Chapter Six
ROADSIDE SAFETY

Table of Contents

Section **Page**

Chapter Six
ROADSIDE SAFETY

The ideal roadway would be free of obstructions or other hazardous conditions within the entire highway right-of-way. This is usually not practical because of economic, environmental or drainage factors. The designer should provide clear zone distances that adequately provide a clear recovery space for the majority of drivers who run off the road. The use of roadside barriers, median barriers, breakaway devices and impact attenuators may be required where the clear zone distance is not practical.

The majority of the Department's roadside safety criteria can be found in Chapter Fourteen of the Montana Road Design Manual. Section 6.2 discusses roadside hardware supports that are not addressed in Chapter Fourteen of the Montana Road Design Manual.

6.1 MONTANA ROAD DESIGN MANUAL

The following roadside safety criteria are discussed in Chapter Fourteen of the Montana Road Design Manual:

1. clear zones,
2. roadside barrier warrants,
3. roadside barrier types and selection,
4. roadside barrier layouts,
5. roadside barrier terminals,
6. median barriers, and
7. impact attenuators (crash cushions).

For those elements not discussed in the Montana Road Design Manual or in this chapter, the designer should review the criteria in the AASHTO Roadside Design Guide.

6.2 ROADSIDE HARDWARE SUPPORTS

Where roadside hardware (e.g., sign supports, luminaires, traffic signals, mailboxes) cannot be reasonably located outside of the clear zone, they should be made breakaway or shielded with a roadside barrier or impact attenuator. This section discusses the hardware criteria for these roadside hardware elements.

6.2.1 Design Criteria

All breakaway devices must be designed or located to meet the following criteria:

1. Design Vehicle. Breakaway devices must fail in a predicable manner when struck head-on by an 1800 lb (820 kg) vehicle at speeds of 20 mph (35 km/h) and 60 mph (100 km/h).

2. Occupant Velocities. Desirably, the resultant occupant impact velocity should be limited to 10 ft/s (3.0 m/s). However, values as high as 16 ft/s (5.0 m/s) are acceptable.

3. Stub Height. To avoid vehicle undercarriage snagging, the remaining portion of a breakaway device should not exceed 4 inches (100 mm) measured over a 5 ft (1500 mm) chord, see Figure 6.2A.

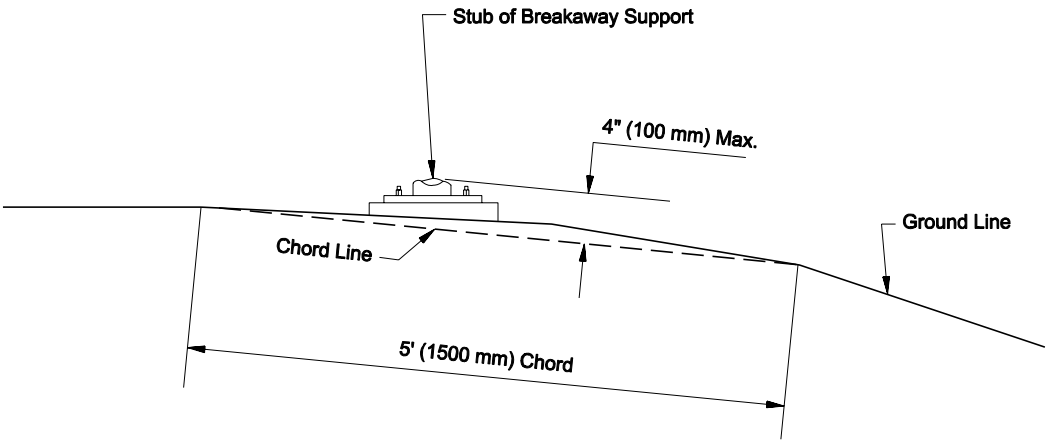
4. Bumper Height. Breakaway devices are typically designed to be impacted by a bumper at a height of 20 inches (500 mm) above the ground. This may require grading around the device or moving the device to ensure the proper height for impact.

5. Multiple Posts. Posts which are within 7 ft (2.1 m) of each other are considered to be acting together (i.e., the impacting vehicle will strike both posts).

6.2.2 Breakaway Supports

6.2.2.1 Overhead Signs

If the overhead sign cannot be mounted on an existing structure, use non-breakaway supports for the overhead sign. Within the clear zone, these structures must be protected with a roadside barrier or, where applicable, with an impact attenuator.



BREAKAWAY SUPPORT STUB HEIGHT MEASUREMENT

Figure 6.2A

6.2.2.2 Large Signs

Large signs are considered to be those with an area of 50 ft^2 (5 m^2) or greater. To achieve satisfactory breakaway performance for large signs, the sign supports should meet the following criteria:

1. Post Mass. Supports for single-post signs and posts that are 7 ft (2.1 m) or further apart on double support signs, should have a mass less than 45 lb/ft (67 kg/m). The total mass of the support below the hinge, but above the breakaway device, should not exceed 600 lb (270 kg). For two posts spaced less than 7 ft (2.1 m) apart, each support post should have a mass less than 18 lb/ft (27 kg/m).

2. Breakaway Device. Breakaway devices for large signs may use one of the following designs:

   a. Fracture Design. This design uses couplers or wood posts with reduced cross sections. When struck, the support breaks away from the foundation. Most fractures designs are considered to be multi-direction (i.e., they may be hit from any direction).

   b. Slip-Base Design. This design consists of two parallel plates that are held together with bolts. Under impact, the bolts slip out of the plates releasing

the support. Depending on the design, slip-bases may be either uni-directional or multi-directional.

3. Fuse Plates. In addition to the breakaway device, a hinge may be used to allow the vehicle to pass through the sign support. The flange on the impact side and web of the post are cut. The uncut rear flange acts as a hinge as the post rotates upwards under the impact of the vehicle. To counteract the wind forces on the sign, a perforated fuse plate is attached across the saw cut flange on the impact side. For multi-directional impacts, the sign support is completely cut and fuse plates added to both flanges.

6.2.2.3 Small Signs

The following discusses the breakaway devices used with small signs:

1. Bending or Yielding. This design requires the post to bend when struck by a vehicle.

2. Fracture. The fracture design requires the sign support to break away under vehicular impact. For wood posts, the cross sectional area is reduced by drilling holes in the support above the foundation. The MDT Detailed Drawings provide additional guidance for this design. For steel posts, the fracture design consists of providing a separate anchor and attaching the sign support to the anchor.

3. Slip Base. As with large signs, slip-base designs may be uni-directional or multi-directional. The MDT Detailed Drawings provide information on the uni-directional design that may be used with tubular sign supports. It should be noted that this slip-base design is only appropriate for signs with single-sign supports. For multi-directional designs, the Department has approved the use of the Telespar, Allied and Transpo Break-Soft slip bases. For alternative slip-base designs, the designer should contact the Traffic Engineering Section.

4. Application. For 2 inch (51 mm) or 2.5 inch (64 mm) steel posts, MDT's practice is to use square tubular posts with either a fracture anchor or a slip-base design. See MDT Detailed Drawings for additional details. For a 3 inch (76 mm) or larger post, use a round steel post with a MDT breakaway device or a Transpo Break-Safe Slipbase.

6.2.2.4 Luminaire Supports

There are three basic designs for breakaway luminaire supports — frangible base (aluminum transformer), slip base and frangible coupling (bolt coupling). MDT typically

does not use the slip-base design for luminaire supports. For more information on the typical luminaire supports used by the Department, see the Traffic Engineering Section's "Electrical Detailed Drawings."

For luminaire supports, the designer should note the following:

1. Heights. Breakaway devices should only be used on luminaire supports that are 60 ft (18.5 m) or less.

2. Mass. The mass of a luminaire support should not exceed 1000 lb (450 kg) to prevent a serious consequence should the support happen to fall on the impacting vehicle.

3. Wiring. Quick disconnect circuitry should be used to ensure that the wiring will not reduce the effect of the breakaway device.

Chapter Thirteen provides additional guidance on the placement of luminaire supports.

6.2.2.5 Traffic Signals

Most traffic signals will use non-breakaway supports. Within the clear zone, these structures may need to be protected with a roadside barrier or, where applicable, with an impact attenuator. Traffic signal supports that use a cast aluminum base are considered to be breakaway and may be placed within the clear zone. Chapter Twelve provides additional guidance on the placement of traffic signal supports.

6.2.2.6 Mailbox Supports

Mailboxes and newspaper tubes served by carriers in vehicles may constitute a safety obstacle, depending upon the placement of the mailbox. The designer should make every reasonable effort to replace all non-conforming mailboxes with the designs that meet the criteria in A Guide to Mailbox Safety in Montana, the AASHTO A Guide for Erecting Mailboxes on Highways, the MDT Detailed Drawings, and Chapter Eighteen of the Montana Road Design Manual.

In general, the design of mailboxes should meet the criteria presented in Chapter Fourteen of the Montana Road Design Manual.

6.2.2.7 Railroad Warning Devices

MDT together with the railroad company will be responsible for determining the types of warning devices that should be used at a railroad crossing (e.g., crossbucks, flashing lights, gates). Once the warning device has been selected, it is the designer's responsibility to determine the level of protection required. Wood crossbucks should be made breakaway using a similar design as for wood sign supports. For railroad signals or gates, breakaway devices are generally not used. These devices may require an impact attenuator if the device is within the clear zone. In general, a longitudinal barrier should not be used with railroad warning devices due to the inability to provide a proper end anchorage beyond the warning device