Roadway Departure Technical Brief No. 1

Maintenance of Traffic Barrier Systems

CATEGORY: Maintenance

ISSUE: Often times it is not immediately obvious when a barrier or terminal is damaged to the extent that it may no longer function as intended. If the consequences of damaged hardware are not properly assessed, repairs may not be made in a timely manner, leading to poor crash performance and opening the responsible authority to possible legal action.

OBJECTIVE: To recommend general guidelines that enable maintenance personnel and contractors to determine when repairs to damaged or deteriorated barriers and terminals are needed and how soon those repairs should be made. Also to provide guidelines on when damaged barriers and terminals should be upgraded, removed, or re-designed.

METHODOLOGY: Several typical "damage" scenarios for W-beam guardrails and terminals will be identified and best-practices will be presented for consideration. NCHRP Report 656, Criteria for Restoration of Longitudinal Barriers, will be summarized and referenced for more detailed information.

To function properly in an impact, a metal beam guardrail must be able to reach its full tensile strength, have limited deflection, and minimize overrides and underrides. Guardrail terminals must be able to anchor the barrier in side impacts and minimize crash severities in end-on impacts. The following sections identify the degrees of damage most likely to compromise the crash performance of these safety appurtenances.

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EXPECTED RESULTS:

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

TYPES OF DAMAGE:

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. Therefore, any damage that decreases the tensile strength of the metal beam should be considered a high-priority repair.

- Vertical tears in the W-beam **(Photograph A)** that extend to the top or bottom of the rail greatly reduce the capacity of the rail and create areas of high stress concentrations, both of which can cause the rail to tear completely through and allow vehicular penetration upon impact. 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 should also be considered a priority repair condition.
- Rail flattening **(Photograph B)** with or without post deflection, increases the chances that an impacting vehicle will overturn upon contact and may increase the deflection distance. Any flattened panel that increases the W-beam section width to more than 18 inches (normal height is 12 inches) should be replaced.

Post / deflection damage:

If a section of barrier is struck a second time before repairs have been made, its performance may be uncertain, depending on the amount of original damage.

- If the barrier has been deflected more than 9 inches over a 25-foot length, its height has been reduced by 2 inches or more from its original height, or if any posts are missing or detached **(Photograph C)**, prompt repairs should be made. These types of damage can result in greater vehicle instability in a crash, leading to rollover, barrier rupture, or barrier overrides.

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.

- If the end post is broken or if either the cable or steel bearing plate is missing **(Photograph D)**, the anchorage is lost and any motorist striking the rail downstream from the terminal would likely penetrate the system rather than be redirected. Thus, if any of these components are deficient, repair work should be a very high priority.
- For those terminal designs that incorporate an energy-absorbing head, it is critical that this head be properly aligned and in position with the W-beam rail element so the rail will "feed" into it in any head-on crash. If the impact head cannot slide along the W-beam, its energy absorbing capacity is seriously compromised, probably resulting in a more severe crash. In **Photograph E**, the impact head is misaligned, reducing or preventing its intended performance in an end-on impact. In addition, this impact head is on a curved section of rail rather than a straight section, a design error that may also compromise crash performance. And since there is no apparent hazard behind this rail, the installation itself may be longer than warranted.

A

B

C

D

E