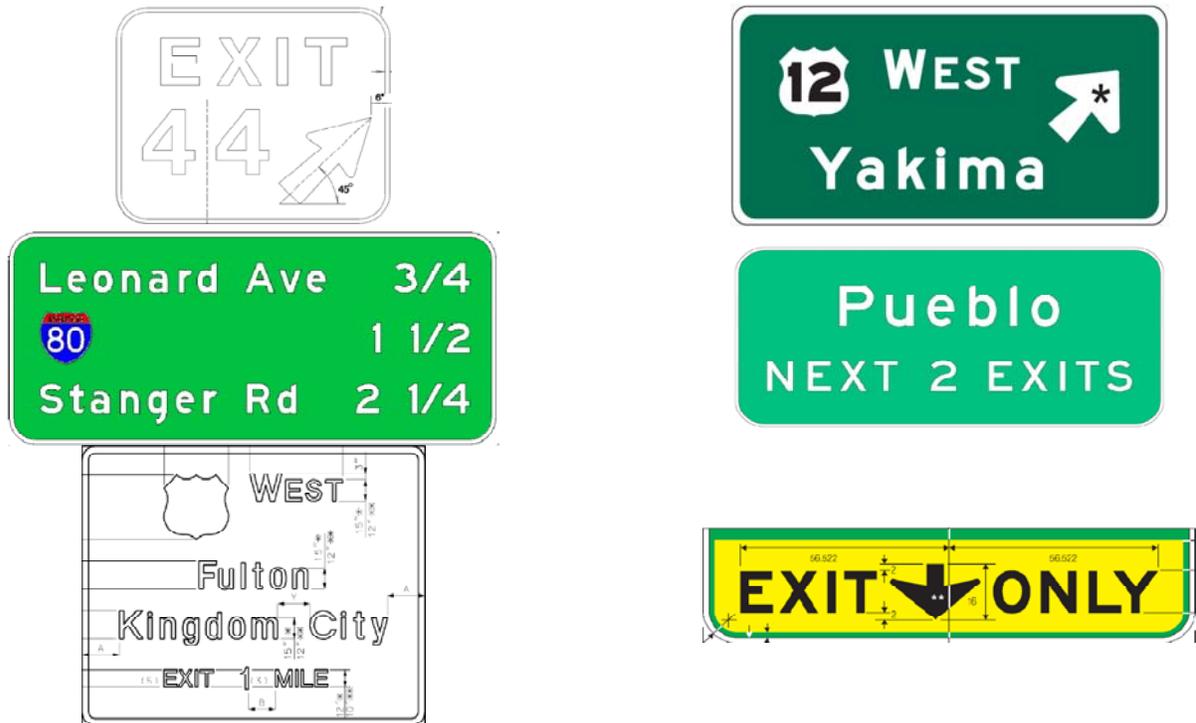


Traffic Control Devices Pooled Fund Study

Development of a Uniform Standard for
Guide Sign Design:
State of Practice for Freeway Guide Signing

Final Report

January 2011



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The objective of the Traffic Control Devices Pooled Fund Study (TCD PFS) is to assemble a group composed of State and local agencies, appropriate organizations and the FHWA to 1) establish a systematic procedure to select, test and evaluate approaches to novel TCD concepts as well as incorporation of results into the MUTCD; 2) select novel TCD approaches to test and evaluate; 3) determine methods of evaluation for novel TCD approaches; 4) initiate and monitor projects intended to address evaluation of the novel TCDs; 5) disseminate results; and 6) assist MUTCD incorporation and implementation of results.

To join the TCD PFS, or for more information about the TCD PFS

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DISCLAIMER

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SECTION 1 - INTRODUCTION

The purpose of this document is to review current practices and provide an example uniform methodology to create a guide sign of any configuration by knowing the desired uppercase letter height of the principal legend. This report reviews different guide signs currently used on freeways across the United States. Upon analyzing guide signs from around the United States, it was quickly determined that a single guide sign has numerous design specifications dependant on its state. Variations were found both in sign layout such as interline and edge spacing as well as message and numeral height seen in cardinal directions and distance messages. Because of the number of different standards and specifications, design of a single type of guide sign is found to vary in both layouts and dimensions between states.

This report reviews design and layout of eleven different guide signs with data taken from 27 states. The majority of this data was collected from State Department of Transportation's sign design manuals or standard drawings. Signs were selected for a number of reasons. It was important that the selected guide signs were common between as many states as possible so that the dimensions could be compared. Because this report develops a method to create a guide sign, it was also important to have a mix of different levels of detail on the selected guide signs. While this report focuses on the theoretical design of guide signs, it must be recognized that guide sign dimensions may vary within each state or jurisdiction due to the physical fabrication process between different manufacturers.

SECTION 2 - STATE OF PRACTICE

SELECTION OF INFORMATION

This section focuses on the signs that were chosen to be analyzed as part of this project. Currently, many of the states within the United States have different guidelines for the design of guide signs. Many of these guidelines provide different methods for laying out what is essentially the same sign. While in most cases, the final product will appear similar, there are many slight variations between the signs. Many of these slight variations are due to differences in dimensions, but in several instances there are major layout differences. This report reviews information available from various states to produce a summary of current practices. Information from 27 states was collected and used for comparison. The states, excluding Alaska, which information was taken from for this report can be seen in blue in Figure 1 below. Signs which were found to be most common were then selected to be used in this report.

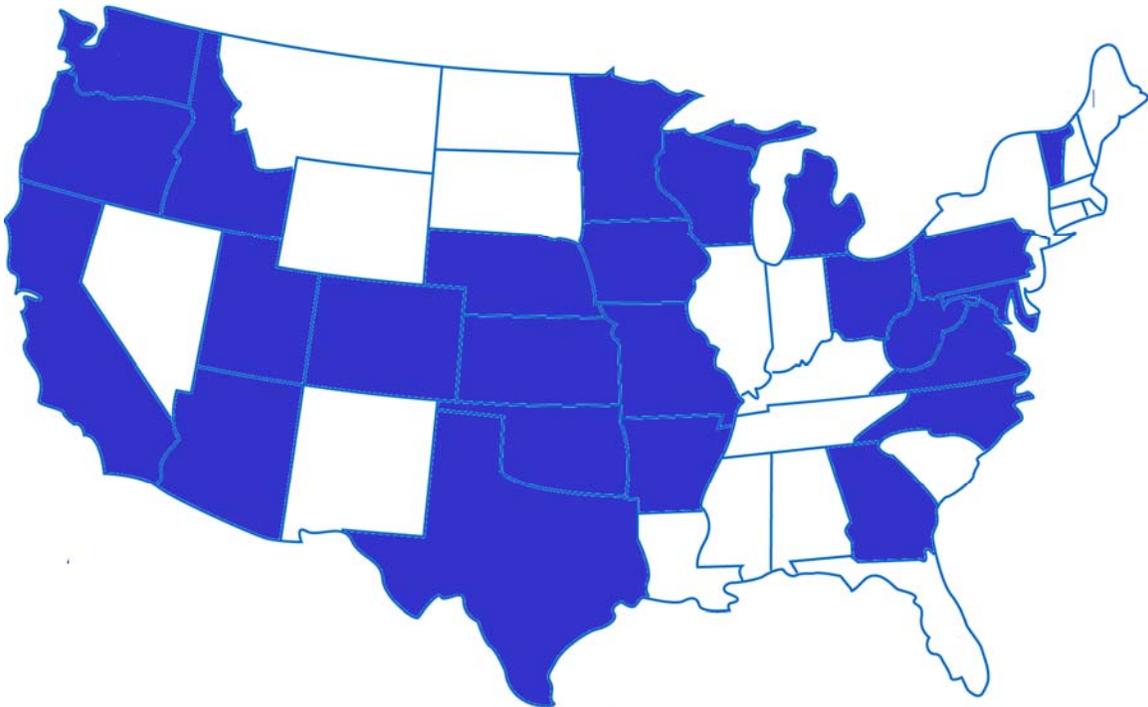


Figure 1: States Providing Information

SELECTED GUIDE SIGNS

As seen in Figure 2, there were a number of guide signs selected to be examined in this report. As mentioned above, these signs were selected due to the ease of obtaining detailed drawings of them from numerous Departments of Transportations. For the purpose of this report, each guide sign has been named to match the common practice.



Figure 2: Summary of Signs Detailed in this Report

It can be seen that the selected signs contain a mix of details. Some items of interest while selecting guide signs were: route shields, angled arrows, vertical arrows, legend consisting of both letters and digits, fractions, and multiple lines of text.

DESIGN OF FRACTIONS

Fractions are commonly used on guide signs to convey a distance message on a guide sign. The release of the 2009 edition of the MUTCD incorporates new language on the design of fractions. Specifically:

Standard:

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

LETTER STYLE

The most common letter styles found in this research were from the FHWA Standard Alphabets (primarily Series E, E-modified, and D) and ClearviewHwyTM. The use of FHWA Standard Alphabets is included in the 2009 MUTCD and the ClearviewHwyTM typeface is currently allowed subject to Interim Approval.

ADVANCE GUIDE SIGN E1-1



MUTCD E1-1



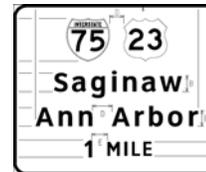
Washington State (E1-1)



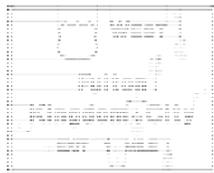
Arizona (E1-1)



Colorado (E1-1)



Michigan (E1-1)



Missouri (E1-1)



Pennsylvania (E1-1)



Texas (E1-1a)



Virginia (E1-1)



North Carolina (E1-1a)

Figure 3: Typical Advance Guide Sign E1-1 Designs

Table 1: Advance Guide Sign E1-1 Summary

Object	Common Dimension (inches)	Range (inches)
Destination Legend	16	N/A
Exit Legend	10	10 - 16
Number Height	15	12 - 15
Word Spacing	10	10 - 24
Line Spacing	12	10 - 13
Edge spacing	N/A	11 - 16
Route Shield Size	36	N/A
Corner Radius	12	9 - 12
Border Width	2	1.75 - 2

An Advance Guide Sign is described in section 2E.33 of the 2009 MUTCD as:

An Advance Guide sign (see Figure 2E-22) gives notice well in advance of the exit point of the principal destinations served by the next interchange and the distance to that interchange.

As seen in Figure 3, the critical features of an Advance Guide Sign are the route shield, destination(s), and distance to the destination. Table 1 provides some of the most common dimensions found for an Advance Guide Sign throughout the states. Much of the variation between states' version of this sign involve the mileage numeral. In the majority of the cases, the numeral was a different size than the surrounding legend. The most common configuration among the states was to specify a 10 inch letter height for the words 'EXIT' and 'MILES' and a 15 inch letter height for the mileage.

Another difference among states regarding the line of copy containing the mileage was how the numeral was aligned. The two common configurations were either to align the bottom of the numeral with the line of copy, or to center the numeral along the center of the line of copy. The most common uppercase letter height for the destination was found to be 16 inches with 12 inches being the most common lower case letter height. All states reviewed in this report specified the height of the shield to be 36 inches.

EXIT NUMBER PLAQUE E1-5P



MUTCD E1-5P



Arizona (E1-5P)



Arkansas (E1-1)



Alaska (E1-5P)



California (G70-3)



Idaho (E1-5P)



Michigan (E1-5P)



Nebraska (E1-5P)



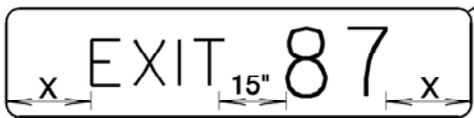
North Carolina (E1-5P)



Ohio (E1-5P)



Oklahoma (E1-5P)



Oregon (E1-5P)



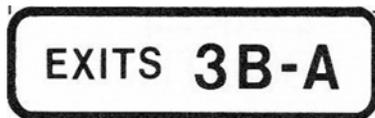
Pennsylvania (E1-5P)



Texas (E1-5P)



Vermont (E1-5P)



Virginia (E1-5P)



Washington State (E1-5P)



Wisconsin (E1-5P)

Figure 4: Typical Exit Number Plaque E1-5P Designs

Table 2: Exit Number Plaque E1-5P Summary

Object	Common Dimension (inches)	Range (inches)
Legend Size	10	10 - 12
Number Size	15	15 - 18
Edge spacing	10	4.5 - 15
Corner Radius	3	2.25 - 9
Border Width	2	1.5 - 2.5

The Exit Number Plaque is used in conjunction with both Advance Guide and Exit Direction signs to notify motorists of the exit number for the given destination(s). This sign is mounted either on the top right or top left of the Advance Guide Sign depending if the exit is on the right or left of the roadway.

Table 2 summarizes the findings for the Exit Number Plaque E1-5P. The general layout of this sign had little variation between states, but the dimensions did. The most prevalent convention to align the exit number with the line of copy is to vertically center the exit numbers with the word EXIT. A layout difference among states is the application of a border. It was found that while the majority of the states created a border around all four sides of this sign, some states only had a border on three sides of the sign, leaving the bottom without a border. Another layout difference found in this research is which horizontal dimension will vary to ensure that the sign is a standard size. The majority of states in this study specify a dimension for the horizontal spacing between 'EXIT' and the exit number. This method leaves the horizontal spacing between each side of the line of copy and the edge of the sign variable. Another method seen in the sign specifications of three states in this study (Arkansas, Alaska, and Oklahoma) involved leaving the horizontal distance between 'EXIT' and the exit number variable. These states instead specified the horizontal distance between each side of the line of copy and the edge of the sign.

Of the surveyed states, the average sign height was found to be 30 inches, while the smallest is 24 and the largest is 42 inches. Of the surveyed states, the letter height of the word 'EXIT' was found to range between 10 and 12 inches, while the mileage stayed fairly constant at either 15 or 16 inches. The average corner radius was found to be three inches, but this also ranged from two to nine inches.

NEXT EXIT E2-1



MUTCD E2-1



Alaska (E2-1)



Colorado (E2-1)



Idaho (E2-1)



Michigan (E2-1)



Missouri (E2-1)



Nebraska (E2-1)



North Carolina (E2-1)



Ohio (E2-1)



Pennsylvania (E2-1)



Vermont (E2-1)



Washington State (E2-1)



Wisconsin (E2-1)

Figure 5: Typical Next Exit E2-1 Designs

Table 3: Next Exit E2-1 Summary

Item	Common Dimension (Inches)	Range (Inches)
Legend	8	8 - 12
Number Size	8	8 - 12
Word Spacing	8	8 - 12
Edge spacing	8	6 - 12
Corner Radius	6	1.88 - 6
Border Width	1	0.75 - 2

The 2009 MUTCD describes the standard for the Next Exit sign in section 2E.34 as:

The Next Exit plaque shall carry the legend NEXT EXIT XX MILES. If the Next Exit plaque is used, it shall be placed below the Advance Guide sign nearest the interchange. It shall be mounted so as to not adversely affect the breakaway feature of the sign support structure.

The layout of the Next Exit E2-1 sign was found to have very little variation between states due to its few features. The summary of most common dimensions found can be seen above in Table 3. It was found that the majority of the surveyed states use the same height for the mileage numeral as the line of copy, and this was most commonly found to be 8 inches. Other common dimensions for both the line of copy and the mileage numeral were 10 and 12 inches. Sign heights varied between 24 and 36 inches, and this variation was mostly in correlation to the letter heights. Similarly to the letter heights, the horizontal spacing between words and the numeral was found to range between 8 and 12 inches. The corner radius was found to mostly vary between 3 and 6 inches, with an exception being Alaska which specifies a 1.88 inch corner radius. The border thickness was found most commonly at one inch and ranges from up to two inches.

NEXT EXIT E2-1A



Guide Sign E2-1a



Alaska



Idaho



Michigan



Mississippi



Missouri



Nebraska



North Carolina



Ohio



Texas



Vermont



Washington State



Wisconsin

Figure 6: Typical Next Exit E2-1a Designs

Table 4: Next Exit E2-1a Summary

Item	Common Dimension (inches)	Range (inches)
Legend	8	8 - 12
Number Size	8	8 - 12
Line Spacing	8	6 - 12
Edge spacing	7	7 - 12
Corner Radius	6	3 - 8
Border Width	1	1 - 2

Next Exit Sign E2-1a is also described in section 2E.34 of the 2009 MUTCD as:

Option:

The legend for the Next Exit plaque may be displayed in either one or two lines as shown in Figure 2E-23.

Support:

The one-line message on the Next Exit plaque is the more desirable choice.

Similarly to Next Exit E2-1, there is not much variation in the layout of Next Exit E2-1a between states. Again, the most commonly found letter height is 8 inches, and the letter heights range between 8 and 12 inches. Many of the other dimensions found were also similar to the single line version of this sign. The line spacing was found to range between 6 and 12 inches with 8 inches being the most common dimension. The majority of the states specified a six inch corner radius, but this ranged from three to eight inches. The border widths on this sign ranged from one to two inches.

EXIT GORE E5-1 AND E5-1A



MUTCD E5-1



Alaska (E5-1)



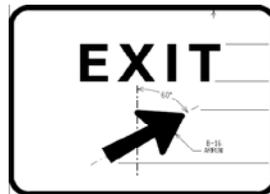
California (G84)



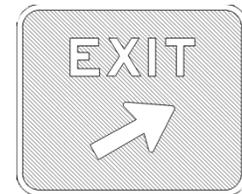
Colorado (E5-1)



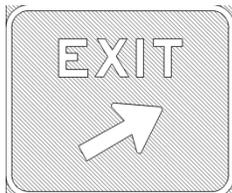
Maryland (E5-1)



Michigan (E5-1)



Mississippi (E5-1)



Missouri (E5-1)



Nebraska (E5-1)



Ohio (E1-5P)



Oregon (E5-1-60)



Pennsylvania (E5-1)



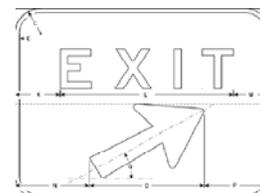
Texas (E5-1)



Virginia (E5-1)



Washington State (E5-1)



Wisconsin (E5-1)

Figure 7: Typical Exit Gore E5-1 Designs



MUTCD E5-1a



Alaska (E5-1a)



California (G84-2)



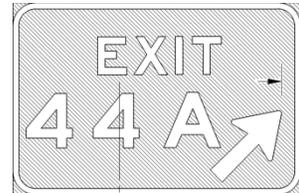
Colorado (E5-1a)



Idaho (E5-101)



Michigan (E5-1a)



Mississippi (E5-1a)



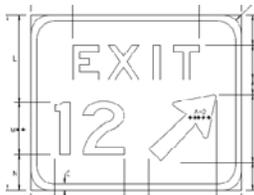
Missouri (E5-1a)



Nebraska (E5-1a)



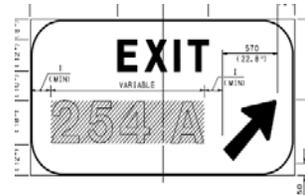
North Carolina (E5-1a)



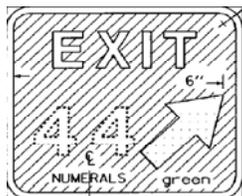
Ohio (E5-1a)



Oregon (E5-1a)



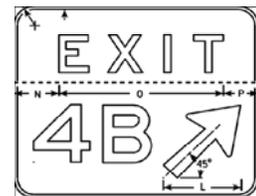
Pennsylvania (E5-1a)



Vermont (E5-1a)



Washington State (E5-1a)



Wisconsin (E5-1a)

Figure 8: Typical Exit Gore E5-1a Designs

Table 5: Exit Gore E5-1 Summary

Object	Common Dimension (inches)	Range (inches)
Legend	12	10 - 12
Line Spacing	10	5.25 - 13.5
Edge spacing	10	4.375 - 12
Corner Radius	6	3.75 - 9
Border Width	2	1 - 2

The Exit Gore Signs E5-1 and E5-1a are described in section 2E.37 of the 2009 MUTCD as:

Support:

The Exit Gore (E5-1 or E5-1a) sign in the gore indicates the exiting point or the place of departure from the main roadway. Consistent application of this sign at each exit is important.

Standard:

The gore shall be defined as the area located between the main roadway and the ramp just beyond where the ramp branches from the main roadway. The Exit Gore sign shall be located in the gore and shall carry the word EXIT or EXIT XX (if interchange numbering is used) and an appropriate upward slanting arrow. If suffix letters are used for exit numbering at a multi-exit interchange, the suffix letter shall also be included on the Exit Gore sign and shall be separated from the exit number by a space having a width of between 1/2 and 3/4 of the height of the suffix letter. Breakaway or yielding supports shall be used.

Guidance:

The arrow should be aligned to approximate the angle of departure. Each gore should be treated similarly, whether the interchange has one exit roadway or multiple exits.

It was found that nearly every state survey had a sign height of 60 inches for the E5-1 sign, and the most common width was 72 inches. Although the most common width was found to be 72 inches, there were numerous states which specified for a 60 inch width. The legend on this sign was found to be almost uniformly 12 inches throughout the surveyed states, with a few exceptions which specified 10 inches. The most commonly found corner radius was six inches, and this dimension ranged from 3.75 to 9 inches. Both the most common line spacing and edge spacing were found to be 10 inches. The most common border thickness was found to be two inches, and this dimension ranged from one to two inches. The angle which the exit arrow makes with the vertical was found to vary between 60, 30, or 45 degrees and some states have specifications for all three of these values.

Table 6: Exit Gore E5-1a Summary

Object	Common Dimension (inches)	Range (inches)
Legend Size	12	10 - 12
Number Size	18	12 - 18
Word Spacing	N/A	6 - 7
Line Spacing	8	5.23 - 13
Edge spacing	8	8 - 14
Corner Radius	6	3.75 - 9
Border Width	2	1 - 2

As seen in Table 6, exit gore E5-1a was found to be very similar to E5-1. A difference with E5-1a is the range of values which were found. Again, the most common sign height was 60 inches, and there was not much variation with this dimension. On the other hand, the sign width did have some variation in dimensions. It was found that the most common width was 72 inches, but this dimension ranged due to the option to include multiple digits and letters for the exit. Another common practice which was recognized was the usage of a 12 inch legend for the word 'EXIT' and 18 inch legend for the exit numerals. The most commonly found corner radius is equal to six inches, with a range from four to nine inches. The most common border thickness is two inches, with the range from one to two inches. Unlike guide sign E5-1, there was not much variation in arrow angle. The majority of states had an angle of 45 degrees from the vertical. In both Exit Gore E5-1 and E5-1a signs, different types of arrows were seen from different states in this study, specifically changes to the length and style of the arrow. Some states specify long tails on the arrow while others specify short tails. For arrow style, the majority of the states specify a flared tail while others specify a straight tail.

EXIT DIRECTION SIGN



Exit Direction Sign



Alaska (E4-21)



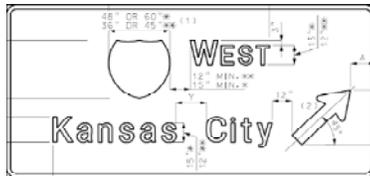
California (G85-6)



Colorado (E6-101)



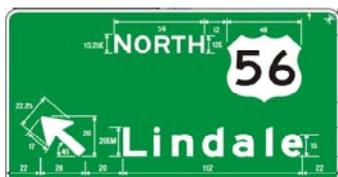
Georgia (E6-101)



Missouri (E6-101)



Minnesota (E6-101)



North Carolina (E6-101)



Washington State (E6-101)



Virginia (E6-101)

Figure 9: Typical Exit Direction Designs

Table 7: Exit Direction Sign Summary

Object	Common Dimension (inches)	Range (inches)
Destination Legend	16	16 - 20
Cardinal Direction Legend	12	12 - 18
Line Spacing	N/A	16 - 33
Edge spacing	N/A	12 - 17
Route Shield Size	36	36 - 48
Corner Radius	12	4 - 12
Border Width	2	2- 3

The Exit Direction Sign is described in section 2E.37 of the 2009 MUTCD as:

Support:

The Exit Direction sign (see Figure 2E-26) repeats the route and destination information that was displayed on the Advance Guide sign(s) for the next exit, and thereby assures road users of the destination served and indicates whether they exit to the right or left for that destination.

Standard:

Exit Direction signs shall be used at major and intermediate interchanges. Populations or other similar information shall not be displayed on Exit Direction signs.

There were many variations in the layout of the Exit Direction between states. These variations are due in part to the complexity of the sign. Some of the variations involve the positioning of the arrow, the interstate shield, the alignment of the destination, and text heights of the direction. Because of these many variations, there was no sign height or width which was much more common than any other. The range in sign heights was found to be from 72 to 108 inches. The most common upper case letter height for the destination was found to be 16 inches, with 12 inches the most common lower case letter height. The most common letter height of the cardinal direction was found to be 12 inches. Five of the nine states with specifications for an Exit Direction Sign specified a larger initial letter in the cardinal direction. Another difference between states is similar to that what was found in the Exit Gore Signs E5-1 and E5-1a was that the arrow tail length and style varied between states.

A consistency between states was that in every instance the destination letter height was larger than that of the cardinal direction. As mentioned, the layout was often slightly different between states and two of the biggest changes were the location of both the shield and the arrow. It can be seen that the shield on the Washington State sign is aligned with the left-hand side of the sign, while in the Missouri example the combination of shield and cardinal direction are centered. Another item of interest on this sign is the location of the arrow. It can be seen that on the Washington State sign, the arrow is near the center of the sign, while in the Missouri example the bottom of the arrow is aligned with the bottom line of copy. Another difference related to the shield is the positioning of the cardinal direction. All of the states except California aligned the top of the cardinal direction with the top of the route shield. California aligns the cardinal direction centered along the numeral on the shield.

POST-INTERCHANGE DISTANCE SIGN



Post-Interchange Distance Sign



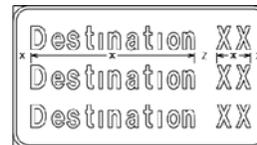
Arkansas (DS40-03WB)



California (G5)



Colorado (E7-1)



Georgia (E7-1)



Maryland (E7-1)



Michigan (E7-1 1.3)



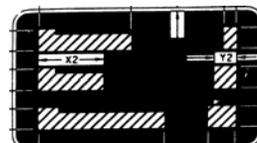
Missouri (E7-1)



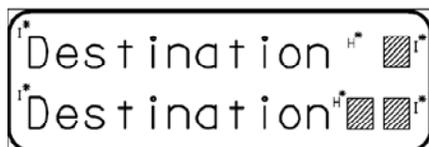
Nebraska



North Carolina (E7-1)



Ohio (E7-H1)



Pennsylvania (E7-1)



Texas (E7-3)



Washington State (E7-1)

Figure 10: Typical Post-Interchange Distance Sign Designs

Table 8: Post-Interchange Distance Sign Summary

Object	Common Dimension (inches)	Range (inches)
Legend Size	13.3	8 - 13.33
Line Spacing	13	5.5 - 13
Edge spacing	8	6 - 14
Number Size	8	6 - 13.33
Corner Radius	6	6 - 12
Border Width	2	1 - 2

The Post-Interchange Distance Sign is typically a post-mounted sign which displays two or three destinations to the passing motorist. The 2009 MUTCD provides the following description in section 2E.39:

Standard:

If used, the Post-Interchange Distance sign shall consist of a two- or three-line sign carrying the names of significant destination points and the distances to those points. The top line of the sign shall identify the next meaningful interchange with the name of the community near or through which the route passes, or if there is no community, the route number or name of the intersected highway.

While the design of the Post-Interchange Distance Sign varies in the surveyed states due to different letter styles, the usage of route shields, and mix of uppercase and lowercase letters, the general spacing of the layout has little variation. The most common sign height was found to be 84 inches. The most common upper case destination legend was found to be 13.33 inches, with 10 inches used for the lower case letters. Although some states specify individual dimensions for both the mileage and the destination, the most common practice is to have both the mileage and destination of equal size. The most common corner radius was found to be 6 inches, with a range from 6 to 12 inches. The most common border thickness was found to be 2 inches, with a range of 1 to 2 inches.

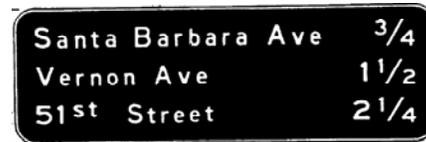
INTERCHANGE SEQUENCE SIGN



Interchange Sequence Sign



Alaska (E8-1)



California (G23)



Idaho (E8-1)



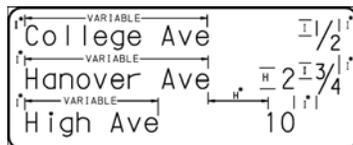
Michigan (E8-1)



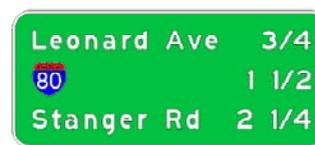
Minnesota (E8-1)



Missouri (E8-1)



Pennsylvania (Interchange Sequence)



Utah (E8-1)



Washington State (E8-1)

Figure 11: Typical Interchange Sequence Designs

Table 9: Interchange Sequence Summary

Object	Common Dimension (inches)	Range (inches)
Legend Size	13.33	13.33 - 16
Number Size	13.33	12 - 15
Line Spacing	12	10 - 15
Edge spacing	12	10 - 16
Corner Radius	12	4 - 12
Border Width	2	N/A

The 2009 MUTCD describes the Interchange Sequence Sign in section 2E.40 as:

Support:

Interchange Sequence signs are generally supplemental to Advance Guide signs. Signing of this type is illustrated in Figures 2E-30 and 2E-31, and is compatible with the sign spreading concept described in Paragraph 3 of Section 2E.11.

These signs are installed in a series and display the next two or three interchanges by name or route number with distances to the nearest 1/4 mile.

The contents of the Interchange Sequence Sign are similar to the Post-Interchange Distance Sign as they both have two or three destinations accompanied with the mileage, but the layout of these two signs have some differences. The main difference between the two signs is the alignment of the mileage numerals and the Interchange Sequence Signs contains fractional values while the Post-Interchange Distance Sign does not. Figure 11 displays some differences of how the numerals are aligned on the Interchange Sequence Sign, most notably either aligning the numerals to the right hand side regardless if they are whole numbers or fractions as seen in Alaska and Minnesota, or by aligning the fraction to the right hand side while the whole numbers are not.

Variability was also seen among states in the ordinal abbreviations on Interchange Sequence Signs. The majority of the states in this study align the bottom of the ordinal abbreviation (“th”) with the bottom of the line of copy. States such as Washington State and California use a smaller letter height for the ordinal abbreviation and align the top of the ordinal abbreviation to the top of the mother number.

Table 9 shows that the most common heights for both the destination and numerals was found to be 13.33 inches, and both the most common line and edge spacing were found to be 12 inches. The corner radius for the Interchange Sequence Sign ranged was from 4 to 12 inches with 12 inches being most common.

NEXT EXITS SIGN



NEXT EXITS Sign



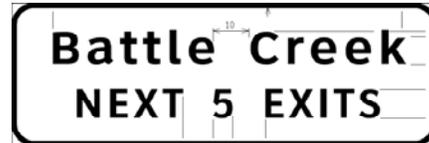
Alaska (E9-11)



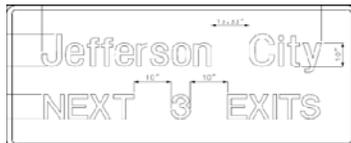
California (G87)



Colorado (E9-1)



Michigan (E9-1)



Missouri (E9-1)



Nebraska (E9-1)



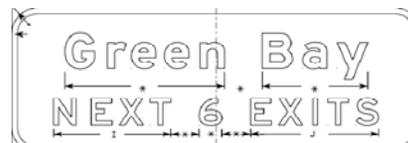
Ohio (E9-1)



Pennsylvania (E9-1)



Washington State (E9-1)



Wisconsin (E9-1)

Figure 12: Typical Next Exits Designs

Table 10: Next Exits Summary

Object	Common Dimension (inches)	Range (inches)
Legend Height	10	8 - 16
Number Height	N/A	15 - 16
Line Spacing	12	9.8 - 12.5
Word Spacing	10	10 - 12
Edge spacing	11	9.8 - 12.7
Corner Radius	6	3.75 - 9
Border Width	2	1 - 2

The 2009 MUTCD describes the NEXT EXITS Sign in section 2E.46 as:

Support:

Many freeways or expressways pass through historical or recreational regions, or urban areas served by a succession of several interchanges.

Option:

Such regions or areas may be indicated by a NEXT XX EXITS sign (see Figure 2E-33) located in advance of the Advance Guide sign or signs for the first interchange.

The layout of NEXT EXITS sign also remained fairly constant between states. The dimension which varied between states was the height of the mileage numeral. The majority of states kept this numeral the same height as the line of copy, but some states enlarge this numeral. The most common sign height was found to be 60 inches, and this dimension ranged from 54 to 60 inches. The uppercase destination letter height was found to be 13.33 inches in the majority of the states, with 10 inches for the lower case letter heights also most common. While the majority of the border thicknesses were found to be two inches, there was a range of 6 to 9 inches in for the corner radius, with nine inches being slightly more common.

EXIT ONLY E11-1



MUTCD E11-1



Alaska (E11-1)



Arizona (E11-1)



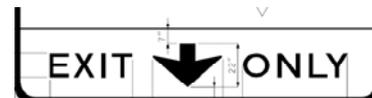
California (W61D)



Colorado (E11-1)



Michigan (E11-1)



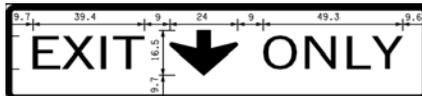
Missouri (E11-1)



Nebraska (E11-1)



North Carolina (E11-1)



Oklahoma (E11-1)



Pennsylvania (E11-1)



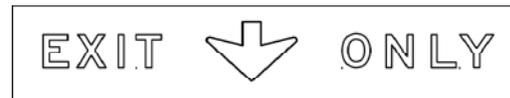
Texas (E11-1)



Virginia (E11-1)



Washington State (E11-1)



Wisconsin (E11-1)

Figure 13: Typical Exit Only E11-1 Designs

Table 11: Exit Only E11-1 Summary

Object	Common Dimension (inches)	Range (inches)
Legend Height	12	10 - 12
Word Spacing	12	6 - 15
Edge spacing	9	6 - 16
Corner Radius	8	3 - 12
Border Width	2	1 - 2
Arrow Height	22	16 - 22

The 2009 MUTCD describes the design of the Exit Only E11-1 sign in section 2E.24:

For lane drops, the Exit Direction sign (see Section 2E.36 and Figure 2E-26) shall be of the format shown in Figures 2E-15 and 2E-16. The bottom portion of the Exit Direction sign shall be yellow with a black border and shall include a diagonally upward-pointing black directional arrow (left or right) for each lane dropped at the exit, with the sign designed and placed so that each arrow is located over the approximate center of each lane being dropped. The words EXIT and ONLY shall be positioned to the left and right, respectively, of the arrow on the E11-1d sign panel for a single-lane drop. For a two-lane drop, the words EXIT ONLY shall be located between the two arrows on the E11-1e sign panel. The number of arrows on the sign shall correspond to the number of dropped lanes at the location of the sign.

Because of the simplicity of Exit Only E11-1, there were not many layout variations between states. The main differences in these signs are the arrow, and the alignment of the legend with the arrow. It is also to be noted that many states use differing arrowheads on their signs. The most common sign height found was 36 inches, and this dimension ranged from 20 to 36 inches. The most common letter height used on this sign was found to be 12 inches. The most common arrow height was found to be 22 inches. While the corner radius also varied with the parent sign, the most common border thickness was 2 inches. There were three trends which were noticed in regards to the border of these guide signs. Some states specified a border around all four sides of the sign, some states specified a border around three sides, and some states did not draw a border at all. States which drew the border around three sides left the top of the sign open, and drew the border on two vertical sides and bottom. States which did not draw a border around this sign used green from the parent sign between the Exit Only E11-1 sign and the border of the parent sign. Under the 2003 MUTCD, the E11-1 guide sign had no border and was fully contained by the parent sign as exemplified by Arizona standards. The 2009 MUTCD changed this standard to include a black border and function as a separate panel, as exemplified by Alaska standards.

SUMMARY

This section of the report shows that although states may share the same sign, many of the dimensions and layouts of these signs are different. Although each of these sign examples is different, it is possible to simplify the sign down to basic dimensions. Using a combination of these dimensions, panel size, and letter height, it is possible to generate a set of standards which will allow the design of any type of guide sign.

SECTION 3 – RATIO METHOD

Due to the variation of layouts introduced in Section 2, guide signs can greatly vary between states. Because different size sign plaques require different dimensions, it is difficult to do a direct comparison between signs of different dimensions. One method to compare dimensions between signs would be to use a ratio method. This method would take each dimension and divide by the uppercase letter height on the sign. This way, the size of the sign would not affect the ability to compare dimensions. The goal is to find a ratio which can be applied to each different dimension on a sign which would allow the creation of a standard guide sign possible by knowing the size of the uppercase letter.

In this section, each of the example signs is analyzed, and the dimensions located in Table 12 will be recorded. The ratios in this section will focus on the dimensions in the vertical dimension as the horizontal dimension is generally a function of the legend length and therefore rely on minimum dimensions more than absolute dimensions. By breaking each sign down to different dimensions and analyzing the ratio of uppercase letter height to the dimension, it is possible to compare dimensions between different types of signs. For the purpose of Tables 13 through 23, *Low* will be defined as the smallest value of the given dimension found in this study, *High* will be the largest, and *Mode* will be the most common.

Table 12: Sign Design Dimensions

Layout
Vertical End spacing (Destination to Top)
Vertical End spacing (Numbers to Top)
Vertical End spacing (Legend to Top)
Vertical End spacing (Shield to Top)
Vertical End spacing (Arrow to Top)
Vertical End spacing (Arrow to Bottom)
Vertical End spacing (Destination to Bottom)
Vertical End spacing (Numbers to Bottom)
Vertical End spacing (Legend to Bottom)
Vertical Interspacing (Legend to Legend)
Vertical Interspacing (Legend to Arrow)
Vertical Interspacing (Legend to Shield)
Vertical Interspacing (Legend to Numbers)
Horizontal End spacing (Destination to Side)
Horizontal End spacing (Numbers to Side)
Horizontal End spacing (Legend to Side)
Horizontal End spacing (Shield to Side)
Horizontal End spacing (Arrow to Side)
Horizontal Spacing (Legend to Legend)
Horizontal Spacing (Legend to Numbers)
Horizontal Spacing (Legend to Shield)
Horizontal Spacing (Legend to Arrow)
Horizontal Spacing (Shield to Cardinal)

Horizontal Spacing (Shield to Shield)
Legend/Symbol Dimensions
Legend (Cardinal Direction UC)
Legend (Cardinal Direction LC)
Legend (Destination LC)
Legend ('EXIT' or 'MILES')
Legend (Numbers)
Legend (Fraction)
Arrow Height
Arrow Width
Shield Height
Shield Width
Sign Dimensions
Sign Height
Sign Width
Border Thickness
Corner Radius

ADVANCE GUIDE SIGN E1-1

Table 13 shows all of the different spacing combinations found on guide sign E1-1. Next, each of these spacing combinations was divided by the uppercase letter height on the sign. This converts each dimension from inches to a unitless ratio. The table below shows the results for guide sign E1-1. It can be seen that nearly all of the spacing combinations are found to have a ratio of between 0.5 and 1 times the uppercase letter height.

Table 13: Ratio Summary of Advance Guide Sign E1-1

Spacing	High	Low	Mode
Vertical End spacing (Shield to Top)	1.00	0.7	0.9
Vertical End spacing (Numbers to Bottom)	0.9	0.7	0.9
Vertical Interspacing (Legend to Legend)	0.75	0.6	0.75
Vertical Interspacing (Legend to Shield)	0.75	0.5	0.75
Horizontal End spacing (Minimum - Legend to Side)	1	0.8	1.00
Horizontal Interspacing (Legend to Legend)	0.75	0.6	N/A
Legend (Destination LC)	0.75	0.75	0.75
Legend ('EXIT' or 'MILES')	1	0.6	0.6
Legend (Numbers)	0.9	0.75	0.9
Shield Height	2.25	2.25	2.25
Shield Width	2.25	2.25	2.25
Sign Height	9	8.25	9.00
Border Thickness	0.13	0.11	0.13
Corner Radius	0.75	0.56	0.75

EXIT NUMBER PLAQUE E1-5P

Table 14 shows the different ratio values which have been calculated for guide sign E1-5P. While the values range for the majority of the different dimensions, it can be seen that the

common ratios are equal to 0.75, 1, or 1.5. These are key values as they are very easy to calculate when creating a standard sign.

Table 14: Ratio Summary of Exit Number Plaque E1-5P

Spacing	High	Low	Mode
Vertical End spacing (Legend to Top)	1.25	0.7	1
Vertical End spacing (Numbers to Top)	1.1	0.5	0.75
Vertical End spacing (Legend to Bottom)	1.25	0.6	1
Vertical End spacing (Numbers to Bottom)	1.25	0.7	1
Horizontal End spacing (Numbers to Side)	1.6	0.5	1
Horizontal End spacing (Legend to Side)	1.6	0.5	1
Horizontal Interspacing (Legend to Numbers)	1.5	0.6	1.5
Legend (Numbers)	1.5	1.3	1.5
Sign Height	3.5	2.4	3
Border Thickness	0.25	0.1	0.2
Corner Radius	0.9	0.19	0.3 & 0.6

NEXT EXIT E2-1

The table below shows the values found for the guide sign E2-1. It can be seen that the most common ratio value for nearly all of the different dimensions was found to be 1.

Table 15: Ratio Summary of Next Exit E2-1

Spacing	High	Low	Mode
Vertical Edge Spacing (Numbers to Top)	1.4	0.5	1
Vertical Edge Spacing (Legend to Top)	1.4	0.5	1
Vertical Edge Spacing (Numbers to Bottom)	1	0.5	1
Vertical Edge Spacing (Legend to Bottom)	1	0.5	1
Horizontal Edge Spacing (Legend to Side)	1.7	0.8	N/A
Horizontal Interspacing (Legend to Legend)	1.5	0.8	1
Horizontal Interspacing (Legend to Numbers)	1.5	0.8	1
Legend (Numbers)	1	1	1
Sign Height	3.75	2.5	3
Border Thickness	0.2	0.075	0.125
Corner Radius	0.75	0.188	0.75

NEXT EXIT E2-1A

Guide sign E2-1a did not have many different dimensions due to the simplicity of this sign, and it can be seen that the ratio of the edge spacing varies. The vertical interspacing has been found to be most common at 0.75, and this is similar to what was seen on a number of other guide signs.

Table 16: Ratio Summary of Next Exit E2-1a

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	1.25	0.7	1
Vertical Edge Spacing (Legend to Bottom)	1.25	0.7	1
Vertical Interspacing (Legend to Legend)	1	0.7	0.75
Legend (Numbers)	1	1	1
Sign Height	6	4.2	4.5
Border Thickness	0.25	0.08	0.125
Corner Radius	0.75	0.3	0.75

EXIT GORE E5-1

The details of the ratio calculation made for guide sign E5-1 can be seen in the table below. Both the most common and the average dimension found for the vertical edge spacing of the legend was equal to 0.8, and this is smaller than a number of other signs which generally specify one times the uppercase letter height as the dimension to the border. The most commonly found dimension from the arrow to the bottom of the sign is near 0.6 times the height of the uppercase letter.

Table 17: Ratio Summary of Exit Gore E5-1

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	1	0.7	0.8
Vertical Edge Spacing (Arrow to Bottom)	1	0.4	0.7
Vertical Interspacing (Legend to Arrow)	1.1	0.4	0.8
Horizontal Edge Spacing (Legend to Side)	1.4	0.6	0.6
Horizontal Edge Spacing (Arrow to Side)	2.2	1.4	N/A
Arrow Height	2.4	1.5	1.5
Arrow Width	2.8	1.4	2.25
Sign Height	6	4.8	5
Sign Width	6	5	6
Border Thickness	0.2	0.08	0.17
Corner Radius	0.75	0.38	0.5

EXIT GORE E5-1A

Guide sign E5-1a is very similar to guide sign E5-1, with an addition of the exit number to the left of the arrow. It has been found that the most common vertical edge spacing of the legend to the top of the sign is nearly 0.7 times the height of the uppercase letter height. This value is actually the lowest ratio found for the same dimension on guide sign E5-1. Similarly, the vertical edge spacing between the arrow and the bottom of the sign was found to be 0.5 times the uppercase letter height, and this is also lower than the same dimension on guide sign E5-1. It

was found that the most common vertical dimension between the legend and the bottom of the sign was a little more than one times the uppercase letter height. The interline spacing between the legend and exit was found to be 0.7 times the size of the uppercase letter height.

Table 18: Ratio Summary of Exit Gore E5-1a

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	0.9	0.7	0.7
Vertical Edge Spacing (Arrow to Bottom)	0.8	0.5	0.5
Vertical Edge Spacing (Legend to Bottom)	1.2	0.8	1.2
Vertical Interspacing (Legend to Numbers)	1.1	0.4	0.7
Horizontal Edge Spacing (Legend to Side)	1.8	0.9	N/A
Horizontal Edge Spacing (Arrow to Side)	0.5	0.5	0.5
Arrow Height	2.4	1.6	1.9
Arrow Width	2	1.4	2
Sign Height	6	4.8	5
Sign Width	8.3	5.4	6
Border Thickness	0.2	0.08	0.17
Corner Radius	0.75	0.38	0.5

EXIT DIRECTION SIGN

The Exit Direction Sign was one of the more complex guide signs which are covered in this report. There are a number of different dimensions on this sign, and many states specified these dimensions differently. Guide sign E6-101 contains a route shield, angled arrow, and two lines of text. The first line of text is generally the cardinal direction followed by the destination.

Table 19: Ratio Summary of Exit Direction Sign

Spacing	High	Low	Mode
Vertical Edge Spacing (Shield to Top)	0.9	0.75	0.9
Vertical Edge Spacing (Arrow to Top)	2.6	1.6	2
Vertical Edge Spacing (Arrow to Bottom)	1.8	0.9	1
Vertical Edge Spacing (Destination to Bottom)	1	0.75	1
Vertical Interspacing (Legend to Legend)	2.1	1	N/A
Vertical Interspacing (Legend to Shield)	0.9	0.5	0.75
Horizontal Edge Spacing (Destination to Side)	3	0.8	N/A
Horizontal Edge Spacing (Shield to Side)	2.6	0.9	N/A
Horizontal Edge Spacing (Arrow to Side)	1.1	0.9	0.9
Horizontal Interspacing (Legend to Shield)	0.9	0.6	0.75
Horizontal Interspacing (Legend to Arrow)	2.2	1	N/A
Legend (Cardinal Direction UC)	0.9	0.75	0.75
Legend (Destination LC)	0.75	0.75	0.75
Arrow Height	2	1.4	1.4
Arrow Width	1.7	1.4	1.4
Shield Height	6.9	4.5	N/A
Shield Width	13.5	10.2	N/A
Border Thickness	0.15	0.1	0.13
Corner Radius	0.75	0.75	0.75

POST-INTERCHANGE DISTANCE SIGN

The Post-Interchange Distance Sign is a three lined guide sign containing destinations and mileage information. Table 20 summarizes the ratio information dealing with this sign. It can be seen that both the vertical edge spacing at the bottom and at the top have a multiplier of 0.9 times the uppercase letter height. The vertical interline spacing is seen to be most commonly found at 0.75 times the height of the uppercase letter. The most common minimum dimension found for the interline spacing between the destinations and the mileage was 1.5 times the uppercase letter height. The lowercase letter heights were commonly found to be 0.75 of the uppercase letter heights while the mileage information was of equal height to the uppercase letter height. The border thickness was most commonly seen at 0.15 of the uppercase letter height while the corner radius was seen to be 0.75 of the uppercase letter height.

Table 20: Ratio Summary of Post-Interchange Distance Sign

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	1.1	0.8	0.9
Vertical Edge Spacing (Legend to Bottom)	1.1	0.8	0.9
Vertical Interspacing (Legend to Legend)	1.1	0.7	0.75
Horizontal Interspacing (Legend to Numbers)	1.5	1	1.5
Legend (Destination LC)	0.75	0.75	0.75
Legend (Numbers)	1	1	1
Border Thickness	0.2	0.13	0.15
Corner Radius	1	0.7	0.75

INTERCHANGE SEQUENCE SIGN

Because the contents of Interchange Sequence Sign are similar to the Post-Interchange Distance Sign, many of the ratios are equivalent between the two. The major difference between the two guide signs is the addition of the fractions in the Interchange Sequence Sign. It has been found that the most common height for a numerator or denominator of a fraction on this guide sign is 0.75 times the height of the uppercase letter.

Table 21: Ratio Summary of Interchange Sequence

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	1.2	0.75	1
Vertical Edge Spacing (Legend to Bottom)	1.1	0.75	1
Vertical Interspacing (Legend to Legend)	1.1	0.7	0.75
Horizontal Interspacing (Legend to Numbers)	1.1	1	1
Legend (Destination LC)	0.75	0.75	0.75
Legend (Fractions)	0.75	0.75	0.75
Border Thickness	0.15	0.15	0.15
Corner Radius	0.9	0.25	0.9

NEXT EXITS SIGN

Details from the NEXT EXITS Sign show that the most common vertical edge spacing provides a greater distance between the legend and the top than the legend and the bottom. It is found that the most common distance between the top and the first line of copy is 0.9 times the height of the uppercase letter height while the distance between the bottom and the second line of copy is one times the height of the uppercase letter. The most common vertical interspacing between lines of copy is found to be 0.9 times the height of the uppercase letter. The other dimensions listed in the table show similarities between a number of other guide signs in this study.

Table 22: Ratio Summary of NEXT EXITS Sign

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	0.9	0.7	0.9
Vertical Edge Spacing (Legend to Bottom)	0.9	0.7	1
Vertical Interspacing (Legend to Legend)	0.9	0.75	0.9
Legend (Destination LC)	0.75	0.75	0.75
Legend ('EXIT' or 'MILES')	0.9	0.6	0.75
Legend (Numbers)	1	1	1
Border Thickness	0.15	0.08	0.15
Corner Radius	0.75	0.75	0.75

EXIT ONLY E11-1

Exit Only Sign E11-1 shows similar features to other guide signs sampled in this report. The vertical edge spacing between the legend and top is found to be a greater distance than the spacing between the arrow and the top and likewise the distance between the legend and bottom is less than the distance between the arrow and bottom of the sign. The arrow is found to be most commonly dimensioned nearly two times the height of the uppercase letter with the width being almost three times the uppercase letter height. The border thickness and corner radii are also similar dimensions to those which have been listed throughout this report.

Table 23: Ratio Summary of Exit Only E11-1

Spacing	High	Low	Mode
Vertical Edge Spacing (Legend to Top)	1	0.5	0.75
Vertical Edge Spacing (Arrow to Top)	0.75	0.3	0.5
Vertical Edge Spacing (Arrow to Bottom)	0.75	0.4	0.5
Vertical Edge Spacing (Legend to Bottom)	1.3	0.75	1
Arrow Height	1.8	1.3	1.8
Arrow Width	2.7	2	2.7
Sign Height	3	2.5	3
Border Thickness	0.17	0.08	0.17
Corner Radius	1	0.25	0.67

SUMMARY

This goal of this section was to convert all dimensions of a sign into a ratio related to the uppercase letter height on the given sign. This conversion will allow the direct comparison between signs of different sizes. It can be seen that while there are a number of similarities between the dimensions on different signs, there are also differences. The next step taken in this

report will be to combine each of these dimensions into one which can be used to create a standard sign.

SECTION 4 – RESULTS

After viewing the results of the ratio of each sign, it can be seen that certain dimensions are difficult to put in ratio form. Some of these dimensions include: sign height, sign width, corner radius, border thickness, shield height and arrow height. For each of these dimensions, a different practice will have to be created. Because of the large variations between signs due to legend length, sign width will not be created as a function of the upper case letter height. To assist in the ease and cost of fabrication, the number of different standards for these dimensions should be minimized.

Reviewing the information from Section 2 of this report shows that all of the signs in this study had a border thickness between one and two inches. While the guide signs studied greatly varied in sign size, a range of letter heights were found to be prevalent. This range related to the range of border widths. For this guide, the border thickness will be designed not by a ratio of the letter height, but by a table. Table 24 provides guidelines to dimension the border thickness relating the width of the border to the guide sign’s letter height.

Table 24: Dimension of Border Thickness

Letter Height	Border Thickness
Letter Height < 12"	1"
Letter Height ≥ 12"	2"

Section 2 of this report also details the most common corner radii which have been found on the signs in this study. Similar to the border thickness, the corner radius is not easily related to a ratio of letter height. Table 25 below provides guidance on dimensioning the corner radius of a guide sign as a function of the length of the sign’s height. This table is based on the practice of using a corner radius equal to 1/8 of the length of the shortest side, but modified to only include the most common dimensions found in the study.

Table 25: Dimension of Corner Radius

Sign Height	Corner Radius
Side Dimension ≤ 36"	3"
36" < Side Dimension ≤ 60"	6"
60" < Side Dimension ≤ 84"	9"
Side Dimension > 84"	12"

The dimensions which most affect the layout of a guide sign are the spacing between lines of copy and their location in relation to the edge of the guide sign. Section 4 of this report categorizes the information which was calculated in Section 3 of this report. Each of these categories will be an aggregate dataset based on a single dimension, but spanning over the entire sample of guide signs studied in this report. The table below lists the eight dimensions which are covered. Unnecessary horizontal dimensions will not be covered in this section. It is also

important to note that the majority of the horizontal dimensions listed in various sign design manuals are only a minimum dimension, and because of this are difficult to design using this ratio method. If a horizontal dimension is not listed, it is to be assumed that the object in question should be centered on the sign.

Table 26: Summary of Ratios

Spacing	Ratio
Vertical Edge Spacing - Legend to Top	1
Vertical Edge Spacing - Legend to Bottom	1
Vertical Edge Spacing - Shield to Top	0.9
Vertical Edge Spacing - Arrow to Bottom	0.5
Vertical Interspacing	0.75
Horizontal Spacing - Legend to Legend	1
Horizontal Spacing - Legend to Shield or Arrow	1

The table above shows that the most common vertical edge spacing between a line of copy and the sign edge is equal to the height of the uppercase letter on the sign. The ratio of vertical edge spacing between a shield and the top of the sign was found to be slightly less than the letter height of the legend. The most common ratio between an arrow and the top of the sign was found to be two times the uppercase letter height. It was found that the vertical edge spacing between an arrow and the bottom of the sign was much smaller than the same spacing between a line of copy and the bottom of the sign, and this ratio is half the height of an uppercase letter. The interspacing was found to be three quarters of the height of an uppercase letter. The horizontal spacing between either two words in a line of copy, or a word and numeral in a line of copy was found to be the height of an uppercase letter. The horizontal spacing between a word or numeral in the legend and a symbol was also found to be most commonly the height of an uppercase letter. Because the width of a sign is often variable to match the length of the longest line of copy, these horizontal ratio values should be a minimum dimension. The horizontal edge spacing dimension is not listed in Table 26 as this value will vary to keep overall horizontal dimensions in increments of six inches.

SECTION 5 – CONCLUSION

This report summarizes the dimensions and layouts of 11 representative guide signs with information found from 27 states. It was found that although many minimum dimensions are specified in the MUTCD for the selected guide signs, the actual values often vary slightly from state to state. In many cases, there are no large differences, but variation does exist. This variation suggests a possible need for a standard design method. The adoption of a uniform method to design guide signs would minimize the variation among states. The most common values provided in this report which are generated from existing practice allows the specification of different layout dimensions when only the uppercase letter height is known for a given guide sign.

APPENDIX



E1-1

State	A	B	C	D	E	F	F-Series	G	H	I	I-Series	J
Arizona		147	14	36	12	16	E(m)	12	12	16	E(m)	12
Colorado	132	144	12	36	8	16	E		10	16	E	
Michigan			11	36	9	16	CV-5-W	12	11	16	CV-5-W	12
Missouri			16	36	12	16	E(m)	12	12	16	E(m)	12
North Carolina	147		14	36	12	16	E(m)	12	12	16	E(m)	12
Pennsylvania	144		12.5	36	12	16	CV-5-W	12	12	16	CV-5-W	12
Texas			15	36	12	16	CV-5-WR		12	16	CV-5-WR	
Virginia	144	162	12	36	12	16	E(m)	12	12	16	E(m)	12
Washington				36		16	E	12		16	E	12

APPENDIX



E1-1 (Continued)

State	K	L	L- Series	M	N	O	O- Series	P	Q	R	S	T	U
Arizona	12	10	E(m)	15		15	E(m)	15					36
Colorado	12.5	10	E		108	15	E		110.5	10		54	36
Michigan	11	12	CV-4-WR	14.5		12	CV-4-WR	13		12			
Missouri	12	16	E(m)										36
North Carolina	12	10	E(m)	15		15	E(m)	15		10	15		36
Pennsylvania	12	10	E			15	E	12.5		10			
Texas	13	10	CV-5-WR	15		15	CV-5-WR	15		10	15		36
Virginia	10	10	E(m)			15	E(m)	11		10		61	36
Washington		12	E			15	E						

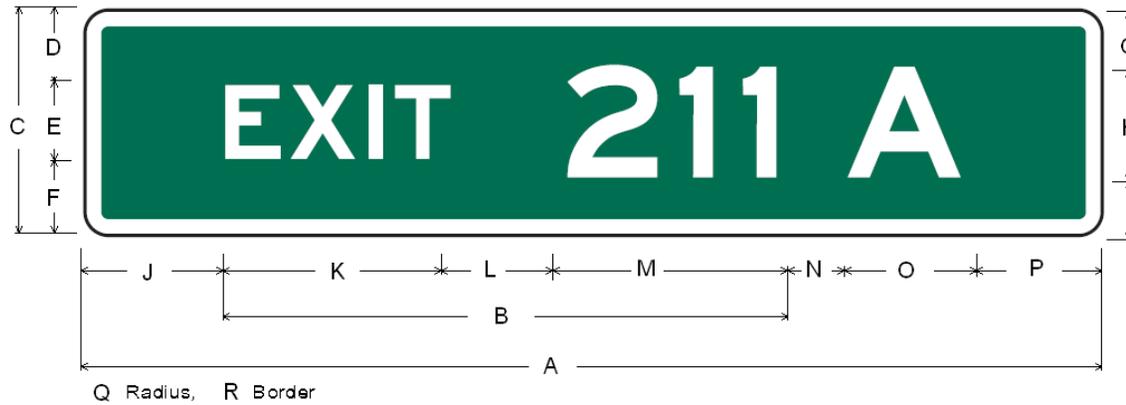
APPENDIX



E1-1 (Continued)

State	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK
Arizona															12	1.75
Colorado		13.4	117.2		26.6	90.8		16.2	34.1	10	19.7	10	37.8		12	2
Michigan		14		14								12			9	2
Missouri										24		24			12	2
North Carolina															12	1.75
Pennsylvania															12	2
Texas		16														2
Virginia	61	16	126	16	29	100	29				57			29	12	2
Washington																2

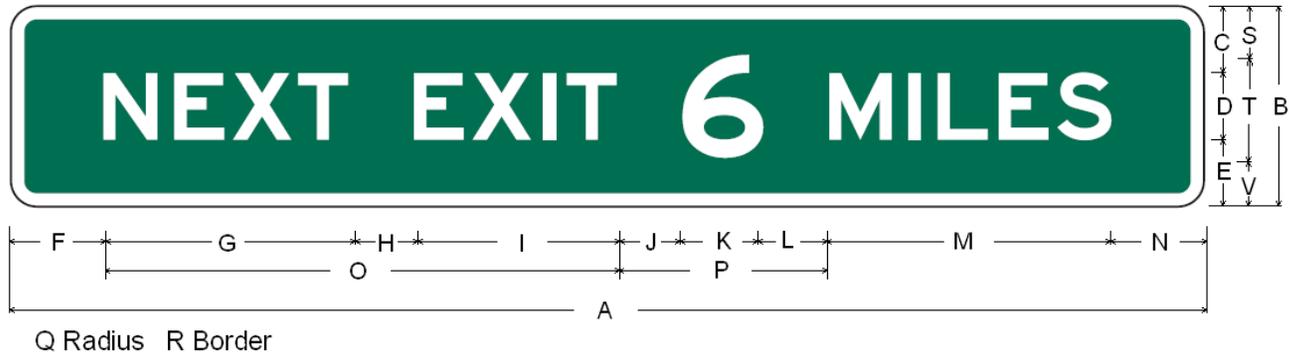
APPENDIX



E1-5P

State	A	B	C	D	E	E- Series	F	G	H	H- Series	I	J	K	L	M	N	O	P	Q	R
Alaska			42	15	12	E(m)	15	13	16	E(m)	15	12						12	2.25	2
Arizona	84		24	7	10	E	7	4.5	15	E(m)	7	6	30	6	36			6	8	1.5
Arkansas			30	10	10	CV-5-W	10	7.5	15	CV-5-W	10	7	31.7					10		
California	120		30		10	D	10		15	E		7.75		10				7.75	6	2.5
Idaho	108		36	13	12	E(m)	11	10	18		13	10	38	15	34.75			10.25	9	2
Michigan			24	8	10	CV-4-W	6	5.5	15	CV-4-W	8			12					9	2
Ohio			24	7	10	E	7	4.5	15	E	7	5	31.19	10				5	3	2
Oklahoma	96	76	30	10	10	E	10	7.5	15	E	10	10						10	3	2
Oregon	102		30	10	10	E(m)	10		15	E(m)				15					3	2
Pennsylvania			30	10	10	E	10	7.5	15	E	10	15	31.2	15				15		
Texas			24		10	CV-4-W		4.5	15	CV-4-W									6	1
Vermont	96		30		10	E	10	7.5	15	E									6	1.5
Virginia	156		24																	
Washington			24		10	E			15	E										2
Wisconsin			30		10	E	8.5	9	15	E		15.75	34.625	15	11.875	9	12	15.75		

APPENDIX



E2-1

State	A	B	C	D	Series	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	V
Alaska	156	30	10	10	E(m)	10								38.25		69.81		0.75	1.88	10	10	10
Colorado	156	30	11	8	E		13.7	32.30	8	27 1/3	8	6.3	8	38.70				1	3	11	8	11
Idaho	156	24	8	8	E(m)	8	Var.	30.38	12	26 1/4	12		12	37.25				1	6	8	8	8
Michigan		30	10	10	CV-3-W	10	11.5		9		9		9		11.5			1.5	6	10	10	10
Mississippi		24	8	8	E(m)	8		33.25	12	27 7/8	12		12	40.50				1	3	8	8	8
Missouri		36	12	12	E(m)	12	12		12		12		12		12			2	6	12	12	12
Ohio	144	24	8	8	CV-4-W	8		23.56	8	23.84	8		8	32.56				2	3	8	8	8
Ohio	144	24	8	8	E(m)	8		29.81	8	23.84	8		8	34.29				2	3	8	8	8
Pennsylvania		30	10	10	E	10	8	31.2	8	26.1	8		9	36.7	8					10	10	10
Texas		24	6	12	CV-4-W	6												1	6	6	12	6
Vermont	162	24	8	8	E	8												1.5	6	8	8	8
Washington	144	24		8	E													1.50	4	10	10	10
Wisconsin	156	24	8	8	E	8		30.38	8	26.25				37.25				1	6	8	8	8

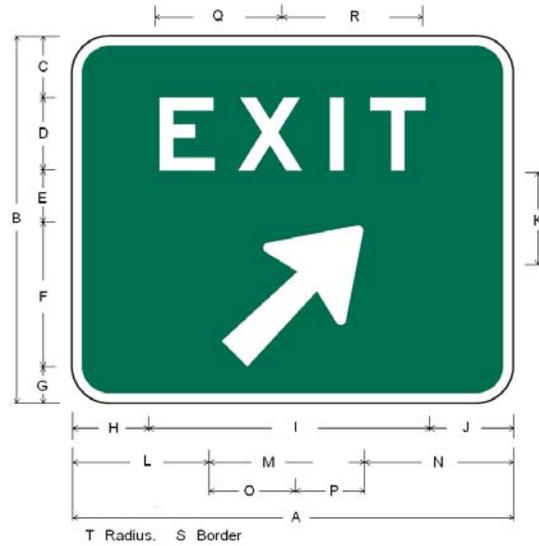
APPENDIX



E2-1a

State	A	B	C	D	D- Series	E	F	G	H	I	J
Alaska	90	48	10	10	E(m)	8	1.25	3	28	10	10
Idaho	90	36	7	8	E(m)	6	1	6	21	8	7
Michigan	96	48	10	10	CV-3-W	8	1.5	6	28	10	10
Mississippi	90	40	10	8	E(m)	6	1	6	24	8	10
Missouri		60	12	12	E(m)	12			36	12	12
North Carolina		50	9	12	E(m)	9	1.75	8	30	12	
Ohio	84	36	7	8	CV-4-W	6	2	6	21	8	7
Ohio	84	36	7	8	E(m)	6	2	6	21	8	7
Texas	108	48	8	12	CV-4-W	8	1	6	28	12	8
Vermont	96	48	12	8	E	8	1.5	6	28	8	12
Washington	108	48		10	E	8	2	6		10	
Wisconsin	84	36	7	8	E	6	1	6	21	8	7

APPENDIX



E5-1

State	A	B	C	D	D-Series	E	F	G	H	I
Alaska	60	60	8.19	10	E(m)	10	23.62	8.19		
California	54	48	9	10	D					
Colorado	60	60	9.5	12	E	10	19		9.5	41
Maryland	60	60	9	12	E(m)	8	23	8	7.25	48.5
Michigan	72	60	12	12	CV-6-W	8.93	16.64	10.43		
Mississippi	72	60	10	12	E(m)	8	18.5	11.5	15.125	41.75
Missouri	72	60	8.625	12	E(m)	10	20.75		17	38
Ohio	72	60	10	12	CV-4-W	5.23	23.54	9.23	15.9	40.2
Ohio	72	60	10	12	E(m)	5.23	23.54	9.23	15.43	41.14
Oregon	72	60	8	12	E(m)	13.50	18.50	8		
Pennsylvania	60	60	8	12	E	11.2	22.80	6		
Texas	72	60	12	12	CV-6-W	9.5	18.5	8		
Virginia	72	60	10	12	E(m)	10	15	10	10.75	47.5
Washington	60	60	10	12	E	10	23.625	4.375		
Wisconsin	72	60	12	12	E	10	18.5	7.5	13.25	48.5

APPENDIX



E5-1 (Continued)

State	J	K	L	M	N	O	P	Q	R	S	T
Alaska										2	3.75
California		14								2	6
Colorado			21.8	16.4						1	9
Maryland			24.5	23						2	
Michigan										1.5	6
Mississippi	15.125		22.5	27	22.5					2	9
Missouri			19.125	33.75						2	6
Ohio	15.9		24.23	23.54	24.23					2	6
Ohio	15.43		24.23	23.54	24.23					2	6
Oregon										2	9
Pennsylvania						11.4	11.4	18.7	18.7		
Texas										2	6
Virginia	10.75		22.25	26.75	20					1.5	8
Washington										2	6
Wisconsin	10.25		23.5	27	21.5					1	6

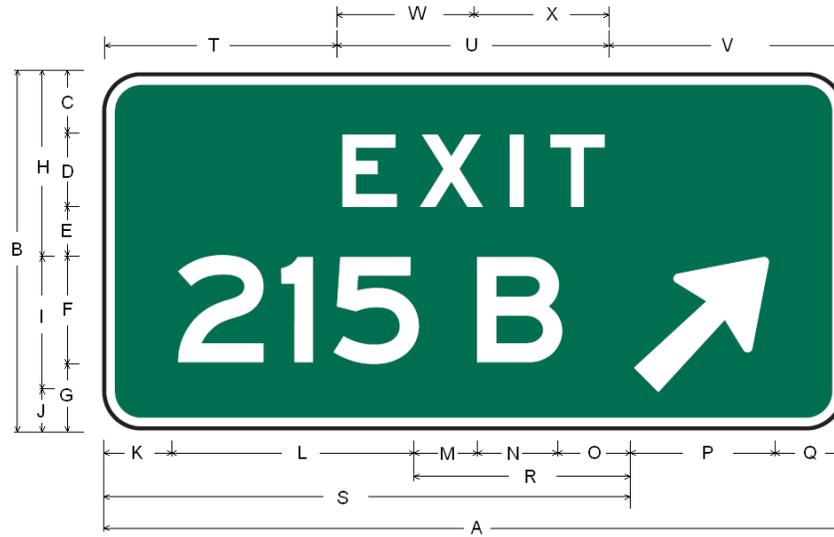
APPENDIX



E5-1a

State	A	B	C	D	D- Series	E	F	F- Series	G	H	I	J	K
Alaska		60	8.19	10	E	10	15	E	8.19		23.62	8.19	
California	54	48	9	10	D	8	12	D					
Colorado	100	60	10	12	E	10	18	E		20.5	19		23.3
Idaho	72	60	8	12	E(m)	8	18	E(m)	14		23	6	
Michigan	72	60	8	12	CV-6-W	8	18	CV-4-W	14		23.96	8.05	
Mississippi	72	60	8	12	E(m)	8	18	E(m)	14		23	6	
Missouri	72	60	8	12	E(m)	8	18	E(m)		25.25	23.50		5
Ohio		60	10	12	CV-4-W	5.23	18	CV-4-W	12		23.54	9.23	
Ohio		60	10	12	E(m)	5.23	18	E(m)	12		23.54	9.23	
Oregon	72	60	8	12	E(m)	8	18	E(m)	14		23	6	
Pennsylvania	84	60	8	12	E	10	18	E	12		22.8	6	10
Vermont	72	60	8	12	E	11	18	E	14	31	23	6	
Washington			10	12	E	13	15	E	10		20.25	10	
Wisconsin	72	60	9	12	E	10	18	E	11	1	23	6	
North Carolina	90		9	12	E(m)	10	15	D	14		23	6	

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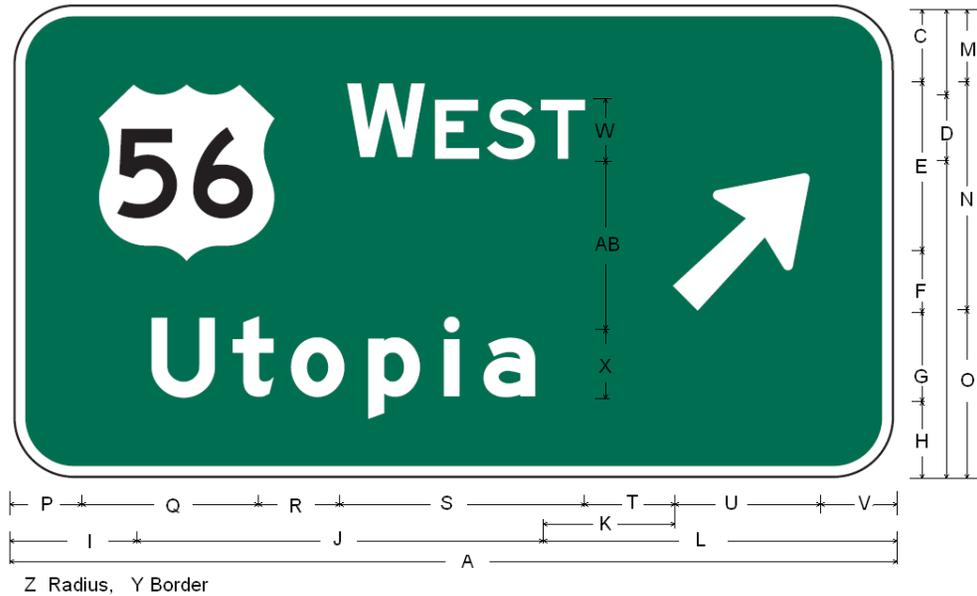


Z Radius, Y Border

E5-1a (Continued)

State	L	M	O	P	Q	R	S	T	U	V	W	X	Y	Z
Alaska													2	3.75
California													2	6
Colorado	41			16.4		9.9		21.4	44.8				1	9
Idaho				23	6		24	11.75	48.50	11.75			1	6
Michigan		7	6		6								1.5	
Mississippi							24		41.75				2	9
Missouri	34.50			23.50		4		17	38				2	6
Ohio				23.54					40.2				2	6
Ohio				23.54					41.14				2	6
Oregon					6		24						2	9
Pennsylvania				22.8	6	10					18.7	18.7		
Vermont					6		24						1	9
Washington													2	6
Wisconsin				23				13.25	48.50	10.25			1	6
North Carolina					6									

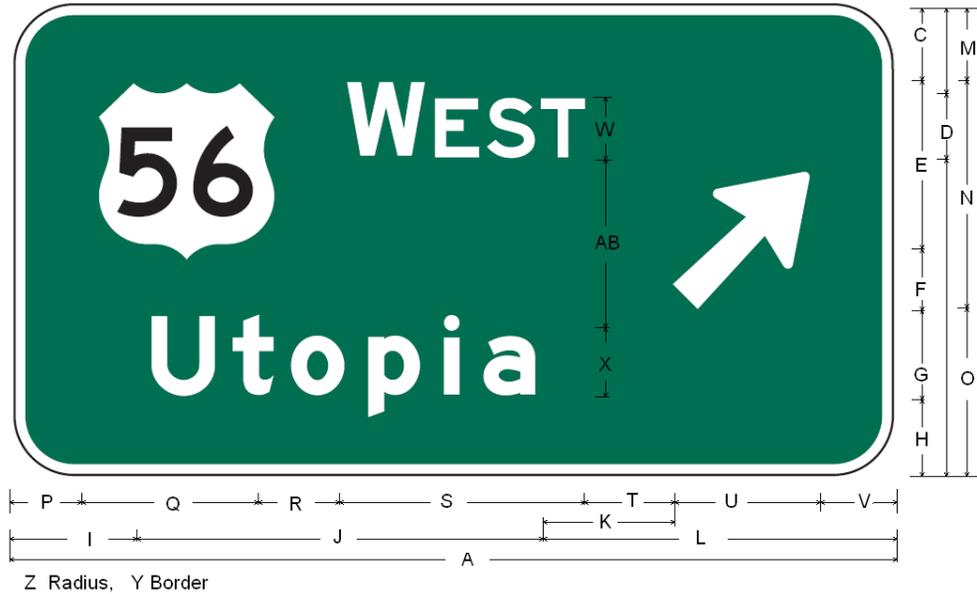
APPENDIX



Exit Direction

State	A	B	C	D	D- Series	E	F	G	G- Series	H	I	J	K	L	M
Alaska		72	14	12	E(m)	36		16	E(m)	14			16		
California		80		12	D			16	E(m)	12					
Colorado	216	84	12	15	E	36	8	16	E		14.9				25.6
Georgia		138	17	18	D	48	14	20	D	17	15		13		
Minnesota	186	90	13.5	12	E(m)	36	11	16	E(m)	13.5	13.4			48.2	28.5
Missouri			15	15	E(m)	36	12	16	E(m)				12		
North Carolina	204	114	15.5	13.25	E	48	15	20	E(m)	15.5		112	20	22	
Virginia	180	96	13	12	E(m)	36	12	16	E(m)	15	16	100	16		41.50
Washington				15	E	36		16	E						

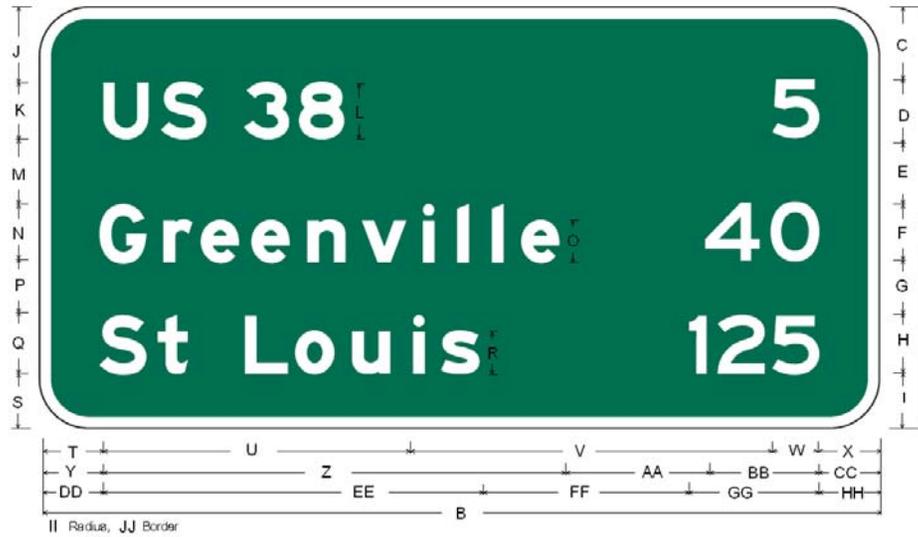
APPENDIX



Exit Direction (Continued)

State	N	O	P	Q	R	S	T	U	V	W	W- Series	X	X- Series	Y	Z	AA	AB
Alaska	23.63		14	36	12			23.63	14	12	E(m)	12	E(m)	2	4		16
California										12	D	12	E(m)	2	12		23
Colorado	32.8		42.2	36	12		35.2	22.7		12	E		E	2	12		
Georgia		17		48	15					15	D	15	D	3	12		
Minnesota	33	28.5	27.8	36	12		25.7	22.9	14	12	E(m)			2	12		33
Missouri	28			36	15					12	E(m)	12	E(m)	2			
North Carolina	28	22		48	12	59		28	22	12	E	15	E(m)	2.5	6		
Virginia		23	17.50	36	12	49	16	27.50	16.50	12	E(m)	12	E(m)	2	12		
Washington										12	E	12	E	2			

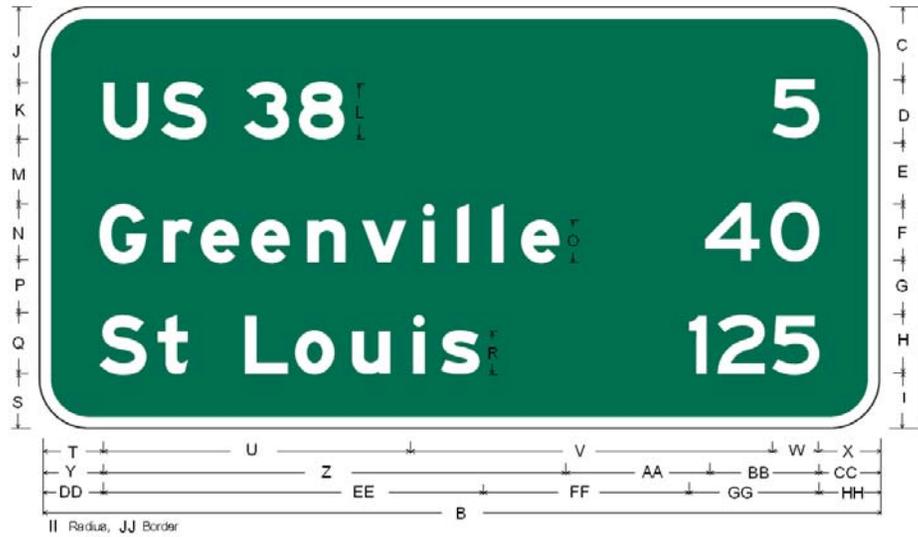
APPENDIX



Post-Interchange Distance Sign

State	A	B	C	D	D-Series	E	F	F-Series	G	H	H-Series	I	J	K	K-Series
Arizona	52	104	8	8	E(m)	6	8	E(m)	6	8	E(m)	8			
Arkansas	84	240	12	13.3	CV-5-W	10	13.4	CV-5-W	10	13.3	CV-5-W	12			
California	84												14	13.3	E(m)
Colorado	60	120	10	8	E	8	8	E	8	8	E				
Georgia	84		12	13.33	D	10	13.33	D	10	13.33	D	12.01		13.33	D
Michigan	48												6.5	8	CV-5-W
Minnesota	48	120	5.1	6	E(m)	9.9	6	E(m)	9.9	6	E(m)	5.1			
Missouri	60		9	8	E(m)	9	8	E(m)	9	8	E(m)	9		8	E(m)
Ohio	84		12	13.33	E(m)	10	13.33	E(m)	10	13.33	E(m)	12	12	13.33	E(m)
Pennsylvania	72		10.1	10.6	CV-5-W	10	10.6	CV-5-W	10	10.6	CV-5-W	10.1		10.6	CV-5-W
Texas	54		9	8	CV-5-W	6	8	CV-5-W	6	8	CV-5-W	9			CV-5-W
Washington	84			13.3	E		13.3	E		13.3	E			13.3	E

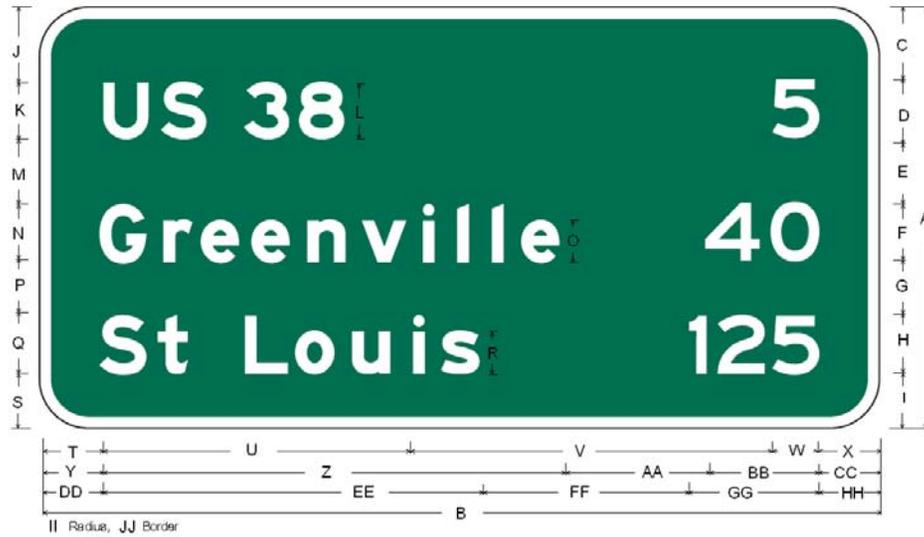
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Post-Interchange Distance Sign (Continued)

State	L	L- Series	M	N	N- Series	O	O- Series	P	Q	Q- Series	R	R- Series	S	T	U	V	W
Arizona														8			
Arkansas														12.1	48.9	157.7	9.2
California	10	E(m)	13	13.3	E(m)	10	E(m)	13	13.3	E(m)	10	E(m)	14				
Colorado														11	62.9	23.5	11.6
Georgia	10	D		13.33	D	10	D		13.33	D	10	D		10		13	
Michigan	6	CV-5-W	5.5	8	CV-5-W	6	CV-5-W	5.5	8	CV-5-W	6	CV-5-W	6.5	7.5		12	
Minnesota														8.6	43.2	50.9	8.7
Missouri	6	E(m)		8	E(m)	6	E(m)		8	E(m)	6	E(m)		6		8	
Ohio			10	13.33	E(m)			10	13.33				12	13.33		20	
Pennsylvania	8	CV-5-W		10.6	CV-5-W	8	CV-5-W		10.6	CV-5-W	8	CV-5-W		8		10.6	
Texas														8			
Washington	10	E		13.3	E	10	E		13.3	E	10	E					

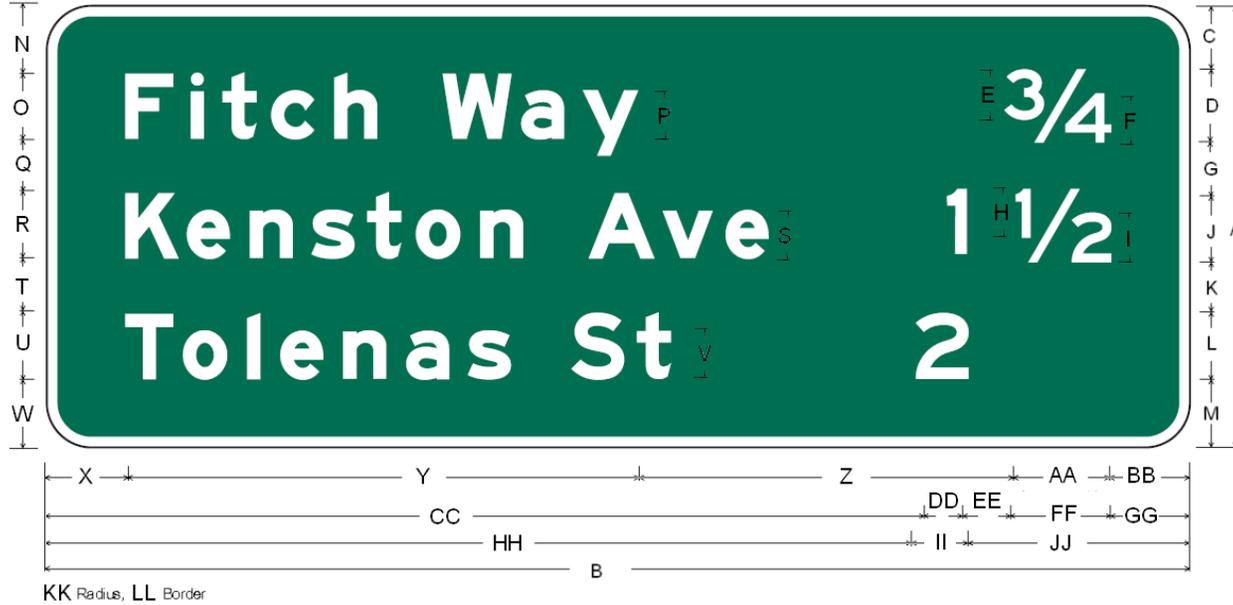
APPENDIX



Post-Interchange Distance Sign (Continued)

State	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
Arizona	8	8				8	8				8	8	1.75
Arkansas	12.1	12.1	141.4	40.9	23.5	12.1	12.1	164.2	18	33.6	12.1	6	2
California												12	2
Colorado		11	49.1	34.5	14.4		11	61.5	19.1	17.4		9	1
Georgia	10	10		13		10	10		13		10	9	2
Michigan	7.5	7.5		12		7.5	7.5		12		7.5	6	1.5
Minnesota	8.6	8.6	54.8	41.5	6.5	8.6	8.6	80.1	11.6	11.1	8.6	6	1.3
Missouri	6	6		8		6	6		8		6	6	1
Ohio	13.33	13.33		20		13.33	13.33		20		13.33	9	2
Pennsylvania	8	8		10.6		8	8		10.6		8		
Texas	8	8				8	8				8	6	1.25
Washington												12	2

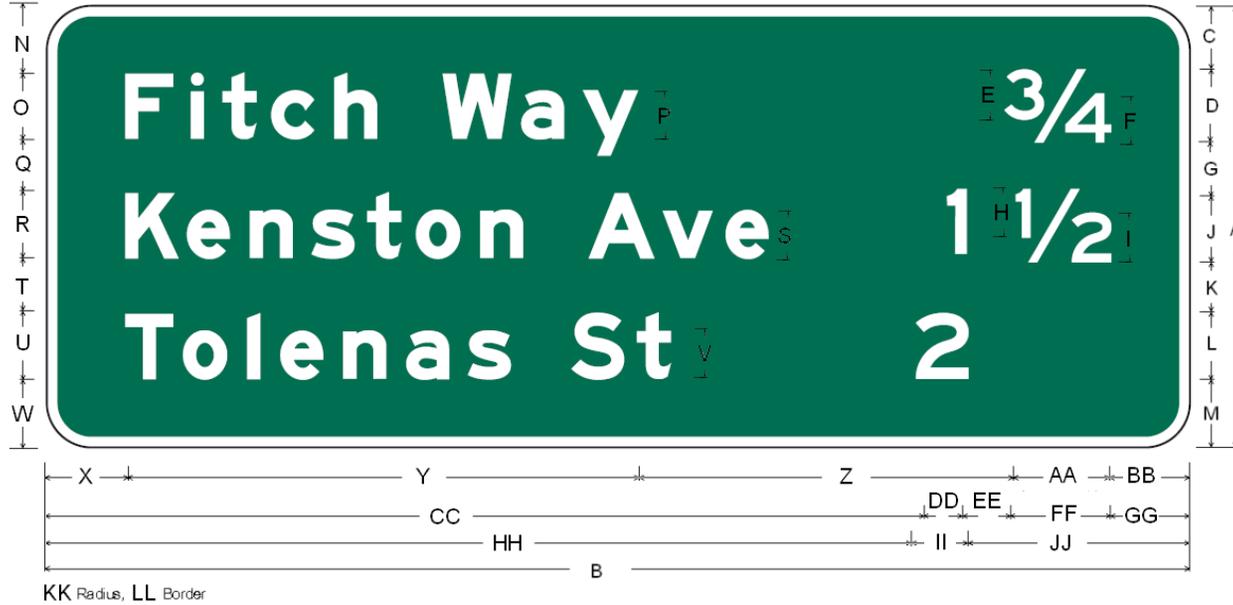
APPENDIX



Interchange Sequence Sign

State	A	B	C	D	E	F	G	H	I	J	K	L
Alaska	96											
California	90				10	10		10	10	12		12
Michigan	96		14.67	15		10	12		10	15	12	13.33
Missouri	84			13.33	10					13.33		13.33
Pennsylvania	84		10.2	15	10	10	9.2	10	10	15	10.2	13.3
Utah	96	222	13.7	13.3	13.3	13.3	9	13.4	13.4	13.4	9	13.3
Washington	84				10	10		10	10			13.3

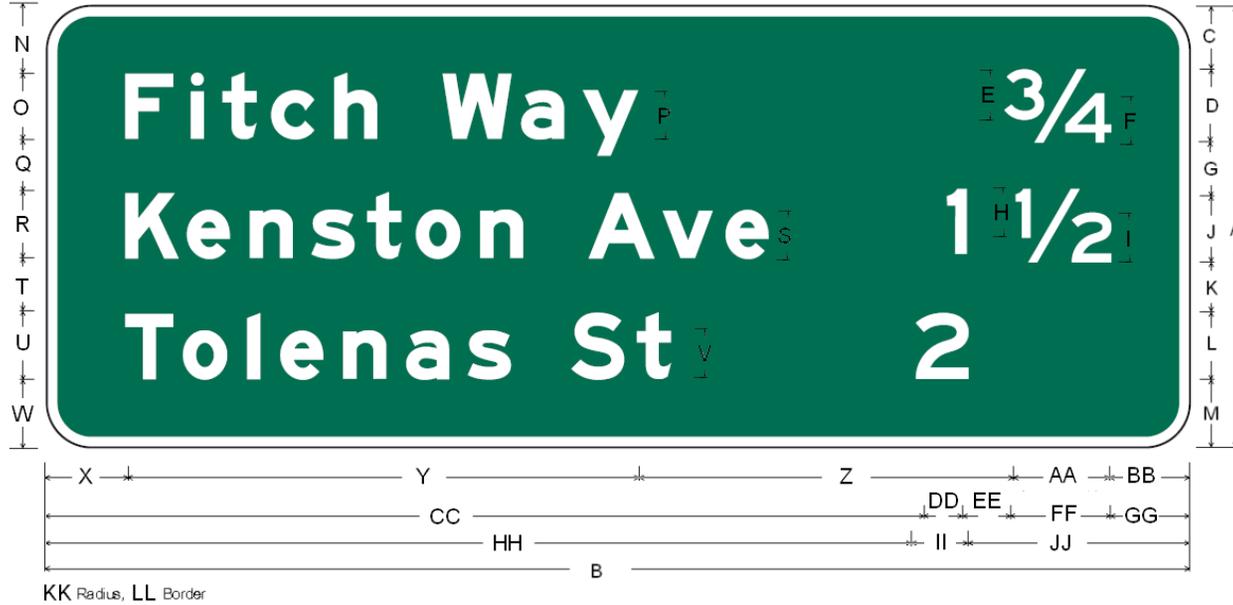
APPENDIX



Interchange Sequence Sign (Continued)

State	M	N	O	O- Series	P	Q	R	R- Series	S	T	U	U- Series	V
Alaska		12	16	E(m)	12	12	16	E(m)	12	12	16	E(m)	12
California		16	13.3	E(m)	10	15	13.3	E(m)	10	15	13.3	E(m)	10
Michigan	14	14	13.33	CV-5-W	10	14	13.33	CV-5-W	10	14	13.33	CV-5-W	10
Missouri		12	13.33	E(m)	10	10	13.33	E(m)	10	10	13.33	E(m)	10
Pennsylvania	11.1	11	13.3	CV-5-W	10	11	13.3	CV-5-W	10	11	13.3	CV-5-W	10
Utah			13.3	E			13.3	E			13.3	E	
Washington			13.3	E(m)	10		13.3	E(m)	10		13.3	E(m)	10

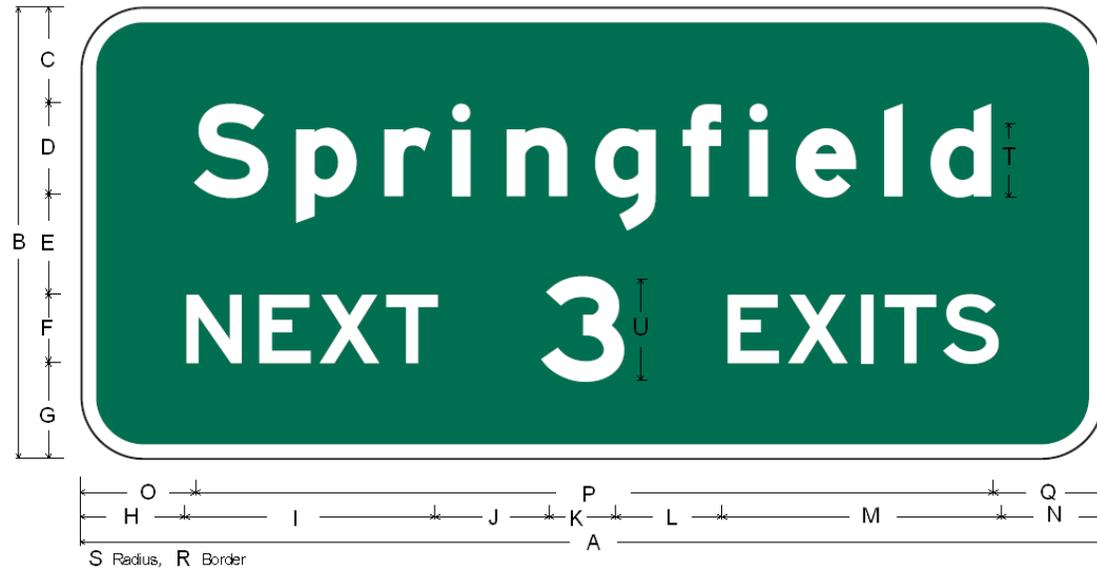
APPENDIX



Interchange Sequence Sign (Continued)

State	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	JJ	KK	LL
Alaska	12	16				16					16	16	4	2
California	14			13.3									12	2
Michigan	14	12		15		12					12	12	9	2
Missouri	12	13				13			6		13	13	9	2
Pennsylvania	11.1	10		13.3		10			10		10	10		
Utah		14.1			34.8			3.9	13.3	27.2			12	2
Washington													12	2

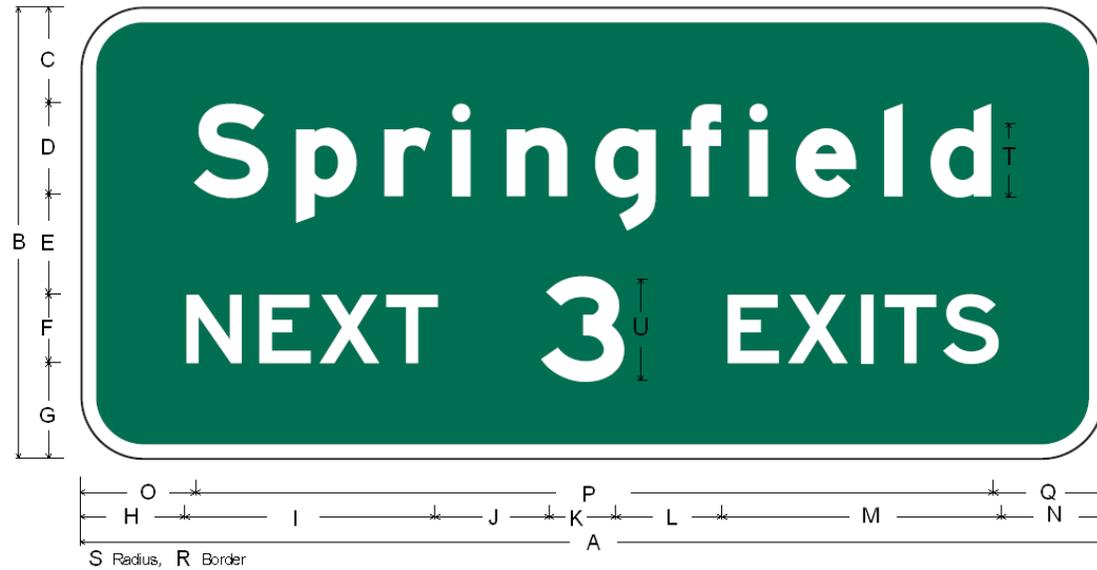
APPENDIX



NEXT EXITS Sign

State	A	B	C	D	D- Series	E	F	F- Series	G
Alaska		60	11	16	E(m)	12	10	E(m)	11
California		54	12	13.3	E(m)	11	10	D	11
Colorado	132	60	12.7	13.33	E	12	10	E	
Michigan	156	60	12	13.33	CV-5-W	10.68	12	CV-4-W	12
Missouri		60	12.34	13.33	E(m)	12	10	E(m)	12.33
Ohio	132	60	12.08	13.33	CV-5-W	12.5	10	CV-4-W	12.08
Ohio	132	60	12.08	13.33	E(m)	12.5	10	E(m)	12.08
Pennsylvania		48	9.8	10.6	CV-5-W	9.8	8	E	9.8
Washington		60		13.3	E	12	10	E	
Wisconsin		54		13 5/16	E(m)		10	E	10

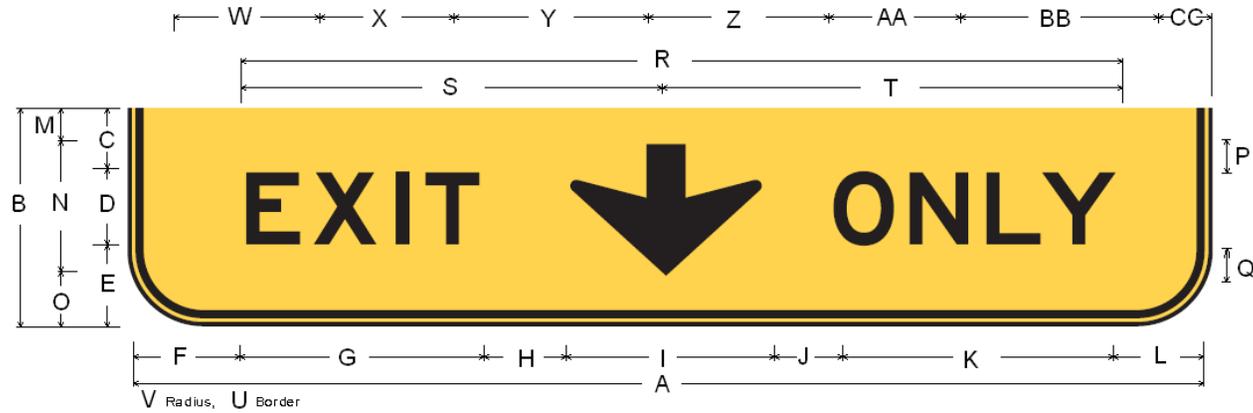
APPENDIX



NEXT EXITS Sign (Continued)

State	H	I	J	K	L	M	N	O	P	Q	R	S	T	T- Series	U
Alaska	16							16		16	2	3.75	12	E(m)	16
California											2	6	10	E(m)	
Colorado	9.7	40.4	10	7.9	10	44.3		32	68		1	9	13.3	E	
Michigan			12		12			7.5		7.5	2	9	10	CV-5-W	
Missouri			10		10			13		13	1	6	10	E(m)	
Ohio		35.7	10		10	38.5		13.33		13.33	2	6	13.33	CV-5-W	15
Ohio		37.26	10		10	41.21		13.33		13.33	2	6	13.33	E(m)	15
Pennsylvania	8		12		12		8	8		8			8	CV-5-W	
Washington											2	9	10	E	
Wisconsin		41.38				45.25					2	9	10	E(m)	

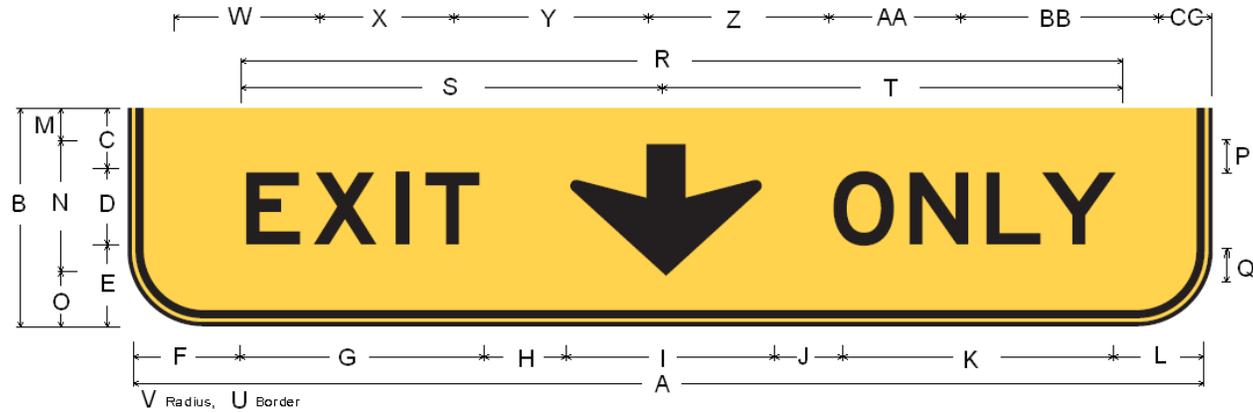
APPENDIX



E11-1

State	A	B	C	D	D- Series	E	F	G	H	I	J	K
Alaska	168	36	10	12	D	14	12	39	12	32	12	49
Arizona			9	12	E(m)	9						
California	126	20		10	D							
Colorado	168	30	9	12	E		13.3	40.9	8	32	8	52.5
Michigan	180	30	8	12	E(m)	10	12		15	32	15	
Missouri	168		12	12	E(m)	12	14	38	9	32	9	48
Oklahoma	150	36	12	12		12	9.7	39.4	9	24	9	49.3
Pennsylvania		34	6	12	E	16	10					
Texas	144	30	9	12	E	9			6	32	6	
Virginia	186			12	E(m)							
Washington	168	36	10	12	E	14	12	39	12	32	12	49
Wisconsin		36	11	12	E			41.75		32		53.63
North Carolina			9	12	E(m)	9						

APPENDIX



E11-1 (Continued)

State	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC
Alaska	12									2	4							
Arizona			16		2	2		56.522	56.522	1.75	8							
California	2											20	20.5	20.5	20.5	20.5	20	2
Colorado			22							1	3							
Michigan	12	3	22	5						2	9							
Missouri	14	7	22	7						2	6							
Oklahoma	9.6		16.5	9.7						2	3							
Pennsylvania		6	22	6			140				10							
Texas										1								
Virginia		9	22	9			161			2	12							
Washington	12									2								
Wisconsin		6	22	8														
North Carolina		7	16		2	2	113.044	56.522	56.522	1.75	8							