A. Purpose

This policy will define merge sign locations on all freeways and expressways.

B. Policy

Merge signs *should* be placed in accordance with Condition A, Table 2C-4 of the 2009 MUTCD. This distance **shall** be measured in an upstream direction, starting at the theoretical gore.

In some cases, particularly existing ramps at tight urban interchanges, this distance *may not* be achievable, due to substandard geometrics. In these cases, the merge signs will have to be installed where they can be accommodated.

State of Wisconsin
Department of Transportation

Traffic Guidelines Manual

ORIGINATOR State Traffic Engineer		2-3-35
CHAPTER 2	Signing	
SECTION 3	Warning Signs	
SUBJECT 35	Advisory Speed on Curves	

A. PURPOSE

To establish uniformity and consistency when determining the proper advisory speed for turns and curves and subsequent installation of advisory speed plaques.

B. BACKGROUND

The MUTCD and Wisconsin Supplement to the MUTCD provides requirements for the proper use of horizontal alignment signing, Advisory Speed plaques, Truck Rollover Warning signs, Advisory Exit and Ramp Speed signs. They are contained in the following sections:

- Horizontal Alignment signs - Section 2C.06 and 2C.07 (2009 MUTCD)
- Truck Rollover Warning signs –Section 2C.13 (2009 MUTCD).
- Advisory Speed Plaques –Section 2C.08 (2009 MUTCD)
- Supplemental warning plaques – Section 2C.53 and 2C.54 (2009 MUTCD).
- Advisory Exit, Ramp and Curve speed signs – Section 2C.14 (2009 MUTCD).
- Horizontal Alignment Sign Usage –Table 2C-5 (2009 MUTCD)

On state trunk highways it is required that all curves and turns less than posted or statutory speed, be signed in advance with curve warning signs for curves 35 MPH or above, or turn warning signs for turns, 30 MPH or less. The WMUTCD (Sections 2C.06 and 2C.07 has instructions related to signing curves, turns, winding roads, etc. The WMUTCD states in Section 2C.06 that if the roadway is less than 1000 ADT, an advisory speed plaque *should* be used to supplement the curve or turn warning sign where the posted speed varies from the curve speed by 10 MPH or more.

The 2009 MUTCD Table 2C-5 (Figure 1 of this policy) states that advisory speed plaques are:

- Recommended where the difference between speed limit and advisory speed is 5 mph.
- Required where the difference between speed limit and advisory speed is 10 mph or more.

Figure 1

2009 MUTCD Table 2C-5. Horizontal Alignment Sign Selection					
Type of Horizontal Alignment Sign	**Difference Between Speed Limit and Advisory Speed**				
	5 mph	**10 mph**	**15 mph**	**20 mph**	**25 mph or more**
Turn (W1-1), Curve (W1-2), Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), and Combination Horizontal Alignment/Intersection (W1-10) (see Section 2C.07 to determine which sign to use)	Recommended	Required	Required	Required	Required
Advisory Speed Plaque (W13-1P)	Recommended	Required	Required	Required	Required
Chevrons (W1-8) and/or One Direction Large Arrow (W1-6)	Optional	Recommended	Required	Required	Required
Exit Speed (W13-2) and Ramp Speed (W13-3) on exit ramp	Optional	Optional	Recommended	Required	Required

Note: Required means that the sign and/or plaque shall be used, recommended means that the sign and/or plaque should be used, and optional means that the sign and/or plaque may be used.

INTRODUCTION

The determination and posting of advisory speeds for changes in horizontal alignment is a universal practice throughout the nation. It was initially tried by the State of Missouri in 1937 followed shortly thereafter by a number of other state highway departments. The pre-eminent research was done by R. A. Moyer and D. S. Berry (1) published by the Highway Research Board in 1940 as a recommendation for signing changes in roadway alignment. Curve advisory speed posting was adopted as a suggested option in the 1948 *Manual on Uniform Traffic Control Devices* (2).

The initial research by Moyer and Berry established the basic need, procedures and criteria for determining advisory speeds. The use of a ball-bank Indicator was recommended as an acceptable instrument for establishing a “safe speed” on a horizontal curve. Their recommendations were the following ranges of values:

Table 1. Recommended Criteria for Curve Advisory Speed Determination
(Source: Moyer and Berry, 1940, Ref. 1)

Speeds (mph)	Ball Bank Reading	Side Friction Factor
≤ 20	14°	0.21
25 – 30	12°	0.18
≥ 35	10°	0.15

The Moyer/Berry research also indicated that the curve “safe speed” could be computed using the standard curve formula if the curve radii and super elevation were known using

the above noted equivalent side friction factors. While they noted the advisory speed as being the "safe speed" for the curve, the advisory speed actually represented the comfortable speed that the curve could be driven without experiencing lateral acceleration discomfort.

This procedure and criteria for advisory speed determination has become nearly universally accepted in the highway engineering profession and typically is used by most transportation agencies. However, there has been concern that the ball-bank method of determining advisory speeds *may* be outdated and not the best procedure. The need to update the procedures and criteria has been noted by the highway community for a number of years. Recognizing the age of the research, minor variations have been made in the criteria and its application in some roadway jurisdictions (3).

Many motorists also have observed that advisory speed signing is overly conservative and many exceed the posted advisory speeds. Another factor is that current vehicles have suspension and steering systems that are significantly improved providing better stability, cornering capabilities and driving comfort compared with typical vehicles at the time of the initial research.

The following guidelines establish new values that satisfy the motorists' needs. The current research has been reviewed with three methods addressed to determine an acceptable advisory speed. The recommended criteria have been adjusted to represent the current driving practices. While it is recognized that most roadways are posted with advisory speeds based on the older criteria, it appears logical to raise the values to provide realistic postings that are compatible with driving practices.

The provisions of the 2009 MUTCD encourage a restudy of the horizontal alignment signing. The MUTCD has a liberal compliance period of at least 10 years to implement the new horizontal alignment signing, so the engineering studies for curve advisory speeds can be done over a period of several years on a systematic basis with appropriate publicity so the public understands the revisions. Drivers will have to modify their driving habits so they do not incorrectly assume that posted advisory speeds can be driven at a higher speed. However, an adequate factor of safety is addressed in the new criteria so drivers even assuming a higher speed is acceptable *should not* be subjected to undue hazards. The older postings, while usually a lower speed, can remain in place until the new engineering study is completed and signs installed. It will be desirable to change all advisory speed plaques along a roadway at the same time to minimize motorist confusion.

DISCUSSION

There are several areas of concern/discussion:

- The ball-bank indicator method *may not* be current nor the best method for determining advisory speeds (5).
- The current practice results in advisory speeds that are too conservative and are far below the 85th percentile speed of drivers traversing the curves (5)(6)(7).
- Current vehicle suspension and cornering capabilities are substantially better than those of vehicles that were used to determine the older criteria (8). As a result, drivers today can comfortably drive curves at speeds higher than those that would have been comfortable with older vehicles.
- The criteria for curve advisory speeds *should* be comparable to the design criteria

in the AASHTO *Policy on Geometric Design for Highways and Streets* (9).

- The curve advisory speed practices in some jurisdictions have deviated from an adequate and universally accepted criteria resulting in posted advisory speeds well below prevailing curve speeds (3)(6). This results in inconsistent curve advisory speed postings from one jurisdiction to another.
- The current criteria do not consider truck advisory speeds and truck roll-over considerations (10)(11).
- Some inconsistencies have been noted in comparing current ball bank criteria with side friction factors used for curve design (8).

The research generally documented that drivers are often exceeding the existing posted advisory speeds by 7 to 10 miles per hour. An increase of 2 degrees for ball-bank indicator readings and comparable side friction factors is equivalent to 8 to 10 miles per hour increase in advisory speeds. The application of an accelerometer that measures lateral acceleration provides a direct determination of side friction factors and accommodates new instrumentation for advisory speed determinations. Minor adjustments in the relationship between ball-bank readings and side friction factors makes the ball-bank procedure and accelerometer determinations comparable. The use of the horizontal curve design speed equation remains an acceptable procedure using the newly recommended side friction factors.

There appears to be no reason to limit the advisory speed determination methods but instead recognize that any of the three methods are acceptable:

- the traditional ball-bank indicator
- design speed equation or
- accelerometer.

There is a fourth method called the Compass Method by Texas Transportation Institute (TTI), but requires extensive field work (measuring points throughout the curve), so is not being considered for WISDOT. The expansion of acceptable determination methods and change in criteria *should* offset current procedural deviations with the new *Manual on Uniform Traffic Control Devices* requirements encouraging wider and universal application of acceptable advisory speeds. The recommended criteria for advisory speed determinations are as follows:

Table 2. Recommended Criteria for Curve Advisory Speed Determination
(Source: Adapted from Carlson and Mason 1999, Ref. 8)
Revised by WISDOT to include Truck Advisory data

Speeds (mph)	Ball Bank Reading	Lateral Acceleration (g)
≤ 20	16º	0.28
25 – 30	14º	0.24
≥ 35	12º	0.21
Truck (All Speeds)	10	0.17

The new criteria are comparable to the current AASHTO design criteria. Some research has proposed higher values, but those values result in advisory speeds that exceed the observed speeds of drivers in curves, are above comfortable lateral acceleration levels, and reduce the margin of safety. Studies show that maximum side friction factors

developed between passenger car tires and wet pavement in poor condition can be as low as approximately 0.35 at high speeds (9)(14).

For large trucks, there is a potential danger of overturning if the truck enters a curve at too high of a speed. For sharp curves, such as loop exit ramps, it *may* be necessary to post truck advisory speeds. Current research indicates that truck-overturning situations are limited and inconsistent when side friction factors are less than 0.35 (12). Theoretically, truck advisory speeds could be determined based on a side friction factor of 0.21, or a ball-bank reading of 12 degrees, and still provide a reasonable overturning safety factor below the 0.35 overturning threshold. But this assumes that the truck follows the exact radius of the curve, which is unlikely in actual practice. Most drivers make steering corrections as they traverse a curve, sometimes steering a radius larger than the actual curve radius, sometimes steering a radius sharper that the actual curve radius. It must be recognized that if the truck is steered on a radius of ⅔ to ¾ of the actual curve radius, then the safety factor below the overturning threshold nearly disappears. As a result, it is recommended that the criteria for posting truck advisory speeds be based on a side friction factor of 0.17, or a ball-bank reading of 10 degrees, for all speed ranges to ensure a reasonable overturning safety factor. This would result in truck advisory speeds below the advisory speeds determined for passenger cars.

For New Construction Projects the following option *may* be used in lieu of the ball bank indicator method:

Method # 1 Determining Advisory Speeds Using the Design Speed Equation

The design of highway curves is based on the relationship between design speed, radius of curvature, super elevation, and side friction (centripetal acceleration). The mathematical relationship between these variables is given by the equation (9):

$$V = \sqrt{15R(0.01e + f)}$$

Where: V = Design speed (mph)
R = Curve radius (feet)
e = Super elevation (%)
f = Side friction factor

The same equation can be used to calculate the advisory speed for a curve, if the curve radius and super elevation are known. The side friction factor is the same as lateral acceleration (measured in “g’s”), and is based on driver comfort. For highway design, side friction factors are set by AASHTO geometric design policies, and are generally in the range of 0.08 to 0.30 depending on design speed. As previously discussed, recent studies have suggested that the values in the current design manual are overly conservative, and when this equation is used to determine the advisory speed for a curve, the lateral acceleration rates contained in Table 2 can be used. This equation *may* have to be solved iteratively because the value for the side friction factor, *f*, is different for different ranges of advisory speed, *V*. For example, suppose that a curve has a 200-foot radius and a super elevation of 4%. If it is initially assumed that the value of the lateral acceleration is 0.21 (applicable for passenger car advisory speeds of 35 mph or more), the calculated advisory speed is 27 mph. This means that the lateral acceleration value *should* have

been 0.24 (applicable for advisory speeds of 25 to 30 mph), and the advisory speed is recalculated as 29 mph. Calculated advisory speeds *should* be rounded to the nearest 5 mph increment, so a 30 mph advisory speed would be used for this curve. The rounded passenger car advisory speeds calculated for various combinations of super elevation and curve radius are shown in Table 3.

Table 3. Rounded Passenger Car Advisory Speeds (mph)
Based on Design Speed Equation

Radius (ft)	Super elevation (%)				
	-2	2	4	6	8
100	20	20	20	20	20
200	25	30	30	30	30
400	35	35	40	40	40
600	40	45	45	50	50
800	50	55	55	55	60
1000	55	60	60	65	65

In some cases, the curve radius and super elevation can be taken from as-built plans for a roadway that has been constructed fairly recently. However, it must be considered that a roadway that has been in service for many years *may* have been resurfaced one or more times since original construction. As a result of resurfacing, the super elevation of the curve *may* have changed, and the original plans *may* no longer be representative of field conditions. In other cases, the original plans *may* no longer be available.

If aerial photography is available, the curve radius can be determined by comparing circular curve templates with the aerial photograph. In the field, the approximate curve radius can be determined by the chord and middle ordinate method of measurement. This is illustrated in Figure 2. To determine the curve radius, measure a chord of any convenient length (usually 100 feet), straight across from one point on the edge of the road to another point on the edge of the road within the curve (line AB in Figure 2) where the curvature is uniform. Also measure the middle ordinate from the center of the chord to the edge of the road (line CD in Figure 2). The radius of the curve can be calculated as:

$$R = \frac{l^2}{8h} + \frac{h}{2}$$

Where: R = Curve radius (feet)
l = Chord length (feet)
h = Middle ordinate (feet)

The precision of this calculation is obviously limited by the ability to accurately measure the middle ordinate which would be as small as 1.25 feet (assuming a chord of 100 feet) for a curve with a radius of 1000 feet.

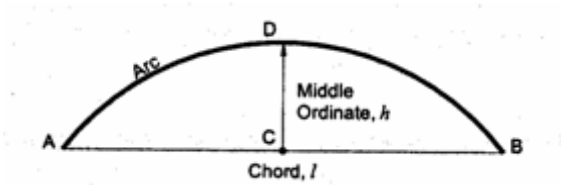

Figure 2. Measurement of Curve Chord and Middle Ordinate
(Source: Northwestern University Center for Public Safety)

The super elevation can be measured in the field using a 4-foot carpenter's level. As illustrated in Figure 3, position the level across the lane. With one end of the level on the road surface, measure the vertical distance from the road surface to the other end of the level. The cross slope of the roadway can then be calculated as the vertical distance divided by the length of the level. The super elevation *should* be measured in several locations along the curve, since it *may* vary. Also, the super elevation *should* be measured separately for each lane of the roadway.

Figure 3. Measuring Super elevation with a Carpenter's Level
(Source: Northwestern University Center for Public Safety)

Another method for determining the super elevation in the field is to stop a vehicle equipped with a ball-bank indicator (discussed in the next section) on the curve and read the degrees of deflection on the ball-bank. The super elevation is calculated as:

$$e = (\tan D) \times 100\%$$

Where: e = Super elevation (%)
D = Degrees of deflection on ball-bank indicator

Again, this measurement *should* be made at several locations within the curve, and *should* be measured separately for each lane.

Method # 2 Ball-Bank Indicator Method

Advisory speeds *may* be determined in the field using a vehicle equipped with a ball-bank indicator and an accurate speedometer. The simplicity of this technique has led to its widespread acceptance as a guide to determining advisory speeds for changes in horizontal alignment. Figure 4 shows a typical ball-bank indicator.

The ball-bank indicator consists of a curved glass tube, which is filled with a liquid. A

weighted ball floats in the glass tube. The ball-bank indicator is mounted in a vehicle, and as the vehicle travels around a curve the ball floats outward in the curved glass tube. The movement of the ball is measured in degrees of deflection, and this reading is indicative of the combined effect of super elevation, lateral (centripetal) acceleration, and vehicle body roll. The amount of body roll varies somewhat for different types of vehicles, and *may* affect the ball-bank reading by up to 1º, but generally is insignificant if a standard passenger car is used for the test. Therefore, when using this technique, it is best to use a typical passenger car rather than a pickup truck, van, or sports utility vehicle.

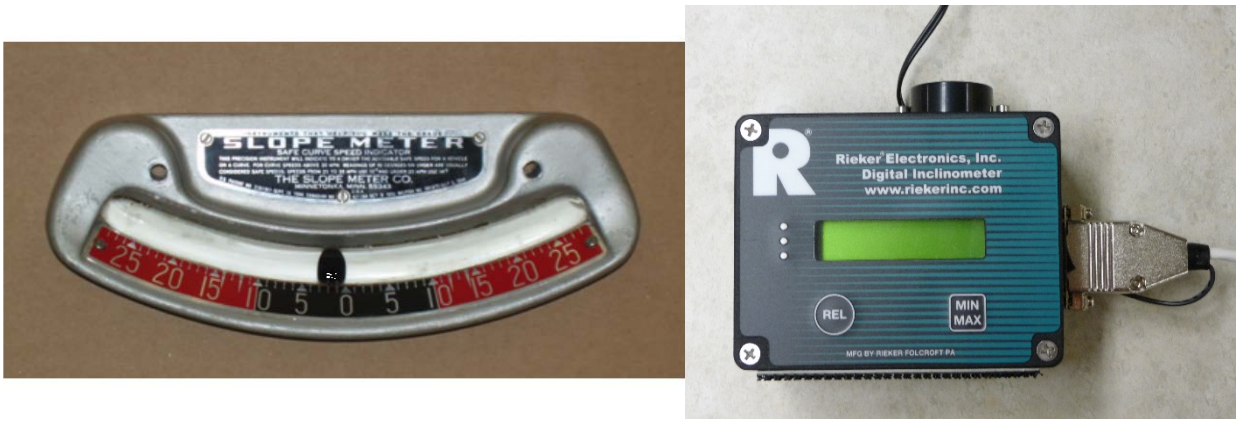

Figure 4. Ball-bank Indicators

To ensure proper results, it is critical that the following steps be taken before starting test runs with the ball-bank indicator:

- Inflate all tires to uniform pressure as recommended by the vehicle manufacturer
- Calibrate the test vehicle's speedometer
- Zero the ball-bank indicator

The vehicle speedometer *should* be calibrated to ensure proper and consistent test results. This can be done by checking the vehicle speed with a radar or laser speed meter, or by timing the vehicle over a measured distance (such as milepost spacing). Alternatively, a moving radar unit can be used to measure speed while conducting the ball-bank test runs rather than relying on the vehicle's speedometer.

The ball-bank indicator must be mounted in the vehicle so that it displays a 0º reading when the vehicle is stopped on a level surface. The positioning of the ball-bank indicator *should* be checked before starting any test. This can be done by stopping the car so that its wheels straddle the centerline of a two-lane highway on a tangent alignment. In this position, the vehicle *should* be essentially level, and the ball-bank indicator *should* give a reading of 0º. It is essential that the driver and recorder be in the same position in the vehicle when the ball-bank indicator is set to a 0º reading as they will be when the test runs are made because a shift in the load in the vehicle can affect the ball-bank indicator reading.

Starting with a relatively low speed, the vehicle is driven through the curve at a constant speed following the curve alignment as closely as possible, and the reading on the ball-bank indicator is noted. On each test run, the driver *should* reach the test speed at a

distance of at least ¼ mile in advance of the beginning of the curve, and maintain the same speed throughout the length of the curve. The path of the car *should* be maintained as nearly as possible in the center of the innermost lane (the lane closest to the inside edge of the curve) in the direction of travel. If there is more than one lane in the direction of travel, and these lanes have differing super elevation rates, drive in the lane with the lowest amount of super elevation. Because it is often difficult to drive the exact radius of the curve and keep the vehicle at a constant speed (cruise-control helps to maintain a constant speed), it *may* take several test runs in each direction be made to more accurately determine the ball-bank reading for any given speed. On each test run, the recorder must carefully observe the position of the ball throughout the length of the curve and record the deflection reading that occurs when the vehicle is as nearly as possible driving the exact radius of the curve.

If the reading on the ball-bank indicator for a test run does not exceed an acceptable level (as indicated by the recommended criteria in Table 2), then the speed of the vehicle is increased by 5 mph and the test is repeated. The vehicle speed is repeatedly increased in 5 mph increments until the ball-bank indicator reading exceeds an acceptable level. The curve advisory speed is set at the highest test speed that does not result in a ball-bank indicator reading greater than an acceptable level.

Figure 5 is an example of a data collection form that can be used to record the results of ball-bank indicator test runs. In the example in Figure 5, test runs were started at 25 mph, with ball-bank indicator reading of about 6°. This is well below the suggested criteria of 14° for a speed of 25 mph. The speeds of the test runs were gradually increased until the speed of 35 mph gave readings of 10° to 12°. These are the highest readings attained without exceeding and the suggested criteria of 12° for a speed of 35 mph or more. This study would result in posting an advisory speed of 35 mph for both directions of travel for this curve. Several alternative field data collection and supervisor approval forms are shown in the Appendix.

BALL-BANK INDICATOR STUDY						
LOCATION: ***STATE ROUTE 43***						
COUNTY: ***DAVIS***			SECTION:			
POSTED SPEED (MPH): ***55***			PAVEMENT CONDITION: ***DRY***			
DATE:			VEHICLE: ***2008 CHEVROLET IMPALA***			
DRIVER: ***SEYFRIED***			RECORDER: ***PLINE***			
REMARKS:						
DIRECTION OF TRAVEL	PHOTO LOG MILE		SPEED (MPH)	BALL-BANK READING (DEGREES)		
	START CURVE	END CURVE		RUN 1	RUN 2 IF NEEDED	RUN 3 IF NEEDED
NORTH	***8.32***	***8.65***	***25***	***6***	***7***	***6***
			30	***9***	***10***	***10***
			35	***12***	***12***	***11***
			40	***15***	***13***	***14***
SOUTH	***8.65***	***8.32***	***25***	***6***	***6***	***5***
			30	***9***	***8***	***9***
			35	***11***	***10***	***11***
			40	***13***	***14***	***14***

Figure 5. Sample Ball-Bank Indicator Data Collection Form

Method # 3 Accelerometer

An accelerometer is an electronic device which can measure the lateral (centripetal) acceleration experienced by a vehicle as it travels around a curve. Typically, method 1 and 2 are used. However, if the Region has an accelerometer, this method is acceptable to use as an alternative to the ball-bank indicator method.

Establishing Advisory Speeds

Using any of the three methods noted above *should* result in the same advisory speed for a curve. It is important to reiterate that the advisory speed criteria are based on driver comfort, not safety. A sufficiently skillful driver *may* be able to traverse a curve on dry pavement at a speed considerably higher than the advisory speed without exceeding the friction capabilities of the pavement. However, most drivers would choose not to drive at a higher speed because they would experience uncomfortable levels of lateral acceleration.

The MUTCD indicates that the “advisory speed **shall** be determined by an engineering study that follows established engineering practices” (Section 2C.08). The Manual further defines an engineering study as “the comprehensive analysis and evaluation of available pertinent information, and the application of appropriate principles, Standards, Guidance, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. An engineering study **shall** be performed by an engineer, or by an individual working under the supervision of an engineer or sign shop supervisor, through the application of

procedures and criteria established in this policy. An engineering study **shall** be documented" (MUTCD Section 1A.13).

Therefore, the establishment of advisory speeds must follow standard procedures developed and adopted by the engineering personnel of an agency. All field work used for determining the advisory speeds must be performed under the supervision of an engineer or sign shop supervisor. Finally, the data collected and analysis performed must be preserved in written documentation. The Appendix contains a sample curve advisory speed study supervisor approval form that can be used to document the field data collection.

The maximum comfortable operating speed on a curve can be determined using any of the three methods discussed above (design speed equation, ball-bank indicator, or accelerometer). The advisory speed for the curve *should* be set at the 5-mph increment nearest to this maximum comfortable speed. The advisory speed to be posted *should not* be arbitrarily reduced below the comfortable speed determined using these methods, because an unrealistically low advisory speed will lose credibility among drivers, and create inconsistencies that *may* lead drivers into traveling at too high a speed through other curves.

Advisory speed plaques are only used in conjunction with appropriate warning signs, and never alone. Turn, Curve, Reverse Turn, Reverse Curve, and Winding Road signs are used in locations where it is desirable to warn drivers of changes in the horizontal alignment of the roadway. The MUTCD indicates that the use of Turn or Reverse Turn signs *should* be limited to changes in alignment where the advisory speed is 30 mph or less. The Curve or Reverse Curve signs are intended for use where the advisory speed is greater than 30 mph.

Where a Reverse Curve warning sign or a Winding Road warning sign is used, the advisory speed *should* be based on the curve with the lowest comfortable operating speed. However, if one curve in the series has a dramatically lower comfortable speed, it would be desirable to place a separate warning sign with the appropriate advisory speed for that individual curve.

In some cases, there *may* be other factors that influence the selection of the advisory speed in addition to the comfortable operating speed on the curve. Available sight distance or deceleration distance (on an exit ramp) *may*, in some cases, require an advisory speed lower than the comfortable operating speed for the curve.

Truck Advisory Speeds

The appropriate warning signs for truck rollover concerns require more than just determination of truck advisory speeds. Large trucks, tank trailers and truck freight trailers have a high center of gravity and are susceptible to rollover crashes on a sharp curve. The loop ramps on freeway interchanges and direct freeway-to-freeway connections are sometimes subject to truck rollover problems. The potential for such crashes *may* increase because of radius of horizontal curvature, inadequate deceleration length or deficient specific signing. Truck rollover theoretically can occur when the lateral acceleration exceeds 0.30, but no calculated lateral acceleration less than 0.35 has been determined in any truck rollover collisions. A Ball Bank reading of 10 degrees (side friction

= 0.17) be used to provide a reasonable factor of safety. This value is about half the critical side friction factor accommodating those occasions where the truck *may* exceed the posted truck advisory speed or the truck travels a curve radius that is less than the actual roadway curvature. These criteria will generally produce a truck advisory speed that is approximately 5 mph less than the advisory speeds determined for passenger cars, except for the lower speed ranges.

The MUTCD, Section 2C.13, Section 2C.14 and Table 2C-5 (Figure 1 of this policy), covers the use of the Truck Rollover Warning sign (W1-13), Advisory Exit Speed sign (W13-2), and the Advisory Ramp Speed sign (W13-3). The application of these signs **shall** be based on an engineering study that considers the roadway and operational characteristics that *may* contribute to a loss of vehicle control and potential truck rollovers. It is suggested that the engineering study for Truck Rollover Warning signs address the following considerations;

1. Speed data and advisory speed determinations.
2. Traffic characteristics.
3. Roadway geometrics.
4. Recommended traffic control devices.

It *should* be noted that any posted Advisory Speed for the Truck Rollover signing *should* reflect the truck advisory speed determination. The MUTCD provides a number of other devices that can be used in conjunction with the above signs to address truck rollover consideration such as:

- Chevron Alignment signs (W1-8)
- Combination Horizontal Alignment/Advisory Speed sign (W1-1a and W1-2a)
- One Direction Large Arrow sign (W1-6)
- Combination Horizontal Alignment/Advisory Exit and/or Advisory Ramp Speed Signs (W13-6 and W13-7)

See TGM 2-3-36 for policies related to exit advisory speed signage.

Additionally, the warning can be enhanced with enlarged signing, a TRUCK header panel, or flashing beacons. The traffic engineering study *should* address the recommended signing for the specific field conditions.

D. POLICY

FIELD REVIEW OF CURVES AND TURNS

1. The setting of advisory speeds on existing curves and turns *should* be performed by the ball-bank indicator method for existing roadways utilizing Table 2 above.
2. The Accelerometer (Method 3) *may* be used as an alternative to the ball-bank indicator for Regions that have this device.
3. For ramps that have problems with truck rollovers and/or have the tippy truck signs installed, the truck ball bank reading of 10 degrees *should* be used.
4. For new construction, the design speed chart (Table 3) noted above *may* be used where the super elevation and radius are known.

Curve signing determined on the basis of calculated values *should* always be verified in the field by the ball bank method.

SIGNING IMPLEMENTATION

1. For consistency of motorist expectation, signing field changes *should* be organized where entire routes are done at approximately the same time. Breakpoints *should* occur in the route at locations where the highway travels through a community that has a speed zone reduction.
2. Signing field changes *should* be incorporated into improvement projects as much as possible. Roadway segments on each side of the improvement project *should* terminate at a STH/STH or municipal limit breakpoint.
3. Table 2C-5 in the 2009 MUTCD (see Figure 1 of this policy) **shall** be utilized in the determining the proper treatment of horizontal alignment sign(s).
4. For advisory speed reductions of 25 mph or greater, chevrons (W1-8 signs) *should* be used. For these advisory speed reductions, a night arrow (W1-6 sign) *may* be used to supplement the chevrons for advisory speed reductions of 25 mph or greater.
5. For advisory speed reductions that are greater than 5 mph and less than 25 mph, the usage of the night arrow (W1-6 sign) is the first choice of sign that *should* be used. For these advisory speed reductions, chevrons (W1-8 signs) are typically used in locations where there are demonstrated problems.
6. For a Winding Road (W1-5 sign)/Advisory speed (W13-1sign) application, where night arrows (W1-6 signs) and/or chevrons (W1-8 signs) are required on specific curves, the first curve in the series **shall** be signed with the night arrow and/or chevrons. Subsequent curves in the winding road series **shall** be signed with night arrows and /or chevrons if recommended/required by Table 2C-5 in the 2009 MUTCD (see Figure 1 of this policy).
7. For a Reverse Curve (W1-4 sign)/Advisory speed (W13-1 sign) application, the curves in the series **shall** be signed with night arrows and /or chevrons if recommended/required by Table 2C-5 in the 2009 MUTCD (see Figure 1 of this policy).
8. Turn warning signs **shall** be used where advisory speeds have been determined to be 30 mph or less.
9. Regulatory speed limit signs are normally not posted on ramps. For application of warning signs on service interchange ramps (non-freeway to freeway), relative to 2009 MUTCD Table 2C-5, a 10-mph reduction from the mainline posted speed *should* be used.
10. Each direction on the roadway should be evaluated independently of the other direction in the determination of the proper horizontal alignment signing.

PHASE IN COMPLIANCE

- In order to allow for resources to make the changes to the advisory speeds, the following **shall** apply:
- When signing is replaced with an improvement project, the advisory speeds **shall** be established based on the new policy. This can either be accomplished by one of the methods noted in this policy.
- For other sections of roadway, the changes **shall** be made for an entire segment of highway between two cities, towns or villages. Curve and turn advisories

should not be changed for one isolated location; rather for an entire segment between communities or within a county.

- Phase in period – December 31, 2019 (2009 MUTCD Compliance Date).

ACKNOWLEDGMENTS

NCUTCD – Regulatory and Warning Signs Technical Committee and Task Force and Bob Seyfried, Northwestern University Center for Public Safety**.**

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3. Paul J. Carlson and John M. Mason, "Relationship Between Ball Bank Indicator Readings, Lateral Acceleration Rates and Vehicle Body-Roll Rates", *Transportation Research Record 1658*. Washington DC: Transportation Research Board, January 1999.
4. *A Policy on Geometric Design of Highways and Streets,* American Association of State Highway and Transportation Officials, Washington, D. C., 2004.
5. R. Milstead, X. Qin, B. Katz, J. Bonneson, M. Pratt, J. Miles, and P. Carlson, "Procedures for Setting Advisory Speeds on Curves, Federal Highway Administration, Washington D.C., 2011.

APPENDIX

<u>SAMPLE FIELD DATA COLLECTION FORMS</u>

1. Curve Advisory Speed Calculations
2. Ball-Bank Indicator Test Supervisor Approval
3. Ball-Bank Indicator Study Form
4. Ball-Bank Indicator Test Summation
5. Curve Advisory Speed Determination Field Data Sheet

Advisory Speed Approval

Jurisdiction:_____

Location:_____

From: _____ **To:** _____

Project No./Title: _____

Advisory Speed Study Attached:

Ball Bank Indicatory Study _____ **Date:**_____

Speed Formula Calculations_____ **Date:**_____

Acceleromter Readings _____ **Date:**_____

Completed By: _____ **Date:**_____

Study Approval:

Name: _____ **Title:**_____

Date:_____

Curve Advisory Speed Calculations
Method # 1

Sheet ___of____

Completed By: _____ **Date:**_____

Jurisdiction:_____

Location:_____

From: _____ **To:** _____

Project No./Title: _____

$$V = \sqrt{15R(0.01e + f)}$$

DIRECTION OF TRAVEL	CURVE BEGIN STA.	CURVE END STA.	CURVE RADIUS (ft)	SUPER-ELEVATION (%)	SIDE FRICTION	ADVISORY SPEED (mph)	WARNING SIGN

Remarks: _____

Study Approval:

Name: _____ **Title:**_____
Date:_____

BALL-BANK INDICATOR STUDY	
LOCATION:	
COUNTY:	SECTION:
POSTED SPEED (MPH):	PAVEMENT CONDITION:
DATE:	VEHICLE:
DRIVER:	RECORDER:
REMARKS:	

DIRECTION OF TRAVEL	PHOTO LOG MILE		SPEED (MPH)	BALL-BANK READING (DEGREES)		
	START CURVE	END CURVE		RUN 1	RUN 2 IF NEEDED	RUN 3 IF NEEDED

BALL BANK INDICATOR TEST SUMMATION
(OPTIONAL)

Jurisdiction: _____ **Date:** _____

Location: _____

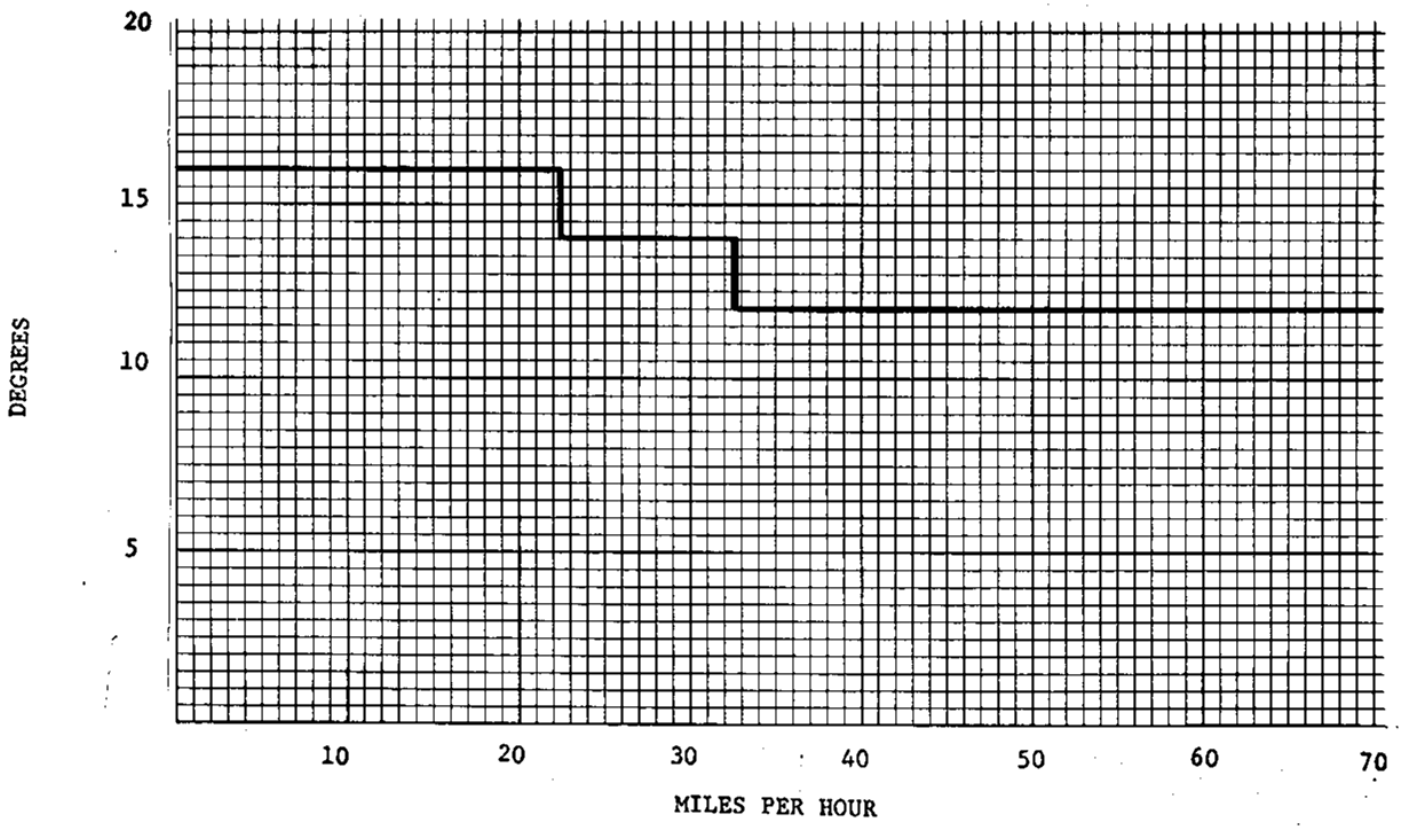
Weather: _____ **Road Surface:** _____

Driver: _____ **Recorder:** _____

Vehicle: _____ **Posted Speed Limit:** _____

Direction: _____ **Begin Curve:** _____ **End Curve:** _____

Show each vehicle test run as a dot on the graph



SUMMARY FOR A SECTION OF ROADWAY

CURVE ADVISORY SPEED DETERMINATION FIELD DATA SHEET	
Highway:	**County:**
Section:	**Date:**
Posted Speed (mph):	**Pavement Condition:**
Vehicle:	**Driver/Recorder:**
Remarks:	

BALL BANK READINGS: 12 degrees for speeds of 35 mph or more
14 degrees for speeds of 25 to 30 mph
16 degrees for speeds of 20 mph or less

Direction of Travel	Curve Direction		Beg. Curve	End Curve	Tangent Length	Ball Bank Reading	Advisory Speed (mph)		Curve Warning Sign	
	LT	RT	MP	MP	Miles	Degrees	Curre nt	Recom-mended	Sign No.	Size

State of Wisconsin
Department of Transportation

Traffic Guidelines Manual

ORIGINATOR State Traffic Engineer		2-4-45.2
CHAPTER 2	Signing	
SECTION 4	Guide Signs – Conventional	
SUBJECT 45.2	Emergency Medical Care Signing Policy	

A. Purpose

The purpose of emergency medical services signing is to provide direction for the motorist to the closest emergency medical care facility or hospital. The 2009 MUTCD, Section 2I.02 allows the usage of emergency medical care signing to facilities other than hospitals provided they meet certain criteria. The 2009 MUTCD also encourages states to develop guidelines for the usage of the Emergency Medical Services Sign. The Emergency Medical Care sign (D9-13C sign or E10-63 or E10-64 sign) provides direction to designated facilities other than hospitals that provide 24-hour emergency care.

Signs (Standard sign D9-13C with appropriate arrow or E10-63 or E10-64 sign) will be furnished and maintained by the Department on the state trunk highway system (if the state trunk highway does not lead directly past the emergency care facility) for emergency medical care facilities that meet the criteria specified in Section B of this policy. When a highway bypasses a municipality that has a qualifying emergency medical care facility, the Department will erect signs at appropriate locations on the bypass where motorists can best be directed into the municipality to the emergency medical care facility.

Signs and trailblazers on connecting streets and on local streets will not be furnished, erected, or maintained by the Department. At that point any further trailblazing is the responsibility of the local unit of government having maintenance jurisdiction over the highway carrying the route to the emergency medical care facility.

Signs *may* be erected only after being authorized by the Bureau of Traffic Operations, when the criteria in the following guidelines are met.

B. Policy

The following are guidelines for emergency medical care facility signing:

1. A sign *may* be warranted for a public or private emergency medical care facility which has continuous emergency care capability as defined by the American Medical Association (AMA) and which is AMA Board Certified. Attached to the policy is a listing of emergency medical care facilities that are Board Certified by the AMA. Emergency

Medical Care facilities included on this list *may* be signed provided they meet the rest of the criteria outlined in this policy.

2. The following criteria **shall** be used to determine if an Emergency Medical Care facility qualifies for signing:
   a. Continuous 24-hour, 7 days per week emergency care capability.
   b. Emergency department facilities with a physician trained in emergency medical procedures on duty (or emergency care nurse on duty within the emergency department with a physician on call).
   c. Board certified by the American Medical Association and a licensed medical care facility by the State of Wisconsin.
   d. Equipped for radio voice communications with ambulances and other hospitals.

3. A sign *may* be warranted on a freeway when the emergency medical care facility is within a community contiguous to or near the freeway, or not more than 15 miles from the freeway.

4. A sign *may* also be warranted on a major highway which is not a freeway but which bypasses a community having a qualifying emergency medical care facility.

5. On a freeway or other highway that bypasses a community having an emergency medical care facility, a sign will be erected:
   a. Only at the point or points giving access to the most direct route to the facility.
   b. Only once for traffic in each direction on a given highway.

6. Emergency Medical Care signs *should not* be erected on the same State Trunk Highway within the same community having a qualifying hospital that is already signed. An exception can be made if the emergency medical care facility is closer to the state trunk highway as described in Item 8.

7. Signs and trailblazers *may* be erected and maintained on the State Trunk Highway System by the Department but not until after trailblazer signs on local roads and streets have been erected.

8. If a new hospital is signed on the same highway in a community that has emergency medical care facility signing, the existing emergency medical care facility signs **shall** be removed. An exception can be made if the emergency medical care facility is closer than the hospital at the same intersection or interchange. In this case, both facilities could be signed.

9. The name of the emergency care facility will not be utilized on the signing unless there is more than one facility on the route, each of which appears on the list of approved emergency medical care facilities, and each of which is approximately the same distance from the point at which the routes to the facilities diverge. The emergency medical care facility name sign will be utilized only at that divergence point, and not with other trailblazers between the beginning of the signed route and the point of divergence, nor between the point of divergence and the emergency medical care facility itself.

The Department will remove signs from the state trunk highways when notified that a facility does not meet the criteria for an Emergency Care Facility, and are not included on the attached list.

Summary of AMA Board Certified Emergency Medical Care Facilities

Updated October 2015

Hospital	Address	City	Region	Remarks
St. Mary's Care Center	Reiner Rd.	Sun Prairie	SW	
Mercy Hospital and Trauma Center	3400 Deerfield Dr	Janesville	SW	
Pro Health Care	240 Maple Ave	Mukwonago	SE	

The following is a listing of freeway exit numbers in Wisconsin.
Changes or additions *should* be reported to the Bureau of Traffic Operations to keep this listing current.

County	Direction of Travel	Interchange with	Exit No.
		USH 10	
Wood	E B and WB	STH 13 North and CTH A - Marshfield	187
Portage	EB and WB	STH 13 South and STH 34 South – Junction City and Wis Rapids	204
Portage	EB	STH 34 North, CTH P and CTH HH – Knowlton and Stevens Point	208
Portage	WB	STH 34 North, CTH P and CTH HH – Knowlton and Junction City	208
Portage	WB	IH 39 and USH 51 North - Wausau	213
Portage	EB and WB	CTH J	230
Portage	EB	Amherst Jct. and Lake Road	237
Portage	EB and WB	CTH B West – Plover and Amherst	238
Portage	EB and WB	CTH A and CTH B East - Amherst	240
Waupaca	EB	STH 49 North and STH 54 West - Waupaca	250
Waupaca	WB	STH 49 North and STH 54 West - Waupaca and Wis. Rapids	250
Waupaca	EB and WB	STH 22 South and CTH K - Waupaca and Wild Rose	252
Waupaca	EB and WB	Churchill St	253
Waupaca	EB and WB	STH 22 North, STH 54 East, CTH A, and CTH K North - Waupaca	254
Waupaca	EB and WB	STH 110 North and CTH A - Weyauwega	260A
Waupaca	WB	CTH F - Weyauwega	260B
Waupaca	EB and WB	STH 49 and STH 110 – Berlin and Fremont	264
Waupaca	EB and WB	STH 96, STH 110, CTH II - Fremont	267
Winnebago	EB and WB	USH 45 North – New London	273
Winnebago	EB and WB	USH 45 South – Oshkosh	276
Winnebago	EB and WB	STH 76 and USH 41 North – Oshkosh and Shiocton	284

USH 10 - continued

Winnebago	WB	STH 76 – Oshkosh and Shiocton	284
Winnebago	EB and WB	CTH CB	286
Winnebago	EB and WB	USH 41 South - Oshkosh	287A
Winnebago	WB	USH 41 North - Green Bay	287B
Winnebago	EB and WB	CTH P - Racine St	289A
Winnebago	EB and WB	CTH AP - Midway Rd	289B
Winnebago	EB and WB	STH 47 - Appleton Ro	290
Winnebago	EB	Oneida St	291

USH 12

Sauk	EB and WB	CTH BD – Fern Dell Rd	212
Sauk	EB and WB	N Reedsburg Rd	214
Sauk	EB and WB	STH 33 WB – Pit Rd	215
Dane	EB and WB	Parmenter St	249
Dane	EB and WB	CTH M – Airport Rd and Century Ave	250
Dane	WB	Parmenter St	251B
Dane	EB and WB	USH 14 West	251A
Dane	EB and WB	Greenway Blvd.	252
Dane	EB and WB	Old Sauk Rd	253
Dane	EB and WB	CTH M and S - Mineral Point Rd	254
Dane	EB and WB	Gammon Rd	255
Dane	EB and WB	Whitney Way	257
Dane	EB and WB	USH 18 West and USH 151 South - Verona Rd and Midvale Blvd.	258
Dane	WB	Seminole Hwy.	258A
Dane	EB and WB	Todd Dr.	259
Dane	EB	CTH D South - Fish Hatchery Rd	260A
Dane	EB	CTH D North - Fish Hatchery Rd	260B
Dane	WB	CTH D - Fish Hatchery Rd	260B-A
Dane	EB	USH 14 East	261A
Dane	EB	USH 151 North - Park St.	261B
Dane	WB	USH 151 North - Park St and USH 14 East	261B-A
Dane	EB and WB	Rimrock Rd	262
Dane	EB and WB	John Nolen Dr.	263
Dane	EB and WB	South Towne Dr.	264
Dane	EB and WB	Monona Dr.	265
Dane	EB and WB	USH 51 - Stoughton Rd	266
Dane	EB	IH 90 East and IH 39 South	267A
Dane	EB	IH 90 West and IH 39 North	267B
Dane	EB and WB	CTH N	272
Walworth	EB and WB	IH 43 and CTH NN	321
Walworth	EB and WB	STH 120 North	328
Walworth	EB	STH 50 East	330A
Walworth	EB	STH 50 West and STH 120 South	330B
Walworth	WB	STH 50 and STH 120 South	330A-B
Walworth	EB and WB	Pell Lake Dr.	335

USH 14

Dane	EB	STH 138	140
Dane	EB and WB	CTH MM	139
Dane	EB and WB	Mc Coy Rd	133

STH 16

Waukesha	EB and WB	CTH P North - Brown St. and Grifford Rd	176
Waukesha	EB and WB	CTH P South - Sawyer Rd	178
Waukesha	EB and WB	CTH C	179
Waukesha	EB and WB	STH 83	181
Waukesha	EB	CTH E and KC - North Ave. and Merton Ave.	182
Waukesha	WB	CTH KC and E - North Ave. and Merton Ave.	183
Waukesha	EB and WB	CTH JK and KE - Jungbluth Rd. and North Shore Dr.	184
Waukesha	EB and WB	CTH KF - Ryan St.	186
Waukesha	EB and WB	STH 190 - Capitol Dr.	187
Waukesha	EB and WB	CTH JJ - Main St.	188

STH 26

Rock	NB and SB	Harmony Town Hall Road	6
Rock	NB and SB	STH 59 and CTH M	8
Jefferson	NB and SB	Business 26 and CTH Y	39
Jefferson	NB	STH 19	43
Dodge	SB	STH 19	43
Dodge	NB and SB	STH 16 EB	45

STH 29

Dunn	WB	WB IH 94	60A
Dunn	WB	EB IH 94	60B
Dunn	EB and WB	USH 12 and STH 40	61
Chippewa	EB and WB	CTH T	68
Chippewa	EB and WB	90th St and Business 29	72
Chippewa	EB and WB	US 53 South	75A
Chippewa	EB and WB	US 53 North	75B
Chippewa		Seymour Cray and Business 29	79
Chippewa	EB and WB	CTH X	80
Chippewa	EB and WB	CTH J	81
Chippewa	EB and WB	CTH X	87
Chippewa	EB and WB	STH 27	91
Chippewa	EB and WB	CTH D	97
Chippewa	EB and WB	CTH H	101
Clark	EB and WB	STH 73 and CTH M	108
Clark	EB and WB	STH 73 and CTH T	118
Clark	EB and WB	CTH X – Cardinal Ave	122
Clark	EB and WB	CTH E	127
Clark	EB	Sprue St/ Highline Ave	131
Marathon	EB and WB	STH 13	132
Marathon	WB	Maple Rd/Spruce St	134
Marathon	EB and WB	STH 97	145
Marathon	EB and WB	CTH H	150
Marathon	EB and WB	STH 107	156
Marathon	EB and WB	72nd Ave	162
Marathon	EB and WB	STH 52	164A
Marathon	EB and WB	USH 51 North	164B
Marathon	EB	USH 51 South	none
Marathon	WB	USH 51 North	none
Marathon	EB and WB	Business 51	171
Marathon	EB and WB	CTH X	173
Marathon	EB and WB	CTH J	177

STH 29 - continued

Marathon	EB and WB	CTH Q	181
Marathon	EB and WB	CTH Y	185
Shawano	EB and WB	USH 45 North and CTH M and Business 29	195
Shawano	WB	CTH Q and Business 29	196
Shawano	EB and WB	USH 45 South	198
Shawano	EB and WB	STH 22	225
Shawano	EB	STH 47 North and STH 55 North and CTH K	227
Shawano	WB	STH 47 North and STH 55 North and CTH K and Business 29	227
Shawano	EB and WB	STH 47 South and STH 117	234
Shawano	EB and WB	STH 55 South and STH 160	242
Brown	EB and WB	STH 32 and CTH Y	249
Brown	EB and WB	CTH FF	255

INTERSTATE 39
(SEE USH 51- INTERSTATE HIGHWAY 39)
(ALSO SEE INTERSTATE 90 FOR I39/I90/I94)

STH 175

Milwaukee	NB and SB	IH 94-Eastbound	38A
Milwaukee	NB and SB	IH 94-Westbound	38B
Milwaukee	SB	USH 18 (Wisconsin Ave.) and Wells St.	38C
Milwaukee	NB	USH 18 - Wisconsin Ave. and Bluemound Rd.	38C
Milwaukee	SB	Vliet St. and State St.	39A
Milwaukee	NB	State St. and Vliet St.	39A
Milwaukee	NB	Washington Blvd.	39B
Milwaukee	NB	Lloyd St.	40A
Milwaukee	NB	USH 41 - Lisbon Ave.	40B

INTERSTATE HIGHWAY 41

Milwaukee	NB	STH 175 - Appleton Ave.	none
Milwaukee	SB	USH 41 - Appleton	47A
Milwaukee	NB and SB	CTH PP - Good Hope Rd	47B
Milwaukee	NB	STH 145 North and 124th St	48
Waukesha	SB	STH 145 - Fond du Lac Ave.	48
Waukesha	NB	STH 100 East - Main St.	50A
Waukesha	NB	CTH F West - Main St.	50B
Waukesha	SB	CTH F and STH 100 East - Main St.	50A-B
Waukesha	NB	Pilgrim Rd - Northbound	51A
Waukesha	NB	Pilgrim Rd - Southbound	51B
Waukesha	SB	Pilgrim Rd	51A-B
Waukesha	NB	CTH Q - County Line Rd	52
Washington	SB	CTH Q - County Line Rd	52
Washington	NB and SB	STH 167 East - Mequon Rd and CTH Y Lannon Rd	54
Washington	NB and SB	STH 167 West - Holy Hill Rd	57
Washington	NB	USH 45 North	59
Washington	NB and SB	STH 145	60
Washington	NB	STH 60 East	64A
Washington	NB	STH 60 West	64B
Washington	SB	STH 60	64A-B
Washington	NB and SB	STH 144	66
Washington	NB and SB	CTH K	68
Washington	NB and SB	STH 33	72
Washington	NB and SB	CTH D	76

INTERSTATE HIGHWAY 41 – continued

Dodge	NB and SB	STH 28	81
Dodge	NB and SB	STH 67	85
Dodge	NB and SB	STH 49 and CTH KK	87
Fond du Lac	NB and SB	CTH B	92
Fond du Lac	NB and SB	USH 151	95
Fond du Lac	NB and SB	CTH VV - Hickory St.	97
Fond du Lac	NB and SB	CTH D and Military Road	98
Fond du Lac	NB and SB	STH 23 - Johnson St.	99
Fond du Lac	NB and SB	CTH OO - Winnebago St.	101
Fond du Lac	NB and SB	CTH N	106
Winnebago	NB and SB	STH 26	113
Winnebago	NB and SB	STH 44 and STH 91-Ripon Rd and South Park Ave.	116
Winnebago	NB and SB	9th Ave.	117
Winnebago	NB and SB	STH 21 - Omro Rd and Oshkosh Ave.	119
Winnebago	NB and SB	USH 45 and TO USH 10 West - Algoma Blvd.	120
Winnebago	NB and SB	STH 76 - Jackson St.	124
Winnebago	NB and SB	Breezewood Lane/Bell St.	129
Winnebago	NB and SB	STH 114 and CTH JJ - Winneconne Ave.	131
Winnebago	NB and SB	Main St. and Oakridge Rd	132
Winnebago	NB and SB	CTH II – Winchester Rd	133
Winnebago	NB and SB	USH 10 East and STH 441 North	134
Winnebago	NB and SB	CTH BB - Prospect Ave.	136
Outagamie	NB and SB	STH 125 - College Ave.	137
Outagamie	NB and SB	STH 96 - Wisconsin Ave.	138
Outagamie	NB and SB	STH 15 and CTH 00 - Northland Ave.	139
Outagamie	NB and SB	STH 47 - Richmond St.	142
Outagamie	NB and SB	CTH E - Ballard Rd	144
Outagamie	NB and SB	STH 441 South	145
Outagamie	NB and SB	CTH N	146
Outagamie	NB and SB	STH 55	148
Outagamie	NB and SB	CTH J	150
Outagamie	NB and SB	CTH U	154
Brown	NB and SB	CTH S	157
Brown	NB and SB	CTH F - Scheuring Road	161
Brown	NB and SB	CTH G - Main Ave.	163A
Brown	NB	Ashland Ave.	163B
Brown	NB and SB	CTH AAA - Oneida Street and Waube Lane	164A
Brown	NB and SB	STH 172	164B
Brown	NB and SB	CTH VK - Lombardi Ave.	167
Brown	NB and SB	STH 54 and STH 32 South - Mason St.	168A
Brown	NB and SB	STH 29 West and STH 32 North	168B
Brown	NB and SB	STH 29 East Shawano Ave.	168C
Brown	NB and SB	USH 141 South - Velp Ave.	170A
Brown	NB and SB	IH 43	170B

USH 41

Brown	NB and SB	CTH M - Lineville Road	173
Brown	NB and SB	CTH B - Sunset Beach Road	176
Oconto	NB and SB	Brown Road	179
Oconto	NB and SB	CTH S	182
Oconto	NB and SB	CTH D - Sampson Road	185
Oconto	NB and SB	USH 141	187
Oconto	NB	Business 41	197
Oconto	NB and SB	STH 22	198
Oconto	SB	Business 41	200

INTERSTATE HIGHWAY 43

Marinette	NB and SB	CTH Y	212
Marinette	NB and SB	Schacht Road	216
Rock	SB	IH 90 East and IH 39 South	1A
Rock	SB	IH 90 West and IH 39 North	1B
Rock	NB and SB	CTH X and Hart Road	2
Rock	NB and SB	STH 140	6
Walworth	NB and SB	USH 14	15
Walworth	NB and SB	CTH X	17
Walworth	NB and SB	STH 50	21
Walworth	NB and SB	STH 67	25
Walworth	NB and SB	USH 12 East	27A
Walworth	NB and SB	USH 12 West	27B
Walworth	NB and SB	STH 11	29
Walworth	NB and SB	Bowers Road	33
Walworth	NB and SB	STH 120	36
Walworth	NB and SB	STH 20	38
Waukesha	NB and SB	STH 83	43
Waukesha	NB and SB	STH 164	50
Waukesha	NB and SB	CTH Y - Racine Ave.	54
Waukesha	NB and SB	Moorland Road	57
Waukesha	NB	Layton Avenue	59
Milwaukee	SB	USH 45 and STH 100 - South	60
Milwaukee	NB	IH 894 West	61
Milwaukee	NB	Michigan St and 10th St	72A
Milwaukee	SB	IH 794 East - Lakefront	72B
Milwaukee	NB	IH 794 East – Lakefront	310C
Milwaukee	NB	Kilbourn Avenue	72C
Milwaukee	SB	IH94 West Madison	72D
Milwaukee	SB	Highland Avenue and 11th St	72E
Milwaukee	NB and SB	Fond du Lac Ave and McKinley Ave	73A
Milwaukee	NB and SB	North Avenue	73B
Milwaukee	NB and SB	Locust Avenue	74
Milwaukee	NB and SB	Keefe Avenue and Atkinson Avenue	75
Milwaukee	NB	STH 190 East - Capitol Dr	76A
Milwaukee	NB	STH 57 - Green Bay Ave and STH 190 West - Capitol Dr.	76B
Milwaukee	SB	STH 57 - Green Bay Ave and STH 190 - Capitol Dr.	76A-B
Milwaukee	NB	Hampton Avenue - Eastbound	77A
Milwaukee	NB	Hampton Avenue - Westbound	77B
Milwaukee	NB and SB	Silver Spring Drive	78
Milwaukee	NB and SB	Good Hope Road	80
Milwaukee	NB	Brown Deer Road - Eastbound	82A
Milwaukee	SB	STH 32 East - Brown Deer Road	82A
Milwaukee	NB and SB	STH 100 West - Brown Deer Road	82B
Milwaukee	NB	CTH W - Port Washington Road	83

Interchanges where IH 43 and IH 894 are concurrent are numbered as interchanges on IH 894

Ozaukee	NB and SB	STH 167 - Mequon Road	85
Ozaukee	NB and SB	CTH C	89
Ozaukee	NB and SB	STH 60 and CTH Q	92
Ozaukee	NB and SB	STH 32 North and CTH V South	93
Ozaukee	NB and SB	STH 33	96
Ozaukee	NB	STH 57	97
Ozaukee	NB and SB	CTH H West and STH 32 South	100
Ozaukee	NB and SB	CTH D	107

INTERSTATE HIGHWAY 43 – continued

Sheboygan	NB and SB	STH 32 North and CTH LL	113
Sheboygan	NB and SB	CTH AA - Foster Rd	116
Sheboygan	NB and SB	CTH V and CTH OK	120
Sheboygan	NB and SB	STH 28	123
Sheboygan	NB and SB	STH 23 East	126A
Sheboygan	NB and SB	STH 23 West	126B
Sheboygan	NB and SB	STH 42	128
Manitowoc	NB and SB	CTH XX	137
Manitowoc	NB and SB	CTH C	144
Manitowoc	NB and SB	USH 151 and STH 42 South	149
Manitowoc	NB and SB	USH 10 East and STH 42 North and CTH JJ	152
Manitowoc	NB and SB	USH 10 West and STH 310	154
Manitowoc	NB and SB	CTH V	157
Manitowoc	NB and SB	CTH K	160
Manitowoc	NB and SB	STH 147 and CTH Z	164
Brown	NB and SB	STH 96 - CTH KB	171
Brown	NB and SB	USH 141 and CTH MM	178
Brown	NB and SB	STH 172	180
Brown	NB and SB	CTH JJ - Eaton Rd	181
Brown	NB and SB	CTH V - Mason St.	183
Brown	NB and SB	STH 54 and STH 57 - University Ave.	185
Brown	NB and SB	Webster Avenue and East Shore Drive	187
Brown	NB and SB	Atkinson Dr.	189
Brown	NB	USH 41 and USH 141	192A-B

USH 45 (IH 41)

Milwaukee	SB	IH 94 - Eastbound	38A
Milwaukee	SB	IH 94 - Westbound	38B
Milwaukee	SB	Bluemound Rd	39
Milwaukee	NB	Bluemound Rd	39
Milwaukee	NB and SB	Watertown Plank Rd	40A-B
Milwaukee	NB and SB	Mayfair Rd and North Ave. - Eastbound	42A
Milwaukee	NB and SB	North Ave. - Westbound	42B
Milwaukee	NB and SB	Burleigh St.	43
Milwaukee	NB and SB	Capitol Dr.	44
Milwaukee	NB and SB	Hampton Ave.	45
Milwaukee	NB and SB	Silver Spring Dr.	46
Milwaukee	NB	STH 175 West - Appleton Ave.	47A
Milwaukee	SB	STH 175 East - Appleton Ave.	47A

Interchanges where USH 45 / IH 41and USH 41 are concurrent are numbered as interchanges on USH 41/ IH 41

Washington	NB and SB	STH 145 - Fond du Lac Ave.	60
Washington	NB and SB	STH 60	63
Washington	NB and SB	CTH PV - Pleasant Valley Rd	65
Washington	NB and SB	Paradise Dr.	68
Washington	NB and SB	STH 33 and STH 144 - Washington St.	71
Washington	NB and SB	CTH D	73

USH 51 and INTERSTATE HIGHWAY 39

Columbia	SB	IH 90/94 and STH 78 South	84
Columbia	NB and SB	Cascade Mountain Rd	85
Columbia	NB and SB	STH 33	87

USH 51 and INTERSTATE HIGHWAY 39 – continued

Columbia	NB	STH 16 East	89A
Columbia	NB	STH 16 West 127 and To STH 127	89B
Columbia	SB	STH 16 and To STH 127	89B-A
Columbia	NB and SB	USH 51 South	92
Marquette	NB and SB	STH 23 West - CTH P	100
Marquette	NB	CTH D	104
Marquette	NB and SB	STH 23 East - STH 82	106
Marquette	NB and SB	CTH J and E	113
Waushara	NB and SB	STH 21	124
Waushara	NB and SB	CTH V	131
Waushara	NB and SB	STH 73	136
Portage	NB and SB	CTH D	139
Portage	NB and SB	CTH W	143
Portage	NB and SB	STH 54 - Bus. 51	151
Portage	NB and SB	CTH B	153
Portage	NB and SB	CTH HH	156
Portage	NB	USH 10 East	158A
Portage	NB	STH 66 West	158B
Portage	SB	USH 10 East and STH 66 West	158
Portage	NB and SB	STH 66 East	159
Portage	NB and SB	Business 51	161
Portage	NB and SB	Casimir Road	163
Portage	NB and SB	USH 10 West	165
Portage	NB and SB	CTH DB	171
Marathon	NB and SB	STH 34	175
Marathon	NB and SB	STH 153	179
Marathon	NB and SB	Kronenwetter and Mosinee (Maple Ridge Rd)	181
Marathon	NB and SB	Bus. 51	185
Marathon	NB and SB	STH 29 East	187
Marathon	NB and SB	CTH N	188
Marathon	NB and SB	CTH NN	190
Marathon	NB and SB	STH 29 West	191A
Marathon	NB	Sherman St.	191B
Marathon	NB and SB	STH 52 and Stewart Avenue	192
Marathon	NB and SB	Bridge St.	193
Marathon	NB and SB	CTH U	194A
Marathon	NB and SB	Bus. 51 CTH K	194B
Marathon	NB and SB	CTH WW	197
Lincoln	NB and SB	CTH Q	205
Lincoln	NB and SB	STH 17 and STH 64	208
Lincoln	NB and SB	CTH K	211
Lincoln	NB and SB	CTH S	225
Lincoln	NB and SB	STH 86 West and CTH D East	229
Lincoln	NB and SB	CTH A	231
Lincoln	NB and SB	USH 8	234

USH 53

La Crosse	NB and SB	STH 157 and Main St	6
La Crosse	NB and SB	CTH S and Sand Lake Rd	7
La Crosse	NB and SB	CTH OT	9
La Crosse	NB	STH 35 South, CTH HD, Business 35 and Holmen Dr	11
La Crosse	SB	STH 35 South, CTH HD and Holmen Dr	11
La Crosse	NB and SB	CTH MH and McHugh Rd	13
La Crosse	NB	STH 35 North and CTH HD	15
La Crosse	SB	STH 35 North, CTH HD, and Business 35	15
Eau Claire	SB	IH 94 East	84A
Eau Claire	SB	IH 94 West	84B
Eau Claire	NB and SB	Golf Rd	85
Eau Claire	NB and SB	STH 93 – Hastings Way	86
Eau Claire	NB and SB	USH 12 – Clairemont	87
Eau Claire	NB and SB	River Prairie Dr	89
Eau Claire	SB and NB	North Crossing and STH 312	90
Chippewa	SB and NB	Melby Street	92
Chippewa	SB and NB	CTH OO	94
Chippewa	SB and NB	STH 29 East	95A
Chippewa	SB and NB	STSH 29 West	95B
Chippewa	SB and NB	Business 29 – CTH X	96
Chippewa	SB and NB	CTH S	99
Chippewa	SB and NB	CTH B	102
Chippewa	SB and NB	STH 40	110
Chippewa	SB and NB	STH 64	112
Chippewa	NB and SB	CTH M	118
Barron	NB and SB	CTH I	126
Barron	NB and SB	USH 8	135
Barron	NB and SB	CTH 0	140
Barron	NB and SB	STH 48	143
Barron	EB and SB	CTH V	150

USH 61

Grant	NB and SB	STH 11 East and STH 35 South	1
Grant	NB	Badger Road and Eagle Point Rd	2
Grant	SB	Badger Rd and Eagle Point Rd	3
Grant	NB	CTH HHH and To CTH H	5
Grant	SB	CTH H and To CTH HHH	5
Grant	NB	USH 61 North Off Ramp at USH 151	8

STH 64

St. Croix	EB and WB	STH 35/CTH E	1
St. Croix	EB and WB	CTH V / Andersen Scout Camp Road	4
St. Croix	EB and WB	CTH VV / Bus 64	5
St. Croix	EB and WB	STH 35 / CTH C / Bus 64	9
St. Croix	EB and WB	CTH A / Bus 64	12

INTERSTATE HIGHWAY 90

La Crosse	EB and WB	CTH B	2
La Crosse	WB	STH 35 and USH 53 South	3
La Crosse	EB	STH 35 and USH 53 South	3A
La Crosse	EB	STH 35 North	3B

La Crosse	EB and WB	USH 53 North and STH 157	4
La Crosse	EB and WB	STH 16	5
La Crosse	EB and WB	CTH C	12
La Crosse	EB and WB	STH 162	15
Monroe	EB and WB	STH 27	25
Monroe	EB and WB	STH 16	28
Monroe	EB and WB	STH 131	41
Monroe	EB and WB	USH 12 and STH 16	43

INTERSTATE HIGHWAY 90 – continued

Monroe	EB and WB	IH 94	45
Monroe	EB and WB	CTH PP	48
Juneau	EB and WB	CTH C	55
Juneau	EB and WB	STH 80	61
Juneau	EB and WB	STH 82	69
Juneau	EB and WB	CTH HH and CTH N	79
Juneau	EB and WB	USH 12 and STH 16	85
Sauk	EB and WB	STH 13	87
Sauk	EB and WB	STH 23	89
Sauk	EB and WB	USH 12	92
Columbia	EB and WB	STH 33	106
Columbia	EB and WB	STH 78 South	108A
Columbia	EB and WB	IH 39 North	108B
Columbia	EB and WB	CTH CS	115
Columbia	EB and WB	STH 60	119
Dane	EB and WB	CTH V	126
Dane	EB and WB	STH 19	131
Dane	EB and WB	USH 51	132
Dane	EB and WB	USH 151South	135A
Dane	EB and WB	USH 151 North	135B
Dane	WB	High Crossing Blvd	135C
Dane	EB and WB	IH 94 East	138A
Dane	EB and WB	STH 30	138B
Dane	EB and WB	USH 12 - 18 West	142A
Dane	EB and WB	USH 12 - 18 East	142B
Dane	EB and WB	CTH N	147
Dane	EB and WB	USH 51 North	156
Dane	EB and WB	USH 51 South - STH 73 and STH 106	160
Rock	EB and WB	STH 59	163
Rock	EB	STH 26	171A
Rock	WB	STH 26 North	171A
Rock	EB	USH 14 West	171B
Rock	WB	USH 14 West and STH 26 South	171B
Rock	EB and WB	STH 14 East	175C
Rock	EB and WB	Racine Street	175A
Rock	EB and WB	STH 11 East	175B
Rock	EB and WB	STH 11 West and Avalon Rd	177
Rock	EB and WB	CTH S	183
Rock	EB and WB	IH 43 North	185B
Rock	EB and WB	STH 81 West	185A

INTERSTATE HIGHWAY 94

St. Croix	EB and WB	STH 35 North	1
St. Croix	EB and WB	CTH F - Carmichael Rd	2
St. Croix	EB and WB	STH 35 South	3

St. Croix	EB and WB	USH 12 - CTH U	4
St. Croix	EB and WB	STH 65	10
St. Croix	EB and WB	CTH T	16
St. Croix	EB and WB	USH 63	19
St. Croix	EB and WB	CTH B	24
St. Croix	EB and WB	STH 128	28
Dunn	EB and WB	CTH Q	32
Dunn	EB and WB	STH 25	41
Dunn	EB and WB	CTH B	45

INTERSTATE HIGHWAY 94 – continued

Dunn	EB and WB	USH 12 - STH 29 and 40	52
Eau Claire	EB and WB	STH 312 and CTH EE	59
Eau Claire	EB and WB	STH 37	65
Eau Claire	EB and WB	STH 93	69
Eau Claire	EB and WB	USH 53	70
Eau Claire	EB and WB	CTH HH	81
Trempealeau	EB and WB	USH 10	88
Jackson	EB and WB	STH 121	98
Jackson	EB and WB	STH 95	105
Jackson	EB and WB	USH 12 and STH 27	115
Jackson	EB and WB	STH 54	116
Jackson	EB and WB	CTH O	128
Monroe	EB and WB	CTH EW	135
Monroe	EB	USH 12	143
Monroe	WB	STH 21	143
Monroe	EB and WB	Industrial Ave	145
Monroe	EB and WB	IH 90	147

Interchanges where IH 90 and IH 94 are concurrent are numbered as interchanges on IH 90

Dane	WB	STH 30 West	240
Dane	WB	IH 90 East and IH 39 South	4A**
Dane	EB and WB	CTH N	244
Dane	EB and WB	STH 73	250
Jefferson	EB and WB	STH 89	259
Jefferson	EB and WB	STH 26	267
Jefferson	EB and WB	CTH F	275
Jefferson	EB and WB	Willow Glen Rd	277
Waukesha	EB and WB	STH 67	282
Waukesha	EB and WB	CTH P	283

**Existing Exit Number is 4A, Future Exit Number should be 240A

Waukesha	EB and WB	CTH C	285
Waukesha	EB and WB	STH 83	287
Waukesha	EB and WB	CTH SS	290
Waukesha	EB and WB	CTH G	291
Waukesha	EB and WB	CTH T	293
Waukesha	WB	STH 16	293C
Waukesha	EB and WB	CTH J South and STH 164 North	294
Waukesha	EB and WB	CTH F	295
Waukesha	EB and WB	USH18/STH164 South/CTH JJ/Barker Rd	297
Waukesha	EB	Moorland Rd	301A-B
Waukesha	WB	Moorland Rd	301A
Waukesha	WB	Moorland Rd	301B
Milwaukee	EB	STH 100	304

Milwaukee	WB	STH 100	304
Milwaukee	WB	IH 41 (USH 45) North	304
Milwaukee	EB and WB	USH 45 North	305B
Milwaukee	EB and WB	IH 894 East and USH 45 South	305A
Milwaukee	EB and WB	STH 181 - 84th St.	306
Milwaukee	EB and WB	68th St. - 70th St.	307A
Milwaukee	EB and WB	Hawley Rd	307B
Milwaukee	EB and WB	V. A. Center - Mitchell Blvd.	308A
Milwaukee	EB and WB	Miller Park Way (STH 175) - South	308B

INTERSTATE HIGHWAY 94 – continued

Milwaukee	EB and WB	STH 175 - North	308C
Milwaukee	EB and WB	35th St.	309A
Milwaukee	EB	26th St. and St. Paul Ave.	309B
Milwaukee	WB	25th St. and Clybourn St.	309B
Milwaukee	EB	13th St.	310A
Milwaukee	EB and WB	IH 43 - Northbound	310B
Milwaukee	EB and WB	IH 794 - Eastbound	310C
Milwaukee	EB	STH 59 - National Ave. and 6th St.	311
Milwaukee	WB	STH 59 - National Ave.	311
Milwaukee	EB	Lapham Blvd. - Mitchell St.	312A
Milwaukee	EB	Becher St. - Lincoln Ave.	312B
Milwaukee	WB	Becher St. - Mitchell St., Lapham Blvd - Greenfield Ave.	312A-B
Milwaukee	EB	Holt Ave.	314A
Milwaukee	EB	Howard Ave.	314B
Milwaukee	WB	Howard Ave	314B
Milwaukee	WB	Holt Ave	314A
Milwaukee	EB	IH 43 and IH 894	none
Milwaukee	WB	IH 894 West - IH 43 South IH 41 North and 894 Bypass	317
Milwaukee	EB and WB	Layton Ave.	316
Milwaukee	EB and WB	Airport - Mitchell Field	318
Milwaukee	EB and WB	College Ave.	319
Milwaukee	EB and WB	Rawson Ave.	320
Milwaukee	EB and WB	STH 100 - Ryan Rd	322
Racine	WB	STH 241 - North 27th St.	325
Racine	EB and WB	Seven Mile Rd	326
Racine	EB and WB	CTH G	327
Racine	EB and WB	CTH K	329
Racine	EB and WB	STH 20	333
Racine	EB and WB	STH 11	335
Kenosha	EB and WB	CTH KR	337
Kenosha	EB and WB	CTH E	339
Kenosha	EB and WB	STH 142	340
Kenosha	EB and WB	STH 158	342
Kenosha	EB and WB	STH 50	344
Kenosha	EB and WB	CTH C	345
Kenosha	EB and WB	STH 165 and CTH Q and Tourist Info	347
Kenosha	WB	Truck Weigh Station	None

STH 145

Milwaukee	NB	Fond du Lac Avenue	None
Milwaukee	SB	Grantosa Drive and Villard Ave.	7A
Milwaukee	NB	STH 181 North - 76th Street	7B
Milwaukee	SB	STH 181 - 76th Street	7B
Milwaukee	NB	Silver Spring Drive - Westbound	8
Milwaukee	SB	Silver Spring Drive - Eastbound	8

Milwaukee	NB and SB	91st Street	9
Milwaukee	NB	Green Tree Road and 102nd Street	10A
Milwaukee	NB	107th Street and Good Hope Road	10B
Milwaukee	SB	107th Street and Fond du Lac Avenue	10B
Milwaukee	NB	Park Place	10C

USH 151

Interchanges where USH 151 and USH 61 are concurrent are numbered as interchanges on USH 61

Grant	SB	STH 35 North/USH 61 North/CTH HH	8
Grant	NB	CTH D and Business 151	18
Grant	SB	CTH D	18
Grant	NB and SB	STH 80/81	19
Grant	NB	CTH XX	21
Grant	SB	CTH XX and Business 151	21
Lafayette	NB and SB	STH 126 South and CTH G	26
Iowa	NB	CTH O and Business 151	37
Iowa	SB	CTH O	37
Iowa	NB	STH 23 South and To STH 39	40
Iowa	SB	STH 23 South and To STH 39 and Bus 151	40
Iowa	NB and SB	STH 23 North	44
Iowa	NB and SB	USH 18 West	47
Dane	NB and SB	CTH ID	58
Dane	NB	STH 78 and Business 18/151	65
Dane	SB	STH 78	65
Dane	NB	CTH ID	69
Dane	SB	CTH ID and Business 18/151	69
Dane	NB and SB	CTH PD and To CTH P	70
Dane	NB and SB	CTH G/Dairy Ridge Rd.	75
Dane	NB	CTH MV and Business 18/151	76
Dane	SB	CTH MV	76
Dane	NB and SB	STH 69	77
Dane	NB and SB	CTH PB and To CTH M	79
Dane	SB	CTH MV and Business 18/151	81

Interchanges where USH 151 and USH 12 are concurrent are numbered as interchanges on USH 12.

Dane	NB and SB	IH 90/94 East and IH 39 South	97A
Dane	NB and SB	IH 90/94 West and IH 39 North	97B
Dane	NB and SB	Nelson Road	98A
Dane	NB and SB	American Parkway	98B
Dane	NB and SB	CTH C and Reiner Road	100
Dane	NB	Main Street and Business 151	101
Dane	SB	Main Street	101
Dane	NB and SB	STH 19 - Windsor Street	102
Dane	NB	CTH N - Bristol Street	103
Dane	SB	CTH N - Bristol Street and Business 151	103
Dane	NB and SB	CTH VV	108
Dane	NB and SB	CTH V	111
Columbia	NB and SB	STH 73 and Business 151	115
Columbia	NB and SB	STH 16/60	118
Dodge	NB	STH 73	120

Dodge	SB	STH 73 and Business 151	120
Dodge	NB	CTH D and Business 151	129
Dodge	SB	CTH D	129
Dodge	NB and SB	CTH G	130
Dodge	NB and SB	STH 33	132
Dodge	NB	Industrial Dr.	134
Dodge	NB and SB	CTH B and Business 151	135
Dodge	NB and SB	CTH A	136

USH 151 – continued

Dodge	NB	CTH M and Business 151	142
Dodge	NB and SB	STH 26	144
Dodge	NB and SB	STH 49	146
Fond du Lac	SB	STH 26 South	147
Fond du Lac	NB and SB	STH 26 North	148

INTERSTATE HIGHWAY 794

Milwaukee	WB	IH 94 West, USH 41 North	1A
Milwaukee	WB	IH 94 East, USH 41 South – IH 43 South	1B
Milwaukee	WB	IH 43 North	1C
Milwaukee	EB	Plankinton Ave.	1D
Milwaukee	EB	Jackson St. - Van Buren St.	1E
Milwaukee	WB	Milwaukee St.	1E
Milwaukee	EB	Lincoln Memorial Dr. – Lakefront	1F
Milwaukee	WB	Michigan St.	1F
Milwaukee	EB	J Lovell St. – St. Paul Ave	1H
Milwaukee	EB	Carferry Dr.	3

INTERSTATE HIGHWAY 894

Milwaukee	WB	IH 94 East	1A
Milwaukee	WB	IH 94 West	1B
Milwaukee	EB and WB	STH 59 and Greenfield Ave.	1D
Milwaukee	EB	Lincoln Ave.	1E
Milwaukee	WB	National Ave.	2A
Milwaukee	EB	National Ave. - Westbound	2A
Milwaukee	EB	Oklahoma Ave.	2B
Milwaukee	EB and WB	Beloit Rd	3
Milwaukee	EB and WB	IH 43 and USH 45 South	4
Milwaukee	WB	STH 24 West - Forest Home Ave.	5A
Milwaukee	WB	South 76th St.	5B
Milwaukee	EB	South 76th St. - South 84th St.	5A-B
Milwaukee	EB and WB	South 60th St.	7
Milwaukee	EB	STH 36 - Loomis Rd	8A-B
Milwaukee	WB	STH 36 - Loomis Rd South	8A
Milwaukee	WB	STH 36 - Loomis Rd North	8B
Milwaukee	EB and WB	STH 241 - South 27th St.	9
Milwaukee	EB	IH 94 West	10A
Milwaukee	EB	IH 94 East (41 South)	10B

State of Wisconsin
Department of Transportation

Traffic Guidelines Manual

ORIGINATOR State Traffic Engineer		2-6-65
CHAPTER 2	Signing	
SECTION 6	Guide Signs – Freeways	
SUBJECT 65	Rest Area Amenity Signs	

A. Purpose

The intent of this guideline is to establish standards for the use of signs that provide information about services available at freeway and expressway rest area facilities. This policy does not include guidance for wayside amenity signs. Guidance for wayside amenity signs can be found in TGM 2-4-65.

This guideline is intended to reduce the number of certain informational signs and messages in order to retain or improve the impact of other guidance and warning signs. This guideline also reflects the need to focus signing efforts and resources on the signs of highest value for safety and mobility.

In the past, rest area amenities such as telephones, historical markers, vending machines, and weather information have been signed for on the advance guide signs for rest areas. Over time, motorists have become accustomed to expecting these certain amenities at rest areas. However, there are still certain amenities that motorists still do not typically expect at rest areas and *may* not be included at all rest areas. By policy, WisDOT does not allow signing of designated Veteran's Memorial Highways on the highway right-of-way itself. Signing for Veteran's memorial highways are encouraged in off right-of-way locations, such as inside a rest area. Therefore, it makes sense to allow the Veterans Memorial Highway Marker sign (E10-56 sign) to remain on the advanced rest area guide sign.

The NEXT REST AREA XX MILES supplemental sign (E5-62 sign) has also been mounted below the advance guide sign to rest areas, where conditions permit. This sign can be very useful in informing motorists of the distance to the next rest area.

B. Policy

1. The NEXT REST AREA XX MILES supplemental sign (E5-62 sign) *should* continue to be installed below the advance guide sign, when applicable.

2. Any rest areas containing Veterans Memorial Highway Markers **shall** have the Veterans Memorial Highway Marker (E10-56 sign) installed below the advance guide sign.

3. All other rest area amenity signs previously installed will be allowed to remain in place until the end of their useful life, and then they *should* be removed and not replaced. Useful life ends when the sign message no longer meets legibility or condition standards. These signs *may* be removed prior to the end of the signs useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or projects that make removal practical.

Purpose

Raised pavement markers are used to either supplement or substitute longitudinal pavement markings. These retroreflective units are either placed on top of the pavement for temporary applications, or embedded into the pavement for permanent applications. Section 3B.11 – 3B.14 of the MUTCD covers permanently installed raised pavement markers, and Section 6F.79 covers temporary raised pavement markers. This policy will clarify application of raised pavement markers on WisDOT maintained roadways.

Policy

Permanent Raised Pavement Markers

Permanent, including plowable raised pavement markers **shall not** be used on state-maintained roadways.

Existing plowable raised pavement markers **shall not** be covered over during a resurface project. Plowable raised pavement markers **shall** be removed, prior to resurfacing the roadway.

Temporary Raised Pavement Markers

The color of the temporary raised pavement markers **shall** match the color of the line that they supplement.

Temporary Raised Pavement Markers, Type I

Temporary Raised Pavement Markers Type I *may* be used in construction zones to supplement pavement marking through shifting tapers. If used in shifting tapers within construction zones, temporary raised pavement markers **shall** remain in place until the

traffic staging changes.

Temporary Raised Pavement Markers, Type II

Temporary Raised Pavement Markers Type II **shall** be used to substitute for pavement markings on seal coat projects. On seal coat projects, temporary raised pavement markers **shall** be used to replace any centerline, lane line, yellow edge line, and channelizing lines covered by the seal coat. White edge lines typically do not require temporary raised pavement markers.

On undivided roadways, W8-12 "NO CENTER LINE" signs **shall** be used to supplement Temporary Raised Pavement Markers Type II until temporary or permanent marking is placed. These signs **shall** be placed at the beginning of the seal coat, at two-mile intervals throughout the project, and at locations where traffic enters the project area from intersections with state trunk and county trunk highways.

On seal coat projects for roadways with less than 3500 AADT, temporary raised pavement markers are acceptable until a permanent marking can be placed.

On seal coat projects for roadways with 3500 ADT or greater, temporary raised pavement markers are acceptable for a maximum of 3 days after the seal coat is placed. Until the permanent markings are placed, temporary pavement markings are required for centerlines, lane lines and yellow edge lines. Permanent markings **shall** be placed within 14 days of the seal coat placement.

The standard application of Temporary Raised Pavement Markers, Type II **shall** be placed as shown on Standard Detail Drawing 15C34-1a:

- Solid 4-inch Line: Place temporary raised pavement markers every 25 ft.
- Broken 4-Inch Line: Place 1 temporary raised pavement marker on each end of each line segment, and an additional temporary raised pavement marker at the center of the line segment.
- Dotted 4-Inch Line: Place 1 temporary raised pavement marker on each end of each segment of dotted line.
- Double Yellow 4-inch Line: Follow the spacing requirements above. For double solid yellow, place the temporary raised pavement markers directly across from each other, with a 6" space between them. For solid/skip combination, see Figure 1. In both cases, place an additional temporary raised pavement marker at the beginning of the solid line segment.
- Solid 8-Inch Line: Place 2 temporary raised pavement markers side by side every 25 feet.
- Dotted 8-Inch Line: Place 2 temporary raised pavement markers side by side on each end of each segment of dotted line.

If same-day pavement marking is being applied on a seal coat project, a reduced amount of temporary raised pavement markers may be used to locate the centerline, beginning and ending of barrier lines and beginning and end of channelizing lines.

At a minimum, the following spacing requirements **shall** be used for Temporary Raised Pavement Markers, Type II for same-day pavement marking operations, as shown in Standard Detail Drawing 15C34-1b:

- Centerline Marking: Place Temporary Pavement Markers at 100' spacing.
- Laneline Marking: Place Temporary Pavement Markers at 100' spacing.
- Beginning and Ends of Barrier Line: Place two Temporary Pavement Markers side by side.
- Beginning and Ends of 8" channel line: Place two Temporary Pavement Markers side by side.

State of Wisconsin
Department of Transportation

Traffic Guidelines Manual

ORIGINATOR State Traffic Engineer		3-2-16
CHAPTER 3	Markings	
SECTION 2	Applications	
SUBJECT 16	Stop Lines	

A. GENERAL

The 2009 MUTCD, Section 3B.16, indicates that for non-signalized intersection approaches, the usage of stop lines are optional. In addition to signalized intersections, there are other intersection approaches where stop lines *should* be used. This policy provides guidance as to when stop lines should be used on approaches to state highways and the policy for installation.

B. GUIDELINES FOR USAGE

Listed below are locations where stop lines *should* be used on the state highway system:

- An approach to a signalized intersection where detection is installed and stopping at a certain point *may* enhance the operation.
- Intersection approaches with unusual geometrics such as large skew angles or non-symmetric approaches.
- Complex multilane approaches.
- An approach to an intersection with the STOP sign installed well in advance of the desired stopping point because of curb radii.
- In advance of a marked or unmarked crosswalk with significant pedestrian volumes.

Stop lines with crosswalks *may* be marked by contract on local road approaches at the request of the municipality with the understanding that the local agency assumes responsibility for their maintenance.

C. INSTALLATION POLICY

- Stop line placement *should* be as far forward as safe and practical to provide visibility, but no closer than four feet from a marked crosswalk or twelve feet from an intersecting live lane (see Standard Detail Drawing 15 C33-1).

- Where traffic on the through highway *may* bypass vehicles slowing or stopped for a left turn, no stop line *should* be marked that would allow encroachment in that area.