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New York State  
Department of  
Transportation  
**ENGINEERING  
INSTRUCTION**

**EI**  
**97-014**

Title: **WEAK POST CORRUGATED GUIDE RAIL AND MEDIAN BARRIER**

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**Approved:**

P. J. CLARK, DEPUTY CHIEF  
ENGINEER, DESIGN DIVISION

8/29/97  
Date

**Administrative Information.** This instruction takes effect for projects initially scheduled for the letting of April 9, 1998 and thereafter, but may be implemented sooner at the Region's discretion. Projects initially planned and designed to be let prior to the April 9, 1998 letting but were postponed because of the "year end rush" to that letting, or a few lettings later, are exempted from this instruction. This instruction doesn't supersede any existing instruction. Nothing is transmitted with this instruction.

**Purpose.** The purpose of this instruction is to advise designers of a federal rule and the measures they should take in response to it. The policy contained in this instruction is considered design policy which hereby modifies the *Highway Design Manual* and which will eventually be incorporated into the *Highway Design Manual*. Details of the federal rule and other background material are contained below in the section of this instruction entitled "Background."

**Background.** The Federal Highway Administration, pursuant to the Intermodal Surface Transportation and Efficiency Act, (ISTEA) (§1073, Public Law 102-240, 12/18/91) issued notice of a final rule on July 16, 1993 which contained the following statement:

"Also, contingent upon the results of ongoing research and service performance available at the time, the FHWA anticipates that approximately five years after adoption of this rule that all new installations of traffic barriers and other roadside safety features on the NHS projects will be only those that have been judged to meet the testing and evaluation criteria in Report 350."

The above quotation is being interpreted to mean that the various operational safety features, such as guiderails, median barriers, and their terminals must all be crash tested with the 2000 kg (4400 pound) pickup truck. Only those that successfully pass such tests may continue to be included in contracts on the National Highway System (NHS) advertised after September 30, 1998. Since final rules are binding on the states, we need to issue instructions bringing our practices into conformance with the rule.

Pursuant to the rule, manufacturers have begun crash testing their products. Additionally, the FHWA itself has financed a number of crash tests of nationally used non-proprietary systems. These tests have included crash tests of weak post corrugated guiderail with 2000 kg pickup trucks at impact angles of 25° and speeds of 100 km/h and 70 km/h, nominally. The weak post corrugated guiderail passed at 70 km/h but not at the higher speed. Consequently, the final rule would prohibit new installations of weak post corrugated guiderail on the NHS where speeds are in excess of 70 km/h in contracts advertised after July 1998.

Since the weak post corrugated guiderail passed at 70 km/h, weak post corrugated median barrier is also considered to have passed at that speed. Likewise, because of the failure of the weak post corrugated guiderail at the 100 km/h speed, the median barrier is also assumed to have failed at that speed. Therefore, the rule prevents the described installations of weak post corrugated median barrier too.

**General Policy.** In general, it is the Department's policy to eliminate or modify roadside hazards whenever reasonable to

do so. If this can't be accomplished, it is appropriate to shield roadside hazards with approved guiderails, one of which consists of standard 12 gage w-shaped corrugated beams which are bolted directly to S75 mm X 8 kg/m (S 3 X 5.7 #/ft) steel posts. These same components are also used to construct median barrier used in some medians. These systems are the "weak post" systems referred to in this instruction. The federal rule has implications regarding the use of these weak post corrugated barriers and it will be our design policy to comply with, and to extend the application of, the federal rule for contracts in design as described below:

**New Construction Projects Policy.** It will be our policy not to include the weak post corrugated guiderail and median barrier in new construction contracts on or off the NHS when operating speeds are higher than 70 km/h (45 mph.) This simply restates the federal rule published in 1993 for the NHS projects but extends it to non-NHS projects. At operating speeds of 70 km/h, (45 mph) or lower, weak post corrugated guiderail and weak post corrugated median barrier continue to be acceptable.

**Reconstruction Projects Policy.** The intent of a reconstruction project is to bring the facility up to current standard practice<sup>1</sup>. Thus, new installations of guiderail and median barrier should conform to the above policy for new construction. In addition, runs of existing corrugated weak post barriers that cannot be eliminated should be replaced if the operating speeds are in excess of 70 km/h (45 mph). The designer is also cautioned that the points of need for the replacement runs will probably be different than the points of need for the original installation because the manner by which point of need determinations are made has changed.

**Interstate and Freeway 3R Projects Policy.** The roadside design of these projects should be treated in the same manner as reconstruction projects<sup>2</sup>. Thus, new installations of weak post corrugated barriers should conform to the above new construction policy. With respect to replacement of existing runs of weak post corrugated barriers on the mainlines of such projects, consideration should first be given to eliminating the need for the runs by regrading the slopes, removing or modifying fixed objects, extending culverts, or otherwise addressing the conditions that led to the installation of the weak post corrugated barrier in the first place. If those actions are practical, as noted above under "Reconstruction Projects Policy," carry them out and eliminate the run of weak post corrugated barrier; if not, replace the run<sup>3</sup>.

The designer is also cautioned that the points of need for the replacement runs will probably be different than the points of need for the original installation because point of need is calculated differently now.

**Non-freeway 3R Projects Policy.** New installations of barrier should conform to the policy for new construction, given above. With respect to replacement of existing runs of weak post corrugated barrier on non-freeway 3R projects, the HDM describes a "basic safety package" of roadside work that is to be carried out. Upgrading of non-current guiderail and median barriers is currently listed as one of the elements of the "basic safety package." Our policies, as written for the 3-6-95 revision number 22 of the HDM would, therefore, require replacement of the weak post corrugated barriers if operating speeds were in excess of 70 km/h (45 mph)<sup>4</sup> since they are technically "outmoded" systems.

The non-current, outmoded, varieties of guiderail and median barriers contemplated in the development of the "basic safety package" concept, however, were the older systems. Some examples of these older systems include the "cable and can" type which was mounted on a variety of heavy posts, an old style heavy post blocked out corrugated beam system with 12'-6" post spacing, and another corrugated beam system in which the beam was bolted directly to a variety of heavy posts. Despite the Weak Post Corrugated Guide Rail's failing the crash test with the pick-up truck, it performs much better than any of the above mentioned systems. Thus, replacement of the weak post corrugated system will not yield the same safety benefit

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1        §10.3.2.1 Highway Design Manual, Revision 22  
2        §10.3.2.2 HDM, Rev. 22  
3        §7.2.13 HDM, Rev. 22  
4        §10.3.2.2B HDM, Rev. 22

that replacement of these older outmoded systems will yield.

Therefore, because operating speeds frequently are lower on these projects than on the freeway projects and because weak post corrugated barrier systems perform much better than the older systems which they replaced, it will not automatically be necessary to replace weak post barrier system on non-freeway 3R projects. Certainly, if there are too many penetrations of the existing weak post corrugated barrier, it should be replaced. On the other hand, if there are very few accidents overall, or if the system is penetrated only infrequently, or not at all, there will be little or no benefit in making the replacement. In recognition of the foregoing, we are by this instruction taking the requirement of replacing weak post corrugated guiderail on non-freeway 3R projects out of the "basic safety package" and placing it into the category of "other work." Generally, "other work" needs to be performed only if the accident data indicates there is a demonstrated safety problem with the article.

Analysis involving the expected cost of guide rail accidents has indicated that the estimated cost of 0.3 accidents per year, per mile (0.2 accidents/year /kilometer) of weak post guide rail to be replaced approximates the replacement cost of the guide rail. Therefore, if the rate of guide rail accidents per mile or kilometer is nearly that, or smaller than that, it will not be necessary to replace the guide rail or run of guide rail.

In addition to the number of accidents per mile or kilometer, if the percentage of guiderail penetration accidents involving passenger car vehicles, including the light truck class<sup>5</sup>, of the existing weak post corrugated guide rail compared to overall passenger vehicle guiderail accidents at the site is lower than or nearly as low as that which would associated with the alternative box beam or heavy post blocked-out corrugated systems, there also would be little benefit to be gained by replacing the guide rail. The penetration rate of box beam, for example, which was observed to be 7%, statistically<sup>6</sup> is not greater than 8.6%. The penetration rate of the weak post corrugated guide rail, which was observed to be 15.6%, is statistically<sup>7</sup> not less than 12.4%. The table below, however, was prepared based on the probabilities of observing various numbers of penetrations in a sample of the stated sizes given that the true rate of guiderail penetration is 10%. A 10% rate was chosen because it was felt that for practical purposes the accident data generated by a guide rail system that performed at the 10% penetration rate would be not distinguishable from that generated by box beam or heavy post barriers.

GUIDERAIL PERFORMANCE REQUIRING REPLACEMENT OF WEAK POST CORRUGATED BARRIER (PASSENGER CAR AND LIGHT TRUCK CLASS ONLY)			
Number of Accidents	Number of Penetrations	Number of Accidents	Number of Penetrations
0 TO 6	ANY NUMBER	37 TO 46	4 OR MORE
7 TO 16	1 OR MORE	47 TO 56	5 OR MORE
17 TO 27	2 OR MORE	57 TO 66	6 OR MORE
27 TO 36	3 OR MORE		

There is nothing in this instruction that prohibits replacing weak post corrugated guide rail or median barrier because the numeric criteria above that would enable retention is met. Regions are free to adopt a policy of more widespread replacements if they wish. Also, while it is not necessary to replace the guide rail when the above numeric criteria is met on non-freeway 3R projects, replacement is encouraged in zones with operating speeds in excess of 70 km/h if convenient, or

<sup>5</sup> Includes pickup trucks, vans, mini-vans and four wheel drive vehicles such as utility vehicles

<sup>6</sup> Confidence level of 95%

<sup>7</sup> At the 95% confidence level.

when significant work on a given run is part of the project. The necessary sections of the Highway Design Manual<sup>8</sup> will be updated appropriately to reflect all this.

**Safety and Guiderail Projects Policy.** Under these projects, existing runs of weak post corrugated barriers should be replaced on the mainlines of Interstate facilities and other high speed freeways and from along their high speed ramps with operating speeds higher than 70 km/h or 45 mph. On non-freeway facilities with operating speeds in excess of 70 km/h (45 mph) existing runs of weak post corrugated barrier should also be replaced if the number of accidents per mile or kilometer exceeds the numbers indicated above and the proportion of penetration accidents involving passenger cars or light trucks, exceeds the values indicated in the table above given in the section entitled "Non-freeway 3R Projects Policy".

**100% State Repair and Maintenance Contracts.** Weak post corrugated guide rail and median barrier may be repaired and maintained without replacement under these contracts on facilities of all types.

**Federal Aid for Repair and Maintenance of Guide Rail and Median Barrier.** The FHWA has informed us that repair and maintenance contracts are not Federal-aid eligible unless they meet our Engineering Bulletin 96-034, Element Specific Work. That bulletin contains the statement "On-call guide rail repair contracts must be designed to assure guide rail warrants are considered and the guide rail installed meets current standards." Accordingly, a run of weak post corrugated guide rail or median barrier can be repaired as "element specific work" under a federal aid "element specific" project only when the conditions exist, as described in this engineering instruction, that would permit a designer to retain the run of barrier should it have been encountered in a 3R project under design.

**What to Replace the Weak Post Corrugated Barriers With.** As indicated above, before assuming that the barrier must be replaced, the designer should check first to see that the barrier is still needed. The designer should also check to see whether it might be more practical to modify or remove the shielded feature. In view of the maintenance requirements and the accident costs associated with barrier accidents, the cost to modify or remove the protected feature could be several times the cost of the barrier itself and still prove the more economical better choice.

If the designer determines it is still necessary to replace the weak post corrugated barrier, he or she should choose from the following systems-- as long as their use is otherwise consistent with deflection and maintenance criteria contained in the *Highway Design Manual*:

- Cable guiderail<sup>9</sup>
- box beam guiderail
- wood post blocked out guiderail
- heavy steel post blocked out guiderail modified with wood post blockouts<sup>10</sup>.

All these systems and their median barrier counterparts have passed crash testing with the 2,000 kg pick-up truck in accordance with NCHRP 350 and would therefore be in compliance with the federal rule.

**What to Use to Terminate Barrier Systems With.** This will be the subject of a separate instruction.

**Contact Person.** Larry Brown of the Design Quality Assurance Bureau (518) 457-4093.

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<sup>8</sup> §10.3.2.2B13 HDM Rev. 22 and §7.3 HDM, when issued

<sup>9</sup> §10.2.3.1 HDM indicates that cable shouldn't be used where the volumes exceed 5,000 per lane ADT unless the increased effort can be made to provide timely repair and maintenance.

<sup>10</sup> See EI 97-016 Heavy Post Blocked Out Guide Rail.