

# INTERNATIONALLY RECOGNIZED ROUNABOUT SIGNS

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## EXECUTIVE SUMMARY

The authors of this paper have chosen the style of roundabout signs used in the United Kingdom in their designs for individual roundabouts and for roundabout interchanges in the United States and Canada. Driving this system, North American motorists will recognize roundabout signs used in other countries, and foreign visitors here will easily recognize our roundabout signs.

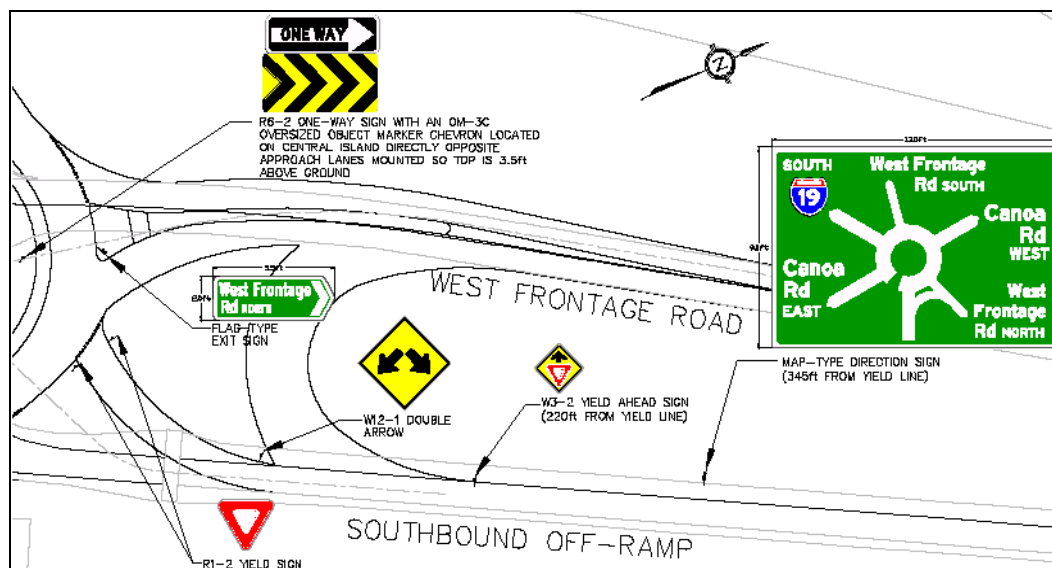
There are eight types of internationally recognized roundabout signs:

1. ROUNDABOUT AHEAD signs,
2. Map-Type signs (primary and secondary),
3. YIELD AHEAD signs,
4. Lane Assignment signs,
5. KEEP RIGHT signs or Illuminated Bollards,
6. YIELD signs,
7. ONE-WAY signs, and
8. Flag-Type signs.

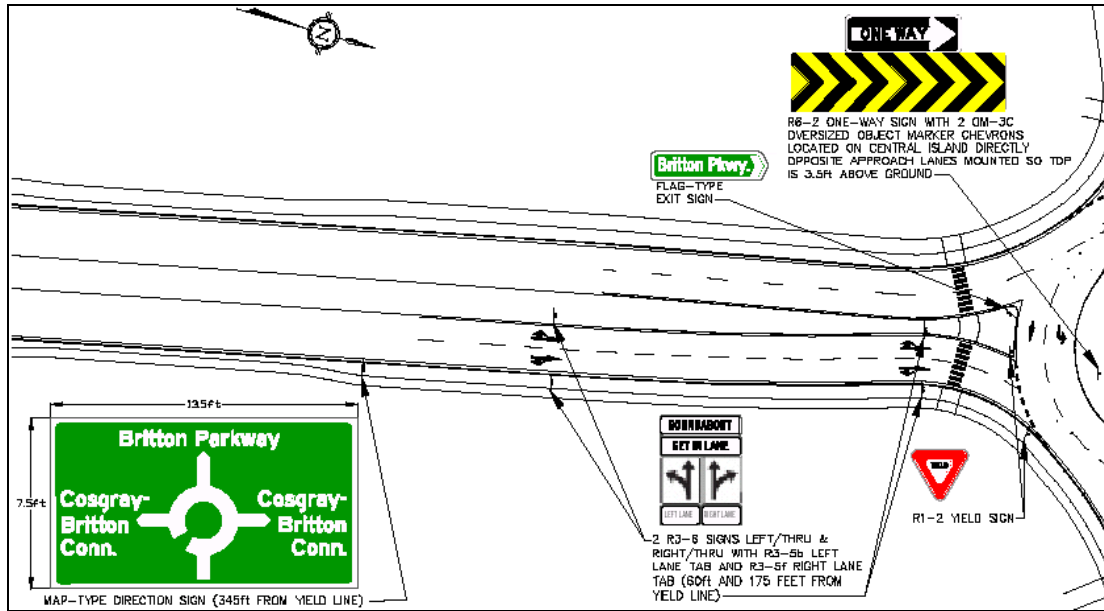
Four of these are used internationally but are generally new to North America: the Map-Type sign, the guide-type Lane Assignment sign, the internally illuminated bollard, and the Flag-Type sign. Principles for their design and use are provided in this paper. It is recommended they be employed in North America due to their success in other countries in clearly conveying roundabout navigation information without sign clutter or information overload. With adoption of these signs, this paper makes the argument that YIELD AHEAD signs are not generally necessary at roundabouts, and that where other roundabout signs such as Map-Type signs are in place ROUNDABOUT AHEAD signs are redundant except on high-speed approaches.

Example sign sequences for these signs are presented herein, and advance sign location tables are provided at the end of this paper.

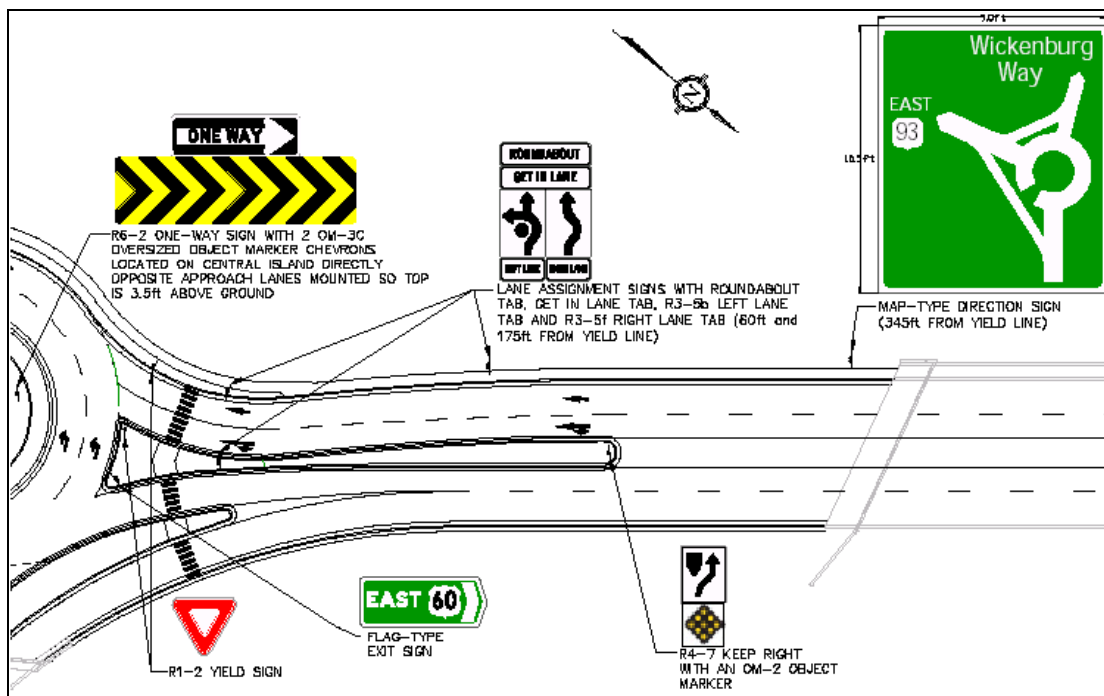
**Figure 1** Sign Sequence for Single-Lane Freeway Off-Ramp



**Figure 2 Sign Sequence for Multi-Lane Approach (Example 1)**



**Figure 3 Sign Sequence for Multi-Lane Approach (Example 2)**



The signs are planned or have been installed by SRM Associates/Roundabouts Canada, Roundabouts and Traffic Engineering, and Ourston Roundabout Engineering, Inc. at single- and multi-lane roundabouts in a variety of operating environments in the states of California, Arizona, Colorado, Wisconsin, and Ohio, and in the provinces of Ontario and British Columbia.

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# 1 BACKGROUND AND PURPOSE

The process of navigating a roundabout involves acquiring and processing information from the geometry of the road, from pavement markings, and from signs. All three elements should be designed and located in order to minimize detection, reading and processing time, and maximize comprehension and ability for motorists to perform the tasks of navigation, guidance and vehicle control.<sup>1</sup> Signs at all roundabouts should aid in detecting the presence of the roundabout ahead, deciding on a destination or exit leg, and slowing to an appropriate speed. Signs at multi-lane roundabouts should also aid in deciding on the correct entry lane.

In the United States sign use is regulated through the federal Manual on Uniform Traffic Control Devices (MUTCD) and its state supplements. In Canada, the Canadian MUTCD and various provincial guides such as the Ontario Traffic Manual (OTM) regulate sign use. While these documents detail the application of regulatory and warning signs, they do not yet provide much guidance on specific signs exclusively used for roundabouts, in particular guide signs.

This paper proposes that the *principles* used in designing guide signs in countries where roundabouts are more widespread than in North America be employed. This takes advantage of international expertise while still complying with regulatory and warning signs in the MUTCD. In particular, guide signing practice in the United Kingdom is referenced. The U.K. has pioneered the use of roundabouts, and has more complex, multi-lane designs on high-speed approaches than any other country.

The roundabout guide signs discussed in this paper are the:

1. Map-Type Roundabout sign,
2. Lane Assignment sign, and
3. Flag-Type Exit sign.

With use of these guide signs, this paper also makes recommendations concerning other signs currently being used at roundabouts: ROUNDABOUT AHEAD, YIELD AHEAD, YIELD, KEEP RIGHT, and ONE-WAY signs.

Finally, this paper lists locations for advance signs for roundabouts, including multi-lane roundabouts. The placement of roundabout-related warning signs is generally as per the MUTCD. Since there is no such direction for locating guide signs for roundabouts, it is proposed they be located as per U.K. practice as well.

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<sup>1</sup> Alexander, Gerson, *A User's Guide to Positive Guidance*, U.S. Federal Highway Administration, Report SA 90 017, September 1990.

## 2 INTERNATIONALLY RECOGNIZED SIGNS

### 2.1 INTRODUCTION

This section describes layout principles for three types of guide signs that are used internationally. This section also describes an internally illuminated bollard used in the United Kingdom. It is proposed all four be adapted for North America. The four types of signs would be used in lieu of some signs now used at North American roundabouts. With the exception of the ROUNDABOUT AHEAD sign, present North American signs were originally developed for other purposes or for other types of intersections.

Table 2.1 lists North American signs recommended to be replaced by the internationally recognized signs.

**Table 2.1** International Signs Replacing North American Signs

<b>Internationally Recognized Roundabout Sign</b>	<b>North American Intersection Signs</b>
Map-Type Roundabout Sign	Stacked Directional Sign Panel and ROUNDABOUT AHEAD Sign
Guide-Type Lane Assignment Sign	Standard or Fishhook Lane Assignment Sign
Illuminated Bollard	KEEP RIGHT Sign and Object Marker
Flag-Type Exit Sign	Street Name Sign or Wayfinding Assembly

It is recommended these international signs be adopted for use with roundabouts for the following reasons:

1. To reduce the number of signs required at roundabouts;
2. To reduce the reading time of guide signs;
3. To aid decisions concerning vehicle speed, exit leg choice and entry lane choice at roundabouts; and
4. To more closely conform with international signing practices.

Various Map-Type signs are already being used at North American roundabouts, and it is recommended that Map-Type signs conforming to the design principles presented herein be adopted. Standard or "fishhook" Lane Assignment signs are being used as well, and it is recommended they or the guide-type Lane Assignment signs in use internationally be used at multi-lane roundabouts. Finally, it is recommended that Flag-Type exit signs be used, and that internally illuminated bollards be considered where practical.

Many of these international signs are planned or are already in use in many jurisdictions in North America. The National Committee on Uniform Traffic Control Devices (NCUTCD) is currently considering recommendations on navigational signs, such as Map-Type and Lane Assignment signs, for roundabouts.

## 2.2 A PORTAL TO INTERNATIONAL SIGNS

An internationally recognized system of traffic signs was endorsed by United Nations treaty through the U.N. Convention on Road Signs and Signals on November 8, 1968. Contracting parties to this treaty included the United Kingdom and most other European countries, as well as a few Asian and African countries. The United States and Canada were not contracting parties.

If the United States and Canada choose to make their roundabout signs nearly identical to those of any one of the contracting countries of the U.N. agreement, then North America's roundabout signs will be similar to those of the other contracting countries. By installing roundabout signs similar to those in wide use around the world, we will familiarize our motorists with signs they are likely to encounter in their travels abroad, and travelers will easily understand signs here. This will also result in fewer crashes in North American roundabouts as well as at foreign roundabouts.

Although France or Norway or any number of countries could be chosen as the portal country to U.N.-agreement roundabout signs, it is recommended the United Kingdom's methodology be chosen because it is excellent and it is easily accessible to North Americans. Their densely illustrated and carefully explained traffic sign manuals are in English. Their roundabout signing system, developed with excellent research and deep experience over a period of 49 years, since the first modern Yield-at-entry roundabouts were built in a few English counties in 1956, is coherent, powerful, and logical. As a result they have very effective roundabout signs.

Source material for this paper is listed in the Bibliography. The Traffic Signs Manual, Chapter 7, *The Design of Traffic Signs*, from which the layout of the Map-Type, guide-type Lane Assignment and Flag-Type signs are based, is available from The Stationery Office (<http://www.tso.co.uk/bookshop/bookstore.asp>).

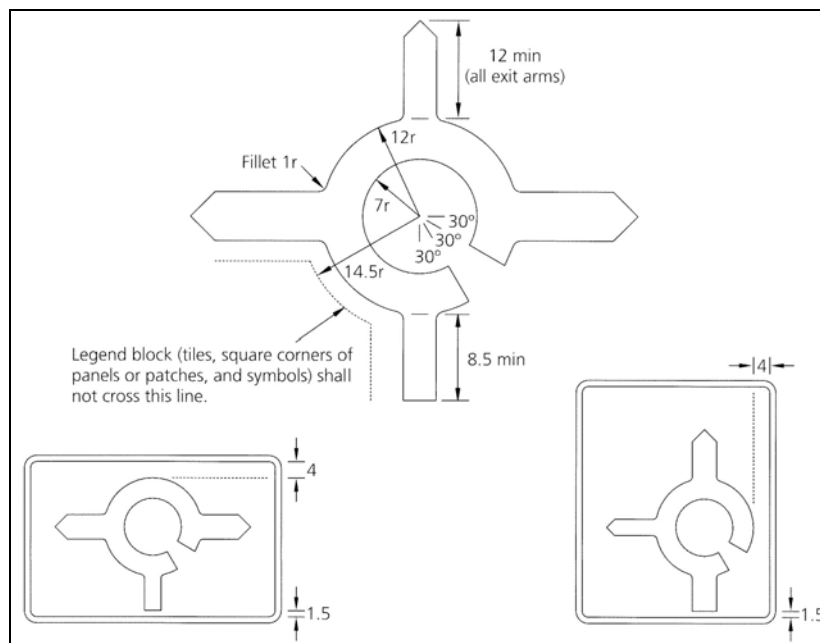
## 2.3 GUIDE SIGN LAYOUT

The main principle behind the design of guide signs in the United Kingdom is relating all aspects of their layout to the x-height and stroke width (sw) of the sign's letters.<sup>2</sup> The x-height is defined as the height of a lower-case letter having no ascenders or descenders, and is equal to 4sw for U.K. guide sign letters. The size of the letters is in turn based on the road's operating speed, so that all proportions are maintained as a sign increases or decreases in size.

Figure 2.1 illustrates the basic layout of a Map-Type roundabout sign in terms of stroke width (note the roundabout symbol is reversed for U.K. motorists). The width of each leg corresponds to the roads' classification: 6sw for highways, 4sw for arterial roads, and 2.5sw for collector and local roads.

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<sup>2</sup> *The Design of Traffic Signs*, Chapter 7, Traffic Signs Manual, U.K. Department for Transport, 2003, p. 9.

**Figure 2.1** Basic U.K. Guide Sign Layout Details

## 2.4 GUIDE SIGN LETTER HEIGHTS

Letter heights on Map-Type, Lane Assignment, and Flag-Type signs should be as per guidelines published in the United Kingdom where not in conflict with local standards.<sup>3,4</sup> Recommended minimum x-heights are summarized in Table 2.2. As mentioned, x-height is defined as the height of a lower-case letter having no ascenders or descenders. Depending on font, the overall height of a letter will be about a third more than the x-height.

**Table 2.2** Recommended Direction Sign Letter Heights (Metric Units)

Operating Speed	Min. x-Height (mm)	
	Map-Type & Lane Assign.	Flag-Type
Up to 50 km/h	100	75
60 km/h	125	100
70 km/h	150	125
80 km/h	200	150
100 km/h	250	200
110 km/h and over	300	300

In this context operating speed refers to prevailing 85th percentile approach speeds. The operating speed on the highest-speed approach should be used to size the letters on Flag-Type exit signs.

<sup>3</sup> *The Design and Use of Directional Informatory Signs*, Local Transport Note 1/94, U.K. Department for Transport, July 1994, p. 22.

<sup>4</sup> Agg, Helen J., *Directional Sign Overload*, TRL Project Report 77, 1994, pp. 26-28.



**Table 2.2** Recommended Direction Sign Letter Heights (English Units)

Operating Speed	Min. x-Height (inches)	
	Map-Type & Lane Assign.	Flag-Type
Up to 30 mph	4	3
35 mph	5	4
45 mph	6	5
55 mph	8	6
65 mph	10	8
70 mph and over	12	12

Letter heights may be increased where numerous competing signs or numerous destinations on the direction sign may increase reading time. In certain situations it may be appropriate that road names associated with minor legs use the next smaller letter height to be consistent with the road's importance. Letter heights should be decreased only where site space is limited.

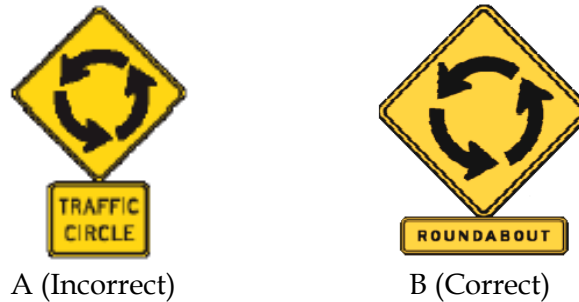
Letter fonts should be as per applicable federal, state or provincial standards. Smaller sign sizes may be possible by considering a more condensed font where boulevard space dictates.

### 3 EIGHT ROUNDABOUT SIGNS

#### 3.1 ROUNDABOUT AHEAD SIGNS

The MUTCD states that Intersection Warning Signs *may* be used to indicate the presence of an intersection. The MUTCD also states that ROUNDABOUT AHEAD signs, as displayed in Figure 3.1, should be installed on approaches to roundabout intersections, even though they are a type of Intersection Warning Sign.<sup>5</sup>

**Figure 3.1** ROUNDABOUT AHEAD Signs with Advisory Plates



ROUNDABOUT AHEAD signs can indicate the presence of a roundabout, but they offer no information as to the shape of the intersection or number of approaches. They are redundant when used with other signs that show a roundabout symbol, such as Map-Type signs.

It is therefore recommended that when Map-Type signs are in place ROUNDABOUT AHEAD signs be installed only under certain conditions, such as sightline restrictions and high-speed approaches. If used, the ROUNDABOUT AHEAD sign should precede all others on an approach.

Various advisory tabs may accompany a ROUNDABOUT AHEAD sign. Common ones are “ROUNDABOUT” as per Figure 3.1B or “TRAFFIC CIRCLE” as per Figure 3.1A. The “TRAFFIC CIRCLE” tab should not be used at roundabouts. Speed advisory tabs may be used, although they are generally not paired with other types of Intersection Warning Signs. A more appropriate tab on high-speed approaches may be one that reads “REDUCE SPEED NOW”.

#### 3.2 MAP-TYPE SIGNS

##### 3.2.1 Background

Map-Type signs are common at intersections internationally because of the number of destinations that often need to be conveyed to motorists. Map-Type signs have been shown to create faster reading times in these cases compared to the stack signs common in North America.<sup>6</sup> Map-Type signs at roundabouts also display the

<sup>5</sup> *MUTCD for Streets and Highways*, 2003 Edition, Section 2C-37, pp. 2C-18 and 2C-20.

<sup>6</sup> Agg, Helen J., *Directional Sign Overload*, p. 17.

configuration of an upcoming intersection. This is an advantage where roundabouts have skewed angles, by-pass lanes or more than four approaches.

### 3.2.2 Map-Type Sign Layout Principles

Where Map-Type signs are used at roundabouts they should be designed in accordance with the following principles:<sup>7</sup>

- 3.2.1 The sign should show route information such as road names, route numbers and/or destinations. Along traffic routes that lead to Interstates or highways, the highway should be identified with a route shield or trailblazer symbol on the sign.
- 3.2.2 A second sign may be necessary if a large amount of information is to be conveyed. The sign furthest from the roundabout, or primary sign, would show route information while the closest, or secondary, sign would show more local information and destinations (i.e. parking areas, points of interest, city centers, etc.). A secondary sign may not be required if the roundabout is not on a major route, and a combined primary and secondary sign may suffice.
- 3.2.3 Primary signs should have a green or blue background with a white border and white letters and symbols as per the MUTCD. Where used to identify local information, secondary signs may have a white background with a black border, and black letters and symbols.
- 3.2.4 The roundabout symbol should be discontinuous between the entering leg and the last leg. The entering leg should point down and the roundabout symbol should be representative of the actual intersection layout. To present a cleaner appearance, arrows without large arrowheads are recommended.
- 3.2.5 Destinations should be below horizontal legs and at the ends of other legs where possible. Horizontal legs should be two-thirds the length of their corresponding destination, while other legs should generally be as long as possible without increasing sign size. Minimum lengths should be 8.5sw for the entering leg and 12sw for all other legs.
- 3.2.6 All legs of a roundabout should be shown, as motorists may count exits until they find their destination. Do Not Enter legs should be denoted by a red circle with a white line in the center. Driveways should not have arrows or destinations.
- 3.2.7 The layout in terms of proportion, symbol size, length of legs, spacing, etc. should be based on the letter stroke width used in the sign. The width of each route leg should be related to the roadway's classification: 6sw for highways, 4sw for arterials, and 2.5sw for collector and local roads.

A photo of a Map-Type roundabout sign that does not comply with these principles is shown in Figure 3.2. The roundabout symbol is not legible from a distance, the large arrowheads make the symbol appear cluttered, and the symbol does not make effective use of sign space.

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<sup>7</sup> *The Design of Traffic Signs*, Chapter 7, pp. 41-59.

**Figure 3.2** Non Conforming Map-Type Roundabout Sign



Examples of Map-Type roundabout signs that do conform are shown in Figures 3.3 and 3.4. Note how clear the symbols are from a distance, and how use is made of the available sign space.

**Figure 3.3** Conforming North American Map-Type Sign



**Figure 3.4** U.K. Primary and Secondary Map-Type Signs



(Also note that roundabouts can have place names. This should be done to identify important roundabouts in North America as well.)

### 3.2.3 Recommended Application

It is recommended that Map-Type signs conforming to the foregoing principles be located on highway, arterial and major collector road approaches to roundabouts to impart clear information as to the configuration of the intersection and the exit leg of their destination.

Map-Type signs of various designs are becoming common at North American roundabouts. Map-Type signs conforming to these principles are planned or have been installed in the states of California, Arizona, Colorado, Wisconsin, and Ohio, and in the provinces of Ontario and British Columbia.

### 3.3 YIELD AHEAD SIGNS

Similar to the use of Advance Traffic Control Signs at other intersections, a YIELD AHEAD sign is required on an approach to the YIELD sign of a roundabout that is not visible for a sufficient upstream distance for a motorist to respond.<sup>8</sup> Just as at other intersections, YIELD AHEAD signs are not necessary at roundabouts otherwise. (In Canada a YIELD AHEAD sign would also be required as a temporary sign for 30 to 60 days after a roundabout has opened.<sup>9</sup>)

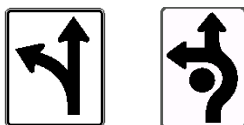
YIELD AHEAD signs may be used as a temporary measure to reinforce Yield-at-entry for roundabouts. It is recommended they be installed permanently if warranted by collision experience, sightline restrictions or poor observance of the YIELD sign.

### 3.4 LANE ASSIGNMENT SIGNS

#### 3.4.1 Background

Lane Assignment signs are needed to present entry lane choice on multi-lane roundabouts. In the U.K. guide-type Lane Assignment signs are used for this purpose. They are similar to corresponding signs in North America except they also convey destination information. Examples of U.S. standard and fishhook Lane Assignment signs are shown in Figure 3.5. A guide-type Lane Assignment sign is illustrated in Figure 3.6.

**Figure 3.5** Standard and Fishhook Lane Assignment Signs



**Figure 3.6** U.K. Guide-Type Lane Assignment Sign



<sup>8</sup> MUTCD for Streets and Highways, 2003 Edition, Section 2C-29, p. 2C-15.

<sup>9</sup> OTM Book 6, *Warning Signs*, Ministry of Transportation Ontario (MTO), July 2001, pp. 92-93, and MUTCD for Canada, Transportation Association of Canada (TAC), Section A3.6.

### 3.4.2 Fishhook Signs

Fishhook Lane Assignment signs are used in some jurisdictions in place of the standard signs prescribed in the MUTCD. The fishhook symbols have been proposed and described elsewhere, including their use in pavement marking arrows.<sup>10</sup> The Markings Technical Committee of the NCUTCD has recommended against their use in pavement markings, but some believe fishhook symbols may be appropriate on signs to negate the tendency of some motorists wishing to turn left at a roundabout to do so in front of the central island. Others think this is a potential issue better addressed through good central island signing and the geometry on the approach.

Fishhook signs are not prescribed in the MUTCD and are thus not enforceable. However, if they do result in better understanding of how to make left turns at roundabouts, then perhaps they may be appropriate as a temporary sign in areas where roundabouts are new. More research is needed in this area.

If fishhook Lane Assignment signs are used, a suggested version is illustrated in Figure 3.7. The meaning of the fishhook symbol in this context is reinforced with the word "ROUNDABOUT" and text is added to further convey lane choice.

**Figure 3.7** Suggested Fishhook Sign



### 3.4.3 Lane Assignment Sign Layout Principles

If guide-type Lane Assignment signs are used, they should be designed in accordance with the following principles:<sup>11</sup>

- 3.4.1 Road names, route numbers and/or destinations should always be at the top of their respective lane arrows. A horizontal bar should group two or more lanes leading to the same destination.
- 3.4.2 The signs should have a green or blue background with a white border and white letters and arrows as per guide signs in the MUTCD.
- 3.4.3 The lane arrows, including any left or right turn arrows, should be centered in their respective lanes and separated by dashed vertical bars. Unlike the Map-Type signs, arrows with "mushroom caps" should be used.

<sup>10</sup> Kinzel, Christopher, *Signing and Pavement Marking Strategies for Multi-Lane Roundabouts: An Informal Investigation*, Urban Street Symposium, July 2003.

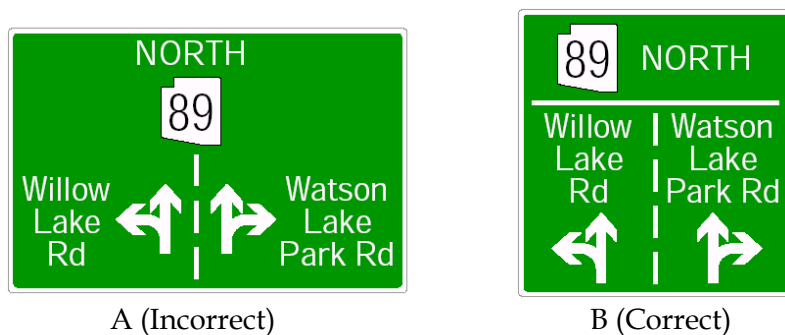
<sup>11</sup> *The Design of Traffic Signs*, Chapter 7, pp. 72-76.

- 3.4.4 Lanes leading to the same destination should be of equal width. The widest lane on the sign should not be greater than twice the width of the narrowest lane. Lanes by-passing the roundabout should be separated from other lanes with a turn arrow or an inclined arrow with chevron pattern.

It is tempting to make these signs diagrammatic; that is, to make them resemble the layout of the intersection by having road names and route numbers at the ends of left and right turn arrows, rather than overtop. This practice can make the signs overly wide and complex. Map-Type signs with their roundabout symbols are better suited to imparting diagrammatic information.

Examples of overly-diagrammatic and conforming guide-type Lane Assignment signs are shown in Figure 3.8. Note how much smaller the sign is in Figure 3.8B compared to 3.8A, as it conveys entry lane choice information only.

**Figure 3.8** Example Guide-Type Lane Assignment Signs



### 3.4.4 Recommended Application

Lane Assignment signs are required on multi-lane roundabouts to guide entry lane choice. Guide-type Lane Assignment signs may be used in locations with numerous destinations, such as at freeway interchanges. Otherwise, standard or fishhook Lane Assignment signs may be adequate.

It is recommended that if guide-type Lane Assignment signs are installed they conform to the foregoing principles. However, some consideration should be given to the fact that, like the fishhook sign, they are not regulatory in nature, and as such may not be enforceable.

Fishhook Lane Assignment signs are already being used in a several jurisdictions. Guide-type Lane Assignment signs are planned in the states of California, Arizona, and Wisconsin.

## 3.5 KEEP RIGHT SIGNS

In North America, KEEP RIGHT signs are used to direct travel past medians, and should be used at the leading end of roundabout splitter islands. Alternatively, an internally illuminated plastic bollard can be used. These bollards are common the U.K., and have been recently modified and installed in Santa Monica, California, to include the black on



white keep right symbol for use in North America as opposed to the white on blue international keep right symbol (see Figure 3.9).

**Figure 3.9** U.K. (Photo Reversed) and North American Illuminated Bollards



Fluorescent lights recessed below grade internally illuminate the bollards. Because the bollards do not rely on retro-reflectivity to be visible at night they can be seen from a greater distance than most signs. This is especially advantageous for roundabouts, which may be situated at the end of one or more horizontal curves. Further, the compact size of the bollards makes them less likely to block the view of pedestrians as compared to a KEEP RIGHT sign/Object Marker combination.

Accordingly, it is recommended that illuminated bollards be considered at roundabouts where practical. The bollards are usually manufactured to deform or break away upon impact, and the recessed illumination can be made waterproof to withstand rain or snow.

### **3.6 YIELD SIGNS**

At roundabouts, it is recommended that two YIELD signs be installed on either side of each approach or at either end of each yield line, especially on multi-lane approaches. Because motorists look to the left to enter a roundabout, it is usually the left-hand YIELD sign that is more visible.

### **3.7 ONE-WAY SIGNS**

Most roundabouts have ONE-WAY signs to indicate counter-clockwise circulation about their central islands. By themselves they are not sufficiently visible to approaching motorists except for small roundabouts, and they imply not only that the circulating road is one-way but the cross road is one-way as well.

For these reasons ONE-WAY signs are usually supplemented by warning chevrons or chevron alignment signs. The most common means is shown in Figure 3.10. The chevron provides visual conspicuity due to its size and color, while the ONE-WAY sign is deemed necessary to provide legal indication of direction of travel.



### 3.10 ONE-WAY Sign/Chevron



Roundabouts on high-speed roads could benefit from having more than one warning chevron per approach. In the United Kingdom several chevrons are often strung together to increase conspicuity of the central island and reinforce direction or travel, as shown in Figure 3.11.

**Figure 3.11** U.K. Chevrons (Photo Reversed)



Increasing the conspicuity of a roundabout's central island, through landscaping and signs, can reduce the potential for entry-circulating collisions. It is recommended that more than one chevron be used per approach where practical, particularly on high-speed roads, as is done in the U.K. The ONE-WAY sign/chevrons should be positioned directly opposite vehicles prior to entry.

(Also note the black areas are wider than the white because lighter colors tend to bleed into darker colors. This could be done with North American chevrons as well.)

## 3.8 FLAG-TYPE SIGNS

### 3.8.1 Background

Flag-Type signs are signs that have the right edge pointing in the direction of travel. They are useful at roundabouts to confirm exit leg choice. The pointed edge has been proven to give more advanced recognition of direction of a destination than simple rectangular signs.<sup>12</sup> This is an advantage at roundabouts where circulating motorists have limited reading time.

Examples of rectangular and Flag-Type exit signs are shown in Figure 3.12.

<sup>12</sup> *Innovative Traffic Control Technology and Practice in Europe*, U.S. Federal Highway Administration, August 1999, p. 19.

**Figure 3.12** Rectangular and Flag-Type Signs



### **3.8.2 Flag-Type Sign Layout Principles**

Where Flag-Type signs are used they should be designed in accordance with the following principles:<sup>13</sup>

- 3.8.1 The sign should show route information such as road names, route numbers and/or destinations. Along traffic routes that lead to Interstates or highways the highway should be identified with a trailblazer symbol on the sign.
- 3.8.2 Where used for major traffic routes, the signs should have a green or blue background with a white border, white letters and symbols and a white arrow at the pointed end to indicate direction as per the MUTCD. Where used to identify local information, they may have a white background with a black border, black letters and symbols and a black arrow at the pointed end.
- 3.8.3 The angle of the pointed end should be approximately 120 degrees.

### **3.8.3 Recommended Application**

It is recommended that Flag-Type signs conforming to the foregoing principles be located on the splitter islands of highway, arterial road and major collector road exits from roundabouts to confirm exit leg choice. The signs should be positioned on the splitter islands to point to the exit leg, but they should not block sightlines.

Flag-Type exit signs are already being used in the states of California, Arizona, Colorado, Wisconsin, Ohio, New York, and Kansas, and in the province of Ontario. Others are planned elsewhere. In some circumstances, such as in sight restricted areas or in snow country, internally illuminated signs have been constructed to aid in driver comprehension and visibility. Examples of internally illuminated Flag-Type signs may be found in Vail, Colorado.

<sup>13</sup> *The Design of Traffic Signs*, Chapter 7, pp. 77-81.

## 4 ADVANCE ROUNDABOUT SIGN LOCATIONS

### 4.1 INTRODUCTION

This section details locations for advance signs for roundabouts. Advance signs consist of Map-Type signs (primary and secondary) and Lane Assignment (standard, fishhook or guide-type) signs, plus ROUNDABOUT AHEAD and YIELD AHEAD signs where necessary.

The type and location of these advance signs should recognize the complexity of the driving task and the primacy of information. Sign sequences should order the tasks of detecting the presence of a roundabout, deciding on a destination or exit leg, slowing to appropriate speed and, for multi-lane roundabouts, deciding on the correct entry lane. These tasks become more difficult as roundabouts increase in approach speed, complexity and number of lanes.

### 4.2 ADVANCE SIGN LOCATIONS

#### 4.2.1 Location Tables

Tables 4.1 to 4.4 list suggested advance sign locations for single-lane and multi-lane roundabouts having primary only and primary plus secondary Map-Type signs. They are based on sign sequencing typical of freeway off-ramps, and on the sources set out in the subsequent sections. The tables are intended as a guideline only, and should not be a substitute for local conditions or engineering judgment, in particular where there are sightline restrictions.

The tables are applicable for roundabouts in the United States. In Canada, the distances of all but the Map-Type signs will be somewhat different due to differences in the placement of advance warning signs (in this case YIELD AHEAD signs).

Distances denoted with a "\*" indicate the sign is discretionary unless required to address sightline restrictions. For example, YIELD AHEAD signs are not generally necessary at roundabouts, and ROUNDABOUT AHEAD signs are only considered necessary on high-speed approaches.

The boxes in the tables that are not shaded represent locations for primary and secondary Map-Type signs as per U.K. guidelines, and locations for YIELD AHEAD signs as prescribed in the MUTCD. The shaded boxes represent suggested locations for the Lane Assignment and ROUNDABOUT AHEAD signs. The Lane Assignment signs are positioned to spread information loading and separate the tasks of exit leg choice and entry lane choice.

Although these locations have undergone a limited amount of field testing in North America, more research and field testing would be welcome to confirm the general appropriateness of all the advance sign locations.

**Table 4.1** Recommended Advance Sign Locations  
Single-Lane Approaches with Primary Map-Type Signs Only (Metric Units)

Operating Speed	Min. Distance from Yield Line (m)		
	Yield Ahead	Primary Map-Type	Rbt. Ahead
Up to 50 km/h	N/A	45	75*
60 km/h	30*	75	115*
70 km/h	50*	105	155*
80 km/h	80*	150	210
100 km/h	130*	195	275
110 km/h and over	170*	260	360

**Table 4.2** Recommended Advance Sign Locations  
Single-Lane Approaches with Primary and Secondary Map-Type Signs (Metric Units)

Operating Speed	Min. Distance from Yield Line (m)			
	Yield Ahead	Secondary Map-Type	Primary Map-Type	Rbt. Ahead
Up to 50 km/h	N/A	45	90	120*
60 km/h	30*	75	130	170*
70 km/h	50*	105	170	220*
80 km/h	80*	150	225	285
100 km/h	130*	195	285	365
110 km/h and over	170*	260	365	465

**Table 4.3** Recommended Advance Sign Locations  
Multi-Lane Approaches with Primary Map-Type Signs Only (Metric Units)

Operating Speed	Min. Distance from Yield Line (m)				
	Lane Assign.	Lane Assign.	Yield Ahead	Primary Map-Type	Rbt. Ahead
Up to 50 km/h	N/A	20	N/A	45	75*
60 km/h	N/A	30	30*	75	115*
70 km/h	20	50	50*	105	155*
80 km/h	40	80	80*	150	210
100 km/h	70	130	130*	195	275
110 km/h and over	90	170	170*	260	360

**Table 4.4** Recommended Advance Sign Locations  
Multi-Lane Approaches with Primary and Secondary Map-Type Signs (Metric Units)

Operating Speed	Min. Distance from Yield Line (m)					
	Lane Assign.	Lane Assign.	Yield Ahead	Secondary Map-Type	Primary Map-Type	Rbt. Ahead
Up to 50 km/h	N/A	20	N/A	45	90	120*
60 km/h	N/A	30	30*	75	130	170*
70 km/h	20	50	50*	105	170	220*
80 km/h	40	80	80*	150	225	285
100 km/h	70	130	130*	195	285	365
110 km/h and over	90	170	170*	260	365	465

**Table 4.1** Recommended Advance Sign Locations  
Single-Lane Approaches with Primary Map-Type Signs Only (English Units)

Operating Speed	Min. Distance from Yield Line (ft.)		
	Yield Ahead	Primary Map-Type	Rbt. Ahead
Up to 30 mph	N/A	150	250*
35 mph	N/A	245	365*
45 mph	175*	345	510*
55 mph	325*	490	690
65 mph	475*	640	900
70 mph and over	550*	850	1,150

**Table 4.2** Recommended Advance Sign Locations  
Single-Lane Approaches with Primary and Secondary Map-Type Signs (English Units)

Operating Speed	Min. Distance from Yield Line (ft.)			
	Yield Ahead	Secondary Map-Type	Primary Map-Type	Rbt. Ahead
Up to 30 mph	N/A	150	300	400*
35 mph	N/A	245	425	545*
45 mph	175*	345	560	725*
55 mph	325*	490	740	940
65 mph	475*	640	935	1,195
70 mph and over	550*	850	1,200	1,500

**Table 4.3** Recommended Advance Sign Locations  
Multi-Lane Approaches with Primary Map-Type Signs Only (English Units)

Operating Speed	Min. Distance from Yield Line (ft.)				
	Lane Assign.	Lane Assign.	Yield Ahead	Primary Map-Type	Rbt. Ahead
Up to 30 mph	N/A	60	N/A	150	250*
35 mph	N/A	100	N/A	245	365*
45 mph	60	175	175*	345	510*
55 mph	150	325	325*	490	690
65 mph	240	475	475*	640	900
70 mph and over	300	550	550*	850	1,150

**Table 4.4** Recommended Advance Sign Locations  
Multi-Lane Approaches with Primary and Secondary Map-Type Signs (English Units)

Operating Speed	Min. Distance from Yield Line (ft.)					
	Lane Assign.	Lane Assign.	Yield Ahead	Secondary Map-Type	Primary Map-Type	Rbt. Ahead
Up to 30 mph	N/A	60	N/A	150	300	400*
35 mph	N/A	100	N/A	245	425	545*
45 mph	60	175	175*	345	560	725*
55 mph	150	325	325*	490	740	940
65 mph	240	475	475*	640	935	1,195
70 mph and over	300	550	550*	850	1,200	1,500

#### 4.2.2 ROUNDABOUT AHEAD Signs

The use of ROUNDABOUT AHEAD signs should be considered discretionary. They should be installed for sightline restrictions and high-speed approaches (posted speed over 80 km/h or 55 mph). For sightline restrictions they should be placed in accordance with good engineering judgment. For high-speed approaches an oversize sign should be used, and advisory tabs such as one reading "REDUCE SPEED NOW" should be considered.

#### 4.2.3 Map-Type Signs

Map-Type signs should be located on all highway, arterial road and major collector road approaches to roundabouts. In residential areas they should be installed on minor collector or local road approaches from directly outside the area, in order to benefit motorists unfamiliar with the local road pattern.

Although Map-Type signs should be used at all roundabouts, it may be difficult to locate them on minor collector or local roads in residential areas where boulevard space is limited. In these cases, ROUNDABOUT AHEAD signs may be used instead if the approaches are not from directly outside the area.

It is recommended their location be as per U.K. guidelines, which are based on operating speed but include separation distance on approaches having both primary and secondary Map-Type signs.<sup>14</sup>

#### 4.2.4 YIELD AHEAD Signs

The advance placement of YIELD AHEAD signs is covered in the MUTCD.<sup>15</sup> (In Canada YIELD AHEAD signs are positioned further from an intersection.<sup>16</sup> The foregoing tables are based on U.S. advance sign placement. Canadian advance sign placement will be somewhat different.)

The use of YIELD AHEAD signs should be considered discretionary. Where used they may be combined with the furthest set of Lane Assignment signs on an approach. This will reduce the number of sign poles and facilitate the later removal of a YIELD AHEAD sign if it is installed as a temporary measure. For high-speed approaches (posted speed greater than 70 km/h or 45 mph) an oversize sign should be used.

#### 4.2.5 Lane Assignment Signs

Lane Assignment signs (standard, fishhook or guide-type) should be installed in advance of multi-lane roundabouts at locations where they would provide motorists with adequate time to chose their lane before entering the roundabout.

<sup>14</sup> *The Design and Use of Directional Informatory Signs*, p. 22.

<sup>15</sup> *MUTCD for Streets and Highways*, 2003 Edition, Table 2C-4.

<sup>16</sup> *OTM Book 6, Warning Signs*, p. 20.

Where standard or fishhook Lane Assignment signs are used, on low-speed approaches (operating speed less than 70 km/h or 45 mph), only one set of signs is necessary. On higher-speed approaches, it is recommended that at least two sets be installed. When the larger guide-type Lane Assignment signs are used, for example on freeway off-ramps where operating speeds are high, two sets should be installed if space permits. For approaches that flare to two lanes, one set of Lane Assignment signs should be installed where the extra lanes begin, rather than where specified in the tables. All Lane Assignment signs should be duplicated on the left-hand side if long medians are present.

## 5 CONCLUSION

As with other elements of the road environment, roundabout signs should be designed and installed to facilitate the tasks of navigation, guidance and vehicle control. They should do so without sign clutter or information overload. Signs should aid in detecting the presence of the roundabout ahead, deciding on a destination or exit leg, slowing to appropriate speed and, where applicable, deciding on the correct entry lane.

The following signs have been discussed in the context of roundabouts:

1. ROUNDABOUT AHEAD signs (discretionary),
2. Primary and Secondary Map-Type signs,
3. YIELD AHEAD signs (discretionary),
4. Lane Assignment signs (for multi-lane roundabouts),
5. KEEP RIGHT signs or Illuminated Bollards,
6. YIELD signs,
7. ONE-WAY signs, and
8. Flag-Type signs.

Of these, Map-Type signs, fishhook and guide-type Lane Assignment signs, and Flag-Type signs are not covered in the MUTCD. It is recommended that the design and location of these signs be generally as per international practice, and specifically as per guidelines in the United Kingdom.

Also detailed in this paper are recommended advance sign locations in the form of tables and sign sequences illustrating their application. The examples are from three actual roundabout projects in the design stages in Arizona and Ohio. Signs conforming to the design principles and locations outlined in this paper are planned or have been installed at roundabouts in the states of California, Arizona, Colorado, Wisconsin, and Ohio, and in the provinces of Ontario and British Columbia.

Two areas have been identified as requiring further research: the effectiveness of fishhook and guide-type Lane Assignment signs for roundabouts versus standard Lane Assignment signs, and further confirmation that the advance sign locations specified in Tables 4.1 to 4.4 are appropriate for roundabouts under given conditions and approach operating speeds.



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