

Determining the Safe Speed for Curves

As a vehicle approaches a curve, the driver will hopefully slow down and negotiate the curve safely. This is possible because signs have been placed by the highway department informing the travelling public of the character of the curve. In order to do this successfully, we need to know which signs should be used, and how to properly place them.

Before we discuss how to determine which sign to use, we need to remember what the curve and turn signs are telling the traveling public. Black-on yellow signs are warning signs. These particular ones provide information to the motorist about the nature of the curve they are approaching. They let the driver know if it is a sharp turn or just a gradual curve. Supplemental plates provide an advisory speed for traveling around the curve.



WHAT DOES THE ADVISORY SPEED MEAN?

The advisory speed for a curve is NOT the safe speed for every vehicle and pavement condition. The advisory speed is a relative value that, for most vehicles, under WET pavement conditions, provides an adequate margin of safety and is reasonably comfortable for most drivers. On a snowy day, for example, we may need to drive even slower than the advisory speed.

It is important to have a consistent, uniform method of placing curve signs. If every curve is posted consistently, the traveling public will have a better understanding of how to drive when they see a particular sign. On the other hand, if some curves are posted differently, the driver may not know what the sign means. That is why the sign regulations are named the *Manual on Uniform Traffic Control Devices* not just the *Manual on Traffic Control Devices*. Uniformity may be the most important aspect of all signage, not just curve signs.

DETERMINING WHICH SIGNS TO PLACE

The choice of which specific sign to place on a curve depends upon several different factors. The number of curves in a series, the advisory speed of the sharpest corner, and the alignment of the first curve, all help to determine which sign to place. When deciding whether to group curves as part of a series, determine if they have the same alignment (for example, two curves to the left or two to the right). If two curves have the same alignment and are separated by more than 200 feet of straightaway, sign them separately. If two curves have

CORNELL LOCAL ROADS PROGRAM

416 RILEY-ROBB HALL, ITHACA, NY 14853

PHONE: (607) 255-8033

FAX: (607) 255-4080

E-MAIL: clrp@cornell.edu

INTERNET: www.clrp.cornell.edu

Tech Tips are published by the Cornell Local Roads Program with support from the Federal Highway Administration, the New York State Department of Transportation, and Cornell University. The content is the responsibility of the Local Roads Program.

opposite alignments (for example, one to the left and then one to the right) and the distance between them is less than 600 feet, group them together. Sequential curves can always be signed separately if needed, just be sure that the sign placement is not confusing to motorists.

Table 1 shows the different signs used to provide information to the public. If the advisory speed is less than or equal to 30 mph, we place turn signs (W1-1 and W1-3). At 35 mph or more, we use curve signs (W1-2 and W1-4). A W1-5 is used whenever there are three or more curves in a series, separated by less than 600 ft of straight road. If there are more than four curves in a row, additional signs may be warranted in the middle of the series. A supplemental plaque showing next XX MILES below the sign at the start of the series may be adequate. After placing the signs, check them out to see if there is any confusion. Table 1 also shows the different sign types used for various roadway configurations. An L (left) and R (right) designation is used to define the direction/orientation of the first turn.

Table 1. Signs used to Indicate Various Curve Configurations

# of Curves	Advisory Speed (mph)	
	Less than or equal to 30 mph	Greater than or equal to 35 mph
1	W1-1 	W1-2
2	W1-3 	W1-4
3 or more	W1-5 	

DETERMINING THE ADVISORY SPEED

To determine the recommended advisory speed, we could carefully measure the maximum superelevation on the curve. However, if there are any bumps or depressions, they may be missed by such a survey. In addition, these surveys can take lots of time to conduct (especially with proper traffic control in place the entire time). A faster, safer, and easier method is to use a Ball Bank Indicator. In a Ball Bank Indicator, a ball held in fluid moves in response to travelling around a curve. The goal of a ball bank study is to determine the speed of travel where the ball stays below the maximum reading. The posted speed is usually rounded down to the nearest 5 mph.

It is important to follow correct procedures when using the ball bank indicator, or incorrect readings may result. The safe ball bank indications are shown in Table 2. These indications are designed to provide for safe comfortable travel around the curve. At slower driving speeds, the maximum ball bank readings are higher.

Table 2. Ball Bank Recommended Speed Indications

Speed Range	Maximum Ball Bank Reading
≤ 20 mph	16°
25-30 mph	14°
≥ 35 mph	12°

HOW TO USE A BALL BANK INDICATOR

1. Mount the ball bank indicator on the dashboard of a standard automobile. Sports cars, trucks, and SUVs with heavy-duty suspensions are not recommended for use. They tend to over or underestimate the curve speeds. Since one of the primary goals of signage is uniformity, a sedan or other typical automobile is recommended for speed studies.



Figure 1. Ball Bank Indicator

2. Level the ball bank indicator. This is done on a level surface with two people in the stationary car. Two people are recommended for safety reasons. One person can drive and the other person can record the ball bank reading.
3. Take a series of ball bank readings at various speeds. The driver should drive smoothly, in the center of the lane, at a relatively slow speed. Cutting the corner will result in a higher indicated advisory speed than you should have, while jerking the wheel will result in a lower advisory speed indication. The highest observed ball bank reading should be recorded. Additional runs should be made, increasing the speed 5 mph each time, until the maximum recommended speed is found. An additional run above the maximum recommended speed indication may be done (if the pavement is dry) to confirm the results of the previous reading.
4. Be sure to check the curve in both directions of travel. The posted speed may be different in opposite directions. If so, post each direction separately. Drivers only can use signs they see.

IMPORTANT POINTS TO REMEMBER

The placing of curve signs is a critical communication tool with the traveling public. They are not regulatory signs and the actual speed driven around the curve will likely be different. The vehicle type, weather, and driver ability can all affect the actual speed. The goal is to provide a consistent message to alert the driver to the nature of the roadway they are about to travel.

EXAMPLE BALL BANK STUDY

Here is a completed example of a form you can use to perform ball bank studies on your roads and streets, showing how the form is used. A [blank single-curve form](#) along with one for use with [multiple curves](#) is available at www.clrp.cornell.edu/tip_sheets/tip/curve.html.

BALL BANK WORKSHEET

Road Name: Speed Street Date: Oct 29, 2014
 Closest Intersection: Side Street Time: 9 am Weather: cool, rain
 Driving Direction: North By: Joe Lunchbucket
 Distance to Intersection / Mile marker: _____

Speed Driven (mph)	Ball Bank Reading	
	Maximum Allowed (degrees)	Recorded reading (degrees)
15	16°	4
20	16°	5
25	14°	8
30	14°	10
35	12°	11
40	12°	13
45	12°	14
50	12°	
55	12°	
60	12°	

# of Curves	Advisory Speed (mph)	
	Less than or equal to 30 mph	Greater than or equal to 35 mph
1	W1-1 	W1-2 
2	W1-3 	W1-4 
3 or more	W1-5 	

Advisory Speed: 35 mph
 Posted Speed Limit: 55 mph

Note: If the Advisory speed is less than the Posted Speed Limit, an advisory speed plate is required.

Recommended Sign(s): W1-2R
W13-1 (35 mph)



This work by the Cornell Local Roads Program (CLRP) is licensed under a [Creative Commons Attribution-NonCommercial-Share Alike 3.0 Unported License](#).

BALL BANK SINGLE-CURVE WORKSHEET

Road Name: _____
 Closest Intersection: _____
 Driving Direction: _____
 Distance to Intersection / Mile marker: _____

Date: _____
 Time: _____ Weather: _____
 By: _____

Speed Driven (mph)	Ball Bank Reading	
	Maximum Allowed (degrees)	Recorded reading (degrees)
15	16°	
20	16°	
25	14°	
30	14°	
35	12°	
40	12°	
45	12°	
50	12°	
55	12°	
60	12°	

# of Curves	Advisory Speed (mph)	
	Less than or equal to 30 mph	Greater than or equal to 35 mph
1	W1-1 	W1-2 
2	W1-3 	W1-4 
3 or more	W1-5 	

Advisory Speed: _____ mph
 Posted Speed Limit: _____ mph

Note: If the Advisory speed is less than the Posted Speed Limit, an advisory speed plate is required.

Recommended Sign(s): _____

