
Warrants for Specific Obstacles

Design Manual
Chapter 8
Roadside Safety

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This section provides guidance on when and how certain obstacles located **within the clear zone** should be treated. Obstacles located at or beyond the clear zone may also be evaluated for treatment on a case-by-case basis. Treatment of these obstacles is encouraged where a relatively minor change can bring about a major safety benefit. For example, a treacherous cliff located just beyond the clear zone could be shielded with a barrier.

Refer to Section [1C-8](#) for information on documenting decisions that do not comply with the best practices listed below.

Embankments

Roadside embankments, whether parallel or perpendicular to the roadway, can pose a risk to drivers and may warrant treatment. Where treatment is warranted, flattening and/or reshaping are the preferred treatment methods.

Transverse Slopes (Perpendicular Slopes)

Refer to Section [3F-3](#).

Parallel Slopes (Foreslopes and Backslopes)

An errant vehicle is more likely to overturn and cause serious injury to its occupants the higher the embankment and the steeper the foreslope. Providing foreslopes that are 4:1 or flatter can mitigate this hazard. Foreslopes that are 6:1 or flatter are preferred wherever possible.

Foreslopes that are 3:1 or flatter do not warrant treatment, regardless of fill height. Foreslopes that are steeper than 3:1 with fill heights greater than 8 feet should be treated. Foreslopes that are steeper than 3:1 with fill heights 8 feet or less may or may not warrant treatment; contact the Methods Section for guidance.

Backslopes as steep as 2.5:1 do not warrant treatment if the slope is uniform, smooth, and free of objects. A backslope steeper than 2.5:1 may warrant treatment if it has a rough face that might cause vehicle snagging or if it flares toward the roadway at a sharp angle. If a steep backslope with a rough face cannot be flattened, reshaping or cutting the face to provide a smooth, nearly vertical surface is preferable to shielding it with a barrier.

Fixed Objects

Fixed objects are those obstacles that, due to their size, shape, or strength, might cause serious damage to any vehicle impacting them. In most cases, shielding fixed objects with a barrier is the least preferred method of treatment. Whenever possible, consider using one of the other treatment methods discussed in Section [8A-3](#).

Bridge Piers

Due to their large size and rigidity, bridge piers pose a significant hazard to motorists.

Shield all bridge piers located within the clear zone. On high-speed multilane facilities, consider shielding piers located beyond the clear zone.

Bridge Endposts

Bridge railings are usually terminated with blunt-shaped endposts which, if left unprotected, could be impacted head-on by an errant vehicle.

Treat the approach end of all bridge endposts located within the clear zone.

For bridges on high-speed roadways, steel beam guardrail is the preferred treatment. However, crash cushions may be used where site conditions cannot accommodate steel beam guardrail.

For bridges in urban areas, posted speed determines which type of treatment should be used:

- If the posted speed is 45 mph or greater, use guardrail or a crash cushion.
- If the posted speed is 40 mph or less, use guardrail, a crash cushion, or a sloped concrete end treatment (Standard Road Plan [BA-108](#)).

Walls

Walls may be considered hazardous, depending on their design. Those having sufficient structural capacity and a relatively smooth face may be able to safely redirect an impacting vehicle. It may be possible to leave such walls in place untreated. Examples may include reinforced concrete retaining walls, ornamental stone walls, and some types of noise walls.

Walls lacking the strength or shape to safely redirect an impacting vehicle should be treated. Examples include MSE walls and concrete block retaining walls.

Fences

Although most types of fences including chain link, tubular steel, and woven field fence are not considered to be significant obstacles, their use should usually be restricted to locations outside the clear zone. This is especially true when such fences are used near a sidewalk or multi-use path. A vehicle impacting the fence could generate flying debris which might cause serious injury to pedestrians or bicyclists. Where these fences are required to be installed within the clear zone, contact the Methods Section for a special design.

Boulders/Revetment/Rock Flumes

Boulders larger than 36 inches in diameter are considered hazardous and should be treated.

Areas of revetment placement, such as at rock flumes or near culvert outlets, could cause an errant vehicle to become unstable. This is especially true where the revetment covers a large area or where it extends more than 4 inches vertically above the surrounding ground. Evaluate the potential for these areas to cause vehicle snagging or instability. Consider treatment where these effects are likely.

Trees and Shrubs

Trees or shrubs with thick trunks may be strong enough to pose a collision risk to motorists.

Trunk diameters are measured at a point 6 inches above the ground surface. For trees with multiple trunks at this height, add the individual trunk diameters together to determine an effective trunk diameter. For shrubs with multiple trunks at this height, use the diameter of the largest trunk as the effective trunk diameter.

Trees and shrubs with an effective trunk diameter of 6 inches or greater should be treated.

Removal is the preferred treatment method. However, in some situations, it may be desirable to keep trees that would otherwise be considered for removal. For example:

- At parks, recreation sites, or residential areas where the functional and/or aesthetic values will be lost.
- If trees are unique based on their size, species, or historic value.

- Where removal would adversely affect endangered/threatened species, wetlands, water quality, or result in significant erosion/sedimentation problems. For further guidance, contact the Office of Location and Environment.

Where removal is not possible or feasible, trees should be shielded with a barrier.

Utility Poles

Utility poles are large, unyielding structures that pose a collision risk to motorists.

Utility poles within the clear zone should be treated.

The most preferable treatment method is to eliminate the need for the poles by burying the utility lines. If this is not possible, the poles should be relocated to the right-of-way line.

Wherever poles are used, the chances of them being impacted can be reduced by providing longer spans between poles, which results in fewer poles being installed.

Luminaire Supports

Luminaire supports can pose a snagging risk to errant vehicles or may cause loss of control.

On high-speed roadways, provide breakaway bases for all new luminaries unless they are placed where they cannot be impacted or if they are located on or behind a concrete barrier.

On low-speed roadways or in urban areas, the use of breakaway supports is discouraged because of the danger to pedestrians from flying debris.

Sign Truss Footings (Overhead Sign Supports)

Sign truss footings are considered hazardous due to their size and strength and must be treated.

Sign truss footings may be eliminated by installing or relocating overhead signs to other nearby structures. The Office of Traffic and Safety and the Office of Bridges and Structures normally determine the location and need for sign trusses. Any proposed changes should be discussed with both offices.

Ground-Mounted Sign Supports

Ground-mounted sign supports can pose a snagging risk to errant vehicles or may cause loss of control. Therefore, use breakaway supports for these devices wherever possible.

Although breakaway sign supports are considered crashworthy, reducing the number of these supports near the roadway can provide a safety benefit as well as a reduction in maintenance needs. Investigate opportunities to attach new signs to other roadside fixtures such as luminaire poles or to mount them behind existing barriers. Consult with the Office of Traffic and Safety to identify nearby sign installations which may accommodate the mounting of additional signs

Railroad Signal Footings

The concrete footings of automatic railroad signals are solid structures that pose a risk to motorists. Because they cannot be made breakaway, they must be treated. Typically, steel beam guardrail is used to shield these obstacles. For design specifics, refer to Section [8D-4](#) and to Standard Road Plan [BA-253](#). If site restrictions prohibit the use of steel beam guardrail, consult the Methods Section for guidance.

Culverts

Culvert openings must be evaluated for treatment. Smaller openings can snag a wheel, causing a vehicle to lose control. Larger openings, such as those at box culverts, have a risk of direct impacts, snagging, or drop-offs. Orientation of the culvert opening also influences the severity risk of these obstacles. For example, a 24-inch pipe opening that is oriented perpendicular to the flow of traffic (such as from a cross-drainage culvert), would tend to be less hazardous than a similar-sized opening that is oriented parallel to traffic (such as from an entrance pipe).

Preferred treatment methods include eliminating the opening (such as by connecting multiple culverts in the median), making the opening traversable (such as with grates), or relocating the opening to a location where it is less likely to be struck (such as extending the culvert beyond the clear zone).

New and Reconstructed Highways

Extend all pipe and box culverts, regardless of size, to the clear zone. Exception: within the median of a divided highway, pipe culverts 30 inches and smaller need only be extended flush with the normal foreslope.

3R Projects

Many culvert situations on 3R projects will need to be evaluated on a case-by-case basis. However, in general:

- Consider applying grates to all box culverts and to pipe culverts greater than 30 inches. Otherwise, extend the culverts to the clear zone.
- Extend smaller pipe culverts flush with the existing foreslope.

For specific design information regarding culvert grates, refer to Section [8B-2](#).

For specific design information regarding culvert extensions, refer to Section [8B-3](#).

Water

Vehicle crashes into bodies of water can be life-threatening, not only due to the impact but also due to the possibility of drowning. Therefore, be liberal when evaluating water hazards and consider shielding any that are questionable, such as shallow streams that occasionally experience heavy flows or deep ponds located beyond the clear zone.

Those portions of a body of water that are 2 feet deep or greater and within the clear zone should be shielded with a barrier if no other treatment options exist. The depth of a body of water is determined from its normal pool elevation.

Others

Although not technically obstacles, the presence of pedestrians and bicyclists should also be evaluated for treatment under certain circumstances.

Consider treating:

- sidewalks and shared-use paths near high-speed roadways. See Section [11A-1](#).
- schools, parks, and playgrounds
- other places where large groups might gather (parking lots, shopping malls, and fair grounds)

Chronology of Changes to Design Manual Section:

008a-004 Warrants for Specific Obstacles

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|------------|---|
| 4/17/2012 | Revised
Updated link on page 3 from 8B-4 to 8D-4. |
| 7/29/2011 | Revised
Added more information for the use of guardrail on bridge and water hazards. Modified Figure 1, re-wrote Bridge Endposts section, changed "riprap" to "revetment". |
| 12/13/2010 | NEW
To document how specific obstacles should be treated. |