RESEARCH PAYS OFF

Redesign of Guardrail to Bridge-Rail Anchorage Secures Benefits

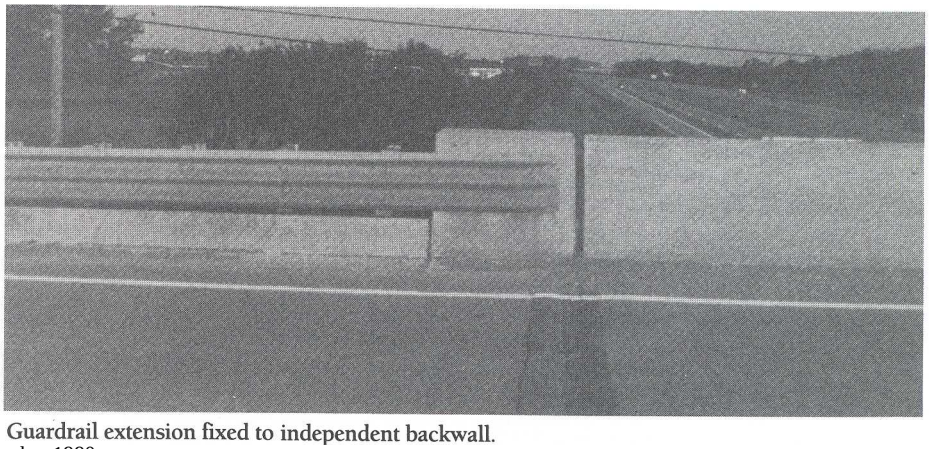
The Michigan Department of Transportation constructs many bridges with the expansion joints located at the abutments. This type of construction creates a problem in accommodating the combined movements of the bridge barrier railing and the guardrail caused by thermal expansion and contraction. The objective of the research described here was to develop a cost-effective method of connecting the bridge rail to the guardrail in a way that would allow for thermal movement and still preserve the tensile ribbon strength essential for the redirection of an errant vehicle.

Problem

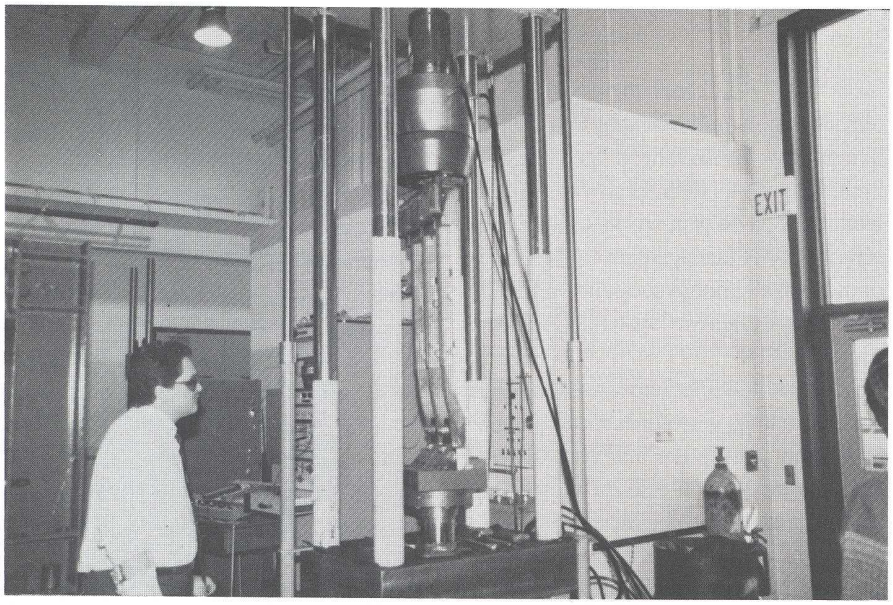
Guardrail to bridge-rail anchorage, where thermal movement is involved, has always been a problem. Although the standard end shoe for W-beam rail is slotted to make installation easier, these slots are not long enough to accommodate the total forward movement. This is also true of the last rail section used with Thrie-beam rail. MDOT's solution to this problem has been to construct a barrier extension fixed to an independent backwall. This extension was used at all four corners and cost $48,000 per structure. A more cost-effective connection system was needed that would use standard guardrail hardware and still meet strength and safety requirements.

Solution

An investigation was conducted into the possibility of modifying the end shoe for the W-beam rail and the last rail section of the Thrie-beam to accommodate the expected movement at the abutment. These two sections were chosen because



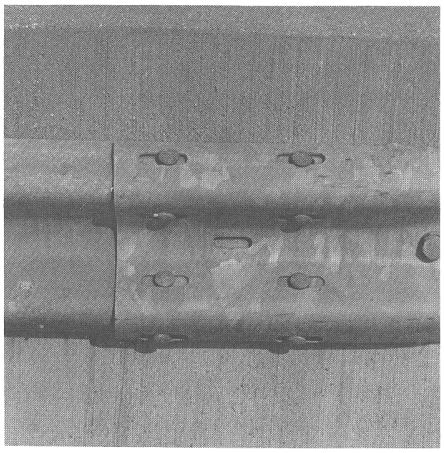
Guardrail extension fixed to independent backwall.



Testing of a modified end shoe.

they were already slotted and only minimum changes would have to be made. Modifying these rail sections would make it possible to connect them directly to the barrier railing on the first span of the structure.

The splice slots in the W-beam rail end shoe were elongated from three to five inches. The five-inch length was chosen to accommodate the expected thermal movement of the system. A test fixture was constructed and the modified end shoe connected to the splice slots of the standard rail section. This combination was subjected to both static and cyclic testing and compared with a standard nonmodified end shoe rail combination. All tests proved that there was no significant loss in tensile strength when the end-shoe modifications were made. Similar modifications for the last rail section of the Thrie-beam rail were also made.

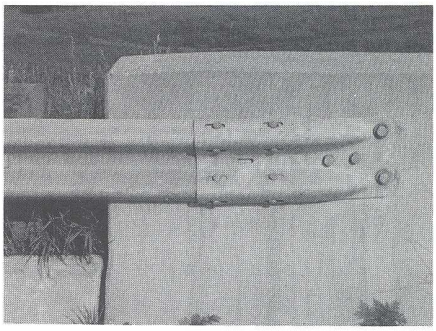

Modified end shoe for W-beam guardrail.

Application

The modified W-beam end shoe and modified Thrie-beam final rail section can be used on any structure that must accommodate expansion at the abutments. These modifications are now used routinely by MDOT.

Benefits

The benefits of this project are already apparent. Since the standard was introduced in August 1987, several of these structures have been constructed using this modification. The new standard has brought about the savings of about $48,000 for each structure to which it has been applied. The total cost of the research was less than $5,000. Even if only five of these structures are constructed, a minimum of $235,000 in savings would be realized. This research fulfilled its objective and provided a more cost-effective, safe guardrail to bridge-rail transition.


W-beam guardrail connected directly to first span of structure.

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Suggestions for "Research Pays Off" topics are welcome. Contact Crawford F. Jencks, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (telephone 202-334-2379).