

Damaged Roadside Hardware: Repair or upgrade?



California Local Roads

CATEGORY: Maintenance

ISSUE: When a traffic barrier, barrier terminal, or crash cushion is penetrated or destroyed in a crash, it is usually replaced or repaired “in-kind”. However, in some cases, it may be more effective to upgrade, relocate, or even remove the damaged hardware and not replace it. Guidelines giving field personnel an overview of the site-specific conditions which should be considered before selecting the most appropriate course of action would be useful.

OBJECTIVE: To identify the types of damage that should receive immediate attention and to recommend general guidelines that enable maintenance personnel and contractors to determine when upgrading damaged or deteriorated barriers, terminals, and crash cushions is a more appropriate course of action than replacement in-kind. Information on when a safety feature should be relocated or even removed will also be provided.

METHODOLOGY: Typical “repair” scenarios for w-beam guardrails, terminals, and crash cushions will be identified and general guidelines will be presented as an aid for determining if upgrading or redesign is a more cost-effective choice than replacement in-kind. National policy generally requires non-crashworthy terminals that are damaged to be upgraded to a design that meets NCHRP Report 350 or MASH crash criteria. Such obsolete terminals include the Breakaway Cable Terminal (BCT) design and, along high-speed roadways, the MELT terminal, shown below. The BCT Terminal has no ground strut and only two weakened posts, making field identification easy.



BCT Terminal



MELT Terminal



U.S. Department of Transportation
Federal Highway Administration

EXPECTED RESULTS:

Provide repair personnel with information that will allow them to evaluate barrier, barrier terminal, and crash cushion damage and to schedule appropriate repair, removal, upgrades, or redesign.

TYPES OF DAMAGE AND REPAIR OPTIONS:

Metal beam railing damage:

Perhaps the most catastrophic failure of a longitudinal barrier is vehicle penetration allowed by physical separation (rupture) of the rail element or over-riding the barrier. Therefore, any damage that decreases the tensile strength or reduces the height of the metal beam should be considered a high-priority repair. This type of damage includes:

- Vertical tears in the w-beam that extend to the top or bottom of the rail.
- Non-manufactured holes (e.g., those caused by crash damage, lug nut damage, or corrosion) in the rail element that intersect the top or bottom edges of the w-beam.
- Any splice that is missing 2 or more bolts.
- Rail flattening, with or without post deflection.
- Barrier deflection more than 9 inches over a 25-foot length. (**Photograph A**)
- Height reduced by 2 inches or more from its original height.
- Any missing or detached posts. (**Photograph B**)

If the installation was an NCHRP Report 350 or MASH design and the damage was localized, replacement in-kind makes sense. If more than 50 percent of a run was damaged and the rail height is less than 27", it may be cost-effective to replace the entire run with Caltran's current w-beam standard. In either case, both the existing type of rail and its location should always be analyzed to determine if placement down a slope or behind a curb contributed to the barrier's failure to contain or redirect a vehicle.

Terminal damage:

The most commonly used w-beam guardrail terminals are designed to transmit tensile forces in the rail to a cable and ground strut anchor system. This anchor keeps the rail in tension in a vehicular impact near the end of the barrier installation. The impact head lessens crash severity in an end-on hit. Critical elements include:

- This damaged BCT terminal should not be replaced in kind. Since the rail is on the departure end of the twin structures on a divided highway, the preferred action here would be removal of all w-beam rail. (**Photograph C**)
- If the end post is broken or missing or if either the cable or steel bearing plate is missing, the anchorage is lost and any motorist striking the rail near the terminal would likely penetrate the system rather than be redirected. (**Photograph D**)
- The impact head must be properly aligned and in position with the w-beam rail element so the rail will "feed" into it in any head-on crash.
- When a w-beam terminal is damaged beyond repair and must be replaced, two questions should always be asked: was it the "best" type of terminal or should it be moved to a location where future impacts are less likely? **Photograph E** shows a damaged MELT terminal. Since this terminal is not considered crashworthy along a high speed route, it should be upgraded, not replaced in-kind.

Note that an energy absorbing terminal should never be used to terminate a curved guardrail. The first 50 feet of the rail must be straight so it will feed into the impact head without kinking.

A



B



C



D



E

