Precise sizing of green (32.3”) and brown (33.7”) panel heights is achieved by specifying exact increment height and minimum under panel edit

- The top legend can be left justified by adjusting horizontal object spacing

4.12 Example #9, Junction with Fraction Sign

Purpose of Example:

- Creation of fraction

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.

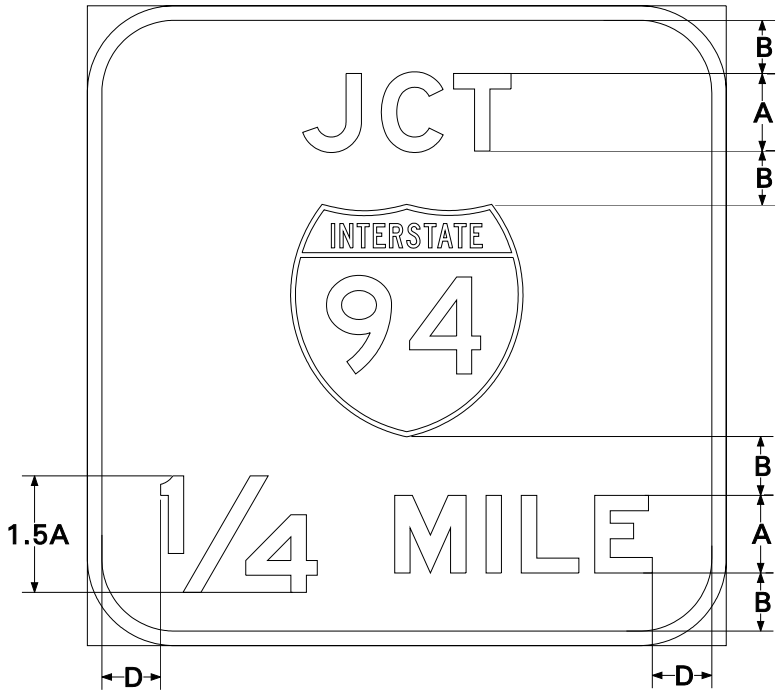
Basic Manual Methods:

Formulas and equivalents for the following example:

A = Letter height

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

D = Horizontal spacing from inside border to legend (approximately ¾ A)



SignCAD Methods:

1. Panel tool -

   Sign type - guide

   Panel color – green

   Border color – white

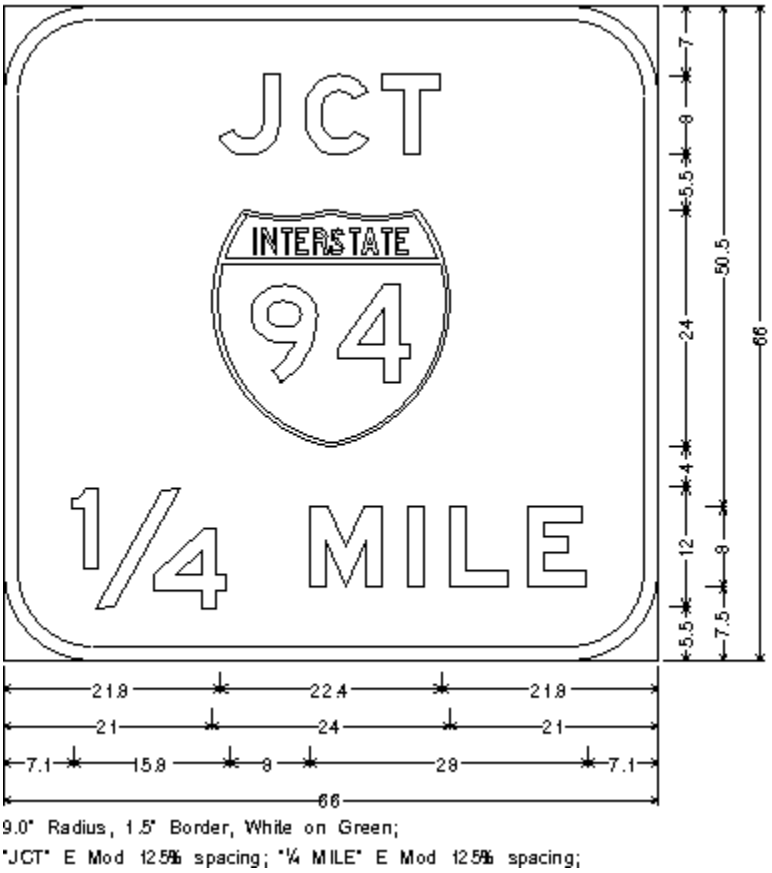
2. Install components (JCT text and route marker)
3. Install ¼ MILE text

   Select text tool

   Adjust height – Fraction is 1.5 times larger than the numerals within it and also 1.5 times larger than MILE. This fraction is 12” tall

   “Shift-4” will create ¼

   Adjust height back to 8” before typing a space and MILE
4. When computing vertical spacing the fraction may be treated more as letter height (8”) than fraction height (12”).

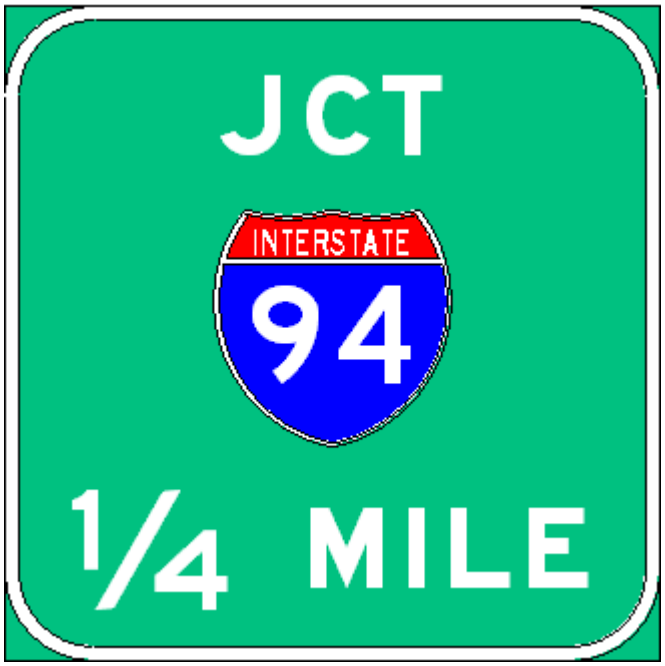


Typical Mistakes

- JCT not centered

- Incorrect fraction design

Final Sign Panel



Example #9, Junction with Fraction Sign

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects (fraction controls)

Font size **(Table 3)** = 8, based on roadway, speed and number of lanes

Route marker **(Table 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” route marker

   8”-fraction (assumed)

   1.5”-bottom border

   total of 43” of space needed for objects

2. Four spaces exist (3 objects) @ ½ to ¾ of font size (8”) = 4”- 6”, use 5”

   4 (5”) = 20” of space required

3. 43” + 20” = 63”

   63” is not divisible by 6, round to closest, use 66” ➔ valid panel side

4. According to border table for Guide Signs, a sign with a short side of 66” a border of 1.5” is used

   ➔ no change to assumption in step #1

5. Panel height (66”) – Object space requirements (43”) = Spacing distance (23”)

   23”/ 4 spaces = 5.75”. use 5.7”.

6. No arrows, however the fraction is 1.5 times the height of the text (8” text ➔ 12” fraction height). Treat fraction the same as arrow: E = B – ½(C – A) = 5.7 – ½(12 – 8) = 3.7”

7. Final vertical spacing summary:

Calculated	Adjustments
1.5” border	
5.7” space	
8” text	
5.7” space	
24” route marker	
3.7” space	3.8”
12” fraction	
3.7” space	3.8”
1.5” border	
sums to 65.8” (add 0.1” to fraction spacings)	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 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 (Section 3.13) to verify desirable installation on a new or existing structure.

The ¼ MILE is the longest object; Horizontal distance is based on ¾ 8” (font size) space on both sides. ¼ = 15.8”, one space 8”, MILE = 26.6”, 3.0” in border and 12” in outside spaces ➔ 65.4”, use 66”, increase outer spaces by 0.3” each

Key Placement Issues

- Use the “shift 4” to create the ¼ legend
- Fraction is coded with a font size of 12”

4.13 Example #10, 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.

Basic Manual Methods:

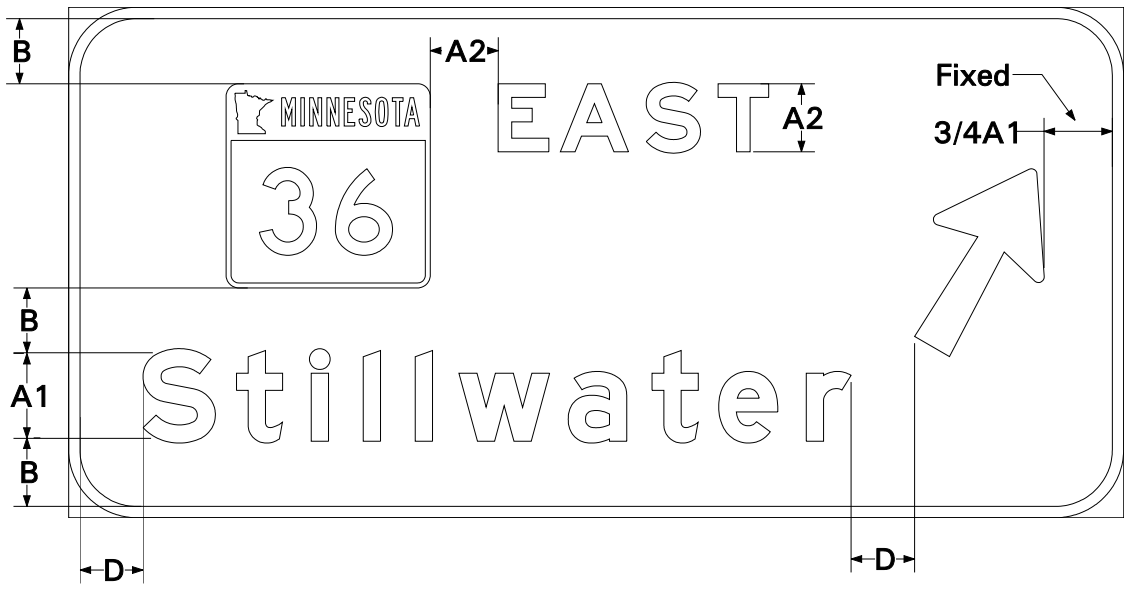
Formulas and equivalents for the following example:

A1 = Letter height

A2 = Cardinal direction letter height

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

D = Horizontal spacing from inside border to legend (approximately ¾ A)



SignCAD Methods:

1. Panel tool –

   Sign type – guide

   Panel color – green

   Border color - white

2. Text tool –

   Font – E modified

   Size – 12 E modified for EAST, 16-12 E modified for Stillwater

   Proper name – Upper-lower case

3. Arrow tool –

   Angle – 60 degrees

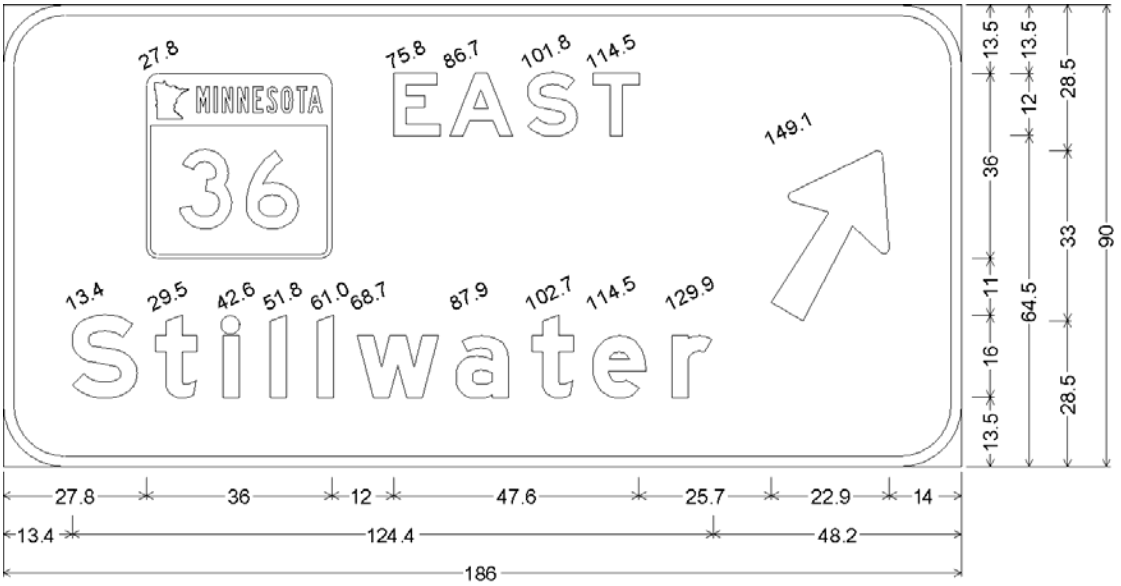
   Arrowhead – 17 (17-36 arrow)

4. Install components into panel one at a time with the arrow last
5. Right justify arrow and adjust right object spacing to 12
6. Top align EAST – Right/click object align top
7. Adjust vertical spacing –

   Right mouse click on object to be spaced – select object spacing (left click)

   Aim is ¾ letter height

8. Horizontal spacing – Left and right of Stillwater adjusted to approximately ¾ of letter height



OH 39-694(R); 12.0" Radius, 2.0" Border, White on Green;
"EAST" E Mod 125% spacing; "Stillwater" E Mod; Arrow 17 - 36.0" 60°;

Typical Mistakes

- Arrow angle incorrect
- Cardinal not top justified on route marker

Final Sign Panel

Example #10, Freeway Overhead Sign

Vertical Size of Panel and Line Spacing

Given:

2 rows of objects: Route marker and text control

Route marker **(Table 4)** = 36, based on freeway and overhead position

Font size **(Table 4)** = 16-12, based on freeway and overhead position

Cardinal Direction Font Size **(Table 4)** = 12

Arrow **(Table 4)** = 17-36, based on roadway and sign type

1. Assume border = 2”

   From top to bottom:

   2”-top border

   36” route marker

   16” legend

   2”-bottom border

   total of 56” of space needed for objects

2. Three spaces exist (2 objects) @ ¾ of font size (16”) = 12”

   3 (12) = 36” of space required

3. 56” + 36” = 92”

   92” is not divisible by 6, round to closest, use 90” ➔ valid panel side

4. According to border table for Guide Signs, a sign with a short side of 90” a border of 2” is used

   ➔ no change to assumption in step #1

5. Panel height (90”) – Object space requirements (56”) = Spacing distance (34”)

   34”/ 3 spaces = 11.33”, use 11.3”.

6. Not applicable

7. Final vertical spacing summary:

Calculated	Adjustments
2” border	
11.3” space	
36” route marker	
11.3” space	11.4”
16” text	
11.3” space	
2” border	
sums to 89.9” (add 0.1” to space between objects)	sums to 90”

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 ¾ of the font size as horizontal spacing, remember that panels are sized in 6” increments.

Stillwater and the arrow are the longest objects; Horizontal distance is based on ¾ 16” (font size) space on both sides. 2” (border) + 12” space + 124.4” (Stillwater) + 12” space + 22.9” (arrow) + 12” (fixed) + 2” (border) = 187.3” => 186” used. 1.3” excess is removed from the spacing right and left of Stillwater => 11.35”

Key Placement Issues

- Sequence of installing components: Arrow installed last
- Fixing arrow position to right side
- EAST is top justified

4.14 Example #11, 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.

Basic Manual Methods:

Formulas and equivalents for the following example:

A1 = City/street name letter height

A2 = Cardinal direction letter height

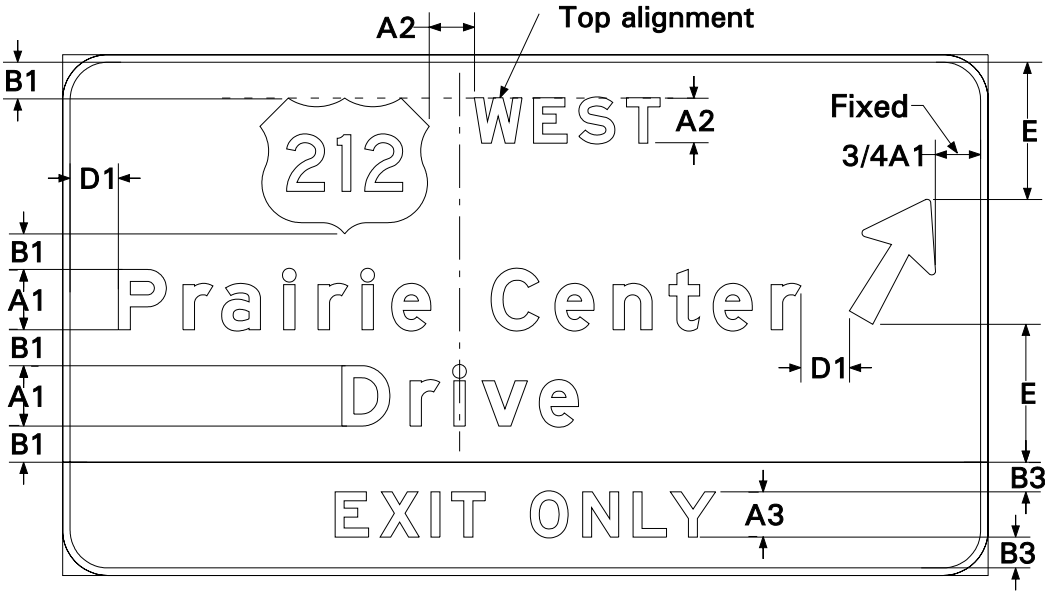
A3 = EXIT ONLY letter height

B1 = Vertical spacing from legend to legend, or from legend to inside border (½ A to ¾ A)

B3 = Vertical spacing from legend to legend, or from legend to inside border (½ A to ¾ A)

D1 = Horizontal spacing from inside border to legend (approximately ¾ A)

E = Vertical spacing from arrow to inside border



SignCAD Methods:

NOTE: create the main panel and the exit panel, then join together

1. Panel tool –

   Sign type – guide

   Panel color – green and yellow (edit the text fill color to black after created)

   Border color – white.

   Custom – no border on bottom

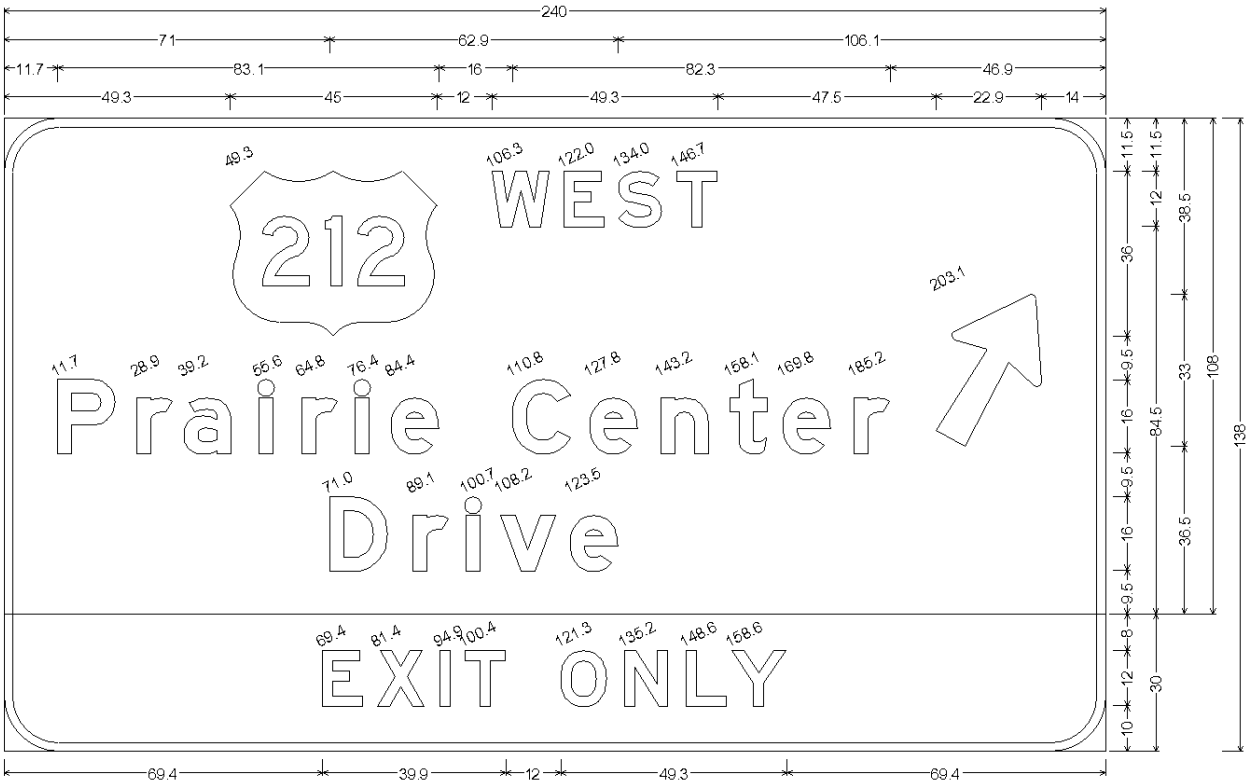
   Size – Enlarge to fit when in multipanel – check column width

2. Install arrow LAST in top panel. Right align arrow and object space 12” on right side. To vertically center the arrow on the green panel the top B1 and bottom B1 must be equal.

3. Top align route marker

4. After joining panels select edit panel (either panel may be edited) –

   Edit multipanel – check dimension as unit



12.0" Radius, 2.0" Border, White on Green;
"WEST" E Mod 125% spacing; "Prairie Center" E Mod; "Drive" E Mod; Arrow 17 - 36.0" 60°;
12.0" Radius, 2.0" Border, White on Yellow;
"EXIT ONLY" Black E Mod 125% spacing;

Typical Mistakes

- Cardinal direction not top justified
- Incorrect arrow and rotation

Final Sign Panel

Example #11, Freeway Exit OH Direction Sign w/ Exit Panel

Vertical Size of Panel and Line Spacing

Given:

3 rows of objects: Route marker and text control

Route marker **(Table 4)** = 36, based on freeway and overhead position

Font size **(Table 4)** = 16-12, based on freeway and overhead position

Cardinal direction font size **(Table 4)** = 12 based on freeway and overhead position

EXIT ONLY **(Table 4)** = 12 based on freeway and overhead position

Arrow **(Table 4)** = 17-36, based on roadway, mounting and sign layout

Main Panel

1. Assume border = 2”

   From top to bottom:

   2” top border

   36” route marker

   16” legend

   16” legend

   total of 70” of space needed for objects

2. Four spaces exist (3 objects) @ ½ to ¾ of font size (16”). Use 10”

   4(10) = 40”

3. 70” + 40” = 110”

   110” is not divisible by 6, round to closest, use 108”

4. According to border table for Guide Signs, a sign with a short side of 108” a border of 2” is used

   ➔ no change to assumption in step #1

5. Panel height (108”) – object space requirements (70”) = spacing distance (38”)

   38”/4 spaces = 9.5”

6. Not applicable

7. Final vertical spacing summary:

Calculated	Adjustments
2” border	
9.5” space	
36” route marker	
9.5” space	
16” text	
9.5” space	
16” text	
9.5” space	
2” border	

sums to 108” (no adjustments required)

Horizontal Size of Panel and Spacing

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

Prairie Center and the arrow are the longest objects; Horizontal distance is based on ¾ 16” (font size) space on both sides. 2” (border) + 12” space + 181.4” (Prairie Center) + 12” space + 22.9” (arrow) + 12” (fixed) + 2” (border) = 244.3”, 246” used. 1.7” additional is added to the left and right of Prairie Center.

Exit Panel

1 row of objects: Text

Font size = 12, based on freeway and overhead

1. Border is 2” based on previous green panel calculations

   From top to bottom:

   12” text

   2” border

   Total of 14” of space needed for objects

2. Two spaces exist (1 object) @ ½ to ¾ of font size (12”). Use 8”

   2(8) = 16” of space required

3. 14” + 16” = 30”, divisible by 6”.
4. Border matches attached panel, no changes
5. Panel height (30”) – Object space requirements (14”) = Spacing distance (16”)

   16”/2 = 8” per vertical space
6. Not Applicable
7. Final vertical spacing summary:

Calculated	Adjustments
8” space	
12” text	
8” space	
2” border	

sums to 30” (no adjustments)

Horizontal Size of Panel and Spacing

Matches attached panel

Appendix A - Font Spacing Charts

LETTER & NUMERAL WIDTHS and SPACE between letters and numerals

SERIES E(M)

To determine the proper SPACE between letters or numerals obtain the code number from table 1 or 2 and enter table 6 for that code number to the desired letter or numeral height.

TABLE 1
LETTER TO LETTER CODE NUMBER

Preceding Letter	Following Letter: B D E F H I K L M N P R U	C G O Q S X Z	A J T V W Y
A	2	2	4
B	1	2	2
C	2	2	3
D	1	2	2
E	2	2	3
F	2	2	3
G	1	2	2
H	1	1	2
I	1	1	2
J	1	1	2
K	2	2	3
L	2	2	4
M	1	1	2
N	1	1	2
O	1	2	2
P	1	2	2
Q	1	2	2
R	1	2	2
S	1	2	2
T	2	2	4
U	1	1	2
V	2	2	4
W	2	2	4
X	2	2	3
Y	2	2	4
Z	2	2	3

TABLE 2
NUMERAL TO NUMERAL CODE NUMBER

Preceding Letter	Following Numeral: 15	236 890	47
1	1	1	2
2	1	2	2
3	1	2	2
4	2	2	4
5	1	2	2
6	1	2	2
7	2	2	4
8	1	2	2
9	1	2	2
0	1	2	2

TABLE 3
WIDTH OF STROKE

Letter or Numeral Height	Stroke Width in Inches
8	1.60
10.67	2.13
13.33	2.67
16	3.20
20	4.00

TABLE 4
WIDTH OF LETTER in inches

	Letter Height: 8	10.67	13.33	16	20
A	8.00	10.67	13.33	16.00	20.00
B	6.38	8.50	10.62	12.75	15.94
C	6.38	8.50	10.62	12.75	15.94
D	6.38	8.50	10.62	12.75	15.94
E	5.94	7.92	9.90	11.88	14.85
F	5.94	7.92	9.90	11.88	14.85
G	6.38	8.50	10.62	12.75	15.94
H	6.38	8.50	10.62	12.75	15.94
I	1.60	2.13	2.67	3.20	4.00
J	6.06	8.09	10.10	12.13	15.16
K	6.50	8.67	10.83	13.00	16.25
L	5.94	7.92	9.90	11.88	14.85
M	7.38	9.84	12.29	14.75	18.44
N	6.38	8.50	10.62	12.75	15.94
O	6.69	8.92	11.15	13.38	16.73
P	6.38	8.50	10.62	12.75	15.94
Q	6.69	8.92	11.15	13.38	16.73
R	6.38	8.50	10.62	12.75	15.94
S	6.38	8.50	10.62	12.75	15.94
T	5.94	7.92	9.90	11.88	14.85
U	6.38	8.50	10.62	12.75	15.94
V	7.32	9.76	12.19	14.63	18.29
W	8.44	11.26	14.06	16.88	21.10
X	6.94	9.26	11.56	13.88	17.35
Y	8.00	10.67	13.33	16.00	20.00
Z	6.38	8.50	10.62	12.75	15.94

TABLE 5
WIDTH OF NUMERAL in inches

	Numeral Height: 8	10.67	13.33	16	20
1	2.38	3.17	3.96	4.75	5.94
2	6.38	8.50	10.62	12.75	15.94
3	6.38	8.50	10.62	12.75	15.94
4	7.38	9.84	12.29	14.75	18.44
5	6.38	8.50	10.62	12.75	15.94
6	6.38	8.50	10.62	12.75	15.94
7	6.38	8.50	10.62	12.75	15.94
8	6.38	8.50	10.62	12.75	15.94
9	6.38	8.50	10.62	12.75	15.94
0	6.63	8.84	11.04	13.25	16.56

TABLE 6
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).

CODE NUMBER	8	10.67	13.33	16	20
1	2.05	2.74	3.42	4.10	5.13
2	1.65	2.20	2.75	3.30	4.13
3	1.10	1.47	1.83	2.20	2.75
4	.55	.74	.92	1.10	1.38

LETTER WIDTHS FOR LOWER CASE E MODIFIED SERIES

LOWER CASE E MODIFIED
WIDTH OF LETTER
in inches

	Letter Height				
	8-6	10.67-8	13.33-10	16-12	20-15
a	5.15	6.87	8.58	10.30	12.88
b	5.20	6.94	8.66	10.40	13.00
c	5.15	6.87	8.58	10.30	12.88
d	5.20	6.94	8.66	10.40	13.00
e	5.20	6.94	8.66	10.40	13.00
f	3.31	4.42	5.52	6.62	8.28
g	5.20	6.94	8.66	10.40	13.00
h	5.20	6.94	8.66	10.40	13.00
i	1.52	2.03	2.53	3.04	3.80
j	2.87	3.83	4.78	5.74	7.17
k	5.15	6.87	8.58	10.30	12.88
l	1.52	2.03	2.53	3.04	3.80
m	8.59	11.46	14.31	17.18	21.48
n	5.20	6.94	8.66	10.40	13.00
o	5.35	7.13	8.91	10.70	13.37
p	5.20	6.94	8.66	10.40	13.00
q	5.20	6.94	8.66	10.40	13.00
r	3.95	5.27	6.58	7.90	9.88
s	5.15	6.87	8.58	10.30	12.88
t	4.07	5.43	6.78	8.14	10.17
u	5.20	6.94	8.66	10.40	13.00
v	6.04	8.06	10.07	12.09	15.11
w	8.00	10.67	13.33	16.00	20.00
x	6.29	8.39	10.48	12.58	15.72
y	6.55	8.74	10.92	13.11	16.38
z	5.34	7.13	8.90	10.69	13.36

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
8-6, 10.67-8, 13.33-10

FOLLOWING LETTER

PRECEDING LETTER	acdegoq			bhiklmnpru			fw			j			st			vy			x			z		
	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10	8-6	10.67-8	13.33-10
AWX	1.86	2.48	3.10	2.12	2.83	3.54	1.74	2.32	2.90	1.18	1.57	1.96	1.51	2.01	2.51	1.27	1.69	2.11	1.51	2.01	2.51	1.92	2.56	3.20
B	2.25	3.00	3.75	2.87	3.82	4.77	2.12	2.83	3.54	1.51	2.01	2.51	2.07	2.76	3.45	1.74	2.32	2.90	1.74	2.32	2.90	2.33	3.11	3.89
CEG	2.12	2.83	3.54	2.63	3.50	4.37	1.92	2.56	3.20	1.39	1.85	2.31	1.86	2.48	3.10	1.86	2.48	3.10	2.01	2.68	3.35	2.18	2.91	3.64
DOQR	2.07	2.76	3.45	2.69	3.58	4.47	2.01	2.68	3.35	1.33	1.77	2.21	1.86	2.48	3.10	1.86	2.48	3.10	2.01	2.68	3.35	2.12	2.83	3.54
F	1.01	1.34	1.67	2.01	2.68	3.35	1.27	1.69	2.11	1.01	1.34	1.67	1.13	1.50	1.87	1.13	1.50	1.87	1.18	1.57	1.96	1.51	2.01	2.51
HIMN	2.75	3.66	4.57	3.25	4.33	5.41	2.63	3.50	4.37	2.12	2.83	3.54	2.57	3.42	4.27	2.57	3.42	4.27	2.69	3.58	4.47	2.81	3.74	4.67
JU	2.69	3.58	4.47	2.87	3.82	4.77	2.63	3.42	4.27	2.07	2.76	3.45	2.39	3.19	3.99	2.39	3.19	3.99	2.51	3.35	4.19	2.75	3.66	4.57
KL	1.62	2.16	2.70	2.39	3.19	3.99	1.51	2.01	2.51	.95	1.26	1.57	1.45	1.93	2.41	1.45	1.93	2.41	1.57	2.09	2.61	1.74	2.32	2.90
P	1.92	2.56	3.20	2.24	2.99	3.74	1.80	2.40	3.00	1.01	1.34	1.67	1.62	2.16	2.70	1.62	2.16	2.70	1.74	2.32	2.90	1.86	2.48	3.10
S	1.86	2.48	3.10	2.57	3.42	4.27	1.74	2.32	2.90	1.28	1.70	2.12	1.68	2.24	2.80	1.68	2.24	2.80	1.80	2.40	3.00	1.92	2.56	3.20
T	1.51	2.01	2.51	2.39	3.19	3.99	1.39	1.85	2.31	1.13	1.50	1.87	1.51	2.01	2.51	1.51	2.01	2.51	1.62	2.16	2.70	1.74	2.32	2.90
V	1.39	1.85	2.31	2.24	2.99	3.74	1.51	2.01	2.51	1.18	1.57	1.96	1.68	2.24	2.80	1.68	2.24	2.80	1.80	2.40	3.00	1.92	2.56	3.20
Y	1.01	1.34	1.67	2.01	2.68	3.35	1.27	1.69	2.11	.86	1.14	1.42	.95	1.26	1.57	.95	1.26	1.57	1.13	1.50	1.87	1.62	2.16	2.70
Z	2.51	3.35	4.19	2.99	3.98	4.97	2.45	3.27	4.09	1.74	2.32	2.90	2.39	3.19	3.99	2.39	3.19	3.99	2.51	3.35	4.19	2.63	3.50	4.37
adhijlmnqu	2.45	3.27	4.09	3.07	4.09	5.11	2.33	3.11	3.89	1.74	2.32	2.90	2.24	2.99	3.74	2.24	2.99	3.74	2.39	3.19	3.99	2.51	3.35	4.19
bfkops	1.74	2.32	2.90	2.45	3.27	4.09	1.62	2.16	2.70	1.07	1.42	1.77	1.57	2.09	2.61	1.57	2.09	2.61	1.68	2.24	2.80	1.80	2.40	3.00
ce	1.86	2.48	3.10	2.51	3.35	4.19	1.74	2.32	2.90	1.18	1.57	1.96	1.68	2.24	2.80	1.68	2.24	2.80	1.80	2.40	3.00	1.92	2.56	3.20
r	1.18	1.57	1.96	1.86	2.48	3.10	1.13	1.50	1.87	.50	.67	.84	1.01	1.34	1.67	1.01	1.34	1.67	1.13	1.50	1.87	1.27	1.69	2.11
tz	1.80	2.40	3.00	2.51	3.35	4.19	1.68	2.24	2.80	1.13	1.50	1.87	1.62	2.16	2.70	1.62	2.16	2.70	1.74	2.32	2.90	1.86	2.48	3.10
vy	1.57	2.09	2.61	2.24	2.99	3.74	1.45	1.93	2.41	.86	1.14	1.42	1.39	1.85	2.31	1.39	1.85	2.31	1.51	2.01	2.51	1.62	2.16	2.70
w	1.63	2.17	2.71	2.24	2.99	3.74	1.51	2.01	2.51	.95	1.26	1.57	1.45	1.93	2.41	1.45	1.93	2.41	1.57	2.09	2.61	1.68	2.24	2.80
x	1.68	2.24	2.80	2.33	3.11	3.89	1.57	2.09	2.61	1.01	1.34	1.67	1.51	2.01	2.51	1.51	2.01	2.51	1.62	2.16	2.70	1.74	2.32	2.90

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

FOLLOWING LETTER

PRECEDING LETTER	acdegoq		bhiklmnpru		fw		j		st		vy		x		z	
	16-12	20-15	16-12	20-15	16-12	20-15	16-12	20-15	16-12	20-15	16-12	20-15	16-12	20-15	16-12	20-15
AWX	3.72	4.65	4.25	5.31	3.48	4.35	2.36	2.94	3.02	3.77	2.54	3.17	3.02	3.77	3.84	4.80
B	4.50	5.63	5.73	7.16	4.25	5.31	3.02	3.77	4.14	5.18	3.48	4.35	3.48	4.35	4.67	5.83
CEG	4.25	5.31	5.25	6.56	3.84	4.80	2.78	3.47	3.72	4.65	3.72	4.65	4.02	5.03	4.37	5.46
DOQR	4.14	5.18	5.37	6.71	4.02	5.03	2.66	3.32	3.72	4.65	3.72	4.65	4.02	5.03	4.25	5.31
F	2.01	2.51	4.02	5.03	2.54	3.17	2.01	2.51	2.25	2.81	2.25	2.81	2.36	2.94	3.02	3.77
HIMN	5.49	6.86	6.50	8.12	5.25	6.56	4.25	5.31	5.13	6.41	5.13	6.41	5.37	6.71	5.61	7.01
JU	5.37	6.71	5.73	7.16	5.13	6.41	4.14	5.18	4.79	5.98	4.79	5.98	5.03	6.28	5.49	6.86
KL	3.24	4.05	4.79	5.98	3.02	3.77	1.89	2.36	2.90	3.62	2.90	3.62	3.14	3.92	3.48	4.35
P	3.84	4.80	4.49	5.61	3.60	4.50	2.01	2.51	3.24	4.05	3.24	4.05	3.48	4.35	3.72	4.65
S	3.72	4.65	5.13	6.41	3.48	4.35	2.55	3.19	3.36	4.20	3.36	4.20	3.60	4.50	3.84	4.80
T	3.02	3.77	4.79	5.98	2.78	3.47	2.25	2.81	3.02	3.77	3.02	3.77	3.24	4.05	3.48	4.35
V	2.78	3.47	4.49	5.61	3.02	3.77	2.36	2.94	3.36	4.20	3.36	4.20	3.60	4.50	3.84	4.80
Y	2.01	2.51	4.02	5.03	2.54	3.17	1.71	2.14	1.89	2.36	1.89	2.36	2.25	2.81	3.24	4.05
Z	5.03	6.28	5.97	7.46	4.91	6.13	3.48	4.35	4.79	5.98	4.79	5.98	5.03	6.28	5.25	6.56
adhijlmnqu	4.91	6.13	6.14	7.67	4.67	5.83	3.48	4.35	4.49	5.61	4.49	5.61	4.79	5.98	5.03	6.28
bfkops	3.48	4.35	4.91	6.13	3.24	4.05	2.13	2.66	3.14	3.92	3.14	3.92	3.36	4.20	3.60	4.50
ce	3.72	4.65	5.03	6.28	3.48	4.35	2.36	2.94	3.36	4.20	3.36	4.20	3.60	4.50	3.84	4.80
r	2.36	2.94	3.72	4.65	2.25	2.81	1.01	1.26	2.01	2.51	2.01	2.51	2.25	2.81	2.54	3.17
tz	3.60	4.50	5.03	6.28	3.36	4.20	2.25	2.81	3.24	4.05	3.24	4.05	3.48	4.35	3.72	4.65
vy	3.14	3.92	4.49	5.61	2.90	3.62	1.71	2.14	2.78	3.47	2.78	3.47	3.02	3.77	3.24	4.05
w	3.26	4.07	4.49	5.61	3.02	3.77	1.89	2.36	2.90	3.62	2.90	3.62	3.14	3.92	3.36	4.20
x	3.36	4.20	4.67	5.83	3.14	3.92	2.01	2.51	3.02	3.77	3.02	3.77	3.24	4.05	3.48	4.35

Appendix B - Glossary of Sign Terms

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

Conventional Highway - A two-lane, two-way section of highway.

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

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-riveted 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"). Mn/DOT 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.

Appendix C - Index

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