

# INSTRUCTIONAL MEMORANDUMS

## To Local Public Agencies



To: Counties and Cities	Date: March 26, 2008
From: Office of Local Systems	I.M. No. 3.215
Subject: Clear Zone Guidelines	

**Contents:** This Instructional Memorandum (I.M.) provides guidelines for providing a clear zone on Local Public Agency (LPA) road or bridge improvement projects. It includes definitions of key terms, application of the clear zone concept, and a summary of the American Association of State and Highway Transportation Officials (AASHTO) recommendations. Please note the following:

1. These guidelines will be used by the Iowa Department of Transportation (Iowa DOT) to review the proposed design values of Federal-aid road or bridge improvement projects.
2. The LPA, at its option, may use these guidelines for non-Federal-aid projects; however, for such projects, the Iowa DOT will not provide any review of the proposed design values, unless specifically requested by the LPA.
3. These guidelines are not applicable for projects on Primary or Interstate highways. For such projects, refer to the Iowa DOT [Road Design Manual](#).

### Definitions

*Clear Zone* – The total roadside border area, starting at the edge of the traveled way, available for safe recovery of errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope, and / or a clear run-out area.

*Recommended Clear Zone Distance* – The total distance, measured from the edge of the traveled way, that a typical vehicle will require to stop or regain control after leaving the traveled way.

*Recoverable Slope* – A foreslope on which a motorist may, to a greater or lesser extent, retain or regain control of a vehicle by slowing or stopping. Slopes 4:1 and flatter are generally considered recoverable. Recoverable slopes may count toward the recommended clear zone distance.

*Non-recoverable Slope* – A foreslope which is considered traversable but on which an errant vehicle will continue to the bottom. Foreslopes from 3:1 up to 4:1 may be considered traversable but not recoverable. Non-recoverable slopes may occur within the clear zone, but do not count toward the recommended clear zone distance.

*Clear Run-out Area* – An area at the toe of a non-recoverable slope which is available for safe recovery by errant vehicles. The clear run-out area may count toward the recommended clear zone distance.

*Critical Slope* – A foreslope which may be too steep to be safely traversed by errant vehicles. Slopes steeper than 3:1 are generally considered to be in this category. Critical slopes may neither be considered part of the clear zone nor counted toward the recommended clear zone distance. Depending on the speed and angle of encroachment, vehicles encountering a critical slope could overturn. Critical slopes occurring within the recommended clear zone distance may warrant shielding with a barrier.

*Obstacle* – A critical slope or any fixed object which is not safely traversable or may pose a hazard to errant vehicles.

### Application of the Clear Zone Concept

The clear zone concept has been developed based on several decades of highway design experience and research. The purpose of providing a clear zone is to reduce the likelihood and severity of crashes that may result when a vehicle leaves the traveled way. This is often referred to as the “forgiving roadside concept”.

Roadside obstacles should be reviewed during the design of any highway or bridge project. Where practical, obstacles should not be located within the recommended clear zone distance. Any obstacles that are located within the recommended clear zone distance should be reviewed, in order of preference, according to the following design options:

1. Remove the obstacle.
2. Redesign the obstacle so that it can be safely traversed.
3. Relocate the obstacle to a point where it is less likely to be struck.
4. Reduce the impact severity by using an appropriate breakaway device.
5. Shield the obstacle with a longitudinal traffic barrier designed for redirection or use a crash cushion.
6. Delineate the obstacle if the above alternatives are not appropriate.

### New Construction or Complete Reconstruction Projects

The clear zone concept is most applicable to new construction or complete reconstruction projects. These projects often involve significant changes to horizontal or vertical alignment, and therefore offer the greatest opportunity to address roadside safety in an economical manner.

### 3R Projects

Clear zone should also be reviewed for Resurfacing, Restoration, or Rehabilitation (3R) projects. However, because the scope of a 3R project is generally focused on the roadway itself, and because funds are usually limited, the clear zone review should be focused on those areas within the project that have identifiable safety problems associated with clear zone widths. For additional guidance, refer to [I.M. 3.214](#), 3R Guidelines.

### Curbed Roadways

Curbs are often provided on urban roadways. Curbs may serve many functions, but research has demonstrated they have limited ability to redirect vehicles that leave the roadway, especially at higher speeds. Therefore, consideration should be given to providing a clear zone for curbed urban roadways as well. However, in contrast to rural roadsides, urban roadsides are typically much more restricted by the presence of existing buildings, utility poles or appurtenances, walkways, trees, etc. These constraints often make it impractical to provide the recommended clear zone distance throughout the entire length of the project. Nevertheless, designers should review those locations that have identifiable safety problems associated with clear zone widths, and where it is practical, provide the recommended clear zone distance behind the curb.

Apart from clear zone considerations, designers should in all cases provide a minimum object setback (sometimes referred to as an operational clearance) from the face of curb to any obstructions. A minimum object setback of 1.5 feet from the face of curb is recommended by the AASHTO Roadside Design Guide (RDG) and AASHTO's Policy on Geometric Design of Highways and Streets, commonly referred to as the "Green Book". *The object setback is not a clear zone.* The clear zone is intended to accommodate vehicles that *leave the roadway*. In contrast, the purpose of the object setback is to provide a roadside environment that is not likely to adversely affect the speed or position of vehicles *on the roadway*. It also serves other practical purposes, such as providing adequate room for snow storage or opening car doors on roadways that allow parking.

Traffic barriers on roadways with curbs may be appropriate in some cases. However, care should be exercised when using curbs in combination with roadside barriers. For more information, refer to the RDG, Section 3.4.1.

### AASHTO Recommendations

The recommended clear zone distance is a function of several variables: traffic speed, traffic volume, horizontal curvature, and roadside geometry. The RDG provides several tables and charts that may be used to obtain the recommended clear zone distance based on these variables. It is important to understand the recommended clear zone distances are neither absolute nor precise. In some instances, it may be acceptable to leave an obstacle within the clear zone distance; in other cases, obstacles outside of the recommended clear zone distance may warrant removal or shielding. As with all design guidelines, use of good engineering judgment is critical.

For Federal-aid new construction or complete reconstruction projects, if the following recommended clear zone distances will not be provided, a design exception shall be requested, as per [I.M. 3.218](#), Design Exception Process.

Very Low Volume Local Roads (ADT ≤ 400 vpd)

The AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400 vpd) indicates a clear zone of 6 feet or more in width may be considered when it can be provided at low cost and with minimum social or environmental impacts. Where constraints of cost, terrain, or potential social or environmental impacts make provision of a 6 foot clear zone impractical; clear zones less than 6 feet, including designs with 0 feet may be used. These guidelines are applicable to both new construction, complete reconstruction, and 3R projects. These guidelines may also be used for collectors with less than or equal to 400 ADT, provided they carry mostly local traffic.

Other Roads (ADT > 400 vpd)

For roads other than very low volume local roads, the recommended clear zone should be provided in accordance with the following tables and figures. These tables and figures have been developed based on the guidance provided in the 2006 Edition of the RDG.

**Table 1 – Recommended Clear Zone Distances, Recoverable Slopes**  
In feet from the edge of traveled way  
(RDG, Table 3.1)

Design Speed (mph)	Design Traffic (ADT)	Foreslopes		Backslopes		
		6:1 or flatter	5:1 to 4:1	3:1	4:1 to 5:1	6:1 or flatter
≤ 40	Under 750	7-10	7-10	7-10	7-10	7-10
	750-1500	10-12	12-14	10-12	10-12	10-12
	1500-6000	12-14	14-16	12-14	12-14	12-14
	Over 6000	14-16	16-18	14-16	14-16	14-16
45-50	Under 750	10-12	12-14	8-10	8-10	10-12
	750-1500	14-16	16-20	10-12	12-14	14-16
	1500-6000	16-18	20-26	12-14	14-16	16-18
	Over 6000	20-22	24-28	14-16	18-20	20-22
55	Under 750	12-14	14-18	8-10	10-12	10-12
	750-1500	16-18	20-24	10-12	14-16	16-18
	1500-6000	20-22	24-30	14-16	16-18	20-22
	Over 6000	22-24	26-32*	16-18	20-22	22-24
60	Under 750	16-18	20-24	10-12	12-14	14-16
	750-1500	20-24	26-32*	12-14	16-18	20-22
	1500-6000	26-30	32-40*	14-18	18-22	24-26
	Over 6000	30-32*	36-44*	20-22	24-26	26-28
65-70	Under 750	18-20	20-26	10-12	14-16	14-16
	750-1500	24-26	28-36*	12-16	18-20	20-22
	1500-6000	28-32*	34-42*	16-20	22-24	26-28
	Over 6000	30-34*	38-46*	22-24	26-30	28-30

\* Where a site specific investigation indicates a high probability of continuing crashes, or such occurrences are indicated by crash history, the designer may provide clear zone distances greater than 30 feet as indicated. Clear zones may be limited to 30 feet for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

The recommended clear zone distance obtained from Table 1 may need to be adjusted on the outside of a horizontal curve at selected locations. This adjustment should be considered when the crash history suggests the need for additional clear zone distance or when all of the following criteria are met:

1. The radius of the curve is less than 2860 feet.
2. The curve occurs on a high-speed roadway (design speed of 55 mph or greater).
3. The curve occurs on a normally tangent alignment (one where the curve is preceded by a tangent of more than one mile in length).

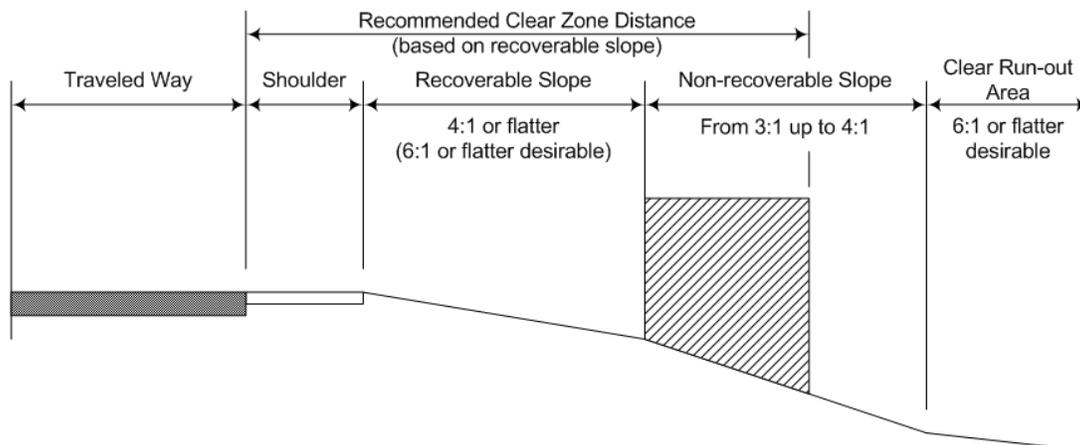
If an adjustment of the clear zone distance is determined to be appropriate, calculate the adjusted recommended clear zone distance by multiplying the recommended clear zone distance obtained from Table 1 by the appropriate Horizontal Curve Adjustment factor, as obtained from Table 2 below:

**Table 2 – Horizontal Curve Adjustment Factors**  
 (RDG, Table 3.2)

Radius (ft)	Design Speed (mph)						
	40	45	50	55	60	65	70
2860	1.1	1.1	1.1	1.2	1.2	1.2	1.3
2290	1.1	1.1	1.2	1.2	1.2	1.3	1.3
1910	1.1	1.2	1.2	1.2	1.3	1.3	1.4
1640	1.1	1.2	1.2	1.3	1.3	1.4	1.5
1430	1.2	1.2	1.3	1.3	1.4	1.4	--
1270	1.2	1.2	1.3	1.3	1.4	1.5	--
1150	1.2	1.2	1.3	1.4	1.5	--	--
950	1.2	1.3	1.4	1.5	1.5	--	--
820	1.3	1.3	1.4	1.5	--	--	--
720	1.3	1.4	1.5	--	--	--	--
640	1.3	1.4	1.5	--	--	--	--
570	1.4	1.5	--	--	--	--	--
380	1.5	--	--	--	--	--	--

**Clear Zones and Non-recoverable Slopes**

Vehicles that encroach upon a non-recoverable slope at high speeds are not likely to recover until they reach the toe of the non-recoverable slope. Therefore, if a non-recoverable slope occurs within the recommended clear zone distance, fixed objects should not be present on the non-recoverable slope or in the vicinity of the toe of the non-recoverable slope. Determination of the width of the clear run-out area at the toe of slope should take into consideration right of way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the travel lane and the beginning of the non-recoverable slope should influence the clear run-out area provided at the toe of the non-recoverable slope. While the application may be limited by several factors, the fill slope parameters which may enter into determining clear run-out area are illustrated in Figure 1 below.



**Figure 1 – Variables Affecting the Clear Run-out Area**  
 (RDG, Figure 3.2)

As Figure 1 shows, when a non-recoverable foreslope is within the recommended clear zone distance, an additional clear run-out area should be provided at the toe of the non-recoverable foreslope. The width of the additional clear run-out area should be greater than or equal to the portion of the recommended clear zone distance that falls on the non-recoverable slope (see cross-hatched area in Figure 1 above).

For many rural roadways, no recoverable slope exists between the shoulder and the beginning of the non-recoverable slope. In such cases, the recommended clear run-out area distance can be determined as follows: Using Table 1 (and if appropriate, Table 2), determine the recommended clear zone distance based on a 6:1 or flatter foreslope. Deduct the shoulder width from this recommended clear zone distance to obtain the recommended clear run-out area distance. The results of this calculation for certain design speeds, traffic volumes, and common shoulder widths are shown in Table 3 below. Clear run-out distances for other shoulder widths may be calculated in a similar manner.

**Table 3 – Clear Run-out Area Distance (6:1 or flatter)**

In feet from the toe of a non-recoverable slope which begins at the edge of shoulder

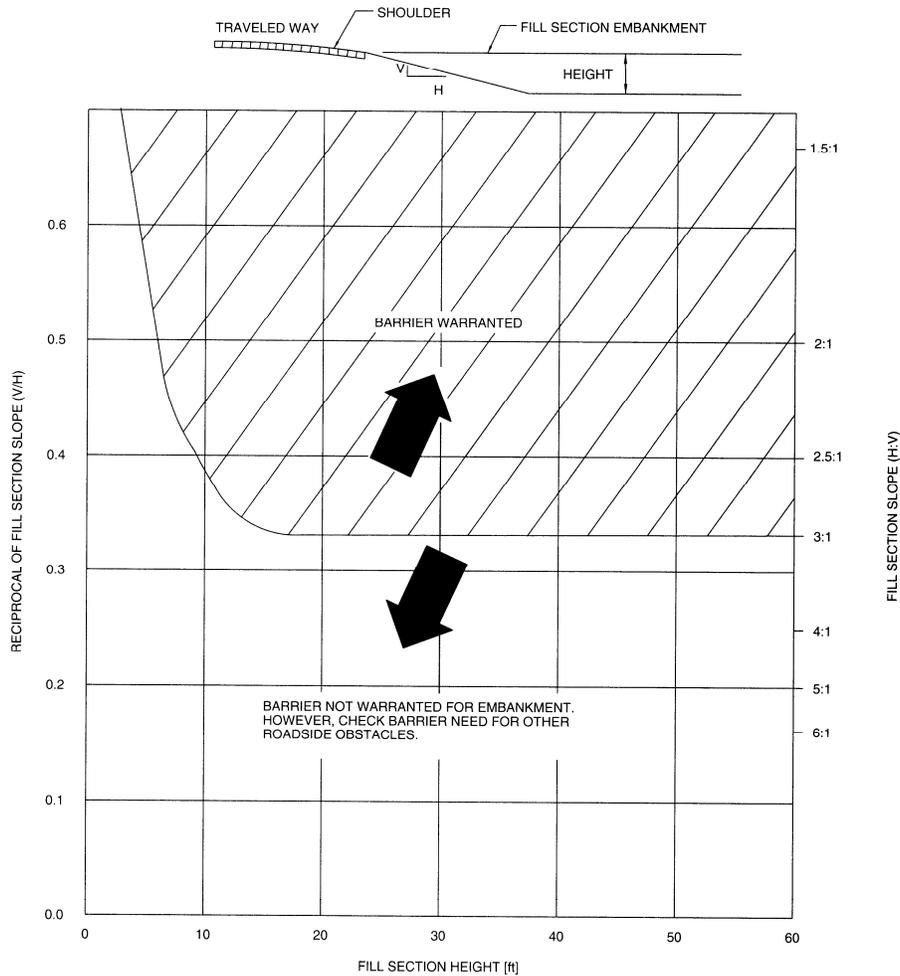
Design Speed (mph)	Design Traffic (ADT)	Shoulder Width (ft)				
		2	4	6	8	10
≤ 40	Under 750	5-8	3-6	1-4	0-2	0
	750-1500	8-10	6-8	4-6	2-4	0-2
	1500-6000	10-12	8-10	6-8	4-6	2-4
	Over 6000	12-14	10-12	8-10	6-8	4-6
45-50	Under 750	8-10	6-8	4-6	2-4	0-2
	750-1500	12-14	10-12	8-10	6-8	4-6
	1500-6000	14-16	12-14	10-12	8-10	6-8
	Over 6000	18-20	16-18	14-16	12-14	10-12
55	Under 750	10-12	8-10	6-8	4-6	2-4
	750-1500	14-16	12-14	10-12	8-10	6-8
	1500-6000	18-20	16-18	14-16	12-14	10-12
	Over 6000	20-22	18-20	16-18	14-16	12-14
60	Under 750	14-16	12-14	10-12	8-10	6-8
	750-1500	18-22	16-20	14-18	12-16	10-14
	1500-6000	24-28	22-26	20-24	18-22	16-20
	Over 6000	28-30*	26-28*	24-26*	22-24	20-22
65-70	Under 750	16-18	14-16	12-14	10-12	8-10
	750-1500	22-24	20-22	18-20	16-18	14-16
	1500-6000	26-30*	24-28*	22-26*	20-24*	18-22*
	Over 6000	28-32*	26-30*	24-28*	22-26*	20-24*

\* See note for Table 1.

#### Clear Zones and Critical Slopes

If a critical slope occurs within the recommended clear zone distance, as per Table 1, the crash history and site conditions should be reviewed to determine if a traffic barrier may be warranted. The RDG provides a generalized recommendation for barrier warrants, as shown in Figure 2 below. This figure is based on studies of relative severity of encroachments on embankments versus impacts with roadside barriers. However, it should be noted that Figure 2 does not account for the probability of encroachment upon the critical slope (i.e., traffic volume) or the cost-effectiveness of installing a barrier (i.e., the potential reduction in crash severity vs. the cost of providing a barrier).

Therefore, even if Figure 2 indicates a barrier may be warranted, if the critical slope is part of a uniform roadway cross section and the crash history of the roadway does not indicate a problem, installation of a traffic barrier may not be warranted. In summary, decisions regarding the use of a critical slope within the recommended clear zone distance should be based on the crash history, site conditions, and good engineering judgment.



**Figure 2 – Comparative Risk Warrants for Embankments**  
 (RDG, Figure 5.1b)

**Use of “Barn Roof” Designs**

When right-of-way or environmental impacts make provision of the recommended clear zone difficult, consideration should be given to using a “barn roof” type of roadway section, as shown in Figure 3 below. This type of section uses a relatively flat foreslope, followed by a steeper foreslope which begins outside the recommended clear zone distance. Since the recommended clear zone distance is less for flatter foreslopes, it may be possible to provide the recommended clear zone distance with less right-of-way or environmental impacts than other roadway sections would require.

**Figure 3 – Typical Barn Roof Section**

