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Road Talk
TTAP

Basic Sign and Delineator Treatments for Horizontal Curve Safety

reprinted from FHWA-SA-07-002, December 2006, Low-Cost Treatments for Horizontal Curve Safety

There are several traffic control devices road agencies can and, in many situations, should consider installing at a horizontal curve, especially curves that data or experience identify as safety concern. These devices are considered "basic" treatments that are found in the *MUTCD*. They include:

1. Horizontal Alignment signs: Turn (W1-1), Curve (W1-2), Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), Hairpin Curve (W1-11), or Loop (W1-15) as an advance warning sign depending on the geometry of the curve(s)
2. Advisory Speed Plaque (W13-1) (with any of the Horizontal Alignment signs)
3. One-Direction Large Arrow (W1-6) sign
4. Chevron Alignment (W1-8) sign
5. Delineators

While there are other safety treatments available to improve curve safety, these signs and delineators are often the easiest to implement for local roadway agencies. Agencies should base selection of one or more of the devices on an engineering study or engineering judgment.

Many curves require nothing more than the standard centerline and edge line (if paved) or one of the basic horizontal alignment warning signs. The decision to add one or more of the other devices listed will be influenced by the factors noted above. Additional consideration is necessary when the curve has been identified as a safety concern or recognized safety problem. The following discussion provides guidelines for using each device. All example signs and markings are from the *MUTCD.*

Used alone or in combination with the supplemental signs and delineators discussed in this article, horizontal alignment warning signs help to warn drivers of unexpected changes on the roadway ahead.

1. HORIZONTAL ALIGNMENT SIGNS

The *MUTCD* prescribes several Horizontal Alignment signs to give drivers advance warning of a horizontal curve. For a single curve

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In this issue...

RoadTalk is a publication of the Tennessee Transportation Assistance Program (TTAP). TTAP is part of a nationwide Local Technical Assistance Program (LTAP) financed jointly by the Federal Highway Administration (FHWA) and Tennessee Department of Transportation (TDOT). Its purpose is to translate into understandable terms the latest state-of-the-art technologies in the areas of roads, bridges, and public transportation to local highway and transportation personnel.

From the Director

As I write this issue, the big news remains our economy, and the massive downturn we've seen since last fall. I can't pretend to know a whole lot about where we're heading economically. I do know that a good many people, me included, are tightening up on expenditures. It just seems like the prudent thing to do, given the uncertainty about where all this is heading. I imagine that many of you are probably thinking the same thing.

My assessment from what I'm reading is that we're suffering a national hangover from a spending binge that couldn't be justified by income, whether national or personal. Maybe it's kind of old fashioned, but I was always taught that you didn't spend money you didn't have, you didn't borrow money you couldn't pay back, and you didn't buy what you didn't need. My parents grew up during the Great Depression, and these values were positively ingrained in them. That's the way I was brought up, for sure. As a kid, we didn't have the biggest house, we only had one family car for many years, and I can still remember having an old black and white TV set long after everyone else had a big fancy color model. "Use it up, wear it out, make it do, or do without."

Downturns like the one we're in now have been routine since the founding of the nation. They're never pleasant, but many economists believe them necessary to promote a healthy long-term economy. Recessions punish those that behave inefficiently or inappropriately from an economic standpoint. We're in such a situation now, where banks made poor loans and people spent way beyond their ability to pay. Those of us who made more reasoned decisions should get out of it just fine. Despite what you might hear and read, the present situation comes nowhere close to what the nation experienced between 1929 and the onset of World War II.

That brings me to my final point for this column: the stimulus bill. I know many are excited about the largess coming from Washington to help stimulate the economy. I'm having a hard time figuring this one out, though. We got in trouble because people spent more than they could afford and banks made bad loans. So, our response is for the nation to spend record amounts to help the economy? The government has only limited ways to generate money to spend: through taxation, by borrowing, or by running the printing press. All of these have dangerous and unforeseen consequences. I think I'd rather tighten my belt and wait this one out.

As always, we at TTAP look forward to serving you. Please don't hesitate to contact us. Hopefully, we can help you with belt-tightening.

David

Trimming the Tree

Now that Christmas is over, it's time to make a plan for the real tree trimming

reprinted from Indiana LTAP Newsletter, Vol. 27, No.1, Winter 2009

Tree pruning is something that can be done at any time during the year. However, the closer you do it prior to spring growth, the better it is for the tree because it maximizes growth and speeds wound closure. Immediately following spring growth is the worst time for trimming, as the tree has just spent much of its energy on foliage production and will have less energy to allocate to wound closure.

Accurate timing is only the first step, though. Pruning a tree properly requires technique and an understanding of tree growth. Otherwise, your pruning mistakes will be evident to everyone come spring. So use the following tips to get started. If you need more information, The International Society of Arboriculture (ISA) has developed standards for tree pruning. You can find their guide at www.treesaregood.com.

Be reasonable

Routine pruning isn't about going in and lopping limbs to make a tree an unnatural shape. It's about maintaining a tree's health: removing limbs that are weak or that are diseased or dead. Proper pruning seldom results in removing more than a quarter of the crown's live foliage. Removing more than that can alter the tree's ability to make food, which tampers with the overall health of the tree and hinders growth. Another reason for pruning involves safety. You should cut any low-hanging limbs that impede pathways or are making contact with buildings or other structures. The principal philosophy is this: No branch should be removed without a reason.

Making the cut

According to the ISA, there are four specific types of pruning that may be necessary to maintain a mature tree in a healthy, safe and attractive condition:

• *Cleaning* is the removal of dead, dying, diseased, crowded, weakly attached and low-vigor branches from the crown of a tree.

• *Thinning* is the selective removal of branches to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, and helps retain the tree's natural shape.

• *Raising* removes the lower branches from a tree in order to provide clearance for buildings, vehicles, pedestrians and vistas.

• *Reduction* reduces the size of a tree, often for clearance for utility lines. Reducing the height or spread of a tree is best accomplished by pruning back the leaders and branch terminals to lateral branches that are large enough to assume the terminal roles (at least 1/3 the diameter of the cut stem). Do not confuse reduction with topping, which is not advised or approved by tree professionals. Compared to topping, reduction helps maintain the form and structural integrity of the tree.

Decide which type of pruning applies to the trees in your care and plan cuts before gearing up and assessing the area. Make pruning cuts just outside the branch collar, which should be left intact because it contains "parent branch tissue" (trunk). The ISA specifies that how much you prune from a tree depends on the size of the tree and its age. The younger the tree, the more you can cut. Just keep in mind that a tree can recover from several small pruning wounds faster than from one large wound. And mature trees become less tolerant of pruning altogether. Try to limit pruning of older trees to removal of dead or hazardous limbs.

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section, there are four signs:

- Turn (W1-1)
- Curve (W1-2)
- Hairpin Curve (W1-11)
- 270-degree Loop (W1-15)

For sections with more than one curve in close proximity, there are three advance warning signs:

- Reverse Turn (W1-3)
- Reverse Curve (W1-4)
- Winding Road (W1-5)

Application Guidelines

Not all horizontal curves require a Horizontal Alignment sign. Curves that have: (1) gentle to moderate curvature for which a speed advisory is not necessary, (2) adequate sight distance through the curve, and (3) adequate pavement markings and/or raised pavement markings and delineators, likely do not require even the Curve (W1-2) sign. As the *MUTCD* states, use the Curve sign where there is an advisory speed of greater than 30 mph and the Turn sign when the advisory speed is 30 mph or less. However, this is subject to engineering judgment that considers the traffic volume, type of road, and other factors. Use the Hairpin Curve sign when the curve is 135 degrees or more.

The two sequential curves signs (left turning followed by right turning or vice versa) are:

- Reverse Turn (W1-3)
- Reverse Curve (W1-4)

The guidance is the same for selecting a Turn or Curve sign and agencies should base their decision on the advisory speed, as with the single Turn and Curve signs.

For road segments with three or more alignment changes in opposite directions in relatively close proximity, the Winding Road (W1-5) sign is appropriate.

Design

Depending on the geometry of the curve or sets of curves, place the appropriate sign the distance in advance of the point of curvature. This minimum advance placement distance is found in Table 2C-4 of the *MUTCD* (http://mutcd.fhwa.dot.gov). For example, if the posted speed of the road is 50 mph and the curve has a posted advisory speed of 30 mph, then agencies would place the sign 100 ft before the point of curvature.

2. ADVISORY SPEED PLAQUES

An Advisory Speed plaque (W13-1) is simply a sign placed below a Horizontal Alignment sign (discussed above) to advise motorists of the safe speed through the curve(s). It is not the legal speed limit.

Application Guideline

The *MUTCD* requires an engineering study to determine if an advisory speed is necessary for the condition. The *MUTCD* further states that ". . . the advisory speed may be the 85th-percentile speed of free-flowing traffic, the speed corresponding to a 16-degree ball bank indicator reading, or the speed otherwise determined by an engineering study because of unusual circumstances." The Institute of Transportation Engineers' Traffic Control Devices Handbook suggests using the plaque whenever the difference between the advisory speed and the posted speed is 6 mph or greater.

The advisory speed plaque is used with a diamond-shaped warning sign to display the maximum recommended speed for the road ahead.

3. ONE-DIRECTION LARGE ARROW SIGN

The One-Direction Large Arrow sign (W1-6) is used to define a change in horizontal alignment. Usually only one of these signs is used for a horizontal curve. It is typically placed on the outside of the curve directly in line with the approaching tangent section. Nothing in the *MUTCD* limits using multiple signs along the curve, but in this case, it would be more reasonable to use a series of Chevron (W1-8) signs. Install this Large Arrow sign only on the outside of a turn or curve in line with, and at approximately a right angle to approaching traffic.

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Application Guideline

MUTCD guidance regarding the application of this sign is to install either the One-Direction Large Arrow sign or the Chevron Alignment sign when the Hairpin Curve sign or the Loop sign is installed. Based on standard practice, this sign is limited to sharper curves (turns). It should not be used when there is no advisory speed plaque.

4. CHEVRON ALIGNMENT SIGN

While designated as a warning sign in the *MUTCD*, the Chevron Alignment (W1-8) sign is intended to emphasize and guide drivers through a change in horizontal alignment. Because of their pattern and size and that several of the signs are in view of the motorist, they define the direction and sharpness of the curve the best of all the traffic control devices. When the chevron sign is used, agencies will also need one of the advance curve warning signs previously discussed.

Application Guidelines

Other than to state that the Chevron Alignment sign may be used as an alternative to supplement to standard delineators or to the One-Direction Large Arrow (W1-6) sign, the *MUTCD* provides no specific guidance as to when agencies should use the Chevron Alignment sign. The Traffic Control Devices Handbook suggests installing Chevrons when the difference between the advisory speed and posted speed is 25 mph or greater.

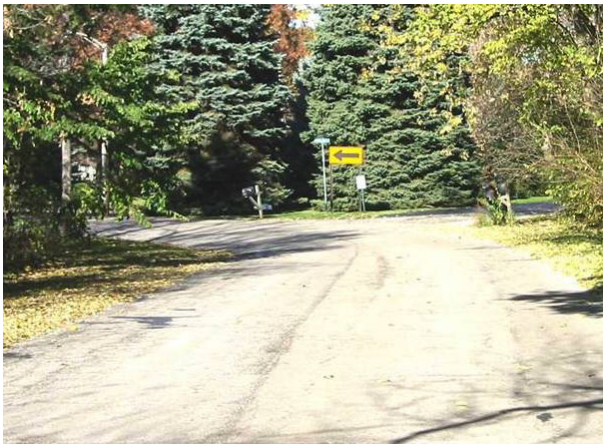
Design

Install a series of these signs on the outside of turn or curve, positioned in line with approaching traffic at approximately a right angle to a driver's line of sight. On two-lane, two-way roads, use two-sided Chevron signs properly aimed to guide traffic traveling both directions.

The *MUTCD* does not specify spacing of the signs; however, it does recommend that spacing allow the motorist to view at least two signs until the change in alignment eliminates the need for the signs. Position Chevron signs 5 ft above the surface in rural areas, and 7 ft in urban areas.

5. DELINEATORS

A commonly used device for showing the curve alignment to the motorist is the delineator—a retroreflective device mounted above the roadway surface and along the side of the roadway in a series to show roadway alignment. A delineator is considered a guidance device rather than a warning device and is most effective at night and during adverse weather when pavement markings are not visible.



The large single arrow warning sign is placed on the outside of the curve in line with and at a right angle to approaching vehicles.

These before (top) and after (bottom) photographs show the chevrons used to provide guidance for the curve ahead.

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Your One-Stop Source for National Highway Specifications Information

reprinted from FHWA FOCUS, January/February 2009

Since 2003, the National Highway Specifications Web site (NHSW) has provided users with a fully searchable, electronic library of information on highway construction specifications for all 50 States, Puerto Rico, the District of Columbia, and Federal Lands and Highways. "As a one-stop source for specification information, the Web site has saved users time and money, while improving practices and promoting higher quality in construction end products," says Ken Jacoby of the Federal Highway Administration's (FHWA) Office of Asset Management.

Recent updates to the NHSW (www.specs.fhwa.dot.gov) have made it even more user friendly, offering an array of easily searchable documents, including standard specifications, construction manuals, standard drawings, innovative contracting methods, and special provisions for new and emerging materials and technologies. With updates completed in late 2008, the site now contains the most current specifications and construction manuals for each transportation agency.

The NHSW was launched as the result of an American Association of State Highway and Transportation Officials Highway Subcommittee on Construction resolution to build a one-stop source of specification information. "The goal was to make the combined knowledge of the many agencies that produce and publish highway construction specifications available and accessible to all," says Jacoby. "Easy access to such information was seen as a key step in promoting and facilitating the development of best practices in the highway industry."

There is a high payoff in assisting States and industry in minimizing unnecessary differences and specification inconsistencies from State to State," says Jim Sorenson of FHWA's Office of Asset Management. "This reduces bidding errors, misunderstandings, and construction costs."

The NHSW site is maintained by FHWA, with material submitted by State departments of transportation and other agencies.

"The NHSW is a great resource. It brings it all together in one place for you," says Duane Brautigam of the Florida Department of Transportation (FDOT). Florida has uploaded resources to the site and also has a link to it on FDOT's Web site. "The addition of design standard drawings and construction administration documents has been very helpful. It gives you a good picture of how a State transportation department does business," notes Brautigam.

The Web site features both a public area, where visitors can search and browse specifications, construction manuals, standard drawings, and related links, and an administrative area, where authorized personnel from State transportation agencies can upload, revise, and delete information to maintain an up-to-date library of the latest specifications and related documents available for their State. The updated NHSW has simplified the process for uploading information, making it easy for States to revise and add to their specifications and other material. Additional improvements include better and faster search capabilities, including searchable libraries of innovative specifications and construction manuals. All specifications and construction manuals can be looked up by agency or searched by keyword. Also added were more links to related Web sites and State standard drawings, as well as contact information for State specification engineers that is accessible to State personnel with authorized administrative login access.

The improvements are the result of a research effort FHWA launched in 2006 to determine how to best enhance the site. This effort included polling users to obtain feedback on both the existing Web site and proposed enhancements, evaluating the existing NHSW to identify areas in need of improvement, and reviewing State transportation department Web sites to verify that the information posted on the NHSW was reflective of current practices.

To learn more about the resources available on the NHSW, visit www.specs.fhwa.dot.gov. To set up administrative access for your agency, contact your FHWA division office. For more information on the NHSW, contact Ken Jacoby at FHWA, 202-366-6503 (email: ken.jacoby@fhwa.dot.gov)

The delineator device is typically either circular or rectangular with a 3-inch minimum dimension. They are usually mounted on posts (which can have retroreflective material as well) 4 ft above the pavement. They can be placed on barriers if they are present—if there are none, then delineators are placed on lightweight breakaway posts.

The *MUTCD* requires the color of the delineators to match the color of the adjacent edge line. For example on a curve on a two-way road, the edge lines on both sides of the road are white, so if delineators are used on the left side of the road they must be white. Delineators on the right side are also white.

Application Guideline

The *MUTCD* does not provide any guidance as to when to install this device. However, given their relatively low cost, they should be considered for curves where any of the advance curve warning signs are used.

Design

Delineators are placed on the right shoulder and, therefore, the reflectors are white (clear) to match the white edge line. Adjust spacing of delineators on approaches to and throughout the horizontal curves so that several delineators are always visible to the motorist.

LEARN MORE ABOUT SAFETY TREATMENTS FOR HORIZONTAL CURVES

To learn more about these and other curve safety treatments, download a full copy of the Federal Highway Administration's Low-Cost Treatments for Horizontal Curve Safety at http://safety.fhwa.dot.gov/roadway_dept/pubs/sa07002/index.htm. TTAP also has several hard copies of this report available. To request a copy of your own, email us at TTAP@utk.edu or call us at 1-800-252-7623.

National Work Zone Awareness Week 2009 (April 6-10)

Visit http://www.workzonesafety.org/news_events/awareness_week2009 for more information.

Trimming the Tree, *continued from page 3*

If you're removing a larger limb, reduce its weight by removing the limb piece by piece, leaving a stub of about a foot or so. To do this, cut about a third of the way upward through the limb, sawing from bottom up (which will help prevent the bark from stripping). Then cut through the branch from the top, just beyond the previous undercut. When you're down to the stub, remove it by cutting it back to the branch collar.

Once you've finished your pruning, you might be tempted to add a wound dressing to the tree to protect against the possibility of disease and decay. However, the ISA reports that most experts advise against this. Research has indicated that wound dressings do not prevent either.

(Article is written by Cindy Ratcliff. Ms. Ratcliff is a freelance writer who specializes in landscape, trees, and chemicals. She can be reached at cindy_ratcliff@yahoo.com

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