

A fundamental task of local government is to provide a safe roadway system at reasonable cost. It should be one which a prudent driver, even a stranger to the area, can travel safely.



Unlike the examples shown here, signs should be clear, easy to follow and avoid confusion.

Traffic control devices are a major tool for this purpose. Legally, traffic control devices are: all signs, signals, pavement markings, and devices placed on, over, or next to a street or highway by authority of a public body having jurisdiction to regulate, warn, or guide traffic.

This bulletin will help local government officials understand and use national and state standards. A companion publication, T.I.C. Bulletin No. 9, covers pavement markings.

Responsibility

In general, the government agency responsible for road maintenance is also responsible for traffic control devices, although this responsibility may sometimes be shared. No traffic control device or its support should bear any message not essential to traffic control, and any unauthorized traffic control device or nonessential sign should be removed. Regulatory signs—Stop signs, speed limit signs, or parking signs, for example—should be used only after the local jurisdiction has adopted an approved regulation by ordinance or resolution.

To be effective and to decrease exposure to tort liability claims, agencies should follow the *Manual on Uniform Traffic Control Devices (MUTCD)* and the *Wisconsin Supplement*, and have both a plan and procedures for handling signing situations.

Once signs are installed there is a responsibility to maintain them in good condition. This includes trimming trees and brush for good visibility and nighttime inspection for adequate retroreflectivity.

Joint responsibility

Several situations can create confusion over which agency is responsible for signs. For example, WisDOT installs and maintains Stop signs on local roads intersecting with state trunk highways. However, the local road agency is responsible for Stop Ahead signs for those intersections. Similarly, county highway departments normally install Stop signs on local roads that intersect with their county trunk highways. This practice may vary, however, so you must determine your own responsibility.

State and county highway departments often contract with municipalities to maintain their highways, but signing and marking responsibility may be divided. For example, the county may provide certain regulatory signs such as Stop signs and speed limit signs, while the city supplies parking signs. Local agencies should clearly understand their responsibilities in these joint jurisdiction situations.

Railroads are another example of joint responsibility. By statute, the railroad company must provide and maintain crossbucks signs (*Sec. 192.29(5) Wis. Stats.*). They are also responsible for supplying advance warning signs for county and town roads, giving them to the counties upon request (*Sec. 192.286 Wis. Stats.*). However, the local agency is responsible for installing and maintaining the advance warning signs. Replacement signs may also be requested from the railroads. Report deficiencies in signing to railroad companies and to the Wisconsin Office of the Commissioner of Railroads.

MUTCD — Manual on Uniform Traffic Control Devices

Authorities have long recognized that traffic control devices need to be uniform in meaning, design, usage, placement, and maintenance. The first *Manual on Uniform Traffic Control Devices (MUTCD)* was published in 1927. The Federal Highway Administration (FHWA) and the Wisconsin Department of Transportation (WisDOT) regularly update and publish these manuals which give the standard for all highways. (See page 12 for ordering information.)

The current *Manual on Uniform Traffic Control Devices* is the 2003 Edition. Wisconsin has adopted the *MUTCD* as its legal document for traffic control devices on all public roadways in the state. In addition, WisDOT has published a *2005 Wisconsin Supplement* that refines and further interprets the federal document. Both documents will be revised from time to time, so it is important to be sure you are working with the most current versions.

The *MUTCD* provides the basic principles that govern design, installation, and use of traffic control devices. Using figures, illustrations, and text, it describes the need for and placement of traffic control devices in normal situations. However, it does not cover every situation and should not substitute for sound judgment. The Manual often outlines the decision process to follow before you install or remove a traffic control device. This helps increase uniformity of signs and markings between local highway authorities.

When local authorities use the *MUTCD*, local roads are more consistently signed and marked. Since drivers expect consistency, this makes roads safer. Consistently following the *MUTCD* should decrease local government exposure to liability in lawsuits over roadway crashes.

Tort liability

Governments are concerned about their tort liability (a private or civil wrong or injury). To protect your agency pay special attention to two concerns: a plan and procedures.

First, the local government should have a plan or approved approach to handling signing situations within its authority and jurisdiction. These should be similar to those of surrounding towns and should be based on some rational analysis of the situation. Adopting and using the current *Manual on Uniform Traffic Control Devices* and the *Wisconsin Supplement* must be one part of this plan.

Second, the local government should set up procedures for service and repair. Because many tort liability suits are based on whether the maintaining authority could or should have known of the hazard, be sure complaints go quickly to the proper people and that



Check signs regularly to ensure they are visible to drivers.

they take appropriate action to maintain all devices in good condition. This includes sign retroreflectivity at night and clear visibility of the sign. You should also keep good, appropriate, up-to-date records on your signs and their condition. T.I.C. Bulletin No. 18, *Roadway Management and Tort Liability in Wisconsin*, has additional information.

Principles

To make good signing decisions and to use the *MUTCD* effectively you should understand some basic principles of good operating practices: driver expectations, positive guidance, and consistency.

Expectations

People generally expect things to operate in certain ways. A person entering a dark room will expect to find a light switch near the door. When the switch is in a different place it takes the person longer to respond to what is actually there. Similar reactions occur when people drive. When a driver's expectation is incorrect, it takes longer to respond properly, or even worse, the driver may respond poorly or wrongly.

A driver expects the next section of road to be like the last one. Studies show that what a driver has just seen—traffic control devices, narrow bridges, straight roads—is what the driver expects for the next half-mile to mile. Driver expectations are also affected by past experience. For example, Stop signs are red and curve warning signs are yellow. Using and placing traffic control devices consistently assures that the driver's expectations are correct.

Positive guidance

Drivers can avoid hazards if they are given sufficient information where they need it and in a form they can use well. Combinations of signs, hazard markers, and, most important, the view of the road ahead, can give positive guidance. For example, if there is a narrow

bridge on a curve and both are obscured by trees, it is important to:

- Give clear warning far enough in advance so drivers are prepared to watch for oncoming vehicles.
- Mark it with a striped object (clearance) marker (designated as W5-52R or L in the *MUTCD*) in line with the bridge railing or curb when it is less than 6 feet from the roadway or driving lanes. Object markers are also recommended when the shoulder narrows at the bridge to help the driver steer onto the bridge approach while continuing to look ahead.

These signs are intended to give drivers effective information when they can use it best.



Place signs—like object markers on narrow bridges or culverts—where drivers need the information.

Consistency

Consistency means that the road, and the signs and markings used, are the same from one section to another. Sudden changes in the nature of the road are inconsistent and violate the driver's expectation. Examples of inconsistencies are: curve warning signs on some curves but not on other similar curves; two lane roads suddenly narrowing to one lane over a bridge; a blacktop road changing to gravel; and a obscured intersection in an area where most intersections can be seen clearly.

Being consistent with signs and markings—using the same types in similar situations—recognizes this principle and improves the effectiveness of these traffic control devices.

Other placement considerations

Many different signing and marking techniques can be used on local roads. It is up to the local official to decide on the type, number and placement of signs. Two important considerations are the ability of the driver to see ahead and consistency within your own roadway system and across nearby jurisdictions. To ensure consistency, become familiar with the signing and safety

precautions that your neighboring communities use. Situations vary and local officials will need to use their own judgment to determine the level or extensiveness of signing. In addition, under federal and state guidelines some situations require using “engineering judgment” while others require making an “engineering study.”

Driver vision

The driver's ability to see ahead is important in determining the level of signing. Drivers can normally handle intersections and other hazardous locations if they can see them in time to act. For example, if a curve in the road can be seen, a large arrow may not be necessary and advance warning signs are not as critical. However, where curves and turns are hidden, warning signs are advisable because drivers can't see these roadway alignment changes and may not be expecting them.

Similarly, an intersection where drivers can clearly see all other approaching vehicles is less likely to require a Stop or Yield sign. In addition, if drivers can see a Stop sign clearly as they approach an intersection, advance warning is generally not as necessary. But if the intersection is hidden or over the crest of a hill, a Stop Ahead sign is needed. Under the *Wisconsin Supplement*, however, a Stop Ahead sign is always required where a county highway intersects with a state highway, regardless of visibility.

Levels of signing

There are degrees or levels of signing. You should think about how much signing is appropriate for a particular situation. An advance turn warning sign is a good example. Although the *MUTCD* does not mandate signing of curves or turns, it makes sense to alert drivers if the turn is not clearly visible or if you have to reduce



Local officials can choose from several levels of signing.

your speed by 10 MPH or more from the posted limit.

You may take several steps depending on the severity of the situation and your judgment. The first could be installing a large arrow. Adding a turn warning sign can give more guidance to the driver. You can go further by adding an advisory speed plate, depending on the speed limit and how much the driver must slow down. For even greater guidance, install chevrons to help drivers guide their cars through the curve. Using oversized signs or double signs (one on each side of the road) can also improve warning effectiveness at troublesome locations.

Once you have decided how to sign turns (using large arrow and turn warning signs, for example), then use similar signing at all turns with similar situations. Locations with additional crash experience or different topography require different actions, but treat similar situations consistently.

Engineering judgment/study

Installing curve and turn signs is one of several types of situations that requires engineering judgment or an engineering study under the 2003 *MUTCD* and 2005 *Wisconsin Supplement*. Engineering judgment, according to these standards, "shall be exercised by an engineer or an individual working under the supervision of an engineer or engineering technician or other trained and qualified personnel whose normal duties include performing engineering studies and the design, placement, operation and maintenance of traffic control devices within a jurisdiction." An engineering study has the same characteristics as engineering judgment but also includes written documentation.

This provision of the *MUTCD* and *Supplement* highlights the importance of having trained and experienced staff responsible for signing on local roads. Agencies are encouraged to seek advice in situations where they may lack experience or training. Towns and small municipalities may contact their County Highway Department or a neighboring city which has traffic engineering staff. Other resources include your County Traffic Safety Commission, WisDOT District Office, and the Transportation Information Center.

Table 1. Minimum sign sizes

Size 1	Minimum designation on <i>MUTCD</i> chart. Stop, curve and turn sign = 24" x 24". For roads with a speed limit of 30 MPH or less. These cannot be used on state highways, connecting highways, or 4-lane or 6-lane highways.
Size 2	Standard size. Stop, curve and turn sign = 30" x 30". For conventional roads; and smallest size for state highways.
Size 3	Oversized. Stop sign = 36" x 36". Generally for roads with a speed limit of 45 MPH or higher.
Size 4	Expressways
Size 5	Freeways
Size 6	Bicycles
Size 7	Snowmobile trails. Intended exclusively for snowmobile trails. Trail charts are available from the Wisconsin DNR.

Sign sizes and types

The 2003 *MUTCD* contains convenient tables for sign sizes based on roadway classification. Each chapter has tables for regulatory, warning, school, and RR crossing signs. The *Wisconsin Supplement* (Section 2A.12) indicates minimum sign sizes (See Table 1).

WisDOT has sign design plates for manufacturing all sign sizes that conform to the *MUTCD*.

Regulatory signs

Regulatory signs tell drivers of traffic laws or regulations that are either not apparent or are site-specific and may only be used after a regulation is formally approved by the local board or council, or by Wisconsin statute.

Put regulatory signs up wherever needed, but avoid unnecessary signs. The sign message should indicate clearly what the driver must do. The driver must be able to see it and read it easily.

Most regulatory signs with word messages are vertical rectangles with black letters on white backgrounds. Exceptions are: Stop signs which are red octagons, DO NOT ENTER and WRONG WAY signs which are red rectangles, and Yield signs which are red triangles.

STOP Because the Stop sign causes substantial inconvenience to drivers, use it only where warranted. The *MUTCD* contains specific guidelines. In general, do not install Stop signs indiscriminately at all intersections and do not use Stop signs to control speed. This quickly breeds contempt for traffic regulation, and drivers begin to disobey the sign's command to stop.

The rule that the right-hand approach traffic has the right-of-way works well without Stop signs if:

- drivers can see well enough to make good judgments
- the intersection has low traffic volumes
- the intersection is not a T

The public recognizes the differing importance of roads and signing should reinforce this expectation. Thus, a minor road should stop for a major road (through highway). At a T intersection, the stem or entering road should normally stop for the cross road.



If your roads handle many vehicles whose drivers are unfamiliar with local conditions, more Stop signs may be needed.

A Stop sign may be warranted at an intersection with one or more of the following conditions:

- Intersection of a less important road with a major road (through highway) where applying the normal right-of-way rule is unduly hazardous.
- A road entering a through road.
- Other intersections where a combination of high speed, restricted view, and crash history indicate a need for more control.



If three or more approaches are required to stop at the intersection, a supplemental plate should be added showing that number. If all approaches must stop, then the MUTCD requires you to install a supplementary plate that reads ALL WAY or 4-WAY. Mount these signs just below the Stop signs.

Normally, Stop signs should be no closer than 12 feet and no further than 50 feet from the intersecting roadway. A minimum 30-inch Stop sign is recommended for conventional roadways.

YIELD The Yield sign assigns right-of-way to traffic on certain approaches to an intersection. Vehicles controlled by a Yield sign need to stop only to avoid interfering with the traffic that has the right-of-way. Yield signs inconvenience drivers less and could replace Stop signs in many situations. Install the sign at the place where the vehicle must stop to yield the right-of-way.

A Yield sign may be warranted on a minor road where one or more of the following conditions exist:

- At an entrance or an intersection where it is necessary to assign right-of-way to the major road, but where a Stop sign is not necessary.
- On a separate or channelized right-turn lane, without an adequate acceleration lane.
- At any intersection where a special problem exists and an engineering study suggests using a Yield sign.

Yield signs should not control the major traffic flow at an intersection. Do not use them on road approaches that are at about 90 degrees to each other where crossing vehicles might collide. Sight conditions must be good for Yield signs to be used.

Speed limit The speed on a speed limit sign must come from statutory requirements or an engineering study and traffic investigation, and it must be approved by local and state agencies. (See T.I.C. Bulletin No. 21, *Setting Speed Limits on Local Roads*, for additional information on setting speed limits.)

Place speed limit signs wherever a speed zone changes, and periodically throughout the zone as reinforcement. In speed zone areas, speed limit signs should be placed just beyond a major intersection to inform drivers entering the roadway of the appropriate speed limit. In 55 mph areas signs may be needed only every 3 to 4 miles. On lower volume roadways, speed limit signs should be installed after major side road or cross road intersections. For low speed limits in urban areas, signs are commonly placed every other block. Table 2 shows guidelines for spacing speed limit signs.

Table 2. Guidelines for spacing speed limit signs

55 MPH	Every 3-4 miles (after major side road or cross road intersections on low volume roads)
45 MPH	2600 feet (a half mile) apart
40 MPH	2000 feet apart
35 MPH	1500 feet apart
30 MPH	1000 feet apart
25 MPH	1000 feet (or less) apart
URBAN/LOW SPEED	Every other block

Avoid confusion. For example, do not place speed limit signs in school zones which have a different statutory speed limit. Do not place them close to an intersection approach when the driver normally will be slowing below the posted speed limit. Also, the *Wisconsin Supplement* says: Do not place a speed limit sign between a Stop Ahead sign and a Stop sign.

Reduce Speed Ahead

Give advance warning of a speed limit using a Reduce Speed Ahead warning sign (W3-5 or W3-5a) where



speed limits change significantly, that is, if the limit is dropping more than 10 MPH, or from 55 MPH to 45 MPH. Existing Reduce Speed Ahead signs (R2-5 series and W13-1W combination black/white) can be used until they wear out. The compliance date is 2018.

School speed limits Wisconsin Statutes (Section 349.12) set the school speed limits at 15 MPH unless modified by the road maintaining authority. Where used, the school speed limit sign shall be either a single panel or assembly of signs with the following messages: School sign (S4-3), Speed limit sign (R2-1) and When Children Are Present sign (S4-2). Instead of using the End of School Zone sign (S5-2), the appropriate speed limit sign (R2-1) shall be used after a school zone.

Weight limit Due to seasonal weakening of the road surface, bridge deterioration, or other impairments, it is often necessary to limit the load permitted on a roadway. The weight limit sign must indicate the specific weight restrictions. For example, use a sign reading NO TRUCKS OVER 6000 LBS. Locate a weight limit sign immediately before the roadway section or structure to which it applies. The words BY ORDER OF (*list the agency*) must be included except in cities and villages. (See T.I.C. Bulletin No. 8, *Using Weight Limits to Protect Local Roads*, for more information.)



It is very important to warn drivers of bridges that are in poor condition. Weight restrictions shall be installed when inspection reports have determined that the bridge has reduced capacity. Bridge weight limit signs should either list the gross weight limit or describe in words the axle and load combinations. Do not use truck symbols because they are confusing. Place additional bridge weight limit warnings in advance at intersections to allow trucks to find a detour.

Seasonal Weight Limit signs should be placed at all intersections with state trunk highways, at all county lines, and at all city and village limits.

In-street pedestrian

The sign (R1-6) may be used for pedestrian crossings if the following standards are met. Not recommended for roadways with 45 MPH or higher speed limit.



- In Wisconsin, the YIELD to Pedestrians sign shall be used. An alternate in the MUTCD (R1-6a STOP for Pedestrians) shall **not** be used.
- When used, they shall be as an in-street sign. Do not use them on the outside shoulder or parking lane.
- Not for use at intersections controlled by a stop sign.
- Make sure sign support meets breakaway standards by using a maximum support size of 2x2 inches square or a 2-inch round post.
- Maximum mounting height is 2 feet to bottom of sign.
- Only one sign per approach at a crossing.
- On two-way streets, signs should face both directions—back-to-back installation is okay.

The In-street Pedestrian sign (R1-6) can also be used with a school plaque (S4-3) on top. These are for school crossings and are used to supplement the standard school signs (S1-1) mounted on fixed supports.



Warning signs

Although signs can warn of a hazard or unexpected situation, the best approach would be to remove the hazard or shield the driver from it. When this isn't possible or feasible, warning signs help. As with regulatory signs, use a minimum of warning signs. Unnecessary use of warnings for obvious conditions tends to breed disrespect in drivers for all signs. The most effective warning signs clearly describe the hazard. Typical situations needing warning signs are:

- Stop Ahead
- Cross roads and side roads
- Horizontal alignment changes
- Hills
- Railroad and other crossings
- Schools
- Narrow bridges

Warning signs are generally yellow diamond shapes with letters, symbols, and border in black. All signs must have a fully retroreflectorized background. Railroad crossings and schools have special shapes (see pages 8 and 9).

STOP AHEAD This sign warns of a Stop sign that is not sufficiently visible to approaching traffic. It may also be used for emphasis where drivers tend to ignore a Stop sign, or on intersections with heavy traffic volumes and high speeds such as state and county roads. The same criteria apply to the Yield Ahead and Signal Ahead signs. It is a requirement that the county erect a Stop Ahead sign where a rural county trunk highway approaches a state trunk highway, regardless of sight distance and visibility. A town must erect a Stop Ahead sign in advance of any Stop sign which controls traffic entering a rural state trunk highway from a town road where the Stop sign is not readily visible for a distance shown in Table 3. Use Table 4 to determine the sign placement.

Table 3. Minimum visibility distance to determine need for sign*

Posted or 85th percentile speed	Minimum visibility distance
25 MPH	155 ft
30 MPH	200 ft
35 MPH	250 ft
40 MPH	305 ft
45 MPH	360 ft
50 MPH	425 ft
55 MPH	495 ft
60 MPH	570 ft
65 MPH	645 ft

* not for sign placement





Cross Road and Side Road signing These warning signs are intended for use on a through highway to warn of an obscured cross road intersection. They are not used on the sign post with junction signing or advance route information signs. Advisory speed plaques may be used with Cross Road

or Side Road signs. To determine if the crossroad is obscured use the following guidelines:

- Traffic on the approaching through highway is not visible to a driver stopped on the cross road at the minimum visibility distance shown in Table 3. You must make a separate survey of sight distance along the through highway, at each intersection, and in each direction where a Cross Road or Side Road sign is proposed, since a sign may be warranted on one approach but not on the other.
- A traffic and engineering study of a special location with demonstrated crash potential shows that a Cross Road or Side Road sign is desirable.

Horizontal alignment signs When a road has one or more bends you may use signs from the following set. In order to be consistent, you are encouraged to use an engineering study and to determine the safe and comfortable speed around each bend (advisory speed). A ball bank indicator (BBI) is helpful. When the BBI shows a maximum reading of 16 degrees, use your test vehicle's speed as the advisory speed. A large arrow sign or chevrons may be useful with Turn and Curve signs.

Turns Use a Turn sign if the advisory speed is 30 MPH or less. An Advisory Speed Plate should be posted



below the Turn sign if the advisory speed is 10 MPH or more below the speed limit on the road.

Curves Use the Curve sign if the advisory speed is 35 to 55 MPH. An Advisory Speed Plate should be posted below the Curve sign if the advisory speed is 10 MPH or more under the speed limit.

Table 4. Guidelines for advanced placement of warning signs (Wisconsin Supplement Table 2C-4. English units.)

Posted or 85th percentile speed	Advanced Placement Distance ¹						
	Condition A: High judgment required ²	Condition B: Stop condition ³	Condition C: Deceleration to the listed advisory speed (MPH) for the condition ⁴				
			10	20	30	40	50
20 MPH	225 ft	N/A ⁵	N/A ⁵				
25 MPH	325 ft	150 ft	100 ft	N/A ⁵			
30 MPH	450 ft	200 ft	150 ft	100 ft			
35 MPH	550 ft	250 ft	200 ft	175 ft	N/A ⁵		
40 MPH	650 ft	300 ft	275 ft	250 ft	175 ft		
45 MPH	750 ft	400 ft	350 ft	300 ft	250 ft	N/A ⁵	
50 MPH	850 ft	550 ft	425 ft	400 ft	325 ft	225 ft	
55 MPH	950 ft	750 ft	500 ft	475 ft	400 ft	300 ft	N/A ⁵
60 MPH	1100 ft	1000 ft	575 ft	550 ft	500 ft	400 ft	300 ft
65 MPH	1200 ft	1000 ft	650 ft	625 ft	575 ft	500 ft	375 ft

Notes

1) Distances are adjusted for sign legibility at 175'—the appropriate legibility distance for a 5" Series D word legend. Distances may be adjusted by deducting another 100' if symbol signs are used. Adjustments may be made for grades if appropriate.

2) Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge, Right Lane Ends, etc.

3) Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Crossroad.

4) Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn or Curve.

5) No suggested minimum distances are provided for these speeds. Placement location depends on site conditions and other signing to provide an adequate advance warning for the driver.



Reverse turn or curve Use the reverse turn or curve where the turns or curves are not more than 600 feet apart and the advisory speeds are within 5 MPH of each other. The sign must show the direction of the first turn or curve. A large arrow sign or a series of chevrons should be placed at each turn according to the *Wisconsin Supplement*.

Winding road Use the winding road sign where a series of 3 or more turns or curves is separated by straight distances of less than 600 feet. A large arrow or series of chevrons should be placed at the first turn or curve (at a minimum) showing its direction. You may give additional guidance with an advisory speed plate.

Arrow A large arrow sign announces a sharp change in travel direction. Place a single arrow on the outside of turns. Placing a double arrow on the far side of a T intersection can be helpful. Locate the sign in line with vehicle headlights to give it maximum visibility to approaching traffic.

Chevrons Use these signs on curves or turns in place of an arrow sign. Chevrons are different from an arrow which focuses attention at one location. They provide additional emphasis and guidance about changes in the roadway's horizontal alignment. Chevrons guide the driver around a curve and are intended to be used in a series, spaced as in Table 5 below. (See photo page 3.) The driver must always have two in view until the alignment change ends and the signs are no longer needed. Start signs just prior to the curve or turn in the tangent area to lead the driver through the change in alignment. Chevrons may be mounted at a 4 foot minimum height from the bottom of the sign.

Table 5. Spacing chart for chevrons (typical)*

80 ft	25-30 MPH
120 ft	35-40 MPH
160 ft	45-55 MPH

* based on advisory speed or ball bank indicator speed



Hill Blocks View The warning sign (W7-6) may be used in advance of a crest vertical curve to advise road users of limited stopping sight distance. Generally used where a driveway is over the crest of the hill.

Snowmobile Crossing These signs may be erected to warn the driver where an authorized snowmobile trail (defined in *Section 350.01(17) Wis. Stats.*) crosses a highway. Use guidelines in Table 3 to see when a Snowmobile Crossing sign may be desirable. Place it in advance of the crossing.



Pedestrian Crossing Use engineering judgment to determine if you need a pedestrian warning sign. When a pedestrian warning sign (W11-2) is installed at the crossing, it is required to include a supplemental down arrow plaque (W16-7P). When the posted speed is 45 MPH or more, make sure the advance warning pedestrian sign and AHEAD plaque (W16-19P) are also used. Fluorescent yellow-green pedestrian signs may be used.

Deer Crossing Put up Deer Crossing signs only after consulting local representatives of the Department of Natural Resources and local law enforcement. Where the crossings cover a considerable distance along the highway, the signs should be installed at intervals of about 5 miles. The sign may be supplemented with a plaque: NEXT (X) MILES.

Railroad Crossing The railroad crossing sign—called a crossbucks—and an accompanying plaque noting more than one track, are required at each crossing approach. They must be retroreflectorized. The railroad company is responsible for placing and maintaining these signs. Report missing or damaged crossbucks to the chief engineer of the railroad concerned or to the Office of the Commissioner of Railroads, if necessary.

The agency responsible for maintaining the local road is also responsible for erecting the round Railroad Crossing advance warning sign. The sign must be placed in accordance with Table 2C-4 of the *Wisconsin Supplement* (reprinted here as Table 4). It is required in advance of all railroad crossings except under special conditions cited in Section 8B.02 of the *Wisconsin Supplement*.

Stop signs at a railroad crossing may be requested by the Commissioner of Railroads. The stop sign should be placed on a separate post next to the railroad crossbucks



Stop signs at railroad crossings should be mounted on a separate post, not on the crossbucks post as in this photo. Proper mounting height is 5 feet in a rural area and 7 feet where there are pedestrians or parked cars.

sign. Before considering this sign, an engineering study is required. The study should take into account such factors as highway and train volumes and speeds, collision history, sight distance to approaching train, and need for active railroad control devices.



School signs A school advance sign is required on roads passing school buildings or grounds.

A school crossing sign plus a supplemental down arrow sign (W16-7) are required by the 2003 MUTCD to be used at an established crossing. The old style sign with the crossing lines (S1-2) is no longer used but existing signs may remain in place until they wear out. Add the arrow under it. If a school crossing sign is used, then a school advance sign is also required as is a supplemental plaque with the word AHEAD under it. Do not use school crossing signs at intersections with a Stop sign.

Placement of the School Advance sign and AHEAD plaque shall be 150 feet minimum and 750 feet maximum. A school crossing sign can be used at signalized intersections. Fluorescent yellow-green signs may be used for school signs.

A School Bus Stop Ahead sign is used to warn of bus loading locations that are not sufficiently visible. If the sight distance is less than the distances on Table 3 based on speed, this sign should be considered.

Low clearance These signs must be posted if clearance is less than 14 feet 6 inches. If the clearance is less than 13 feet 6 inches, you must place additional warning signs far enough ahead of the obstruction so drivers can find an alternative route. You shall also include the distance to the low clearance obstruction.

One lane bridge A one lane bridge sign (word message type only) must be used in advance of a bridge or culvert which has a clear roadway width less than 16 feet (18 feet if a large number of commercial vehicles use the bridge or where the sight distance is limited). Striped object markers should be placed at the four corners of the narrow bridge railing or guardrail.

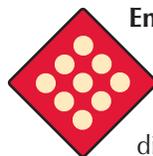
Narrow bridge A word message type (only) sign must be used in advance of a bridge or culvert which has a roadway driving lane, not including shoulders, of at least 16 feet but less than 24 feet. Narrow bridge signs shall also be used where the bridge roadway (driving lane excluding shoulders) is narrower than the approach roadway. A striped object marker shall be installed when a bridge parapet or curb is less than 6 feet from the edge of the nearest driving lane.



Object markers Type 3 object (clearance) marker signs are rectangles with alternating black and yellow diagonal stripes. On the sign used on the right-hand side of the road, the lines slant from upper right to lower left aiming down to the road (see photo). This is a mirror

image of the one used on the left-hand side where the lines slant from upper left to lower right.

Use object markers on railings of all narrow and one-lane bridges. Align the inside edge of the marker with the inner edge of the obstruction. Some objects, like culvert headwalls, trees, or poles, that are not actually in the roadway may be so close to the road's edge that they need a marker. In some cases there may not be a physical object, but other roadside conditions such as low shoulders, drains, or traffic islands may make it undesirable for a driver to leave the roadway. Use a minimum mounting height of 4 feet to the bottom of the sign.



End of Roadway markers Use red retro-reflective panel markers (diamond shaped) for locations where the roadway ends. They can be either a retroreflective diamond panel or a marker with yellow retroreflector buttons.

Driveway delineators Delineators used for driveways should be blue.

Roadway delineators Match delineator color to the pavement marking it is next to, i.e yellow on the left and white on the right side.

Guide signs

Guide signs guide drivers along roads, inform them of intersecting routes, direct them to their destination, and in general give information to help them along their way. Typical guide signs include route markers, direction and distance to cities or recreational sites, and street names. Most guide signs are green with white letters or white with black letters.



Street name signs These may use any colors or any combination of colors except red. Green is preferred for background. Lettering should be 6-inch CAPS, or upper case letters of 6 inches and lower case letters of 4½ inches. When you capitalize only the

first letter of each word, it is easier to read. Four-inch CAPS may be used on 25 MPH local roads. All new or replaced street name signs must be retroreflectorized. The 2003 *MUTCD* gives a phase-in period, until 2012.

Construction signs

Construction signs also can be regulatory, warning, or guide signs. The most common are warning signs. These have black letters on an orange background. Standard orange flags or yellow flashing warning lights are permitted with these signs if they do not obstruct the sign face. On open road, place advance warning signs well ahead of where the construction starts. Where a series of advance warning signs is used, they need to be separated from each other and from the beginning of construction. On city streets, where more restrictive conditions prevail, sign spacing distances are reduced in proportion to the speed limit. The *MUTCD* section on construction (Part VI) gives guidelines for using cones, barricades, and flagging. These also apply to roadway maintenance activities. Various videotapes on work zone traffic control and a booklet, *Work Zone Safety*, are available from the T.I.C. See Resources on page 12.

General sign information

All signs shall be retroreflectorized or illuminated so the same shapes and colors show day and night. Street lighting is not a means of illumination. Currently, local judgment and nighttime inspection are used to determine the need for replacement. Future regulations in the *MUTCD* will specify methods of inspecting signs for proper retroreflectivity. It will require you to choose one of several methods:

- Visual nighttime inspection
- Measured sign retroreflectivity
- Expected sign life
- Blanket replacement
- Control signs

All signs should have a vandalism notice. Place stickers on existing signs or stencil the message on the sign face. For durability, stencil paint should be the same as that used on the sign face.

The state statute also requires all signs to have the agency identification number on the back (86.19(5) *Wis. Stats*). This helps in returning recovered signs. It is also useful to stencil the sign back with the installation date. Use this to check the replacement schedule. Some agencies have found that stenciling their name and zip code on the sign improves their recovery of stolen signs.

Placement

Since warning signs are primarily for drivers who are unfamiliar with the road, it is very important to locate them carefully. Use the prevailing speed to determine the advance distance.

Table 4 gives suggested minimum distances for stop, merge, and deceleration in urban and rural conditions. If using these distances would result in a sign that is not clearly visible to approaching traffic, just over a hill crest for example, move the warning sign to a location with adequate visibility distance—generally, not more than a few hundred feet, and farther away from the hazard. *Remember*, use Table 3 to determine *if* a sign is needed (including the need for Stop Ahead or School Bus Stop Ahead signs). Use the advanced placement guidelines in Table 4 to determine *where* to place the sign.

Installation

To be effective, follow roadway design and alignment in placing signs. Mount them vertically at a right angle facing the traffic they serve. Generally locate signs on



Stop sign is mounted too low.

the right-hand side of the roadway. For special emphasis, use duplicate signs opposite each other on both sides of the road.

In rural areas, you shall mount the sign at least 5 feet above the pavement (measured from the sign bottom). In business, commercial and residential districts, where parking or

pedestrian movement is likely to occur, the sign should be at least 7 feet above the ground level.

In general you should not place two or more signs on the same post if they carry unrelated messages. Two signs with related messages can be placed together (for



Only signs with related messages should share a post. This curve sign and speed advisory are correctly mounted and are at proper installation height and off-set.

example, a curve sign with a speed advisory). In this case, the bottom sign may be mounted one foot below the normal minimum height. You can also place one regulatory sign with another regulatory sign, such as a speed limit sign with a NO PARKING sign, for example, but don't combine a regulatory sign with a warning sign.

Normally, the near edge of the sign should be at least 6 feet from the edge of the driving lane (pavement) or 6 feet from the shoulder whichever is greater. For maintenance purposes a minimum of 12 feet from the driving lane is preferred. In cities they may be closer where road width is limited or where existing poles are close to the curb. Generally, they should be 2 feet behind the curb. Be careful that there are no shrubs, trees, utility poles, or other objects in front of the sign to obscure its message.

Supports

Don't make sign posts too strong. Whether they're wood or steel, the posts you use to hold up small traffic signs shouldn't be too big. This protects vehicle drivers who may crash into them. Federal Highway Administration crash tests show that treated pine nominal 4x4-inch posts, and nominal 4x6-inch posts with 1½-inch bored holes, are acceptable in new installations as small sign supports for all speed conditions. Standard 2-inch diameter steel pipe is not acceptable. Steel flange channel U-posts of 3 pounds per foot are marginal, depending on steel type. A 2-inch square, perforated steel tube has been shown to be effective for urban areas where signs are not too large. For signs on steel posts use multiple posts when signs are larger than 9 square feet or wider than 3 feet. For signs on wood posts use multiple posts when signs are larger than 20 square feet or wider than 4 feet. Use multiple posts spaced to support larger-than-average signs, rather than using heavier posts or poles.

Wood posts are bulky, heavy to handle, and need an auger to dig the hole for them. When they're hit they usually splinter and go down. But they are stiffer and longer than metal posts and can also hold signs on different sides. Wood should be treated with an acceptable preservative.

Steel posts can be driven with a post driver. They're easy to store. Channel posts usually have punched holes making it easy to attach signs. Metal pipe posts should be set in concrete so they don't twist in the ground. If you use a sleeve, make sure it doesn't protrude more than 4 inches above the ground or it will negate the breakaway feature.

Markings

Pavement markings are painted centerlines, edge lines, crosswalks, and special messages. Markings have definite and important functions in traffic control. Sometimes they supplement the regulations or warnings of other traffic control devices. Used alone they can produce results that other devices can't: effectively

designating a lane, locating the road center, and locating a stopping point. This is information that could not otherwise be understandable.

Pavement markings have limitations. They can be obliterated by snow, they may not be clearly visible when wet and are not very durable under heavy traffic. Despite these limitations, they can convey warnings or information without diverting the driver's attention from the roadway. See the T.I.C. Wisconsin Transportation Bulletin No. 9, *Pavement Markings*, for details.

The 2003 MUTCD gives the following information about markings:

Centerline markings Centerlines help separate traffic on two-way roads. No passing zones must be marked when centerlines are used. Guidelines for setting no passing zones are included in the *Wisconsin Supplement* to the *MUTCD*.

Required for

- Paved urban arterials and collectors with traveled width of 20 feet or more and 6000 or more vehicles a day.
- Paved streets or highways that have 3 or more lanes.

Recommended for

- Paved urban arterials and collectors with a traveled width of 20 feet or more and 4000 or more vehicles a day.
- Rural arterials and collectors that have a traveled width of 18 feet or more and 3000 or more vehicles a day.

Optional for

- Paved two-way traveled ways that are 16 feet or more in width.

Edgeline markings Edgelines help delineate the road and guide drivers at night. They may now be used without a centerline unless the roadway type requires a centerline (see above). Edgelines are:

Required on

- Rural arterials 20 feet or more in width and 6000 or more vehicles per day.

Recommended on

- Rural arterials and collectors with a traveled width of 20 feet or more and 3000 or more vehicles per day.
- Where engineering study or judgment indicates a need for edgelines.

Yield markings When used, Yield markings shall consist of isosceles triangles pointing toward approaching vehicles.

Summary

The *Manual on Uniform Traffic Control Devices*, 2003 Edition, with the 2005 *Wisconsin Supplement*, is the Wisconsin standard. Use them, or the latest approved revisions, to ensure statewide consistency in signing and marking.

- Certain signs are required. Examples include:
 - Stop signs at intersections with through highways such as county or state trunk highways
 - Railroad crossing advance warning signs (for most cases)
 - School zone signs
 - Bridge weight restrictions
 - Speed limit, parking, and other regulations adopted by local ordinance
 - Narrow and one-lane bridges, including object markers on the bridge railings
 - Low clearance
- To increase effectiveness and limit liability, make sure signs are consistent with those of surrounding communities and are based on a rational analysis of the situation.
- Effective signs use the principles of driver expectation, positive guidance, and consistency. They are placed considering speed, visibility, accidents, extent of non-local traffic, and complaints.
- Do not use too many signs. Unnecessary signs breed driver disrespect for all signs.
- Before erecting regulatory signs, the local government council or board must adopt an approved regulation.
- Mount signs 5 feet above the pavement in rural areas, 7 feet in urban areas. Don't place unrelated signs together on the same post.
- Place signs a minimum of 6 feet (12 feet preferred) from the road edge except in cities where there are sidewalks or other space limitations.
- All regulatory, warning, guide, and construction zone signs must be retroreflectorized or properly illuminated.
- Don't use posts that are too strong. They are a hazard.
- Place warning signs the correct distance ahead of the hazard (Table 4).
- Inspect regularly for sign visibility and retroreflectivity.

Resources

T.I.C. publications

Available online or by request from the T.I.C. (see below). *Flagger's Handbook* (pocket-size guide)

Pavement Markings, Wisconsin Transportation Bulletin, No. 9

Roadway Management and Tort Liability in Wisconsin, Wisconsin Transportation Bulletin, No. 18

SAFER Manual—Safety Evaluation for Roadways

Setting Speed Limits on Local Roads, Wisconsin Transportation Bulletin, No. 21

Using Weight Limits to Protect Local Roads, Wisconsin Transportation Bulletin, No. 8

Work Zone Safety, Guidelines for Construction, Maintenance and Utility Operations (pocket-size guide)

Other publications

Manual on Uniform Traffic Control Devices, 2003 Edition. Ordering information is on the Web site: <http://mutcd.fhwa.dot.gov>

Wisconsin Supplement to the MUTCD, WisDOT, 2005. Available from WisDOT, 608/266-2375; <http://www.dot.wisconsin.gov/business/engrserv/wmutcd.htm>

Videotapes

Many videotapes address signing issues. They are loaned free through county Extension offices. For a full list see the T.I.C.'s current Videotape Lending Library Catalog. Also available on the T.I.C. Web page (see below). Here are some examples:

Setting Speed Limits, Vermont Local Roads
10 min., #17786

Sign Maintenance and Installation
27 min., #17821

Signs Marking and Delineation, FHWA
43 min., #16860

Traffic Control Devices, FHWA
24 min., #16861

Traffic Control: What Works
13 min., #17989

Revised August 2005 © Wisconsin Transportation Information Center. Written by Thomas Heydel, Traffic Operation Engineer, WisDOT District 2.

Wisconsin Transportation Bulletin is a series of fact sheets providing information to local town, municipal and county officials on street and highway design, construction, maintenance, and management. These fact sheets are produced and distributed by the Wisconsin Transportation Information Center LTAP, a project of the University of Wisconsin–Madison, Department of Engineering Professional Development, funded by the Federal Highway Administration and the Wisconsin Department of Transportation. UW–Madison provides equal opportunities in employment and programming, including Title IX requirements.



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