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Evaluation Tests Of Defiant Self Rectifying Safety Steel Post Manufactured By Defiant International, Inc.

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16. ABSTRACT

Background:

On June 5, 1969, Messrs. William and Bernard Milligan, representing Defiant International, Inc. of Farrell, Pennsylvania conferred with Messrs. Wallace Ames and Robert Doty of the Structural Materials Section, Materials and Research Department, California Division of Highways.

The subject of the conference was the Defiant Self Rectifying Steel Safety Post. The Milligan brothers were referred to the Materials and Research Department by Mr. Cal Lee, Traffic Department, District 07. Mr. Lee felt there was a need for a sign or delineator that would remain functional after a vehicle impact and felt this particular device might warrant evaluation by the Materials and Research Department. Further inquiries with Headquarters Traffic and Construction Departments revealed additional interest in the problem of providing "indestructible" delineation and signing and in establishing a test criteria and standard of performance for evaluating devices such as this. It was therefore decided to test and evaluate the Defiant Safety Post to determine its self rectigying characteristics and the ability of an attached sign to remain functional after vehicular impacts.

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August 7, 1969
M & R No. 39675

Mr. John L. Beaton
Materials and Research Engineer
California Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is a report on:

EVALUATION TESTS OF

"DEFIANT SELF RECTIFYING SAFETY STEEL POST"

MANUFACTURED BY DEFIANT INTERNATIONAL, INC.

ERIC F. NORDLIN
Principal Investigator

JOHN J. FOLSOM
Co-Principal Investigator

ROGER A. PELKEY
Co-Investigator

Very truly yours,

Eric F. Nordlin

Eric F. Nordlin
Assistant Materials and Research
Engineer - Structural

69-11

I. BACKGROUND

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II. CONCLUSIONS

1. When impacted at 60 mph, the 48" Defiant safety post will remain functional although damage to the shaft can be expected that will probably require eventual replacement of the post.

2. When impact speeds drop to 30 mph, the 48" post will suffer very little damage and replacement will not be necessary.

3. When impacted at 60 mph, no significant damage is expected to be sustained by the 18" Defiant safety post.

4. Although a guide sign might remain attached to the post after impact, its effectiveness for delineation or to convey a message is very questionable. In most impacts the sign will require replacement.

5. Vehicle damage from an impact into either the 18" high or the 48" high posts can be expected to be very minimal even at speeds up to 60 mph.

III. DESCRIPTION

Two models of the Defiant Safety Post were tested. They were identically constructed differing only in the over-all height of the post which was 18 in. and 48 in. (Figures 1 and 2). A standard 30 in. height is also available. The manufacturer also indicated they can adapt this same principle to a wide range of heights and sizes.

The functional part of this device consists of a 2-in. dia. steel pipe post secured to a semi-triangular $\frac{1}{4}$" thick steel base plate by a strong coil spring. The spring is attached to a hook welded to the base plate at one end and to a steel plug welded inside the post, approximately 12-in. up from the base plate, at the other. The principle is that when force is applied to the post the spring stretches allowing the post to lay over. When the force is removed the tensioned spring restores the post to the upright position (Figures 3 and 4).

For the present designs it is necessary to have a rigid concrete footing to attach and support the base plate.

IV. DISCUSSION

The principle of operation of the post appears quite simple yet effective to a degree. During the impact tests neither unit failed to return to the upright position. However, in the case of the 48" post, the sustained damage was sufficient so that eventual replacement would be necessary. Also, there was a slight loss of spring tension in this longer post as a result of the 60 mph impact. The manufacturer felt this loss of tension was due to displacement of an interior spring guide rather than overstressing of the spring. He felt the problem was not serious and could be easily corrected in future models.

Although the guide plates attached to the posts were destroyed by the impacts, and the reflector stripped off, the regained post and deformed guide plate did continue to present a degree of delineation, at least during daylight hours. Reflectorization of the post, itself, or attachment of protected reflex reflectors on or in the post, could possibly provide adequate nighttime delineation even after the loss of an attached sign.

Replacement of the destroyed sign would be relatively easy as would replacement of an entire unit should this be deemed necessary. The unit cost of approximately $20 will likely (not including footing or hardware) preclude the widespread utilization of this device as a replacement for the current guide markers. However, for certain problem locations where providing continuous delineation is critical, the Defiant safety post may merit consideration. From a maintenance standpoint, it would appear that sign replacement could be accomplished in a minimum amount of time with little difficulty, particularly where used as a support for a W61R horizontal reflector unit which might be located in a gore or on traffic islands.

V. INSTALLATION

The units tested were installed on the day of the test at our Lincoln airport test facility. The base was bolted down to an existing concrete footing with ½" diameter "red head" bolt studs (Figures 5 and 6). The same studs were utilized for all impact tests on both units.

Although care was taken to drill the concrete and install the "red heads" to match the base mounting holes, difficulty was encountered in the alighment and the base mounting holes required reaming to obtain proper alighment. However, larger dimensional tolerances between the holes and bolts and the use of plate washers will facilitate installation and this is not considered a serious problem. On both units ¼" diameter bolts were used for mounting the warning signs. A W60R guide plate was installed on the 48-in. post and a W61R horizontal reflector plate on the 18-in. post.

VI. PHYSICAL TESTS

The physical tests were conducted on the devices on June 27, 1969. In attendance were the following personnel: representing the manufacturer was Mr. Wm. F. Milligan, representing the Materials and Research Department were Messrs. Folsom and Pelkey.

The test vehicle was a 1961 Chevrolet hard top supplied by the manufacturer.

Test No. 1 was a 60 mph head-on impact into the 48-in. high unit. The test driver reported no significant physical and only a slight audible indication of impact. The device deflected down on impact and rebounded immediately to the upright position after passage of the vehicle over it. Although permanent damage to the post appeared to consist only of a slight final bend (approximately 6°) at the point of impact with the bumper (Figure 7), high speed film analysis showed the unit initially bent approximately 20° upon impact. The slapping of the post against the ground took much of the initial bend out. The guide plate was deformed with all three center-mount reflectors stripped off. There was no damage to the base, but the return spring did appear to lose some of its tension. Operation of the device was unaffected although a noticeable "wobble" was evident. Damage to the vehicle was very minor and consisted only of a ½" deep concave dent in the leading edge of the bumper and hood (Figure 8).

Test No. 2 was a head-on 30 mph impact into the same unit impacted in Test No. 1. The test driver reported similar physical results to the first test. However, it could be felt slightly more than the 60 mph impact. There was no significant increase in damage to either the post or the vehicle.

Test No. 3 was a 60 mph head-on impact into the 18-in. horizontal unit. Collision into this shorter unit produced a slightly more physical and audible indication of impact. This was primarily attributed to the fact that the point of impact on the vehicle was at a less rigid point on the front bumper, deforming it approximately 4-in. (Figure 9). There was no damage to the post which rebounded immediately to the upright position. There did not appear to be any loss of spring tension as observed on the 48-in. unit. The guide plate was deformed beyond repair with all three reflectors either stripped off or badly damaged (Figure 10).

Test No. 4 was a non-impact test where the vehicle wheel was driven directly onto post of the 18-in. unit, deflecting it flat against the pavement. As the wheel was driven off, the post snapped back to the upright with no apparent damage (Figure 11).

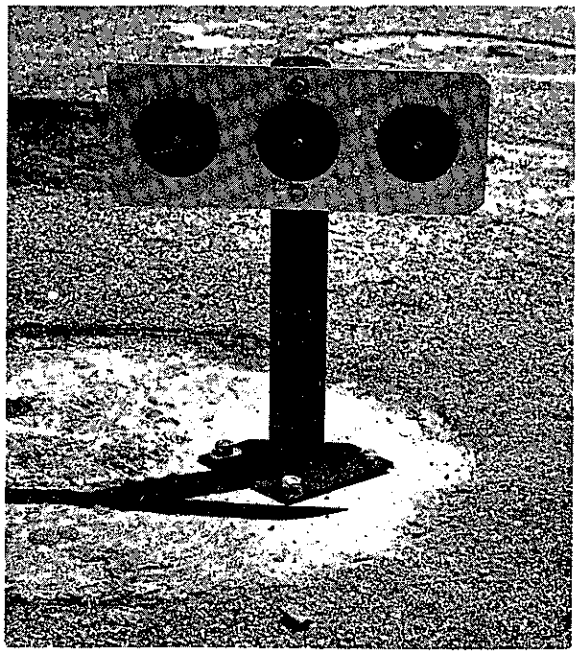

FIGURE 1

FIGURE 2

FIGURE 3

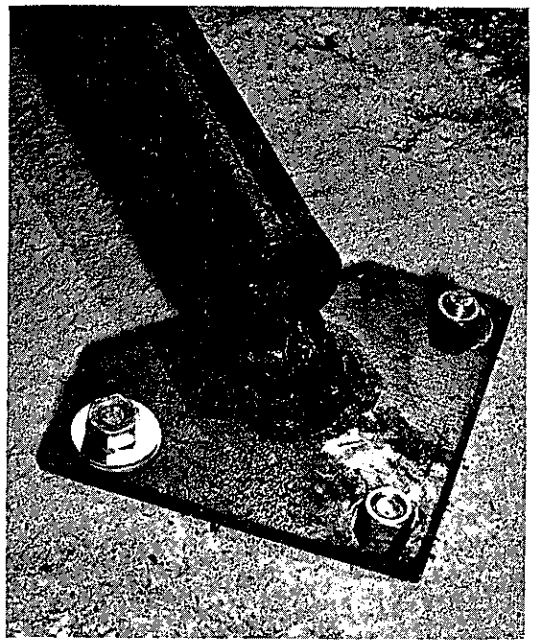

FIGURE 4

FIGURE 5

FIGURE 6

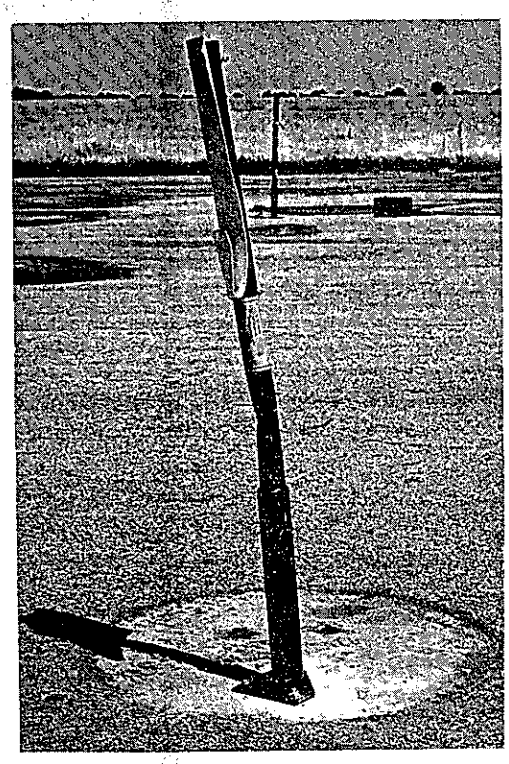

FIGURE 7

FIGURE 8

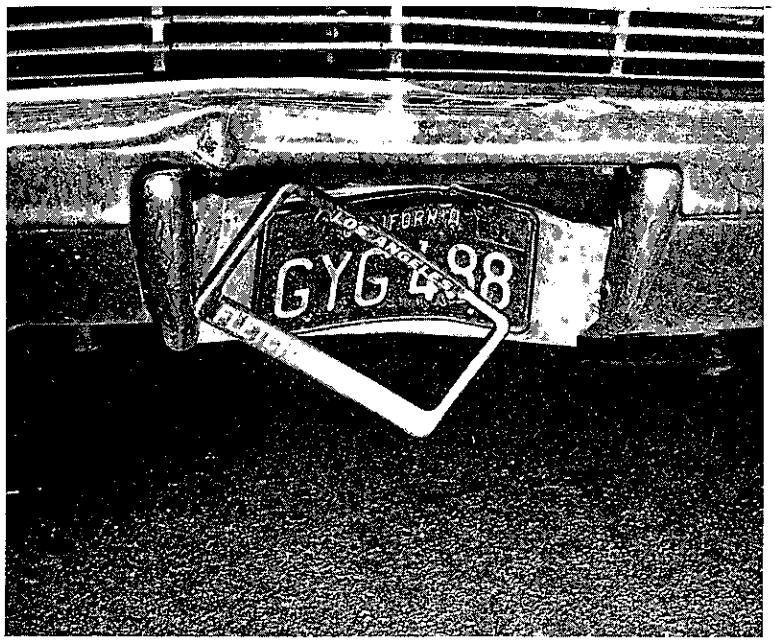

FIGURE 9

FIGURE 10

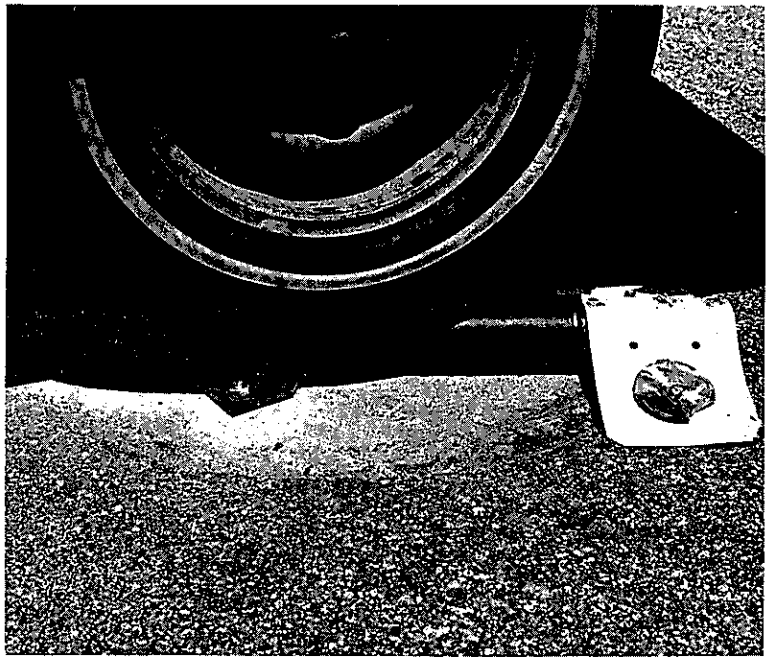

FIGURE 11