Traffic Engineering & Highway Safety Bulletin

Military Traffic Management Command Transportation Engineering Agency
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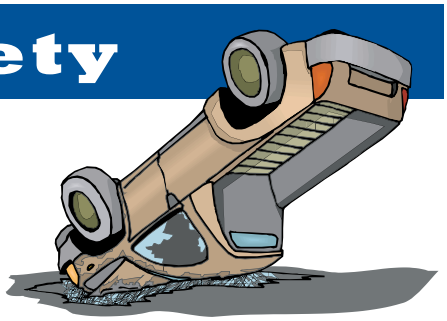
Roadside Safety



Did You Know...

- In 1998, one-third of motor vehicle deaths involved vehicles leaving the roadway and hitting fixed objects such as **trees** or **utility poles** along the road.
- 37 percent of roadside fatalities involved **trees** and **utility poles**.
- 49 percent of roadside fatalities occurred between 2100 hours and 0600 hours.
- 45 percent of drivers killed in roadside crashes had a blood alcohol content at or above 0.10 percent.
- 43 percent of drivers killed in roadside crashes were men younger than 35 years old.

Reducing Roadside Hazards Saves Lives

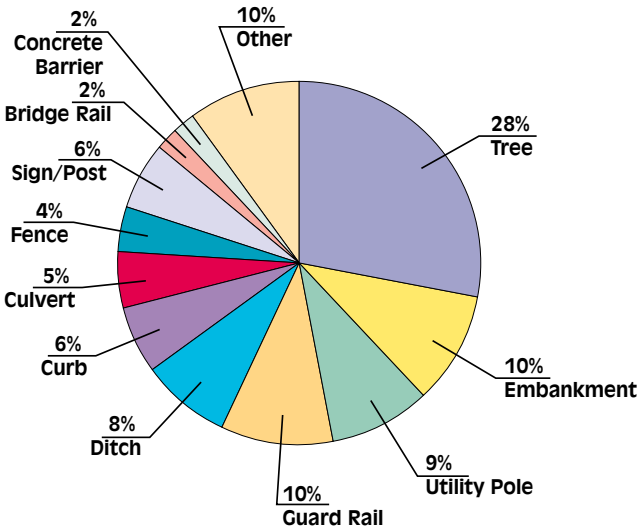
Regardless of the reason for a vehicle leaving the road, a roadside that is free of fixed objects such as trees and poles, with stable, flattened slopes, will help to reduce crash severity. The concept of the "forgiving roadside" accounts for errant vehicles that leave the roadway, and supports a roadside design where serious consequences of such incidents are reduced.

There are many reasons why a vehicle will leave the pavement and encroach on the roadside including:

- Driver fatigue and inattention
- Driving under the influence of drugs or alcohol
- Excessive speed
- Roadway conditions
- Bad visibility, possibly due to deficient roadway delineation
- Collision avoidance
- Vehicle failure

Crashes caused by driver error, such as driving under the influence of alcohol, speeding, or falling asleep, can be addressed by educational and enforcement programs. Contact your safety office for more information about these educational programs.

Percent Distribution of Roadside Hazard Crash Deaths, 1998



In This Issue:

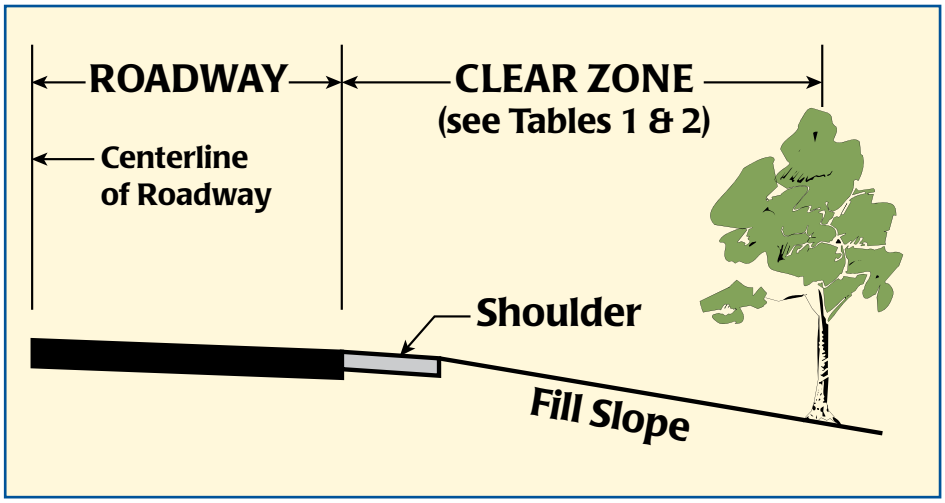
Providing a Clear Zone

The ***forgiving road*** concept includes the development of roadside ***clear zones.*** A clear zone is the total roadside border area, starting at the edge of the traveled way that is available for safe use by errant vehicles (Figure 1). This area may consist of a shoulder, a recoverable area, a nonrecoverable slope, and/or a clear run-out area. The desired clear zone width depends on traffic volumes, speed, and roadside geometry.

Increasing the roadside clear zone is the best way to limit crashes involving fixed objects. With a wider clear zone, fewer motorists who run off the road crash.

Safe design requires a minimum width for the roadway clear zone. Use Tables 1 and 2 to determine the required clear zone. (See Figure 2 for cut and fill slope examples.)

Figure 1
Clear Zone



Clear Zone - The total roadside border area, starting at the edge of the travel way that is available for safe use by errant vehicles.

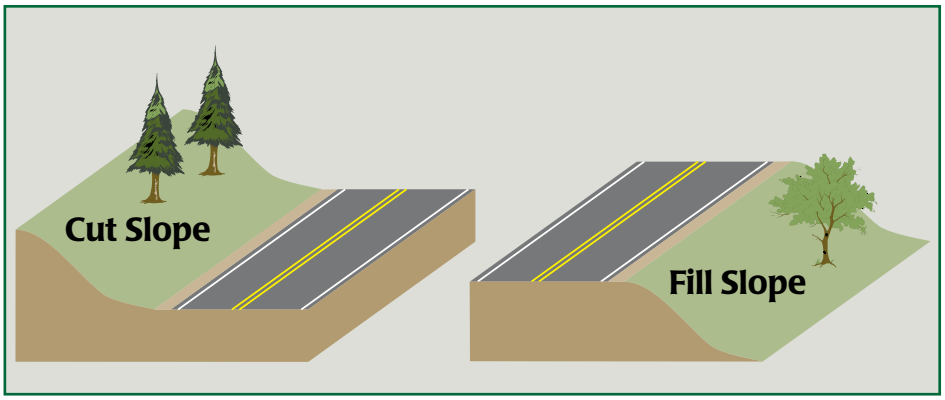
Forgiving Roadside - The concept of accounting for errant vehicles that may leave the roadway (in roadside design) to help reduce serious consequences of a crash.

Table 1 - Clear Zone Distances (in feet from edge of driving lane)

Design Speed	Design ADT	Fill Slopes			Cut Slopes		
		6:1 or Flatter	5:1 to 4:1	3:1	3:1	4:1 to 5:1	6:1 or Flatter
40 MPH or Less	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 MPH	Under 750	10-12	12-14	*	8-10	8-10	10-12
	750-1500	12-14	16-20	*	10-12	12-14	14-16
	1500-6000	16-18	20-26	*	12-14	14-16	16-18
	Over 6000	18-20	24-28	*	14-16	18-20	20-22

* Since recovery is less likely on the unshielded, traversable 3:1 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Determination of the width of the recovery area at the toe of slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories.

Figure 2
Cut and Fill Slopes



Problem - Solution - Benefit

An Army installation reported a crash in which a driver was killed when the vehicle ran off the road and hit a unneeded retaining wall. The installation officials removed the retaining wall at a cost of about $2,000. The action will prevent future injuries and **save at least one life every ten years.**

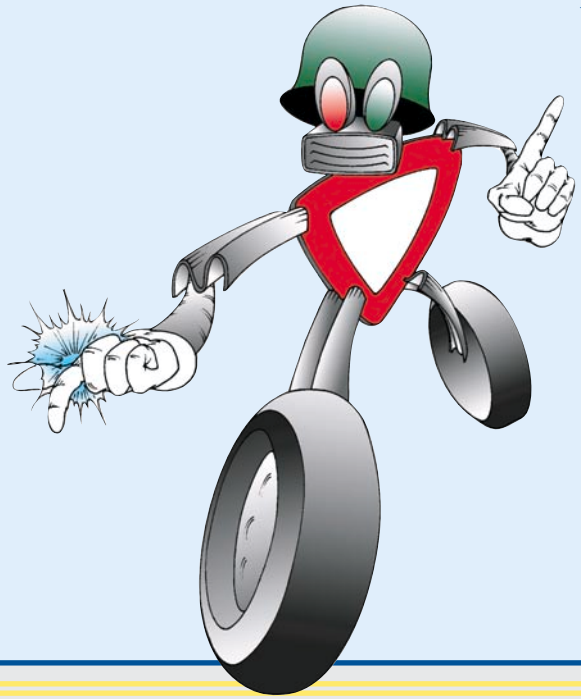
For low speeds (30 mph or less), we recommend at least four feet of clearance for curbed streets in urban areas. The *Roadside Design Guide,* published by the American Association of State Highway and Transportation Officials (AASHTO) in 1996, contains a complete discussion of current information and operating practices for roadside safety. *The Highway Safety Design and Operations Guide*, also published by AASHTO, provides useful information on safe highways.

On horizontal curves, additional clear zone will be required on the outside of curve since it is more likely for vehicles to leave the roadway (see Figure 3 on page 4.) To determine clear zone on a curve, multiply the distance in Table 1 by the appropriate adjustment factor shown in Table 2.

Clear zone widths shown in Table 1 should be provided in all new designs and at locations where there is a history of run-off-the-road crashes. Clear zone widths shown in Table 1 may not be practical at all locations. Consult MTMCTEA engineers if you need more information.

What's Wrong With This Picture??

Answer on Page 5



Roadside Crashes Involving Trees and Utility Poles

Trees

Trees were involved in 28 percent of roadside fatalities. Essentially, there are two methods to address the problem of roadside trees.

1. **Driver-aid treatments** – Help to keep the motorist on the road.

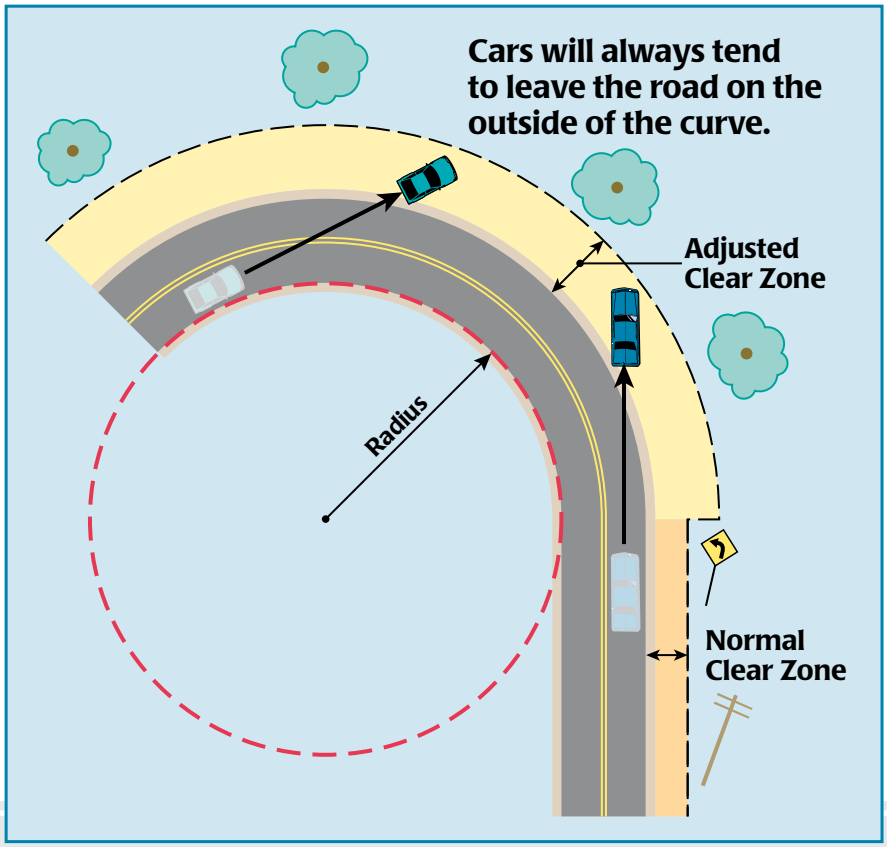
- *Rumble Strips* – A series of intermittent, narrow, transverse areas of rough-textured, slightly-raised, or depressed road surface that is installed to alert road users to unusual traffic conditions.
- *Pavement markings* – Centerline and edge line pavement markings, in good condition, provide a particularly effective method of defining roadway edges.
- *Delineators and signs* – Installing advanced warning signs and roadway delineators can help to alert motorists where extra caution is advised.
- *Roadway improvements* – Improvements to the roadway itself can help reduce run-off-the-road crashes.

Table 2 - Horizontal Curve Adjustments*
(Clear zone curve corrections)

Radius (ft.)	Design Speed (MPH)		
	40	45	50
2900	1.08	1.10	1.12
2300	1.10	1.12	1.15
1950	1.11	1.15	1.18
1650	1.13	1.17	1.22
1450	1.15	1.19	1.25
1300	1.17	1.22	1.28
1150	1.19	1.24	1.31
1000	1.23	1.29	1.36
850	1.26	1.34	1.42
750	1.30	1.38	1.48
650	1.34	1.43	1.53
600	1.37	1.47	
400	1.54		

*Multiply the clear zone distance derived from Table 1 by the curve correction factor derived from Table 2 to obtain the proper clear zone on the outside of the curve in feet. This factor applies only to the outside of curves. Curves flatter than 2900 feet do not require an adjusted clear zone.

Figure 3 - Adjusted Clear Zone for Horizontal Curve



2. **Forgiving roadside** – Protect motorists if they do leave the road.

- *Remove* – Removal of trees should be considered when those trees are determined both to be obstructions and to be in a location likely to be hit.
- *Shield* – Roadside barriers should only be used when the severity of striking the tree is greater than the barrier, and when removal is not a viable option.

In general ALL plantings within a clear zone should consist of shrubs and other plantings that will not grow into fixed objects.

Utility Poles

Utility poles pose the same problems as trees and were involved in 9 percent of roadway fatalities. Measures to alleviate utility pole hazards include:

- *Bury utility lines.*
- *Increase the lateral offset of utility poles from the roadway edge.* Ideally, utility poles should be located outside the clear zone.
- *Reduce the number of utility poles.* Often the number of utility poles can be reduced by combining uses such as telephone and electricity on one pole. Also, in many cases the number of poles can be reduced by increasing spacing between the poles.

Answer from Page 3

Proper clear zone is not provided. This location has fill slope of greater than 6:1, a speed limit of 40 mph and daily traffic volume of 1200 vehicles. Therefore a clear zone of 12 feet is recommended.

- *Install breakaway utility poles.* This method is designed to decrease the severity, not the frequency of roadside crashes.
- *Install guardrails in front of utility poles.* This method is designed to decrease the severity, not the frequency of roadside crashes.

Since utility poles are generally privately owned and installed devices, improvements can often be complicated. Installations should encourage cooperation with utility companies in making improvements.

Implementing these suggestions will greatly help to reduce injuries and fatalities on installations roadways.

MTMCTEA Can Help!

MTMCTEA highway engineers stand ready to help installations with their traffic engineering concerns—especially those involving high accident locations. We preform many types of studies with an emphasis on low-cost improvements that are immediate or short-term and yield high benefits to their implementation costs. Generally, the studies conducted include:

- Fatal crash analysis
- Safety audits
- High accident locations
- Traffic engineering
- Traffic impact (such as BRAC)
- Access roads
- Force protection
- Signal operations

IN THE NEXT ISSUE

More Roadside Safety:

- **Rumble Strips – A Highway's Alarm Clock**
- **Guardrail End Treatments**
- **Roadway Delineation**

Contact Us

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- American Association of State Highway and Transportation Officials. *The Highway Safety Design and Operations Guide.* Washington. D.C. 1997.
- Transportation Research Board, National Academy of Sciences. National Cooperative Highway Research Program (NCHRP) Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features.* 1993.
- www.fhwa.dot.gov
- www.tea.army.mil
- www.ite.org

Training

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Penn State University; The Penn Transportation Institute	(814) 865-4700	www.pti.psu.edu
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Northwestern University Center for Public Safety	(800) 323-4011	www.northwestern.edu/nucps/index.htm
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University of Washington; College of Engineering	(206) 543-2100	www.engr.washington.edu/epp
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