

TEST AND EVALUATION OF RURAL MAILBOX INSTALLATIONS

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SUMMARY

Six full-scale vehicular crash tests were conducted to evaluate the impact behavior of various mailbox support designs, including four mailbox installations in a row and eight mailbox installations in a row. Table 1 summarizes the results of these tests. Table 2 lists the test articles, and Figure 1 gives a schematic of the test arrangement. Figures 2 through 5 show the typical mailbox support configurations referenced in Table 1. Figures 6 through 11 show mailbox mounting details.

The first four items listed under ACCELEROMETER DATA in Table 1 pertain to performance measures as recommended by NCHRP (1). The "change in vehicle momentum" is a performance measure specified by AASHTO (2). The reader should refer to the references cited for recommended limits on these performance measures. Special provisions were made to evaluate the accelerometer data in tests 1, 2, 3, and 6 since two test articles were impacted in each of these tests. In effect, each of these tests was treated as two separate impacts, and the values shown in Table 1 are for each respective impact.

All tests were conducted at 60 mph (97 km/h). A 1975 Chevrolet Vega weighing 2335 lb (1060 kg) was used for tests 1 through 5 and a 1974 Chevrolet Vega weighing 2365 lb (1074 kg) was used for test 6. The direction of vehicle travel in all cases involving delineator or U-posts was perpendicular to the weak bending axis except for test 2 where the direction of vehicle travel was parallel to the weak bending axis. All support assemblies were embedded in soil having properties corresponding to the properties recommended for appurtenance testing (1).

Test 1 - Photos of the test articles and vehicle for test 1 are shown in Figures 12 through 18. Sequential photos from high-speed film are shown in Figure 19, and Table 3 contains time-displacement-event data. Photos of the installations and vehicle after the test are shown in Figures 20 through 24. Accelerometer data are shown in Figures 25 and 26. Both systems easily met recommended safety performance standards for highway signs (1,2). As shown, the post in test 1A fractured about 18 inches (45.7 cm) above ground. In test 1B the adapter pipe was pulled out of the V-loc anchor. It is noted that the V-loc anchor system (3) used in test 1B rotated approximately 15 degrees in the direction of vehicle travel subsequent to impact. This indicated that the projected area of the stabilizer fins on the anchor system was insufficient to provide the needed soil bearing resistance. Larger fins were used in test 3B.

It was also noted that the strength of the 1.12 lb/ft (1.7 kg/m) delineator or U-post did not appear adequate for wind loads and loads that would be imposed by normal use of the mailbox. Although no formal strength analysis was conducted the resistance of the post to lateral and twisting loads was obviously marginal at best. As a consequence of these observations, it was concluded that at a minimum a 2 lb/ft (3.0 kg/m) delineator post was needed to provide sufficient strength for a mailbox support.

Test 2 - Photos of the test articles for test 2 are shown in Figures 27 through 30. Sequential photos from high-speed film are shown in Figure 31, and time-displacement-event data are shown in Table 4. Photos of the installations and vehicle after test 2 are shown in Figures 32 through 36. Accelerometer data are shown in Figures 37 and 38. Both systems easily met recommended safety performance standards for highway signs (1,2). In test 2A the support hooked onto the car and was pulled from the ground. In test 2B the bolts in the splice sheared off, as desired, and the post separated from the base. Note that the stub used in test 2B was bent and would probably not have been reusable.

Test 3 - Photos of the test articles and vehicle for test 3 are shown in Figures 39 through 46. Sequential photos from high-speed film are shown in Figure 47, and time-displacement-event data are given in Table 5. Photos of the installations and vehicle after test 3 are shown in Figures 48 through 50. Accelerometer data are given in Figures 51 and 52. Both systems easily met recommended safety performance standards for highway signs (1,2). In test 3A the support hooked onto the car and was pulled from the ground. In test 3B the adapter pipe was pulled out of the V-loc anchor. Note the difference in the size of the stabilizer fins for test 3 versus test 1 (see Figures 3 and 39). The increased size of the fins in test 3 prevented any significant rotation and movement of the V-loc anchor.

Test 4 - Photos of the test articles for test 4 are shown in Figures 53 through 56. Sequential photos from high-speed film are shown in Figure 57, and time-displacement-event data are shown in Table 6. Photos of the installation and vehicle after the test are shown in Figures 58 and 59. Accelerometer data are given in Figures 60 and 61. Upon impact the first two posts hooked onto the car and were pulled from the ground. The other two posts were bent over as the boxes were stripped from the posts. The eccentric impact load caused the vehicle to spin about 180 degrees before it came to rest. Results of test 4 indicate that an installation of four 2 lb/ft (3.0 kg/m) U-posts is only marginally acceptable in terms of recognized performance limits (1,2).

Test 5 - Photos of the test articles and vehicle for test 5 are shown in Figures 62 through 65. Sequential photos from the high-speed film are shown in Figures 66, and time-displacement-event data are shown in Table 7. Photos of the installation and vehicle after the test are shown in Figures 67 through 69. Accelerometer data are shown in Figures 70 and 71.

Mailbox number 2 in this test was attached to the mounting bracket with four bolts rather than the usual six. This was done to determine the adequacy of a four-bolt attachment. Since box 2 did not separate from the bracket (although the bracket separated from the post during the ridedown of the post), it was concluded that four bolts are adequate.

In test 5 the first post hooked onto the car and was pulled from the ground. Posts 2 through 7 hooked but were then flattened by the advancing test vehicle. Post 8 was pulled from the ground. As a consequence of large impact forces and the hooking action of the posts, the vehicle spun sideways then rolled over three times. These results clearly show the unacceptability of an installation having eight 2 lb/ft (3.0 kg/m) full-length* U-posts. Analyses of tests 4 and 5 show that no more than four 2 lb/ft (3.0 kg/m) full-length U-posts should be placed in a row. However, this does not necessarily preclude the use of more than four U-posts in a row, provided the support system involves a breakaway mechanism. For example, the Eze-Erect system as evaluated in test 2B may be acceptable for installations having four or more supports. The adequacy of such installations can best be determined from additional crash tests.

*By full-length it is meant that the post has no splices and is driven into the ground in one piece.

Test 6 - Photos of the test articles and vehicle for test 6 are shown in Figures 72 through 76. Sequential photos from the high-speed film are shown in Figure 77, and time-displacement-event data are shown in Table 8. Photos of the installations and the vehicle after test 6 are shown in Figures 78 through 81. Accelerometer data are shown in Figures 82 and 83.

In test 6A the 4 lb/ft (6.0 kg/m) U-post was pushed over by the impacting car. After impact the box separated from the post. However, it attained a velocity approximately equal to that of the car at separation and therefore did not impact the windshield. Changes in vehicle velocity and momentum were well below the recommended limits (1,2).

In test 6B, the wooden post fractured upon impact and the mailbox separated from the post. The windshield of the vehicle then impacted the almost stationary mailbox. The box shattered and almost penetrated the windshield. The concrete pedestal at the base of the post rolled under the car at impact and fractured into several chunks, damaging the vehicle's control arms and a tie rod. Changes in vehicle velocity and momentum were well below the recommended limits (1,2).

CONCLUSIONS

1. A 1.12 lb/ft (1.7 kg/m) full-length¹ delineator post (U-post) is a satisfactory mailbox support from a safety standpoint. However, it does not appear structurally adequate for wind loads and loads imposed during normal use of the mailbox.
2. A 2 lb/ft (3.0 kg/m) delineator post (U-post) when used with an adapter and V-loc anchor system can safely support a No. 2 size single mailbox or two No. 1 size mailboxes. Care should be taken to select an appropriate V-loc anchor that will provide sufficient soil bearing capabilities. Suppliers of the V-loc system should be consulted for recommended sizes.
3. A 2 lb/ft (3.0 kg/m) full-length¹ delineator post (U-post) can safely support a No. 2 size single mailbox or two No. 1 size mailboxes.
4. A 2-1/2 lb/ft (3.7 kg/m) Eze-Erect² sign support system can safely support a No. 2 size mailbox.
5. A 4 lb/ft (6 kg/m) full-length¹ rail steel U-post can safely support a No. 1-1/2 size mailbox.
6. No more than four 2 lb/ft (3 kg/m) full-length delineator posts (U-posts) should be used in a row for mailbox supports.
7. A mailbox support consisting of a 4 in. by 4 in. (10.2 cm by 10.2 cm) wood post with a concrete pedestal for a base exhibited undesirable impact characteristics, and its use should be discouraged.
8. Care must be taken to insure proper attachment of the mailbox to the support post. Details of satisfactory attachments are presented for both one and two mailbox installations.

¹Full-length means the post has no splices and is driven into the soil in one piece.

²Eze-Erect sign supports are manufactured by Franklin Steel Co. (4).

TABLE 1. SUMMARY OF TEST RESULTS

TEST NO.	1A	1B	2A	2B	3A	3B	4	5	6A	6B
VEHICLE DATA Weight (1b) Impact Speed (mph)	2335 60.88	59.45	2335 60.16	57.38	2335 59.52	2335 56.86	2335 60.71	2335 59.54	2365 59.65	56.87
TEST ARTICLE DATA No. Posts No. Boxes Box Size No.	1 1 1	1 1 1	1 1 2	1 1 2	1 2 1	1 2 1	4 4 2 ea 1 2 ea 1 1/2	8 8 4 ea 1 4 ea 1 1/2	1 1 1 1/2	1 1 1 1/2
Figure Showing Support and Mounting Details	2,7	3,7	2,9	4,9	2,10	3,10	2,7,8	2,7,8	4,8	5
ACCELEROMETER DATA Impulse Period Subsequent to Vehicle Impact (sec) Change in Vehicle Velocity during Impulse Period (mph) Occupant/Compartment Impact Velocity (ft/sec) Maximum 10 msec Avg Vehicle Deceleration Subsequent to Occupant/Compartment Impact (g's) Change in Vehicle Momentum during Impulse Period (1b-sec)	0.115	0.150	0.124	0.151	0.119	0.120	0.275	0.250	0.114	0.114
	1.43b	0.81b	2.78b	1.20b	2.66b	1.27b	9.55c	19.33b	2.78b	2.53b
	2.10b	1.19b	4.08b	1.76b	3.90b	1.86b	14.01c	28.35b	4.08b	3.71b
	-----N	e	g	l	i	g	i	b		
	152b	86b	296b	128b	283b	135b	1016c	2056b	300b	272b
VEHICLE DAMAGE CLASSIFICATION TAD SAE Passenger Compartment Penetrated? Windshield Broken? Vehicle Remain Upright?	FC-0 12FDMN0 No No Yes	FC-0 12FDMN1 No No Yes	FC-0 12FDMN0 No No Yes	FC-0 12FDMN1 No No Yes	FC-0 12FDMN0 No No Yes	FC-0 12FDMN1 No No Yes	FC-0 12FDMN1 No No Yes	L&T-6 12XDA04 No Yes No	FC-0 12FDGN1 No No Yes	No No Yes

a period during which there are measurable decelerations.

b left accelerometer output only.

c coverage of left and right accelerometer output.

TABLE 2. TEST MATRIX.

TEST NO.	POST SIZE & TYPE ¹	NO. POSTS	NO. MAIL-BOXES	MAILBOX SIZE ²
1	A 1.12 lb/ft Delineator	1	1	No. 1
	B 2 lb/ft Delineator (with V-loc Socket) ³	1	1	No. 1
2	A 2 lb/ft Delineator	1	1	No. 2
	B 2-1/2 lb/ft Franklin Steel (Eze-Erect) ⁴	1	1	No. 2
3	A 2 lb/ft Delineator	1	2	No. 1
	B 2 lb/ft Delineator (with V-loc Socket) ³	1	2	No. 1
4	2 lb/ft Delineator	4	4	2 ea No. 1 2 ea No. 1-1/2
5	2 lb/ft Delineator	8	8	4 ea No. 1 4 ea No. 1-1/2
6	A 4 lb/ft Franklin Steel ⁴	1	1	No. 1-1/2
	B 4 in. x 4 in. Wood (Precast Concrete Base)	1	1	No. 1-1/2

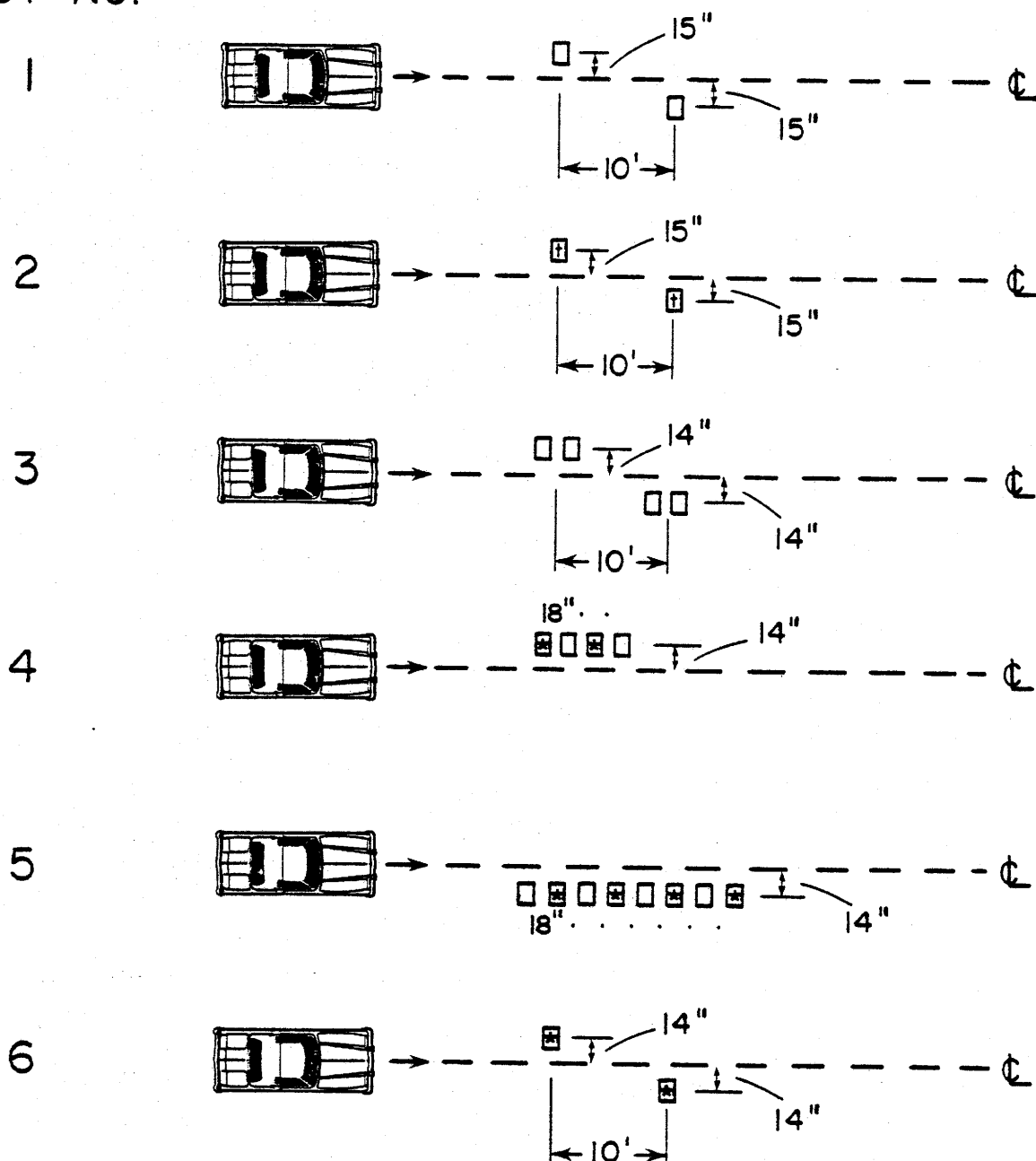
¹All posts are driven 2 ft into the ground unless a special embedment method is noted in parentheses.

²See reference 5 for description of mailbox sizes.

³Manufactured by reference 3.

⁴Manufactured by reference 4.

TEST NO.



† MAILBOX SIZE NO. 2

* MAILBOX SIZE NO. 1 1/2

ORIENTATION OF DELINEATOR POSTS FOR ALL TESTS

EXCEPT TEST 2: → }

FOR TEST 2: → ^

Figure 1. Test Layout.

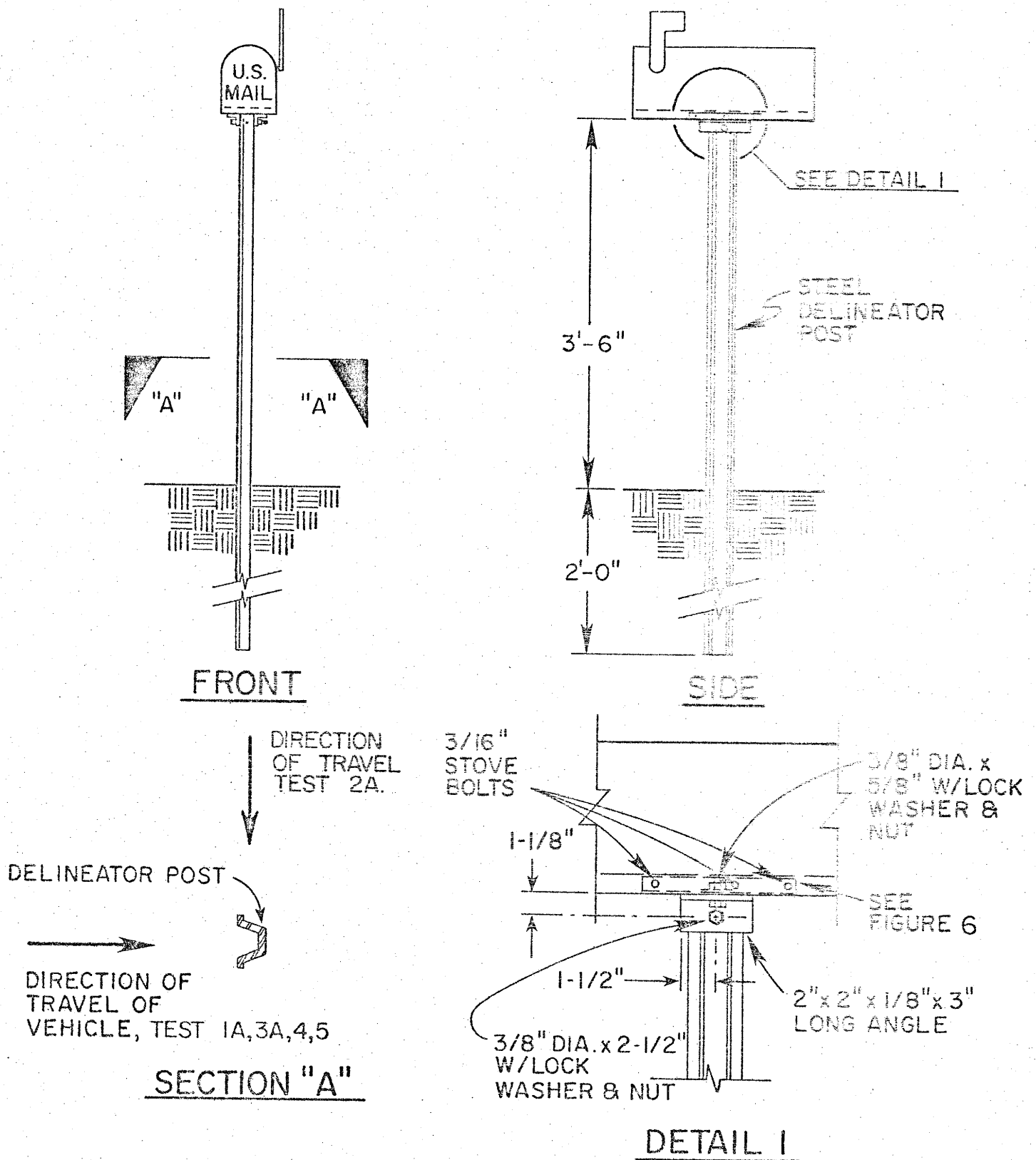


Figure 2. Mailbox Support Configuration Type A.

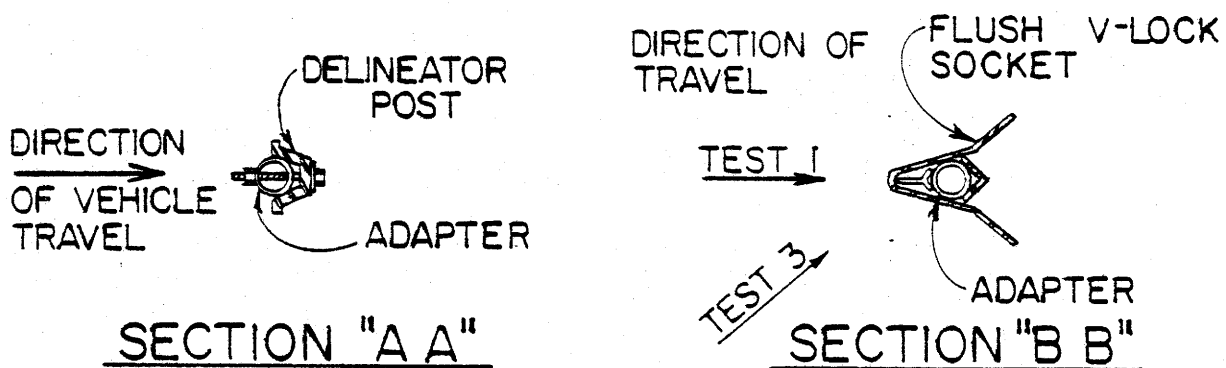
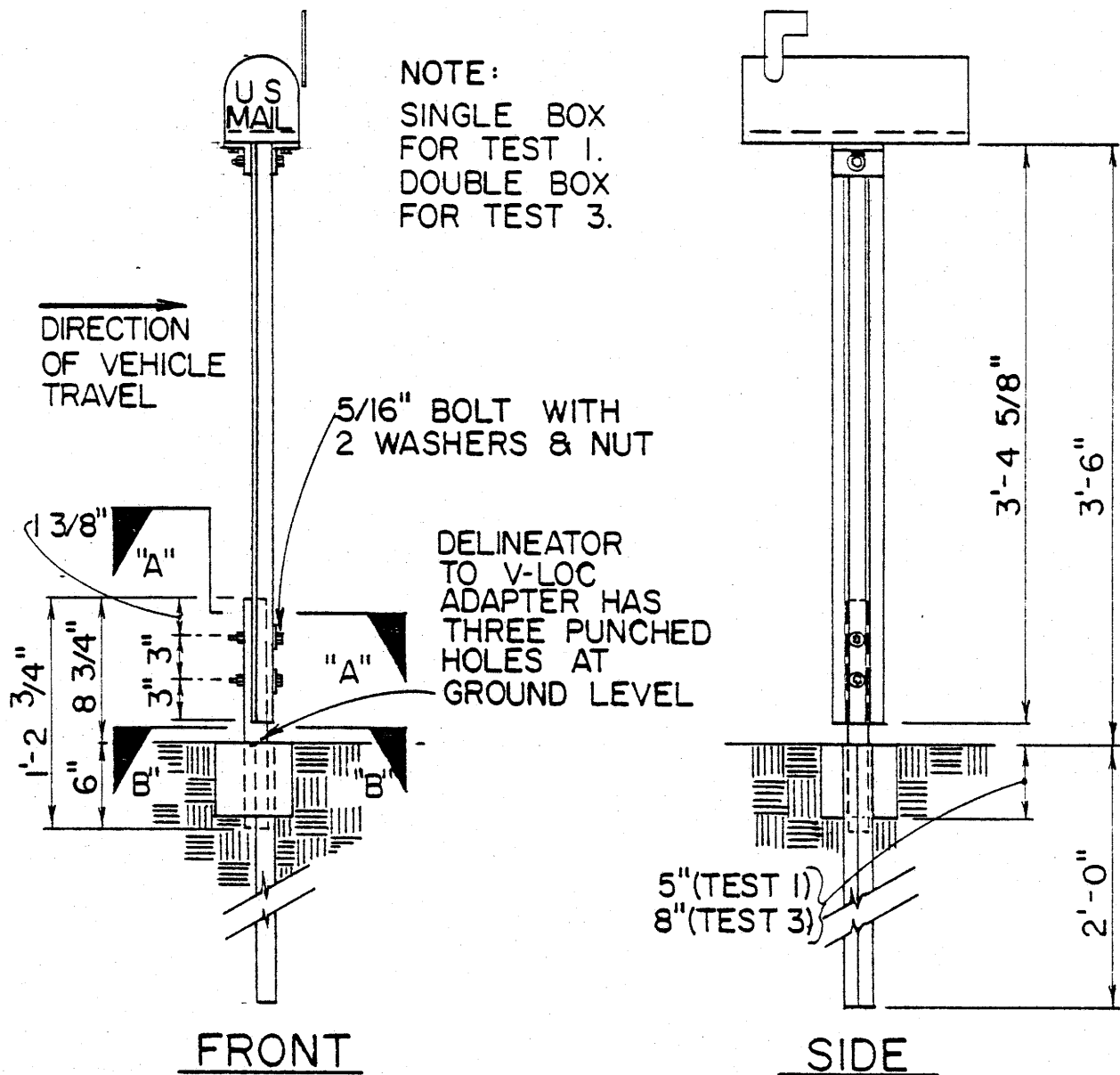


Figure 3. Mailbox Support Configuration Type B.

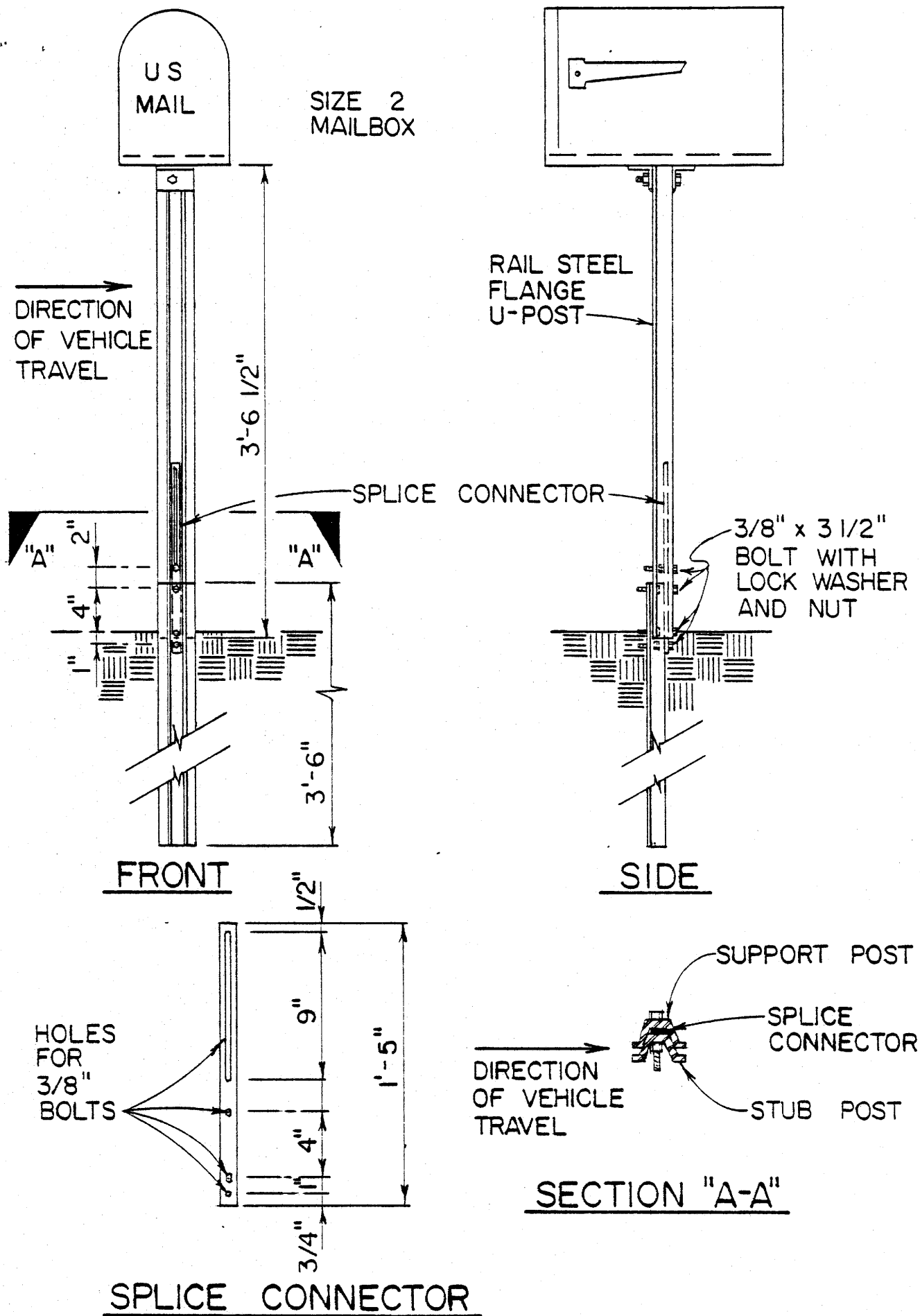
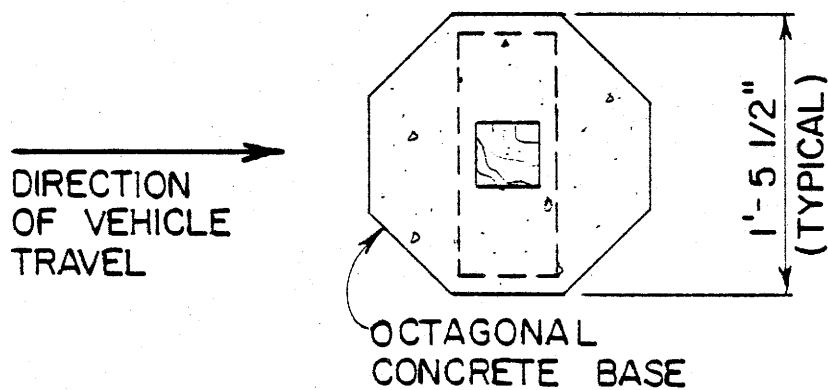
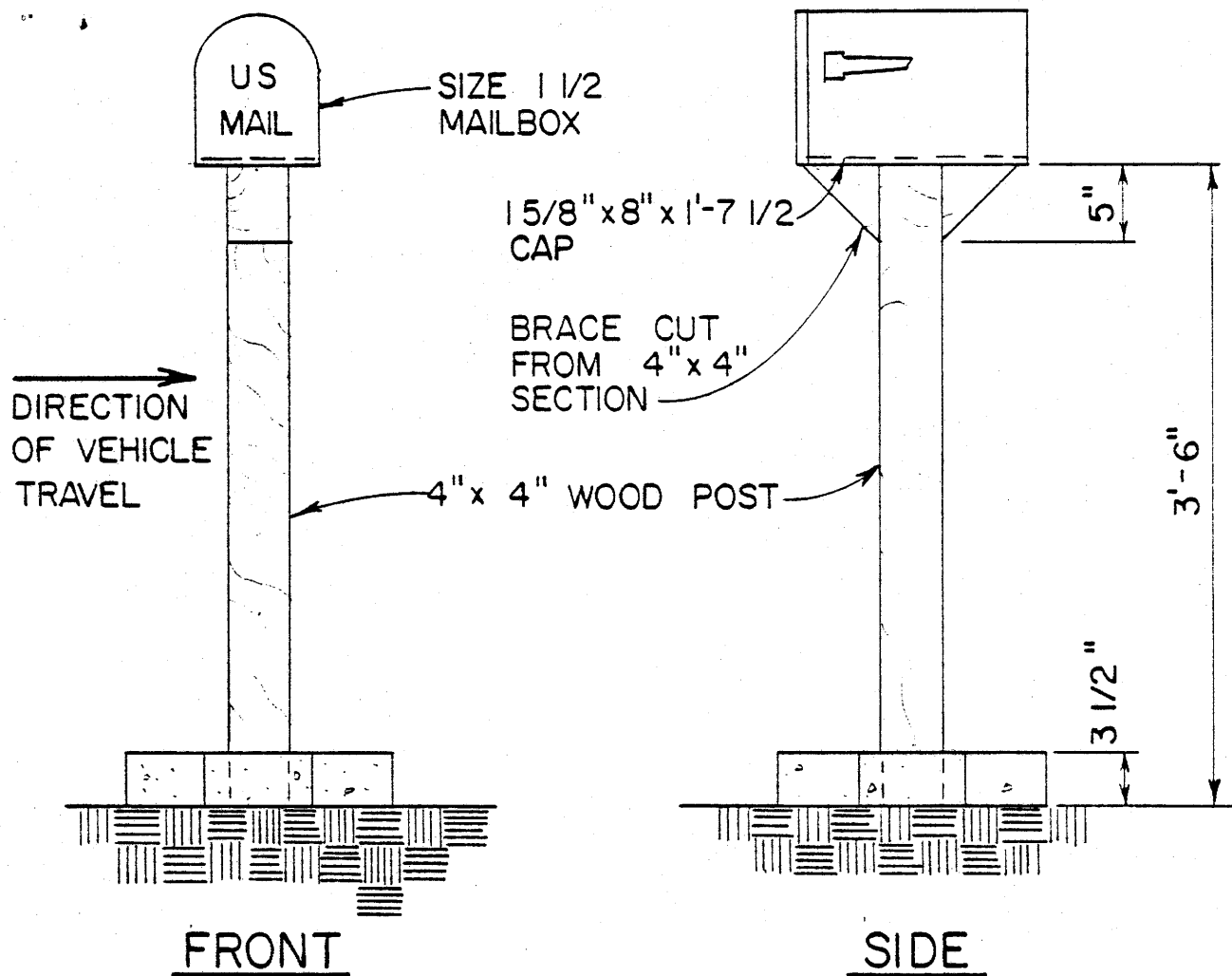


Figure 4 . Mailbox Support Configuration Type C.



PLAN

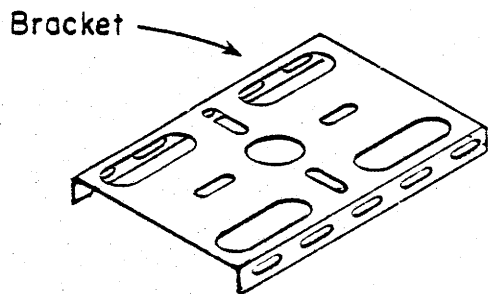
FASTENERS

CAP TO POST	3 EACH	16d NAILS
BRACE TO CAP	4 EACH	8d NAILS
MAILBOX TO CAP	6 EACH	1 1/2" COMPOSITION ROOFING NAILS

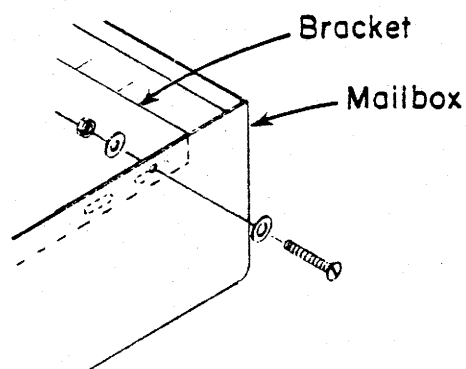
Figure 5. Mailbox Support Configuration Type D.



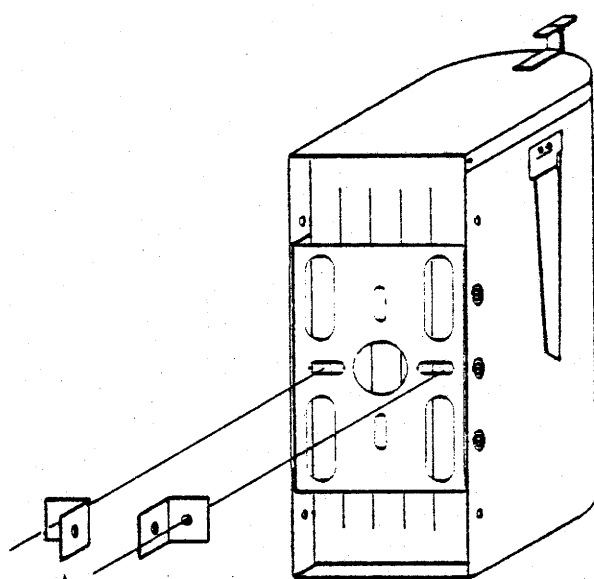
17



For bracket details
see Figure 6.



Bracket to mailbox fastener :
3/16" dia. x 3/4" screw ;
2 washers and 1 nut for each screw

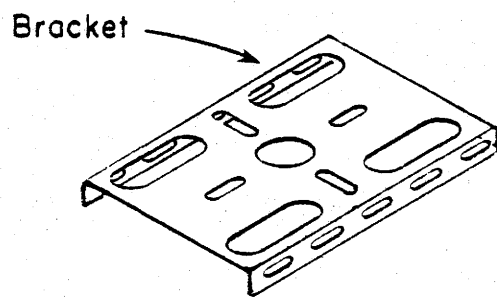


For angle details
see Figure 11.

Angle to bracket fastener :
3/8" dia. x 5/8" bolt with
lock washer and nut

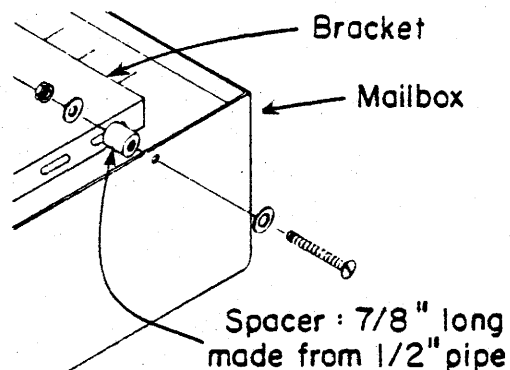
Angle to delineator fastener :
3/8" dia. x 2-1/2" bolt and nut

Figure 7. Mailbox Mount for Size No. 1 Mailbox.



Bracket

For bracket details
see Figure 6.

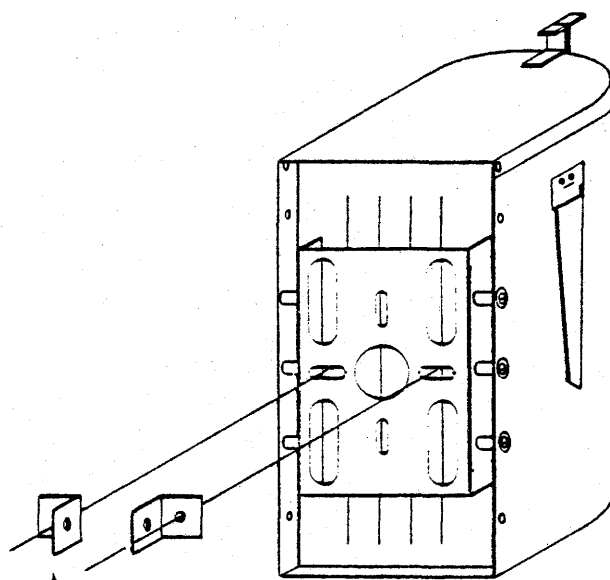


Bracket

Mailbox

Spacer : 7/8" long
made from 1/2" pipe

Bracket to mailbox fastener :
1/4" dia. x 2" screw with
2 washers and 1 nut for each screw

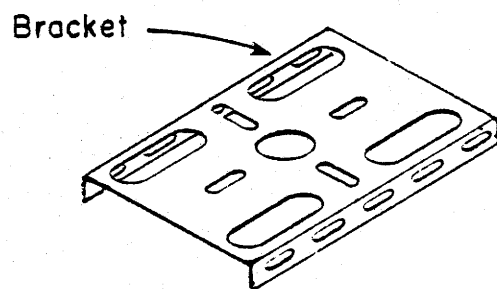


Angle to bracket fastener :
3/8" dia. x 5/8" bolt with
lock washer and nut

Angle to delineator fastener :
3/8" dia. x 2-1/2" bolt and nut

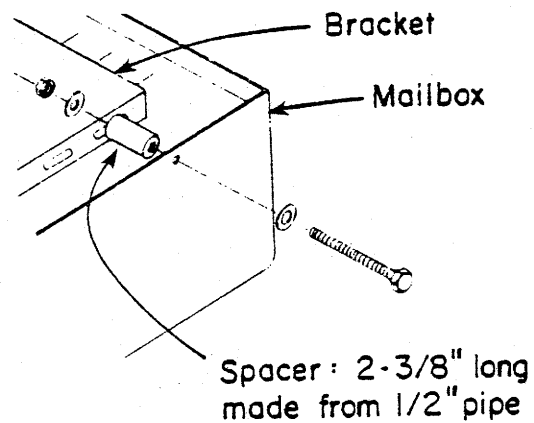
For angle details
see Figure 11.

Figure 8. Mailbox Mount for Size No. 1½ Mailbox.



Bracket

For bracket details
see Figure 6.
(Two required)

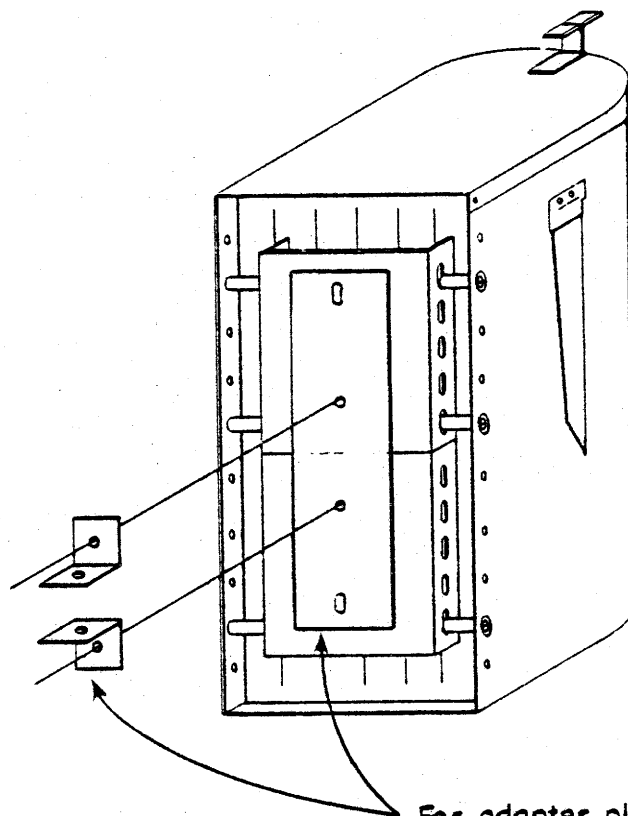


Bracket

Mailbox

Spacer : 2-3/8" long
made from 1/2" pipe

Bracket to mailbox fastener :
1/4" dia. x 3" bolt with 2 washers
and 1 nut for each bolt



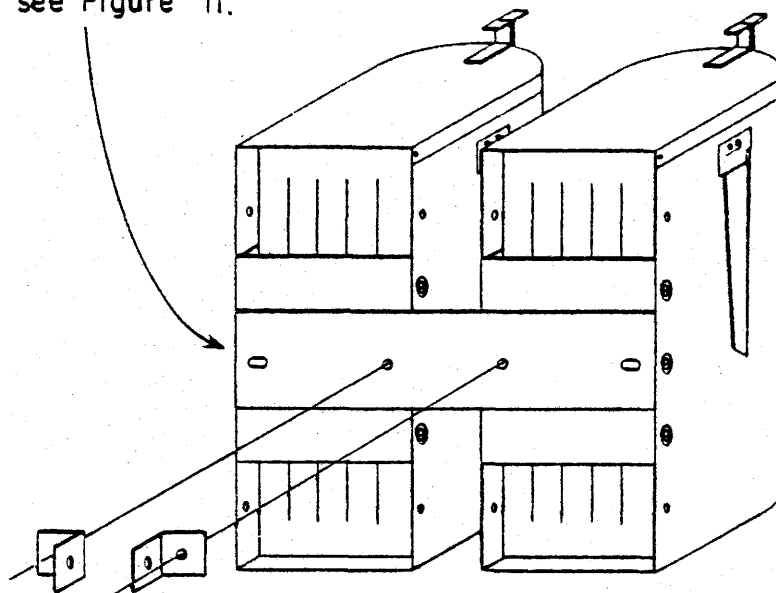
Adapter plate to bracket
fastener : 4 ea. 3/8" dia. x
5/8" bolt ; each bolt has a
lock washer and nut

For adapter plate details and angle details
see Figure 11.

Figure 9. Mailbox Mount for Size No. 2 Mailbox.

For bracket to mailbox details see Figure 6.

For adapter plate details
see Figure 11.

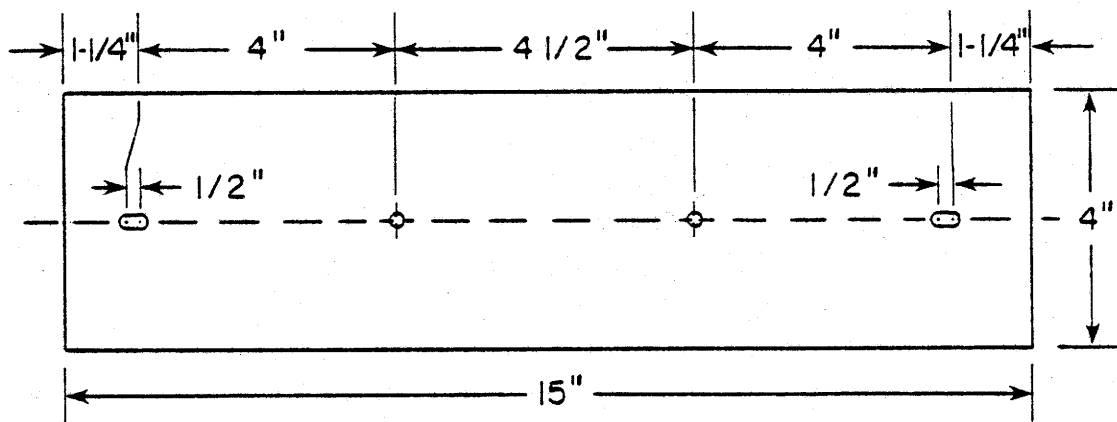
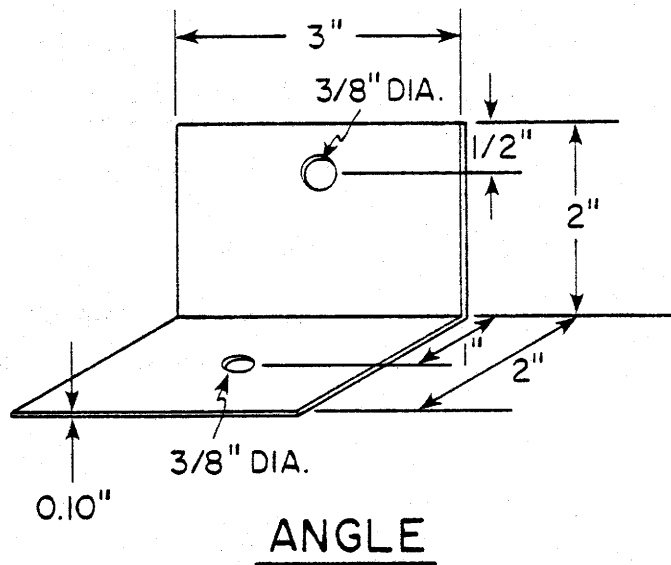


Adapter plate to
bracket fasteners:
4 ea. $\frac{3}{8}$ " dia. x $\frac{5}{8}$ "
bolt; each bolt has a
lock washer and nut

For angle details
see Figure 11.

Angle to delineator fastener:
 $\frac{3}{8}$ " dia. x $2\frac{1}{2}$ " bolt
and nut

FIGURE 10. Double Box Mount for Size No. 1 Mailbox.



HOLES ARE 3/8" DIA.
0.10" THICK (CUT FROM USED SIGN BLANK)

ADAPTER PLATE

Figure 11. Adapter Plate and Angle Details.



Figure 12. Test 1 Mailbox Installation Looking in the Direction of Vehicle Travel.

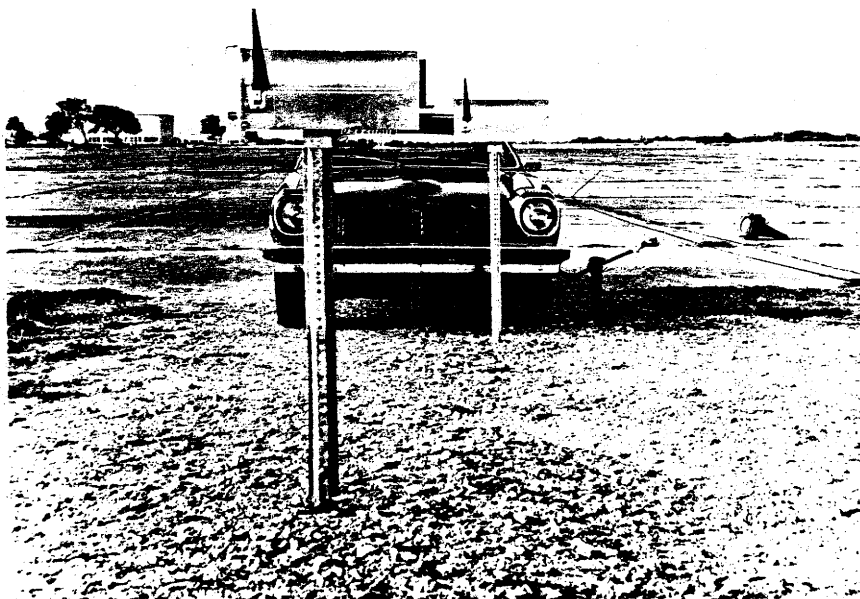


Figure 13. Test 1 Mailbox Installation Looking Opposite the Direction of Vehicle Travel.



Figure 14. Test 1A Mailbox Installation.



Figure 15. Test 1B Mailbox Installation.

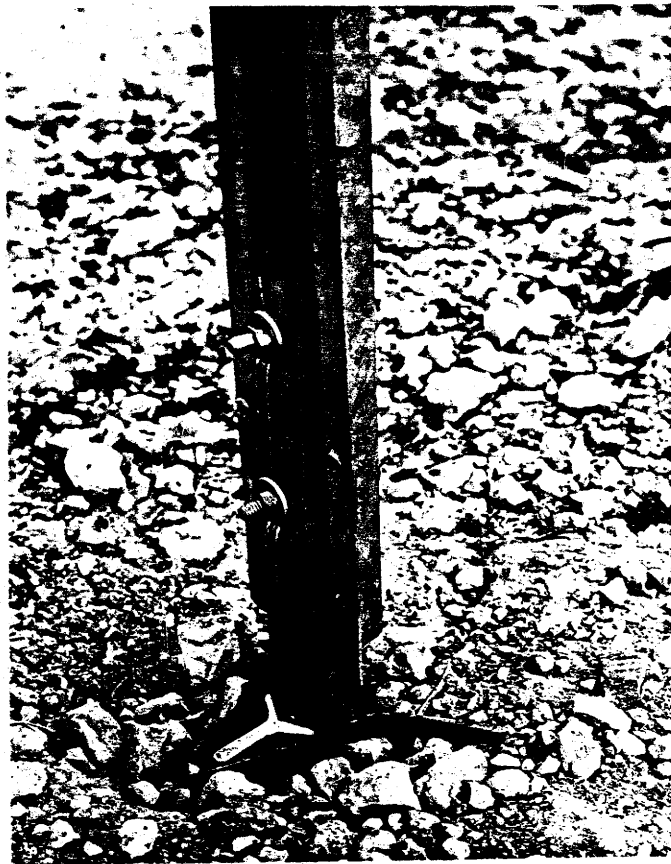


Figure 16. Test 1B Detail of V-Loc Socket Installation.

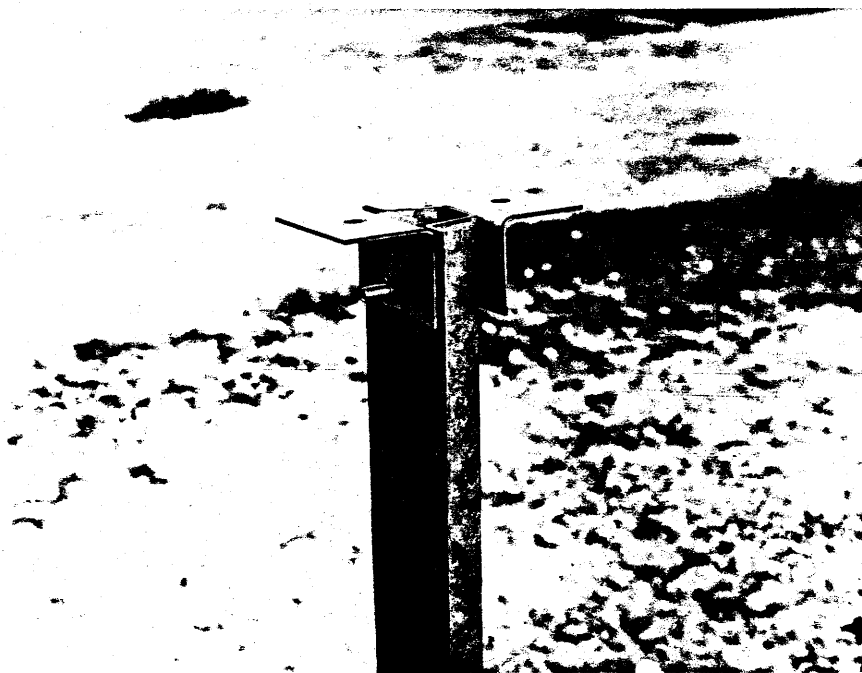


Figure 17. Typical Configuration of Angles-to-Support Connection.



Figure 18. Test 1 Vehicle Before Impact.



0.000



0.010

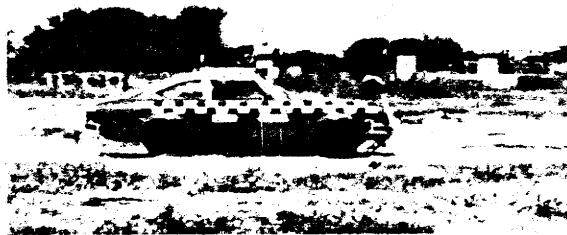


0.035

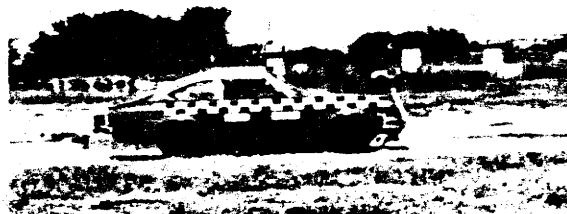


0.115

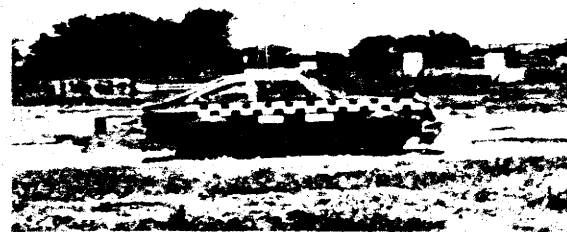
Figure 19. Sequential Photographs for Test 1.



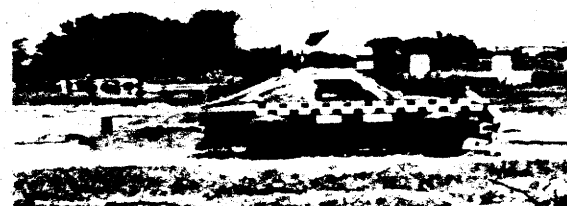
0.130



0.133



0.150



0.178

Figure 19. Sequential Photographs for Test 1 (continued).

TABLE 3. TIME-DISPLACEMENT-EVENT SUMMARY, TEST 1.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with 1A
0.010	0.88	Support for 1A breaks
0.035	3.05	1A box strikes hood
0.115	9.93	Impact with 1B
0.130	11.23	1A assembly thrown clear
0.133	11.45	1B assembly pulls out of socket
0.150	12.94	1B box strikes hood
0.178	15.30	1B assembly carried away by vehicle

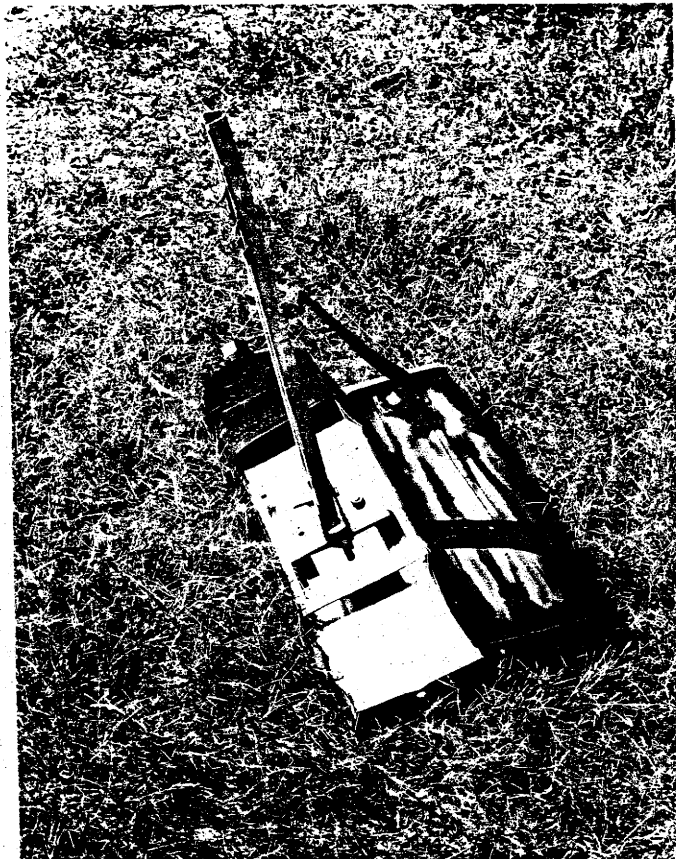


Figure 20. Test 1A Mailbox After Impact.

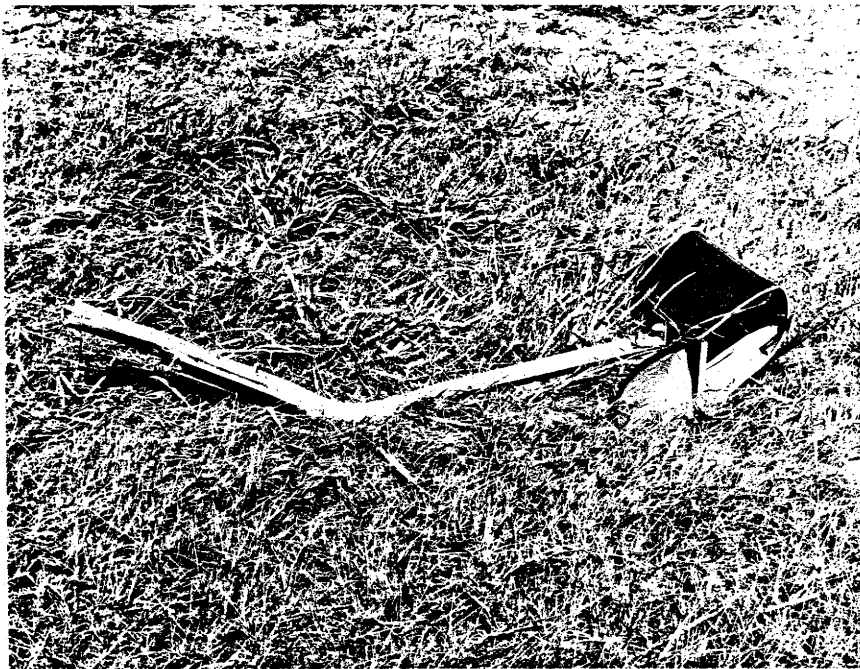


Figure 21. Test 18 Mailbox After Impact.



Figure 22. Test 1 Ground Connections After Impact
Looking Opposite the Direction of Vehicle Travel.

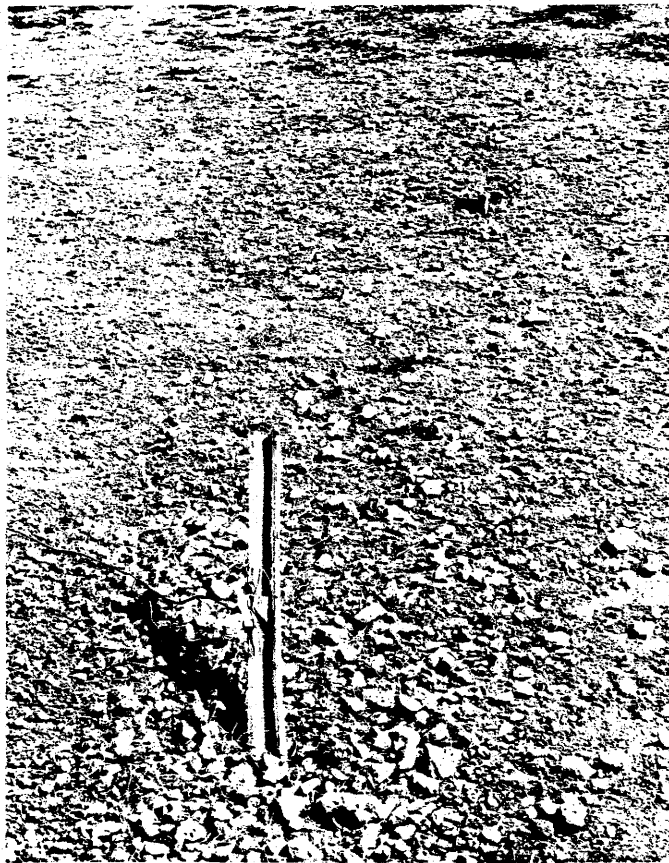


Figure 23. Test 1 Ground Connections After Impact Looking in the Direction of Vehicle Travel.



Figure 24. Test 1 Vehicle After Impact.

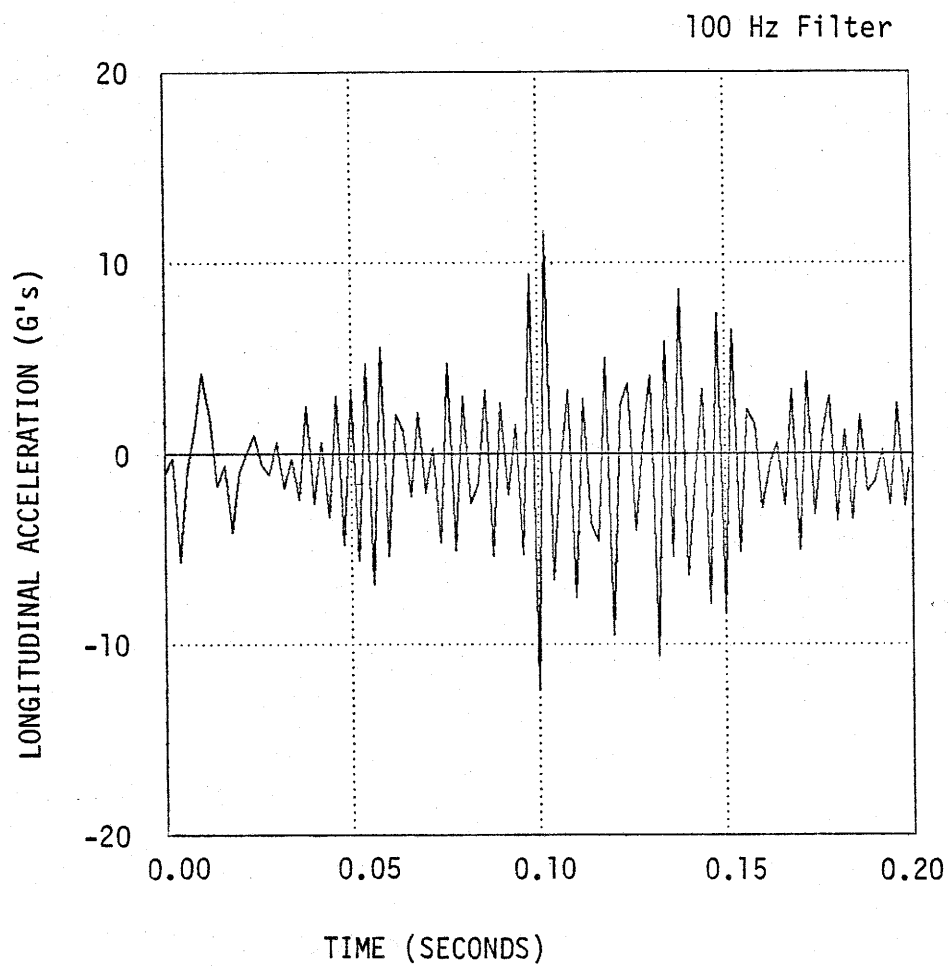


Figure 25. Longitudinal Acceleration From Vehicle's Left B-Pillar Accelerometer for Test 1.

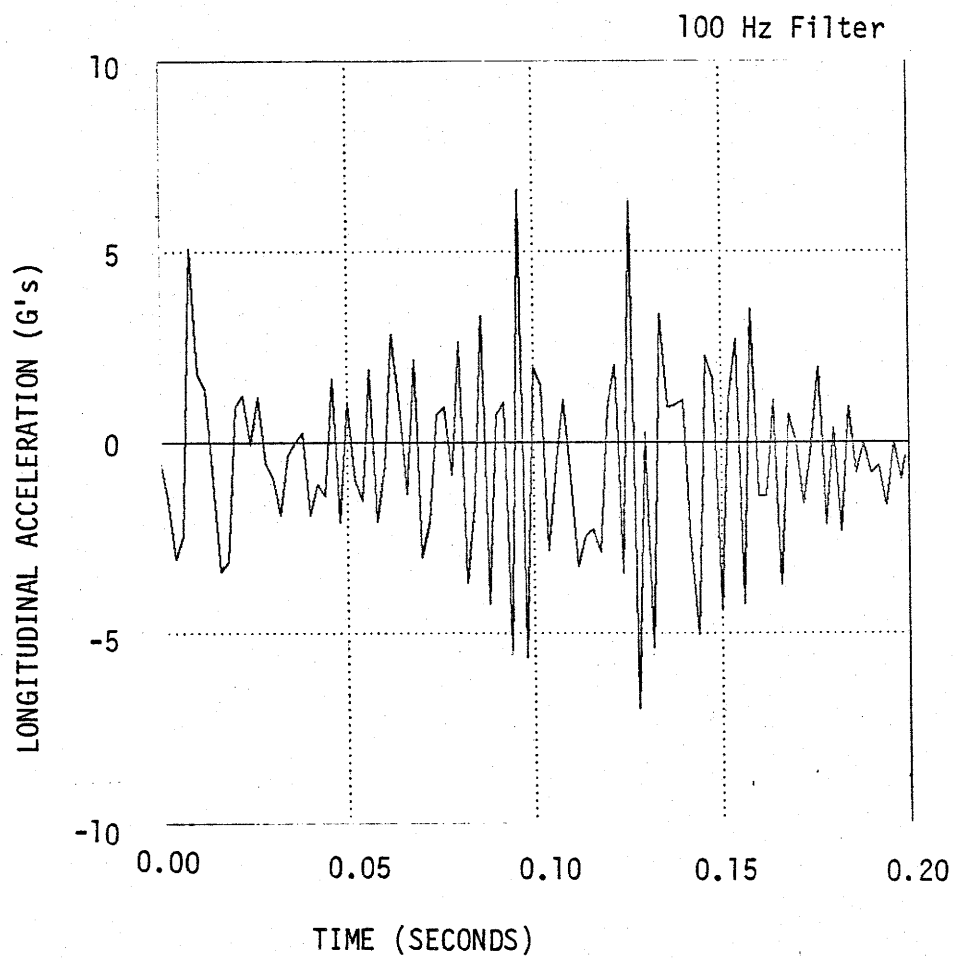


Figure 26. Longitudinal Acceleration From Vehicle's Right B-Pillar Accelerometer for Test 1.



Figure 27. Test 2 Mailbox Installation Looking in the Direction of Vehicle Travel.

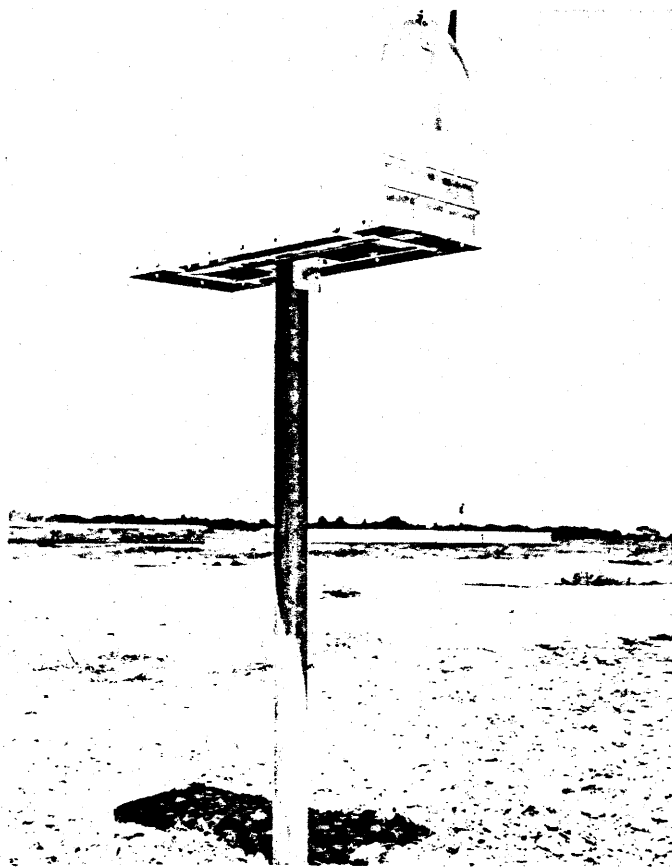


Figure 28. Test 2A Mailbox Installation.

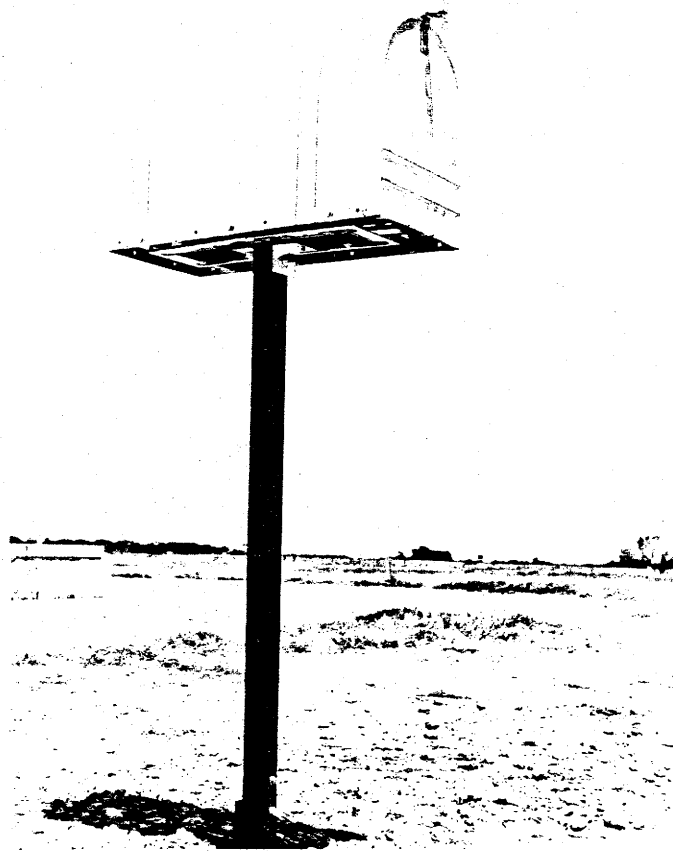


Figure 29. Test 2B Mailbox Installation.

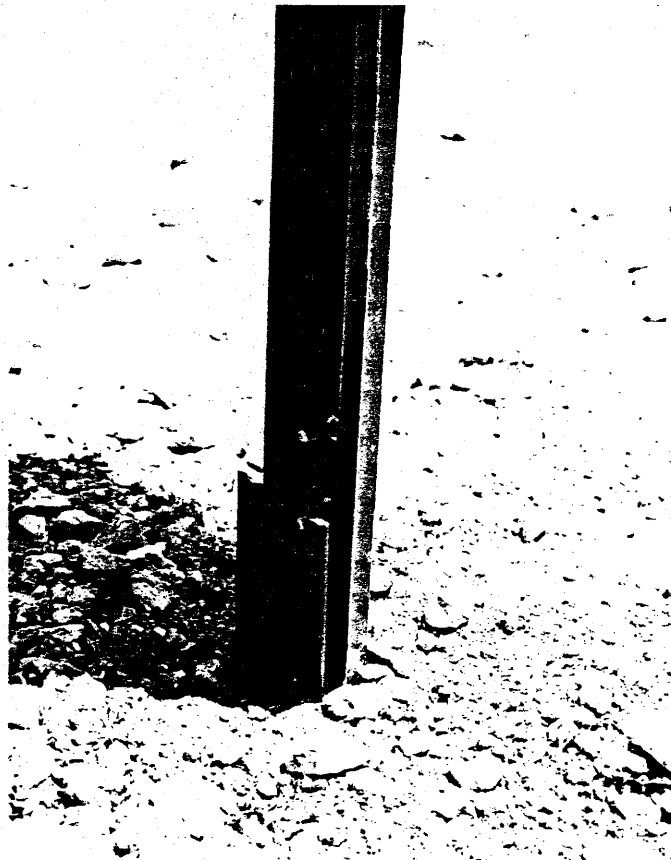
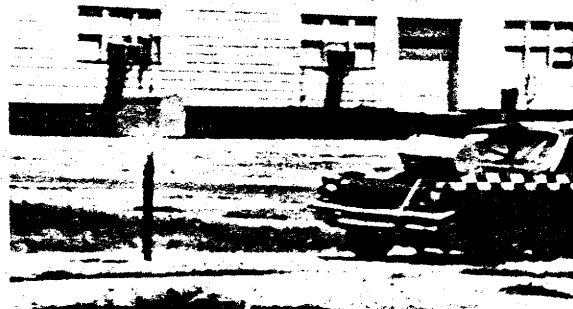


Figure 30. Test 2B Detail of Eze-Erect Installation.



0.000



0.028



0.038

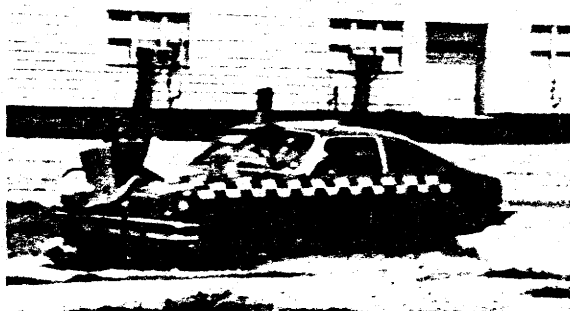


0.124

Figure 31. Sequential Photographs for Test 2.



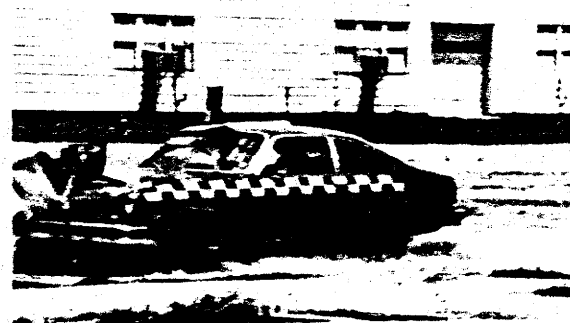
0.134



0.167



0.169



0.195

Figure 31. Sequential Photographs for Test (continued).

TABLE 4. TIME-DISPLACEMENT-EVENT SUMMARY, TEST 2.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with 2A
0.028	2.37	2A box strikes hood
0.038	3.20	2A support pulls out of ground
0.124	10.68	Impact with 2B
0.134	11.57	2B support post separates from stub-post
0.167	14.55	2B box strikes hood
0.169	14.79	2B support post leaves ground
0.195	17.16	2A & 2B assemblies carried away by vehicle

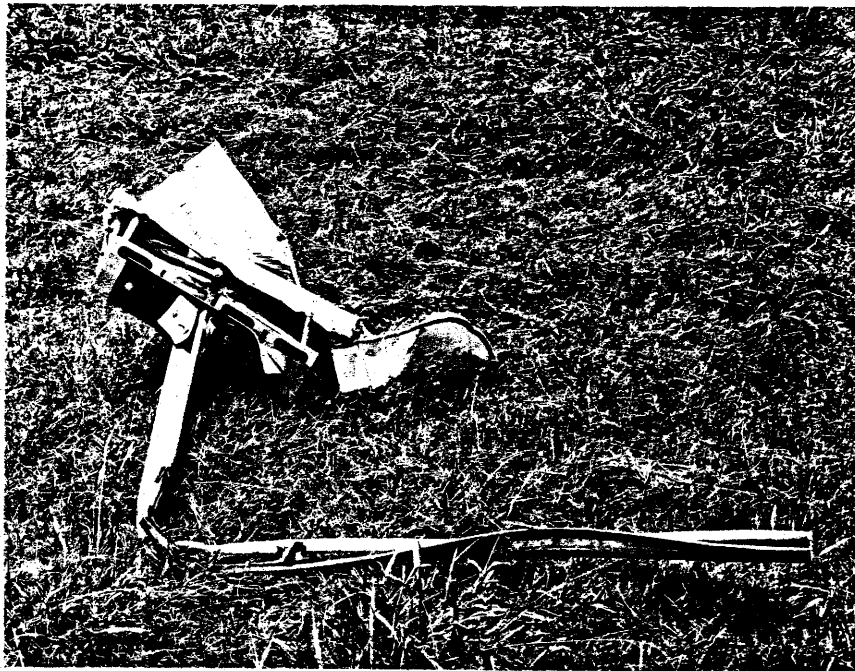


Figure 32. Test 2A Mailbox After Impact.



Figure 33. Test 2B Mailbox After Impact.



Figure 34. Test 2B Mailbox Mount Close-Up After Impact.

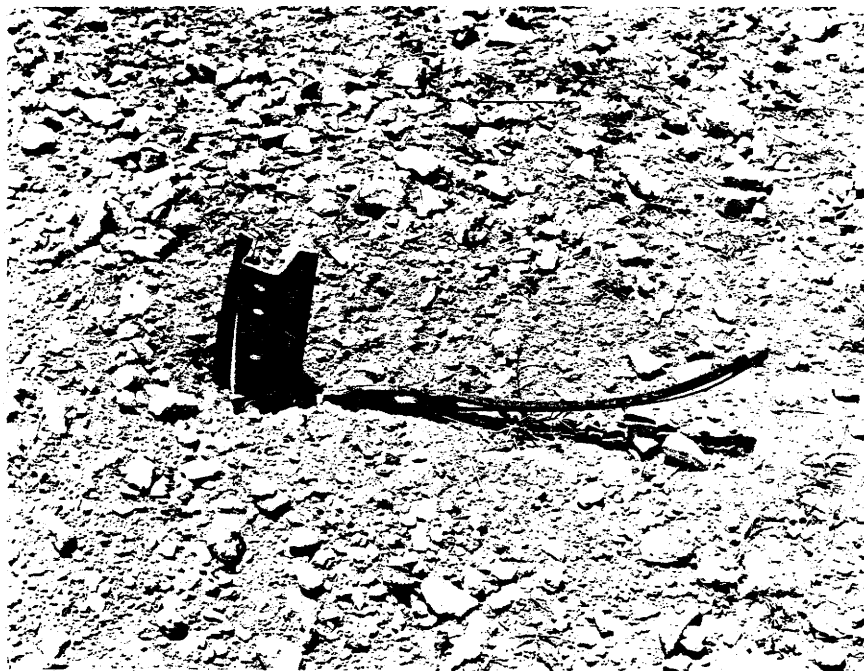


Figure 35. Test 2B Eze-Erect Ground Connection After Impact.

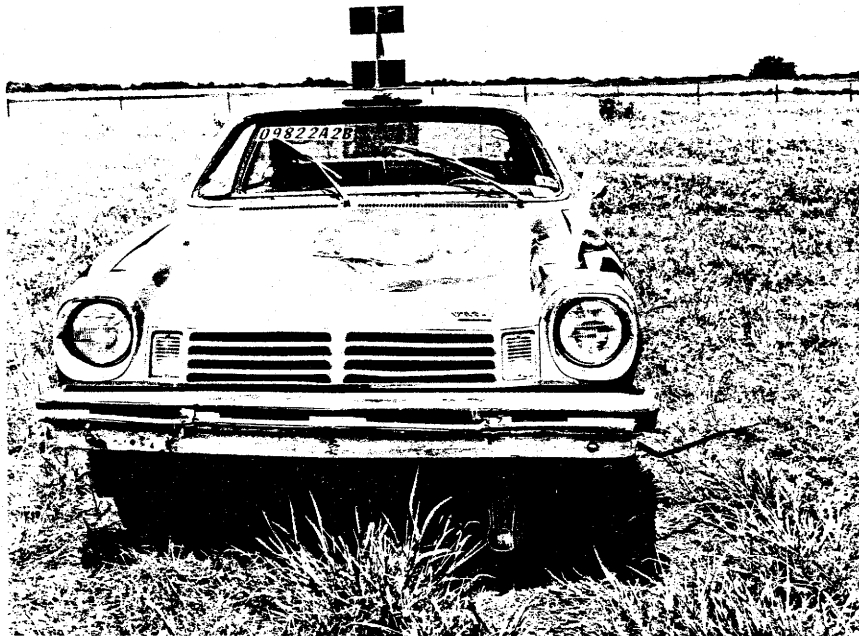


Figure 36. Test 2 Vehicle After Impact.

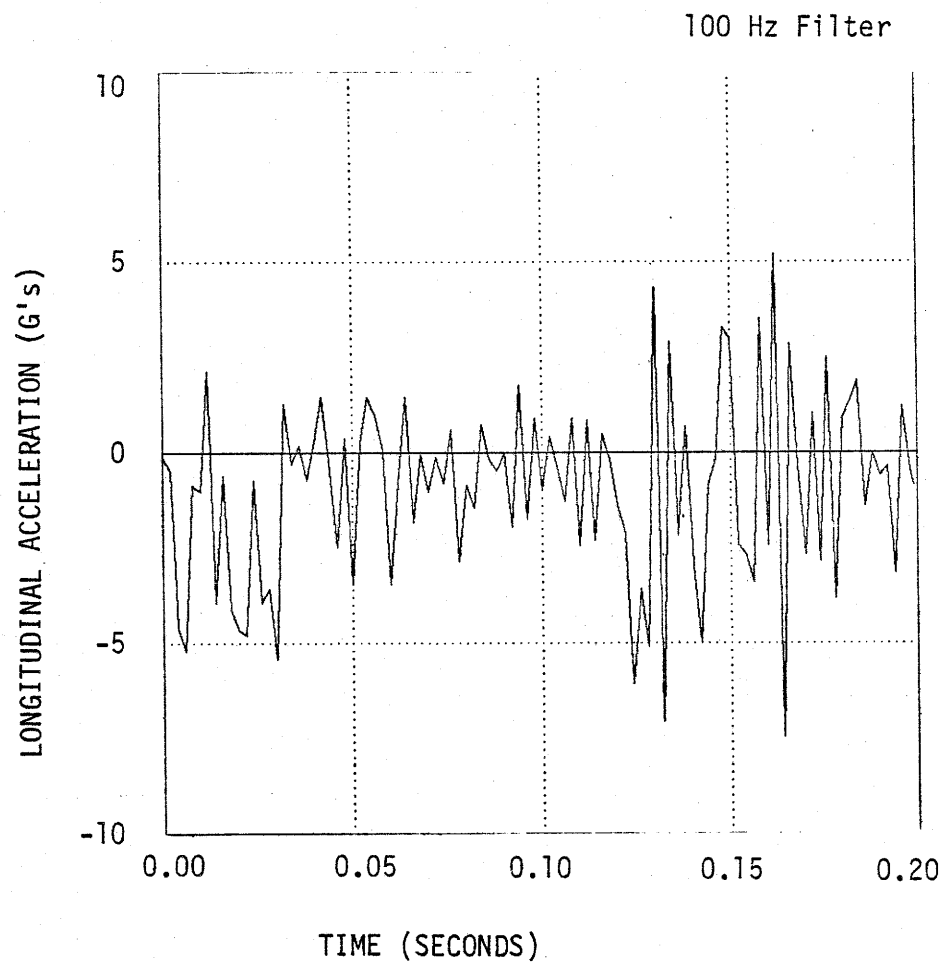


Figure 37. Longitudinal Acceleration From Vehicle's Left B-Pillar Accelerometer for Test 2.

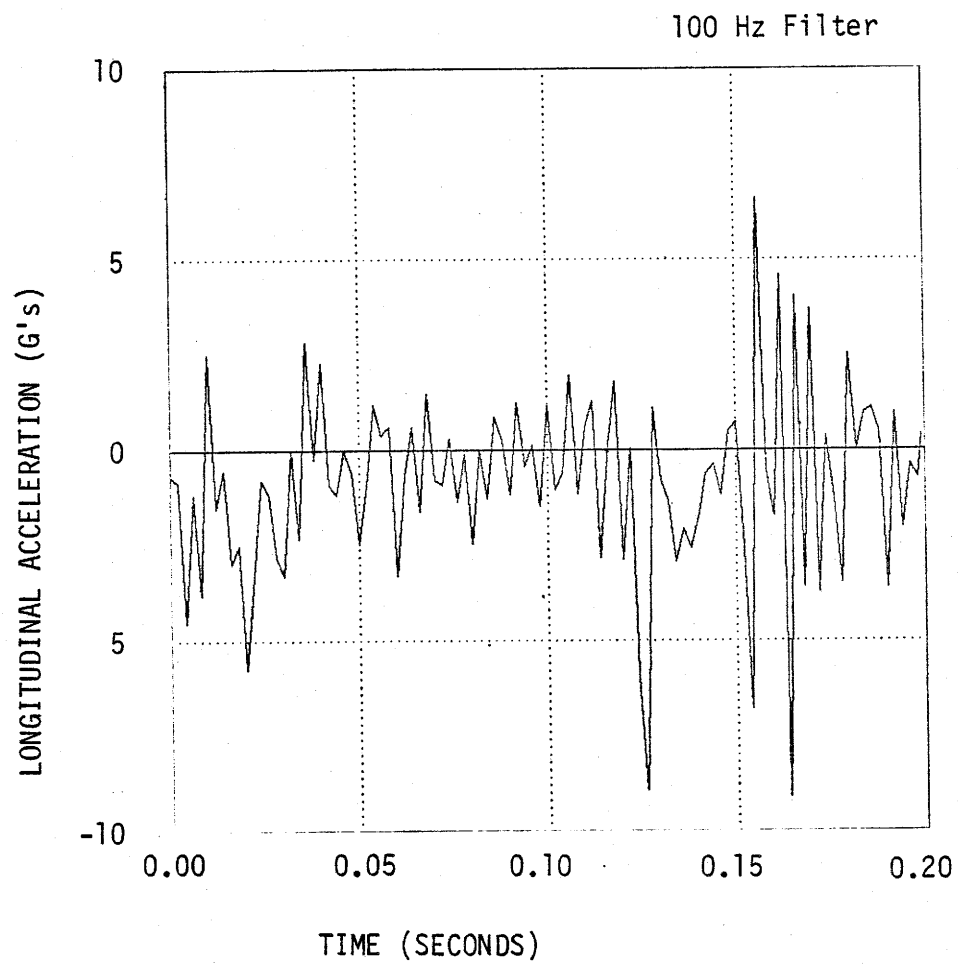


Figure 38. Longitudinal Acceleration From Vehicle's Right B-Pillar Accelerometer for Test 2.

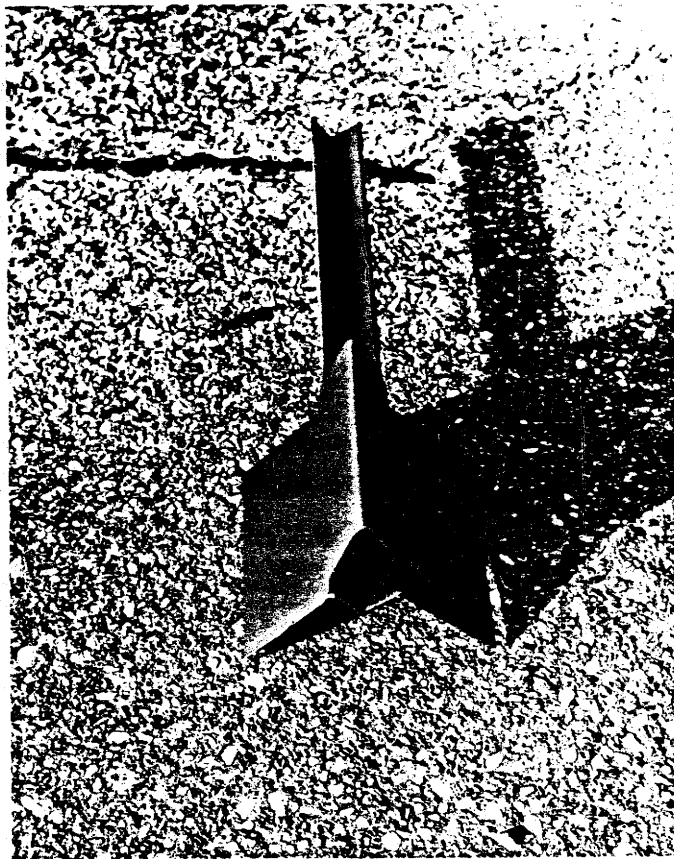


Figure 39. Modified V-Loc Socket for Test 3B.



Figure 40. Socket Installation with Pionjar Hammer for Test 3B.

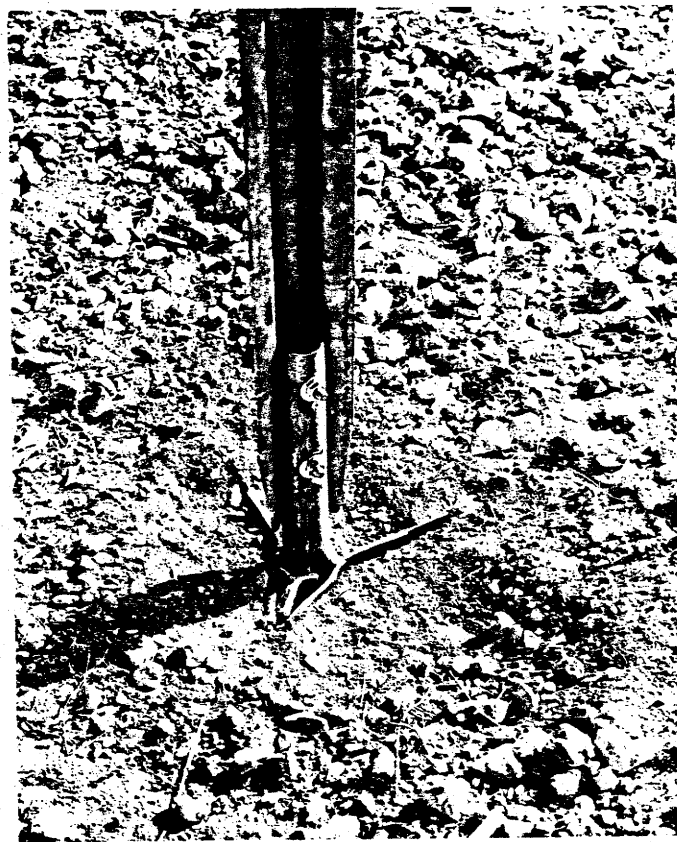
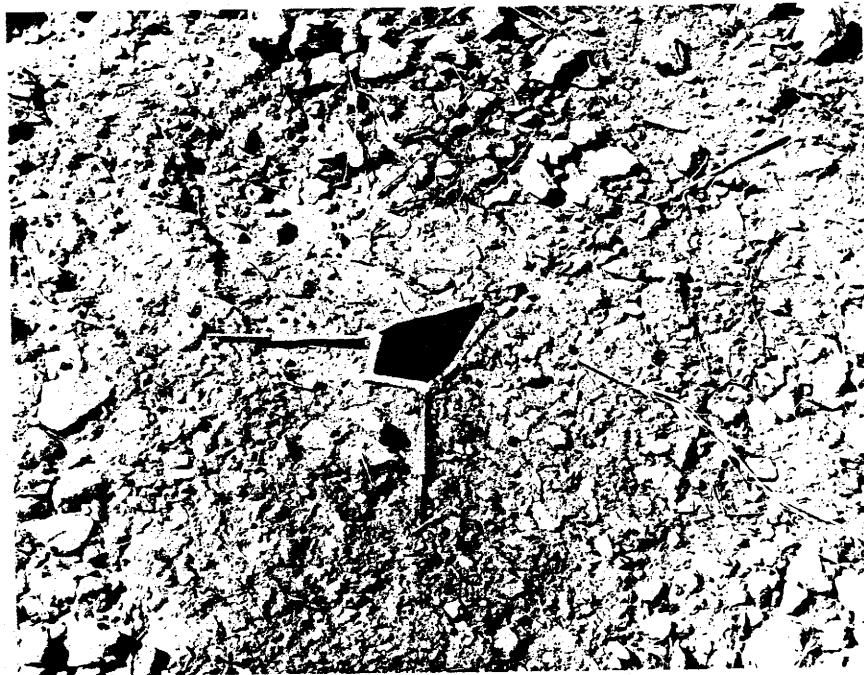


Figure 41. Support-to-Socket Connection for Test 3B.

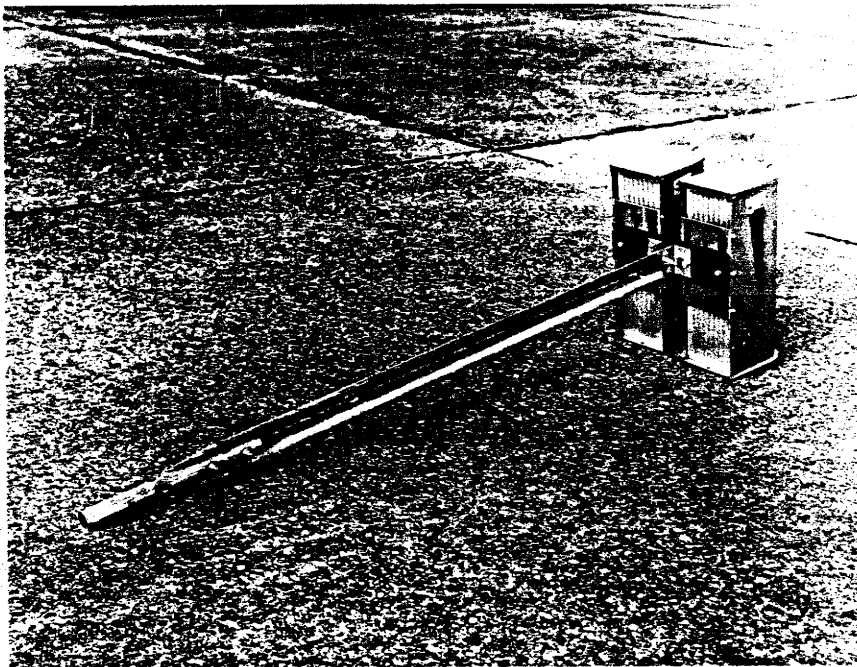


Figure 42. Test 3B Mailbox and Support Assembly Before Installation.



Figure 43. Test 3 Mailbox Installation Looking Opposite the Direction of Vehicle Travel.



Figure 44. Test 3A Mailbox Installation.

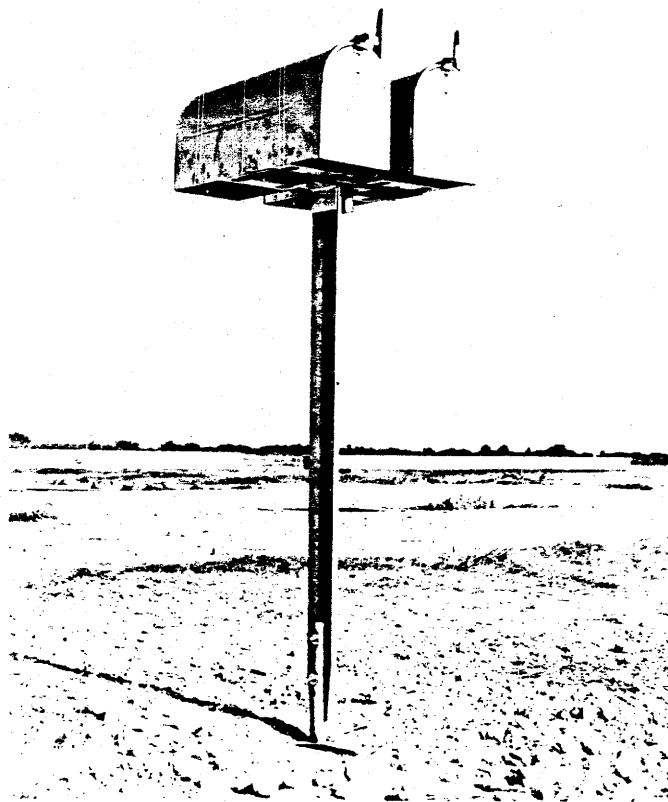


Figure 45. Test 3B Mailbox Installation.



Figure 46. Test 3 Vehicle Before Impact.



0.000



0.025



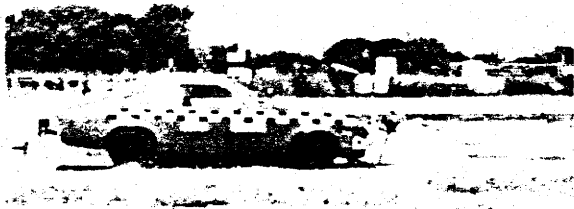
0.038



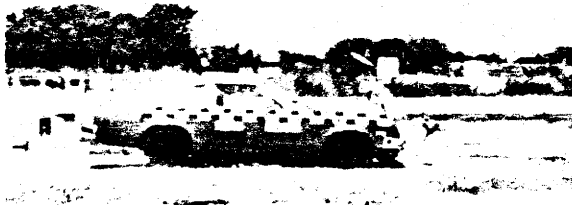
0.088



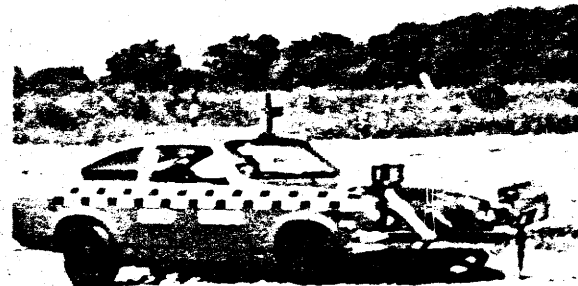
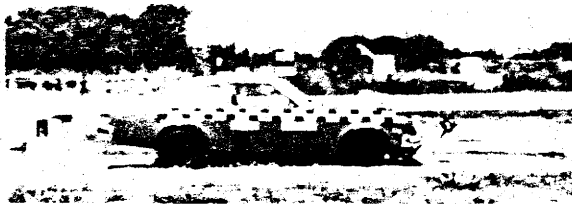
Figure 47. Sequential Photographs for Test 3.



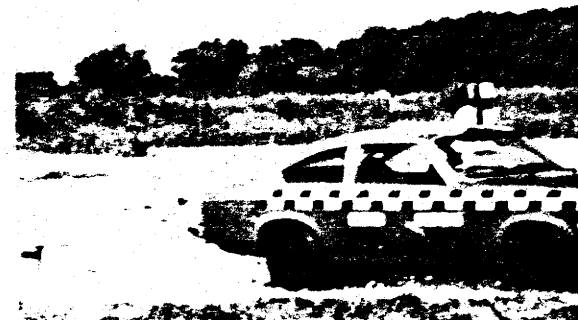
0.118



0.135



0.145



0.250

Figure 47. Sequential Photographs for Test 3 (continued).

TABLE 5. TIME-DISPLACEMENT-EVENT SUMMARY, TEST 3.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with 3A
0.025	2.09	3A boxes strikes hood
0.038	3.15	3A support pulls out of ground
0.088	7.27	3A support strikes ground
0.118	9.73	Impact with 3B
0.135	11.15	3B support pulls out of socket
0.145	11.95	3B boxes strike hood
0.250	20.50	3B thrown free of car; 3A carried away by vehicle

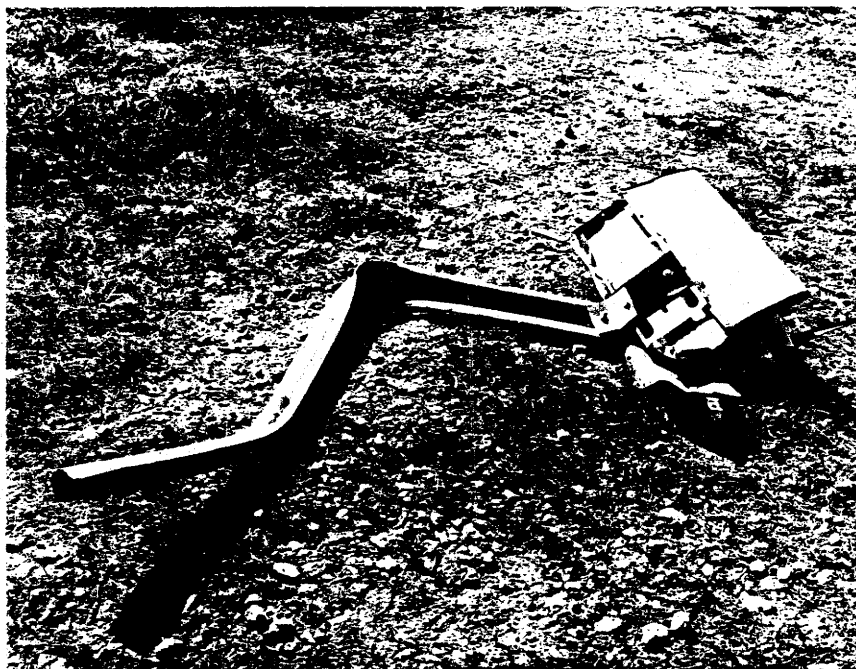


Figure 48. Test 3A Mailbox After Impact.

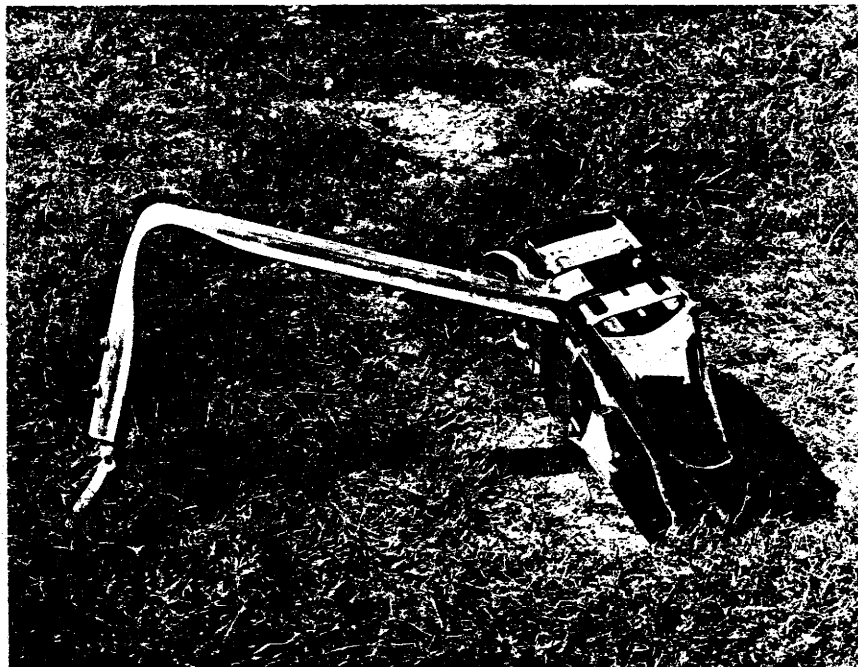


Figure 49. Test 3B Mailbox After Impact.



Figure 50. Test 3 Vehicle After Impact.

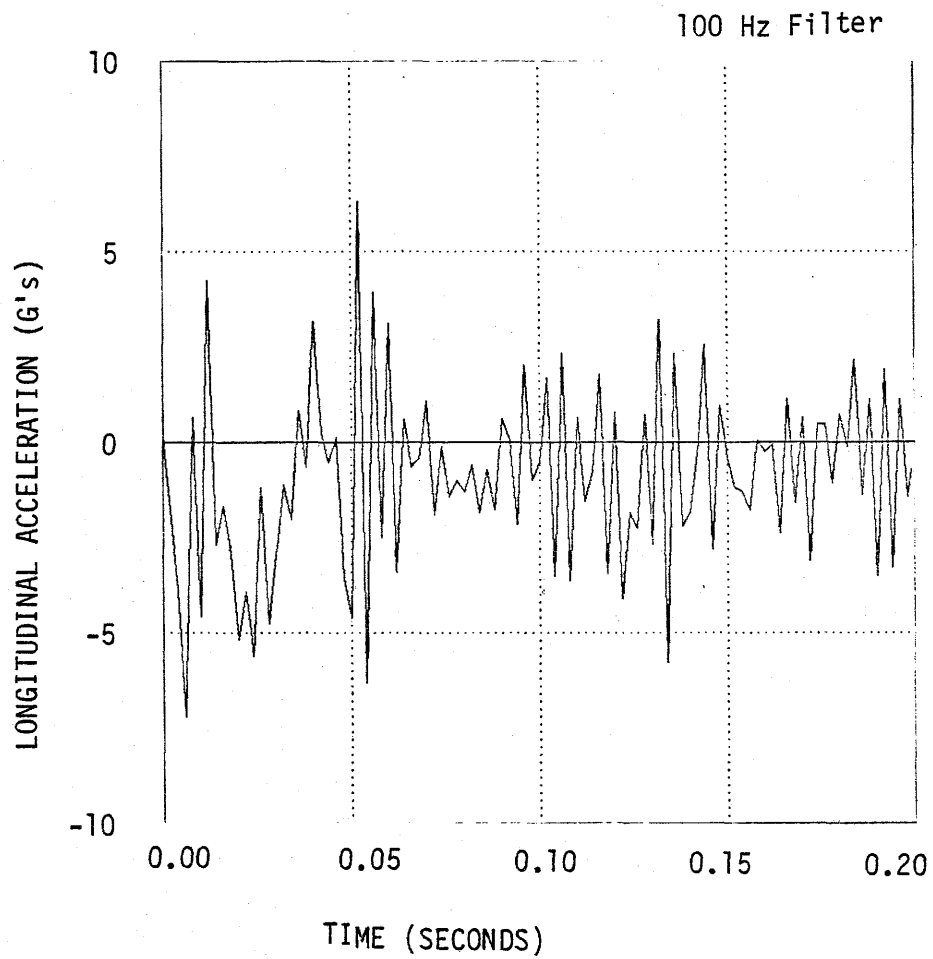


Figure 51. Longitudinal Acceleration from Vehicle's Left B-Pillar Accelerometer for Test 3.

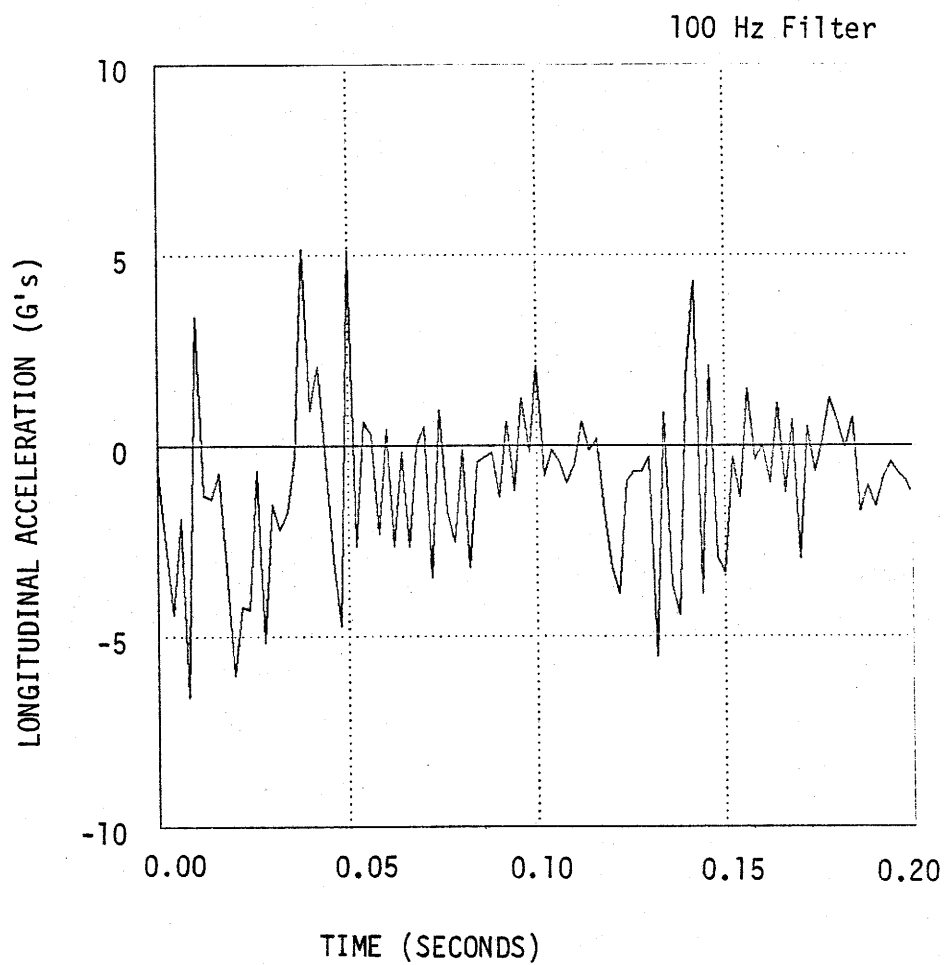


Figure 52. Longitudinal Acceleration from Vehicle's Right B-Pillar Accelerometer for Test 3.

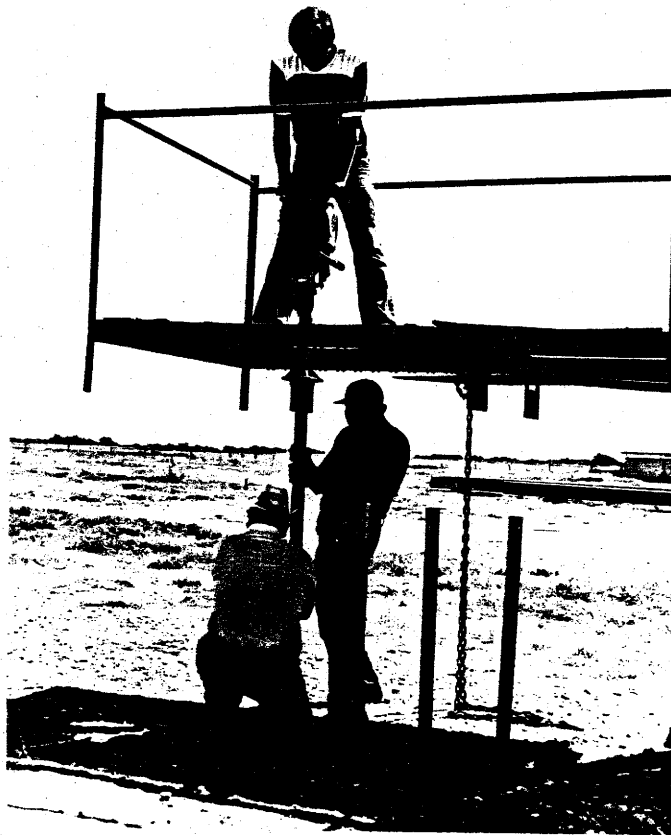


Figure 53. Driving Delineator with
Pionjar Hammer for Test 4.

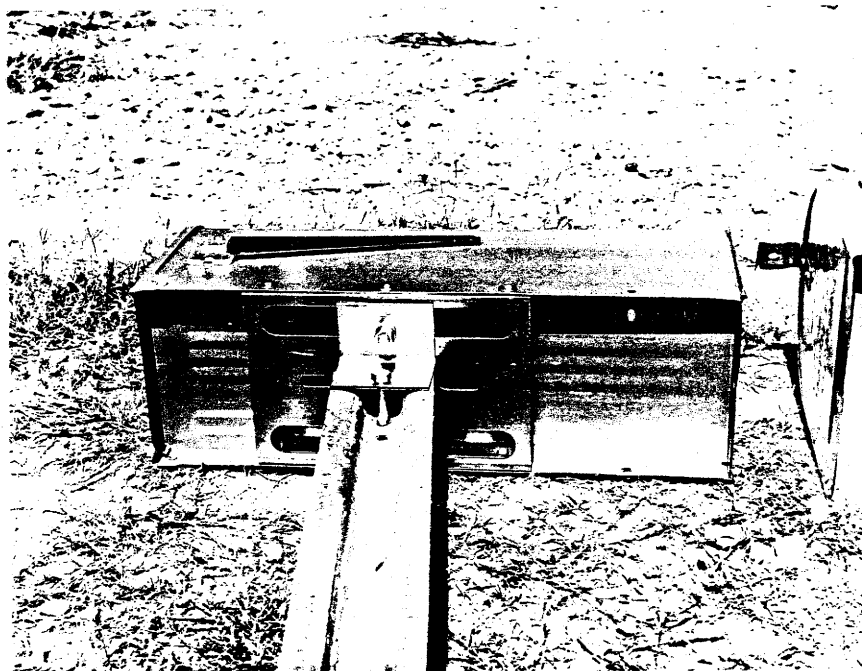


Figure 54. Typical Size #1 Mailbox Mount.

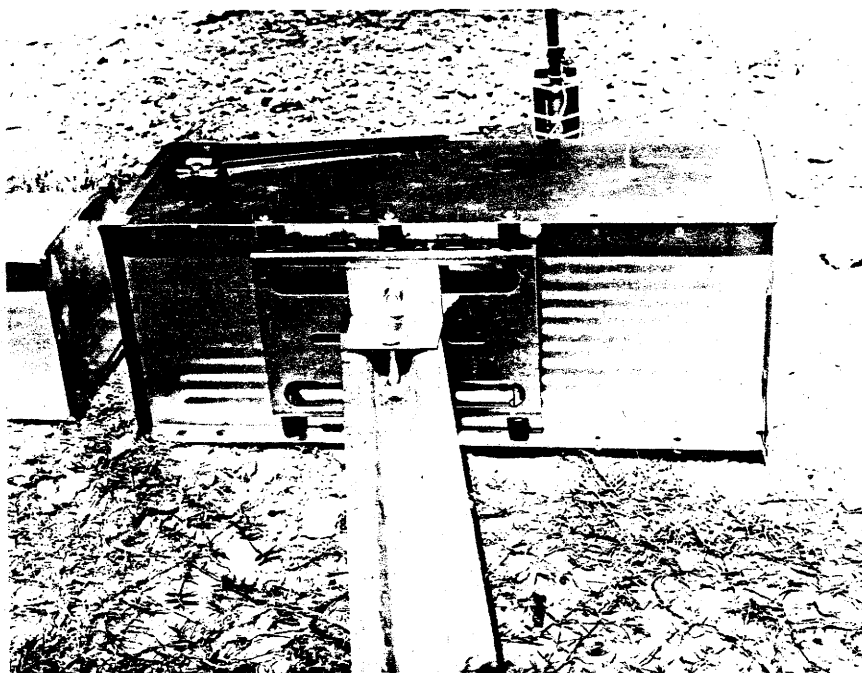


Figure 55. Typical Size #1-1/2 Mailbox Mount.

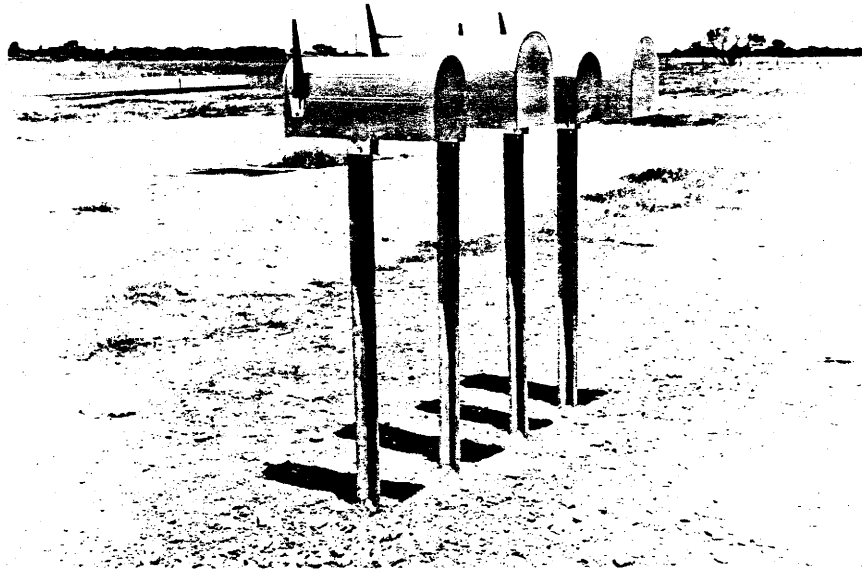
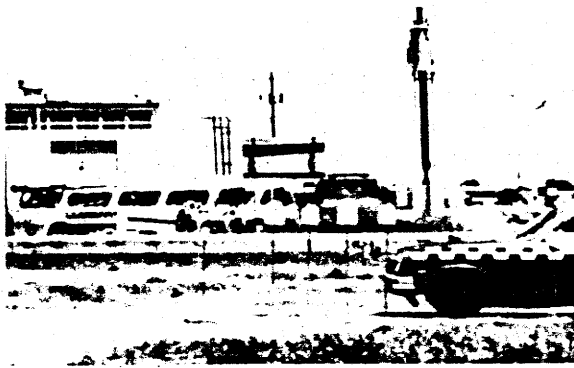
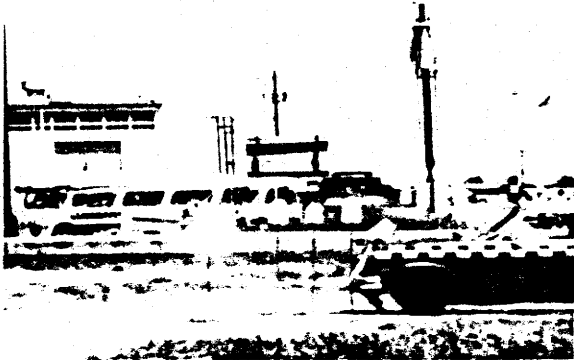


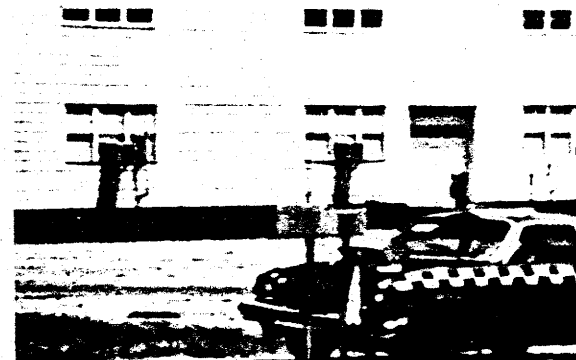
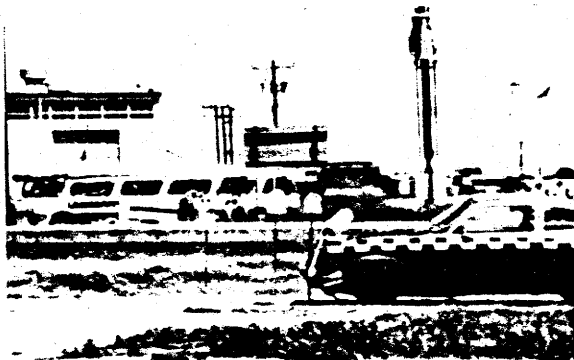
Figure 56. Test 4 Mailbox Installation.



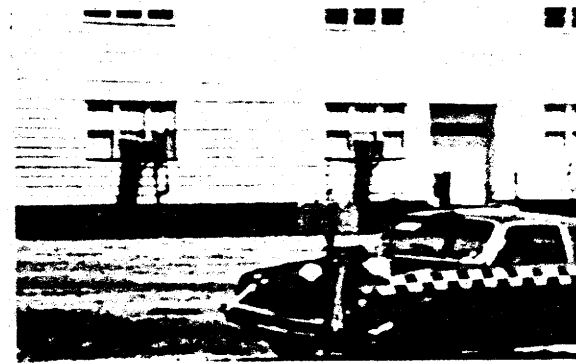
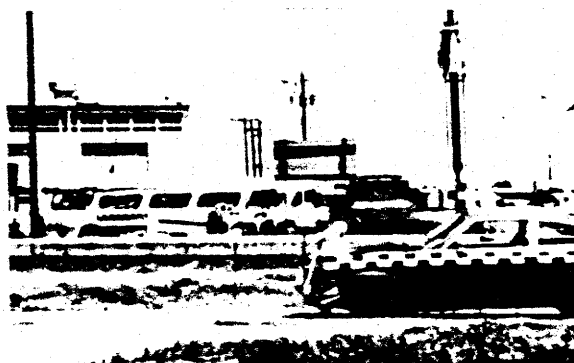
0.000



0.018

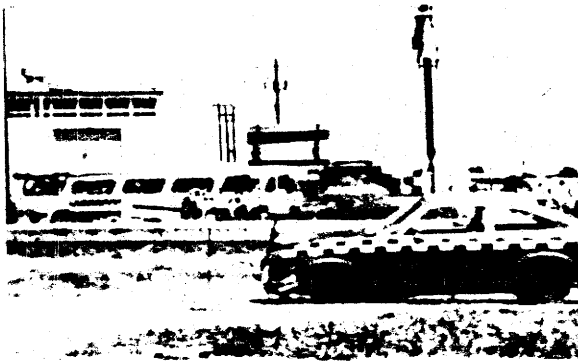


0.038

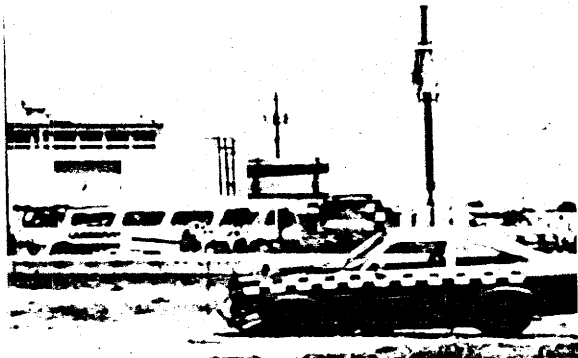
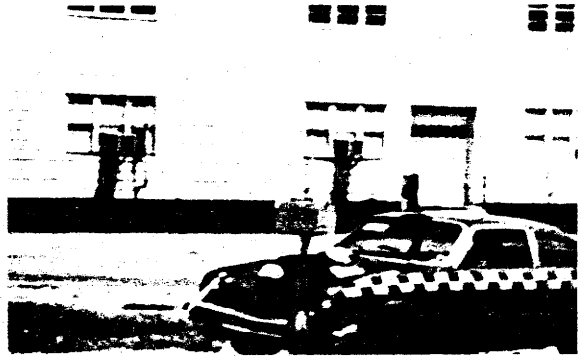


0.053

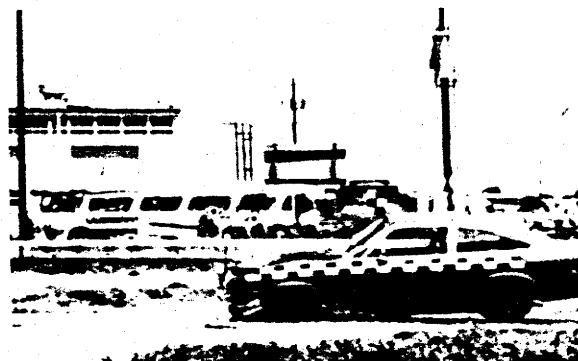
Figure 57. Sequential Photographs for Test 4.



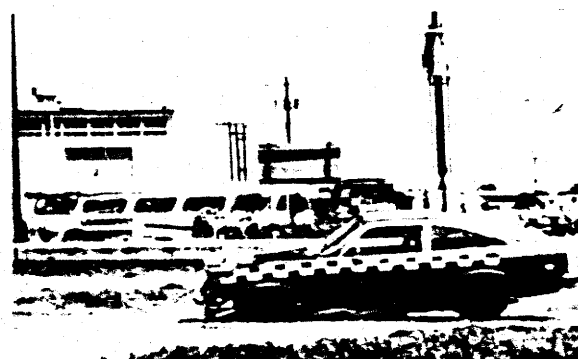
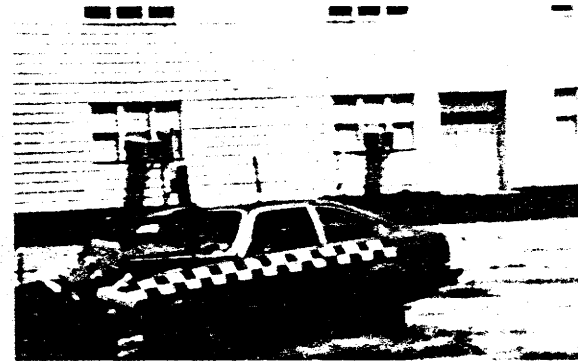
0.060



0.179



0.136



0.197

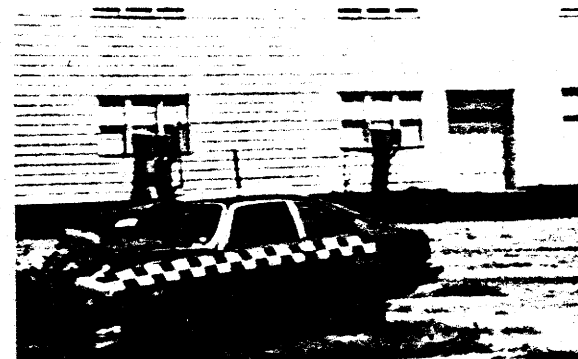
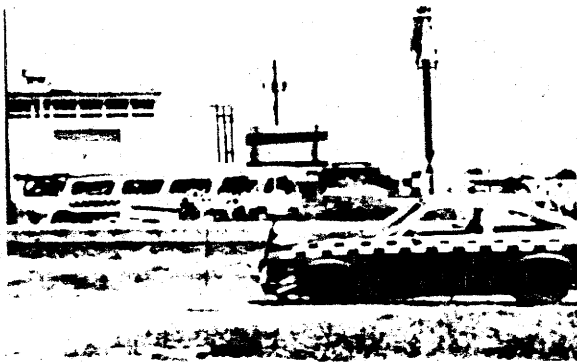
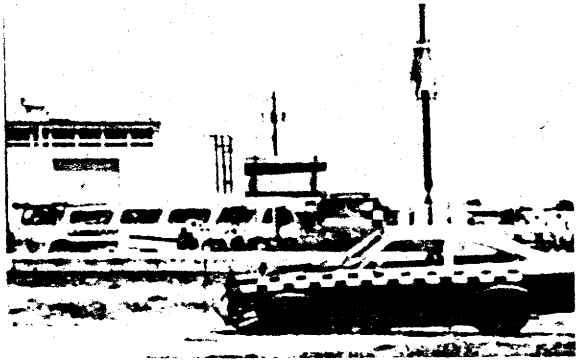
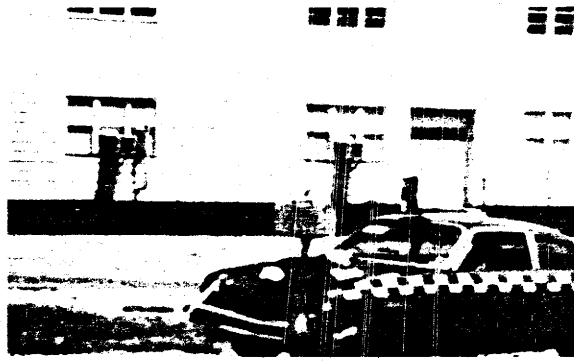


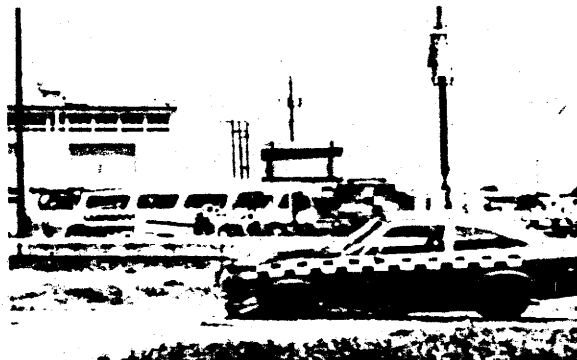
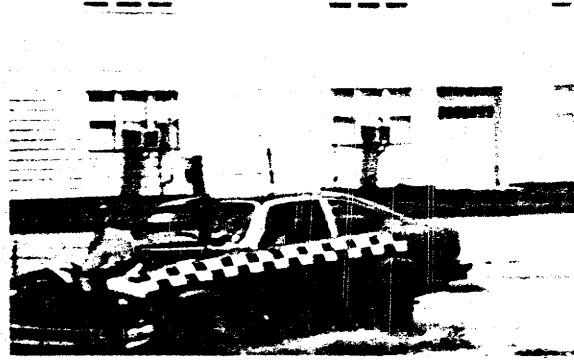
Figure 57. Sequential Photographs for Test 4 (continued).



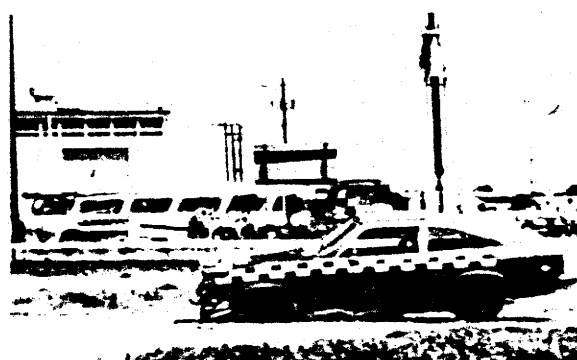
0.060



0.179



0.136



0.197

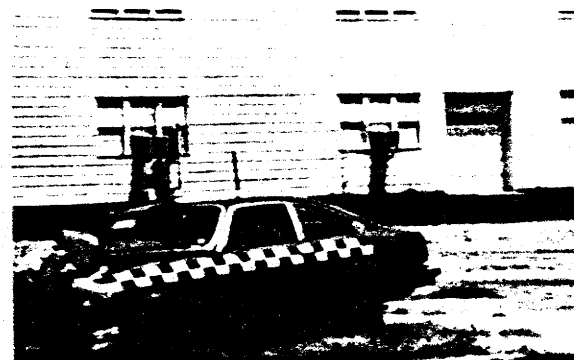


Figure 57. Sequential Photographs for Test 4 (continued).

TABLE 6. TIME-DISPLACEMENT-EVENT SUMMARY, TEST 4.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with box #1
0.018	1.52	Impact with box #2
0.038	3.24	Impact with box #3
0.053	4.49	Impact with box #4
0.060	5.07	Left underside of car strikes ground
0.179	13.93	Left underside of car leaves ground
0.186	14.49	Left rear tire leaves ground
0.197	15.27	Vehicle carries away four boxes and two posts



Figure 58. Test 4 Ground Connections After Impact.

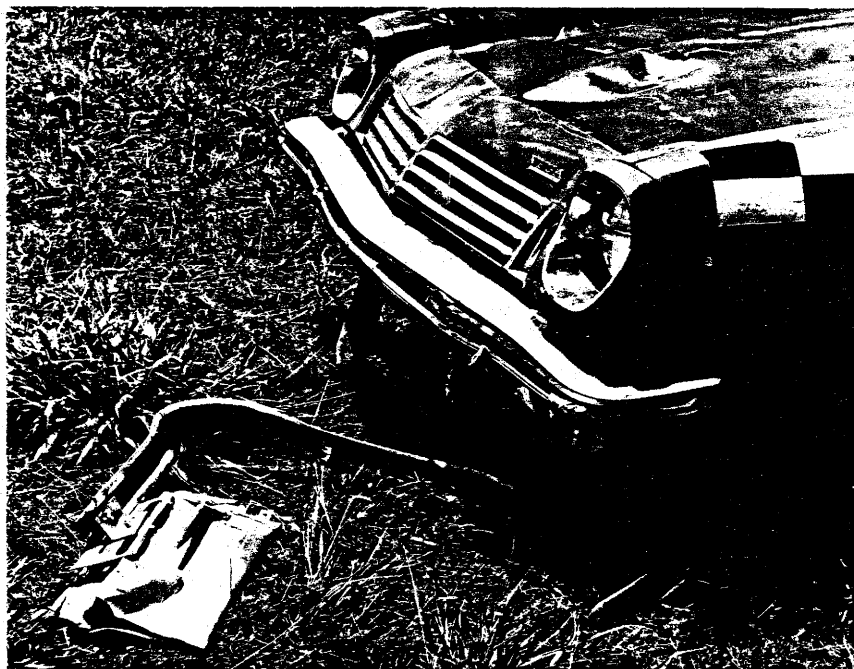
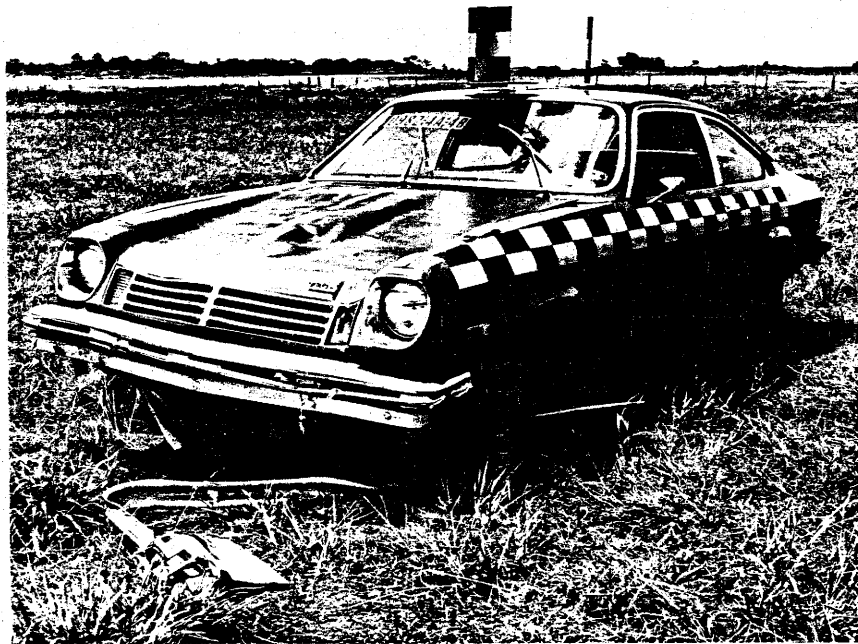


Figure 59. Vehicle After Test 4.

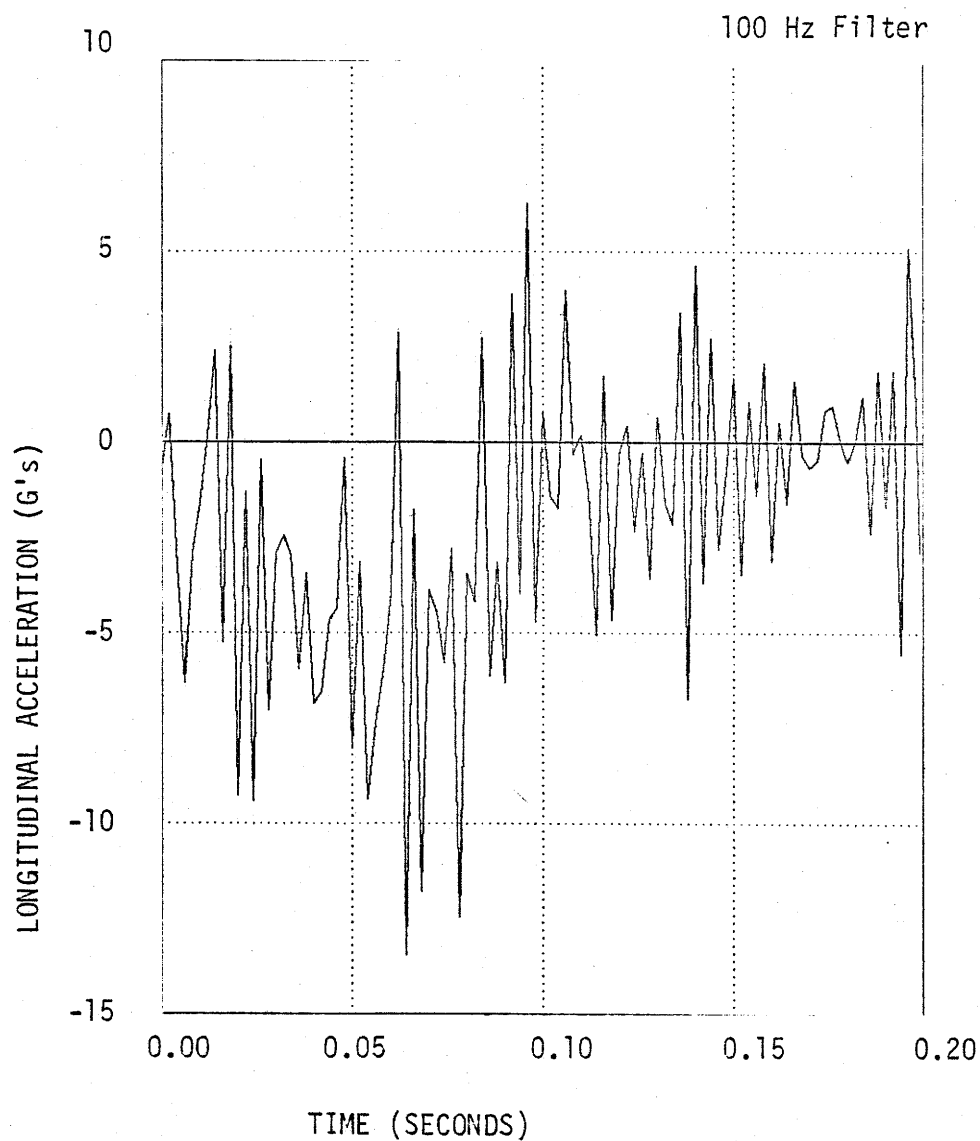


Figure 60. Longitudinal Acceleration from Vehicle's Left B-Pillar Accelerometer for Test 4.

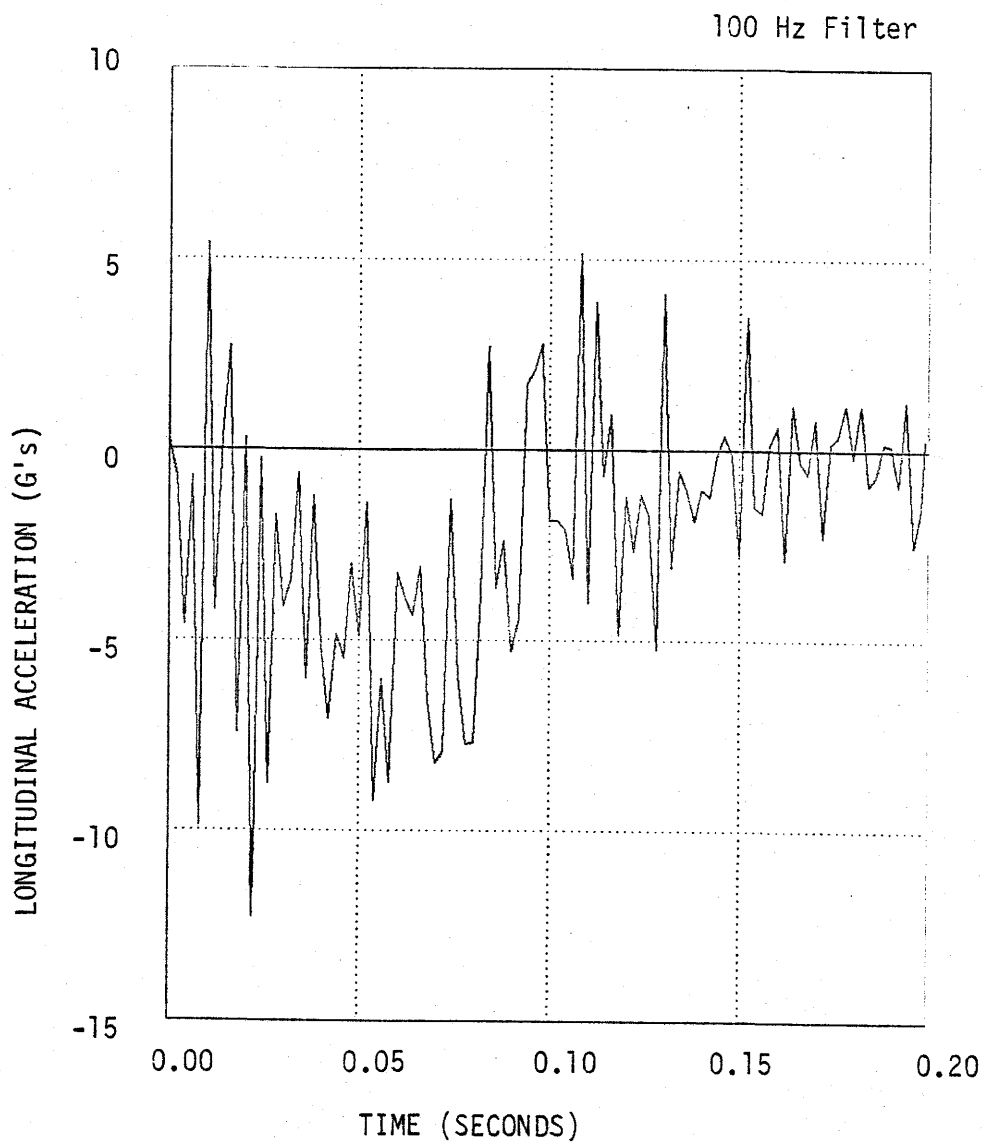


Figure 61. Longitudinal Acceleration from Vehicle's Right B-Pillar Accelerometer for Test 4.

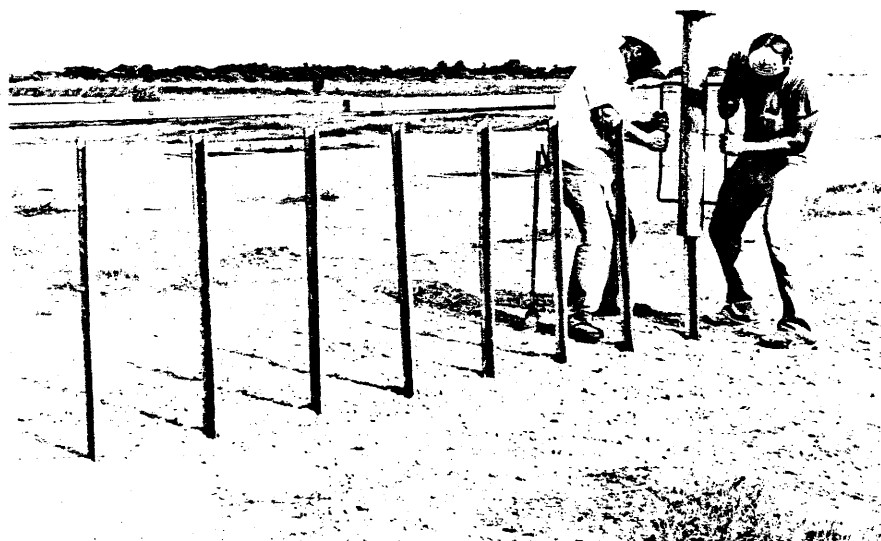


Figure 62. Driving Delineator with Special Tool for Test 5.

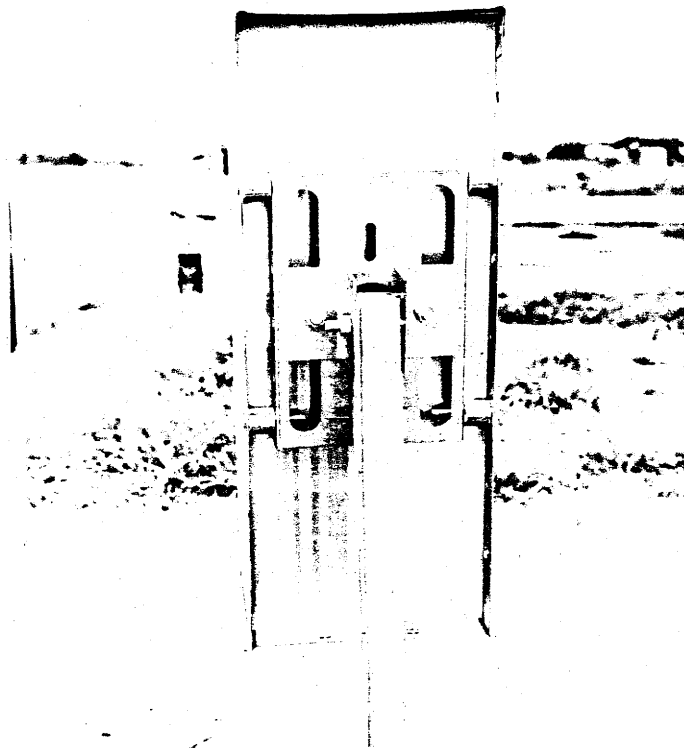


Figure 63. Special 4-Spacer Mount Used Only
for Mailbox Number Two of Test 5.

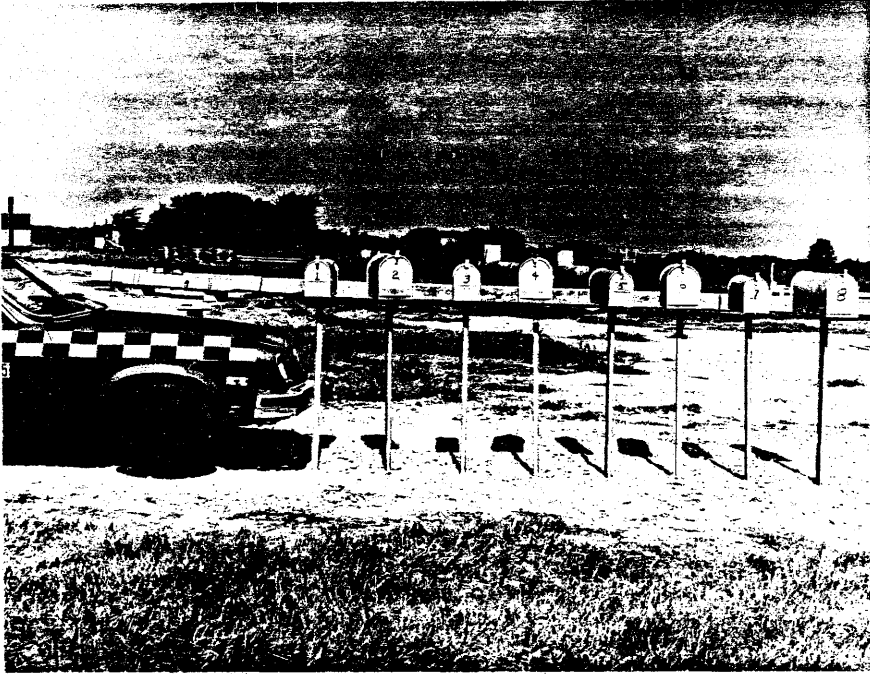
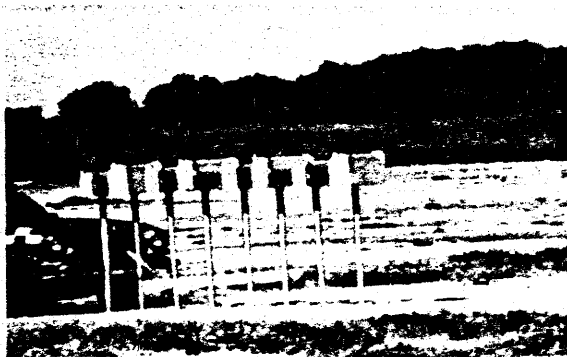


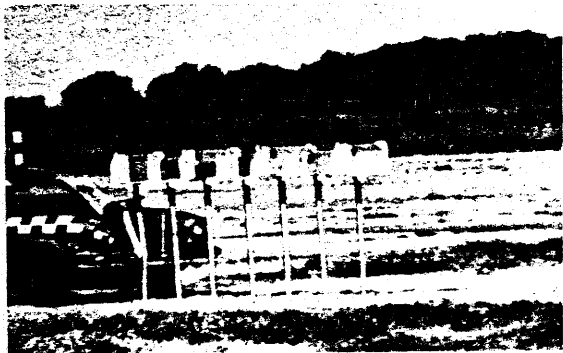
Figure 64. Test 5 Mailbox Installation.



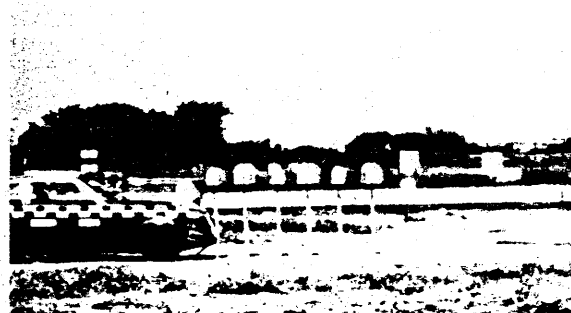
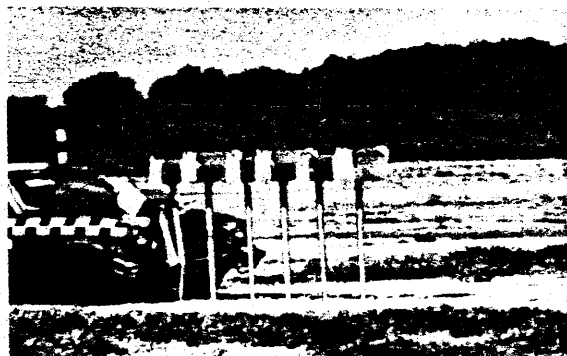
Figure 65. Test 5 Vehicle Before Impact.



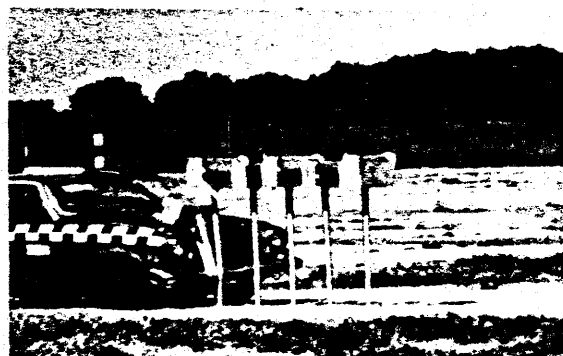
0.000



0.018

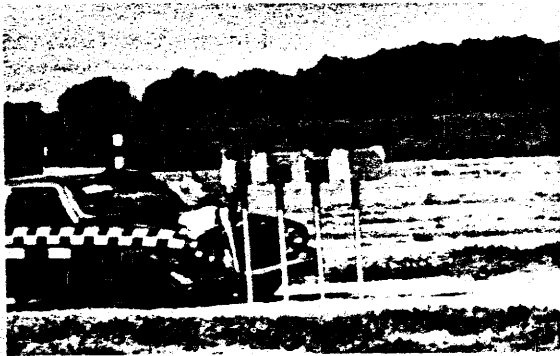


0.038

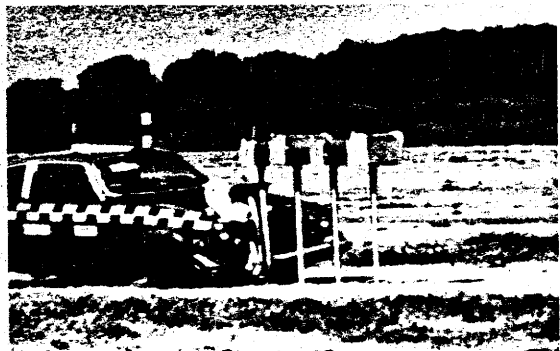


0.055

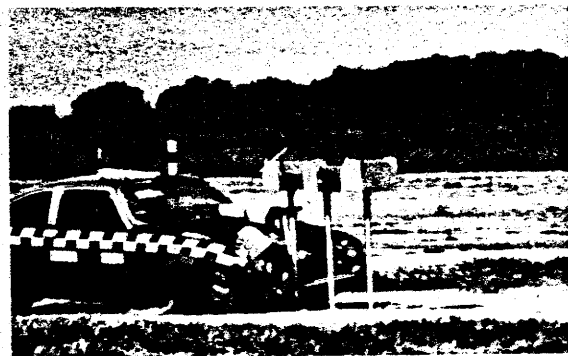
Figure 66. Sequential Photographs for Test 5.



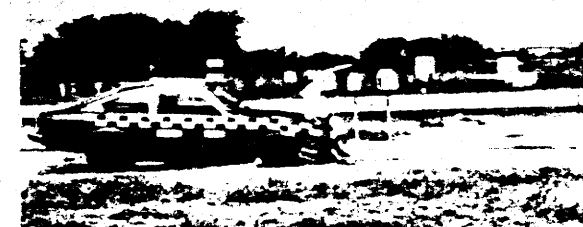
0.065



0.075

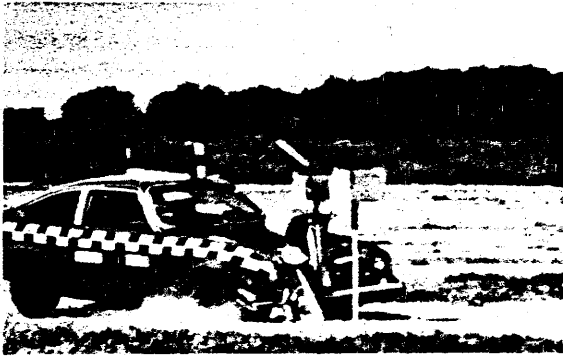


0.095



0.103

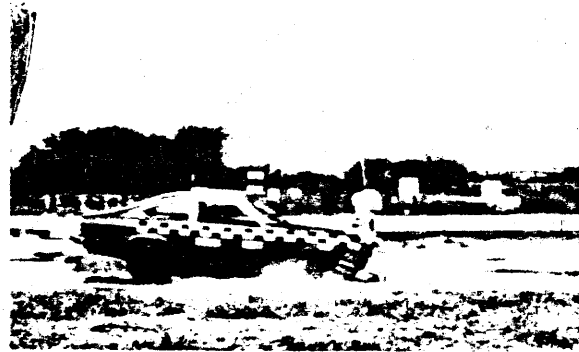
Figure 66. Sequential Photographs for Test 5 (continued).



0.118



0.140



0.143



0.163

Figure 66. Sequential Photographs for Test 5 (continued).



0.341

Figure 66. Sequential Photographs for Test 5 (continued).

TABLE 7. TIME-DISPLACEMENT-EVENT SUMMARY, TEST 5.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with box #1
0.018	1.53	Impact with box #2
0.038	3.24	Impact with box #3
0.055	4.64	Impact with box #4
0.065	5.46	Right underside of car strikes ground
0.075	6.22	Impact with box #5
0.095	7.68	Impact with box #6
0.103	8.20	Clump of boxes hits ground in front of car
0.118	9.17	Impact with box #7
0.140	10.60	Impact with box #8
0.143	10.76	Right underside of car leaves ground
0.163	11.92	Right rear tire leaves ground
0.341	21.29	Vehicle ascending

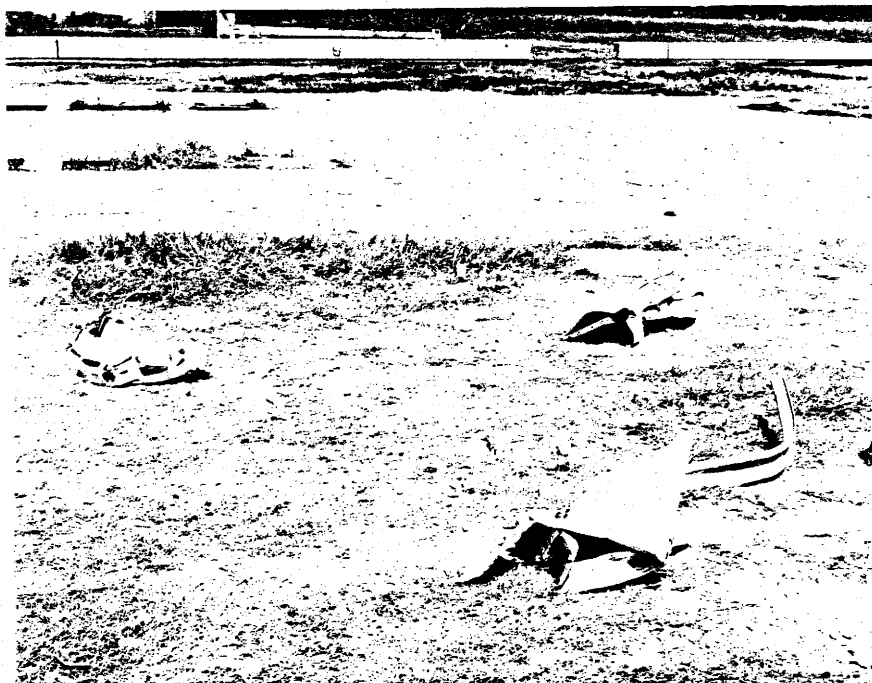
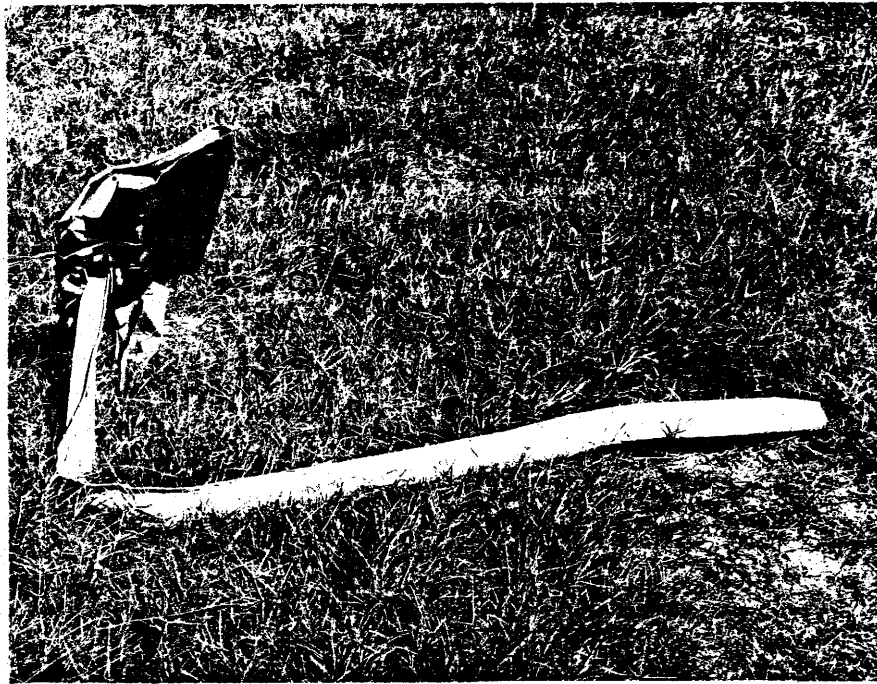


Figure 67. Mailboxes after Test 5.



Figure 68. Test 5 Ground Connections After Impact.



Figure 69. Test 5 Vehicle After Impact.

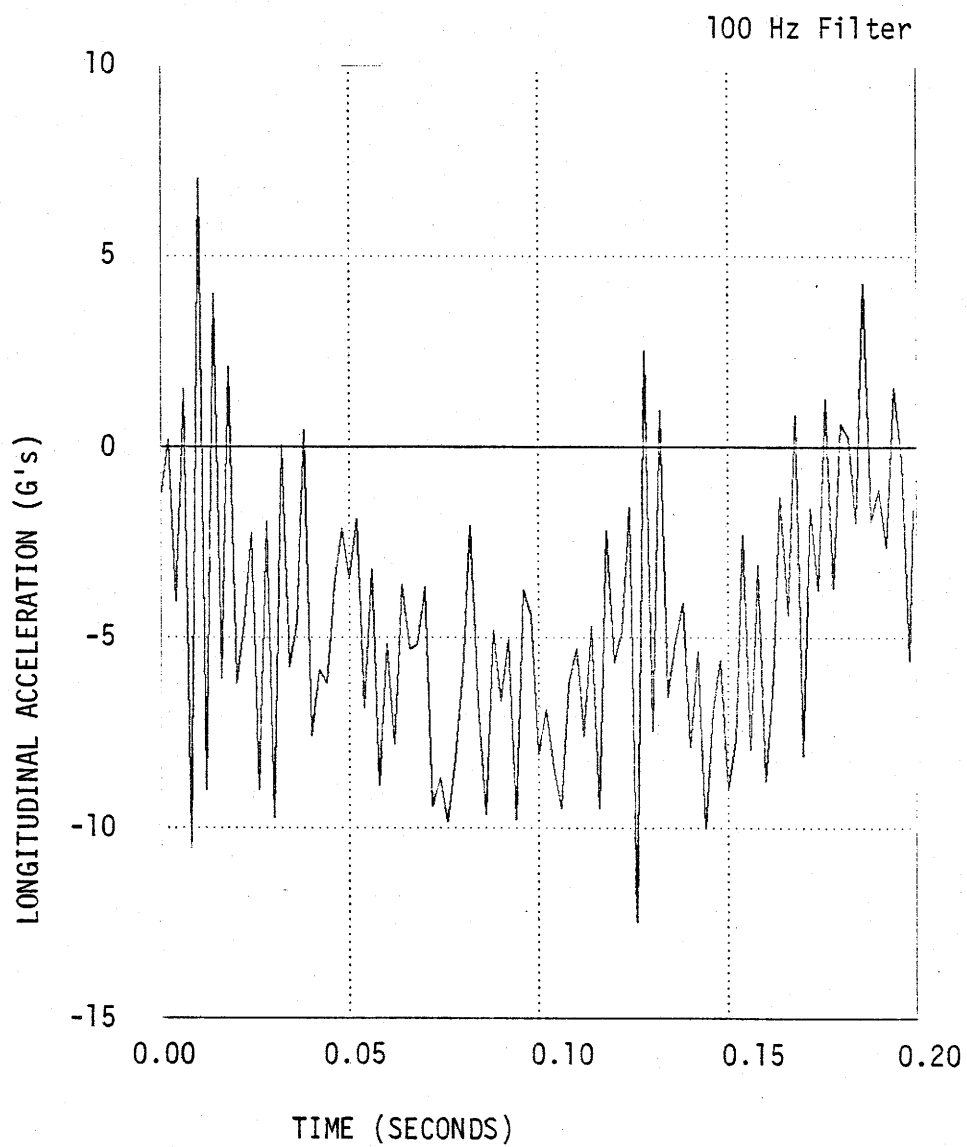


Figure 70. Longitudinal Acceleration from Vehicle's Left B-Pillar Accelerometer for Test 5.

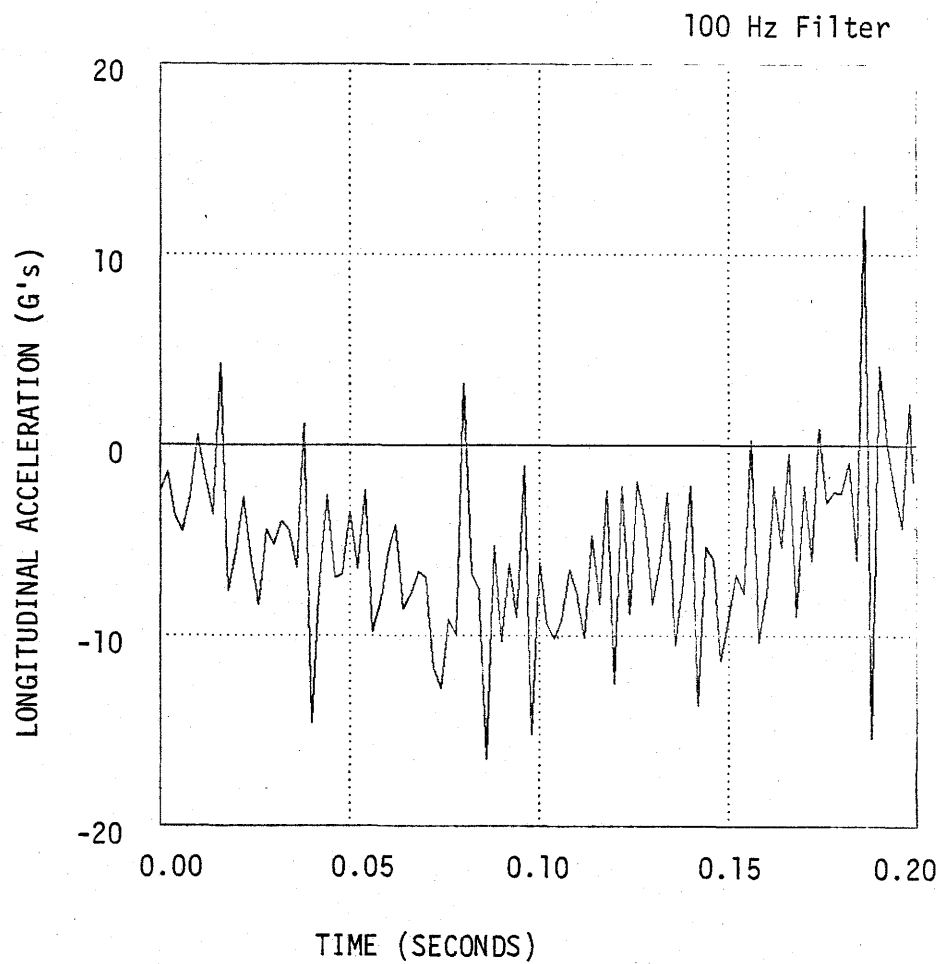


Figure 71. Longitudinal Acceleration from Vehicle's Right B-Pillar Accelerometer for Test 5.

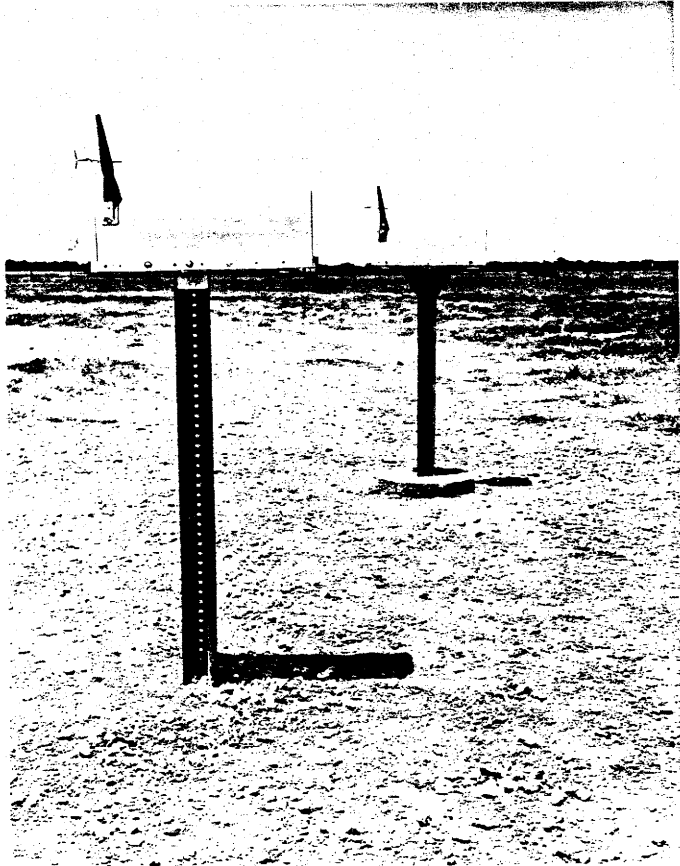


Figure 72. Test 6 Mailbox Installation Looking in the Direction of Vehicle Travel.



Figure 73. Test 6 Mailbox Installation Looking Opposite the Direction of Vehicle Travel.



Figure 74. Test 6A Mailbox Installation.

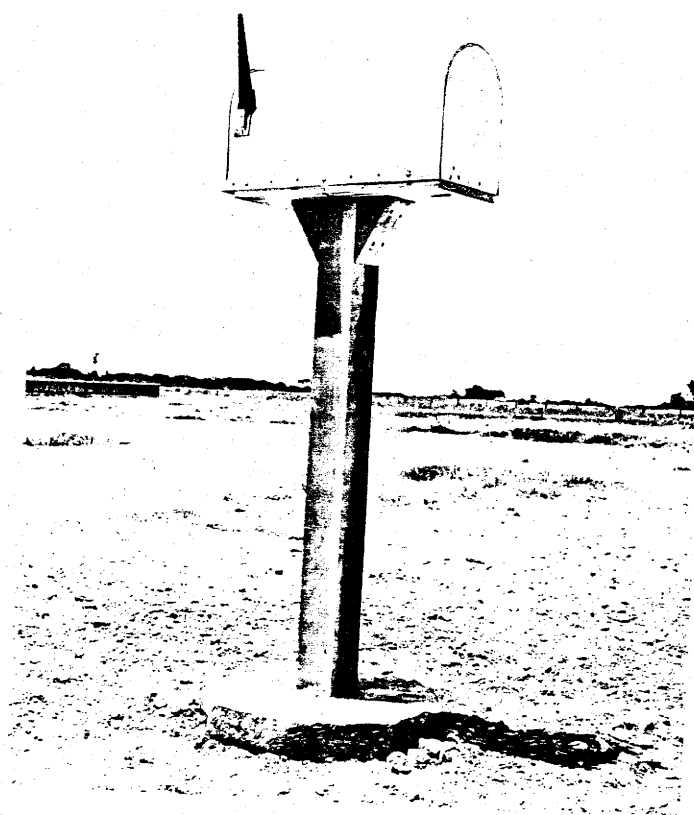


Figure 75. Test 6B Mailbox Installation.

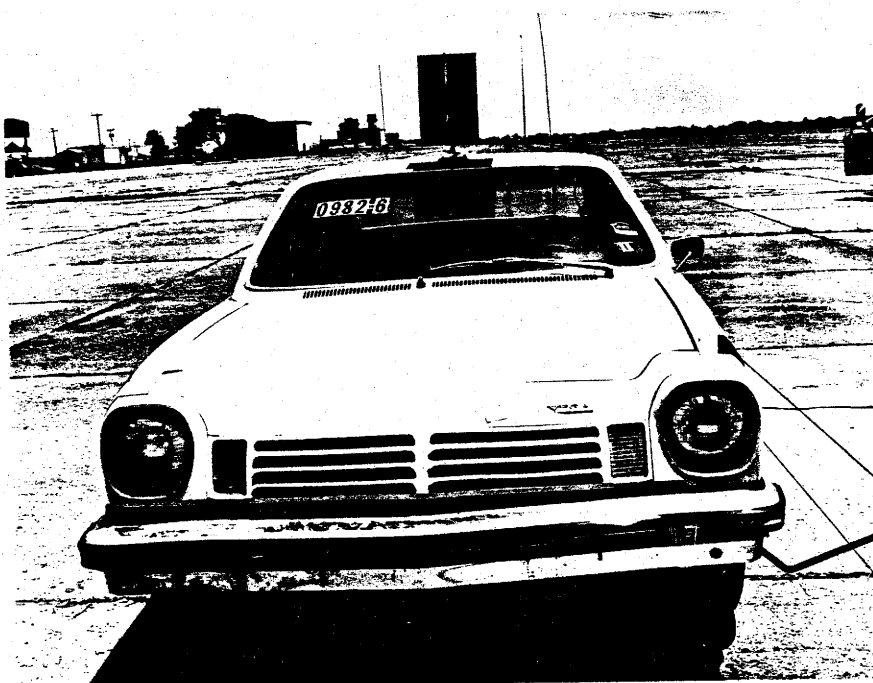
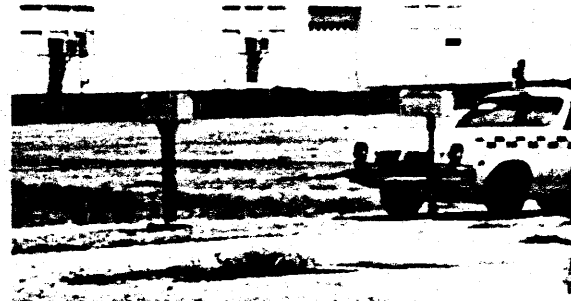
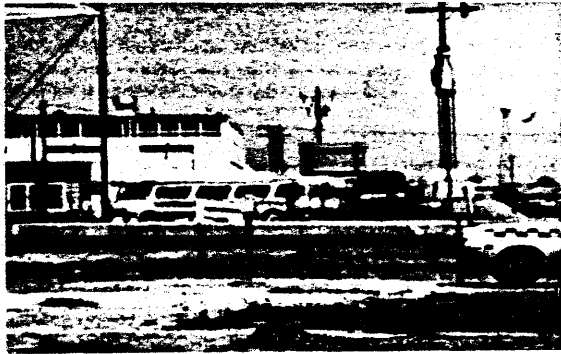
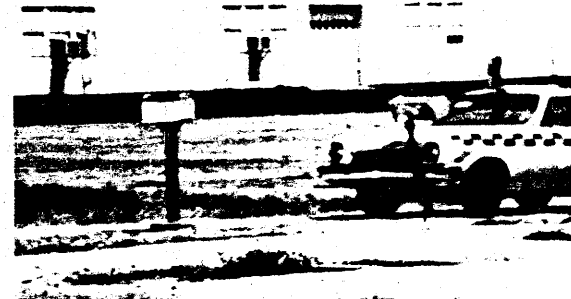


Figure 76. Test 6 Vehicle Before Impact.



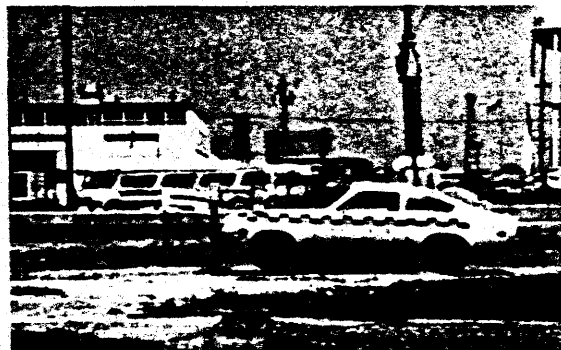
0.000



0.015

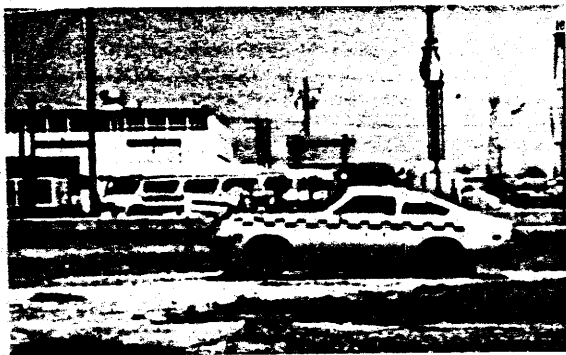


0.035

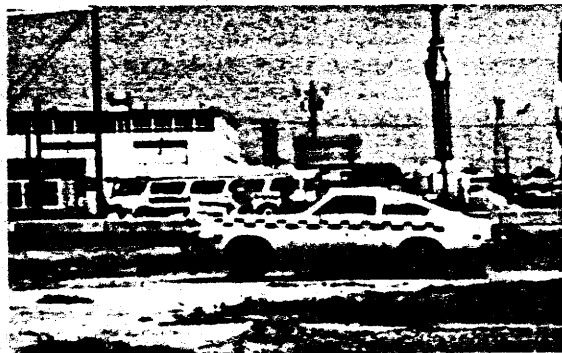


0.114

Figure 77. Sequential Photographs for Test 6.



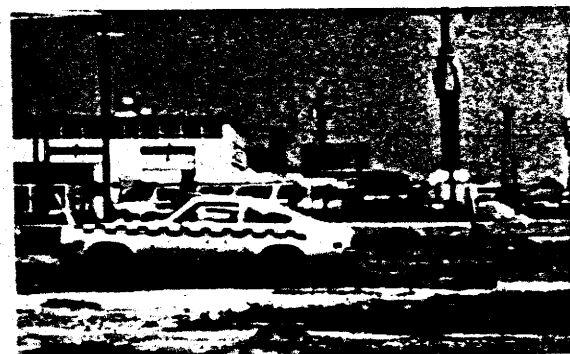
0.129



0.152



0.182



0.223



Figure 77. Sequential Photographs for Test 6 (continued).

TABLE 8. TIME-DISPLACEMENT-EVENT SUMMARY, TEST 6.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with 6A
0.015	1.30	6A box breaks off of support post
0.035	2.96	6A box impacts hood
0.114	9.43	Impact with 6B
0.129	10.64	6B box separates from support post
0.152	12.47	6B concrete base begins to break up
0.182	14.95	6B box impacts windshield
0.223	18.21	6B box leaves windshield

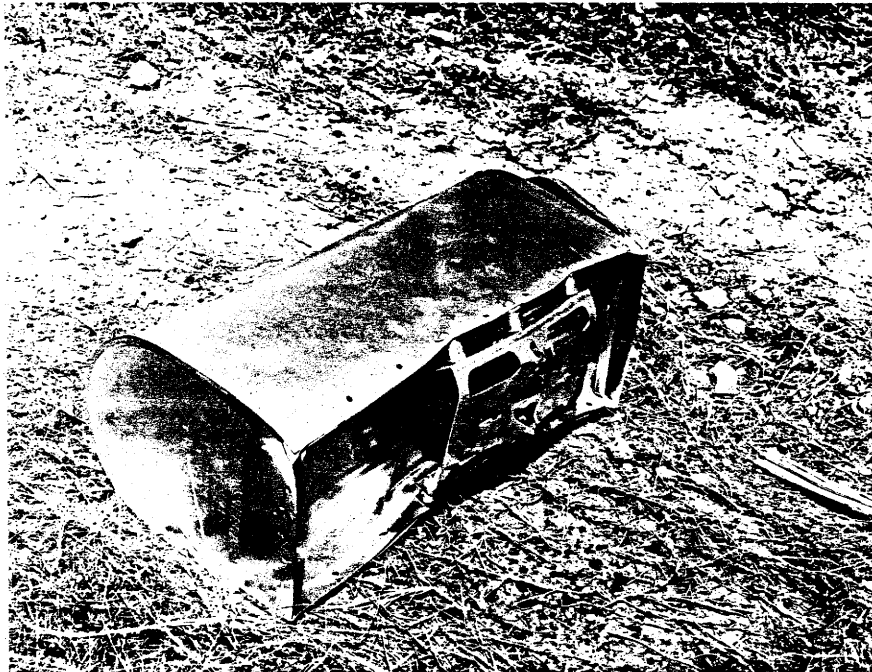


Figure 78. Test 6A Mailbox After Impact.



Figure 79. Test 6 Ground Connections After Impact Looking in the Direction of Vehicle Travel.

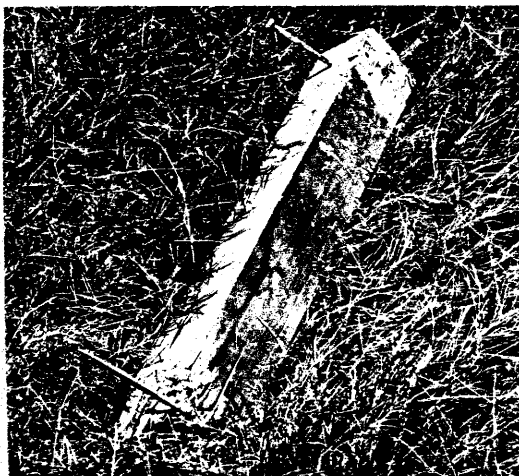
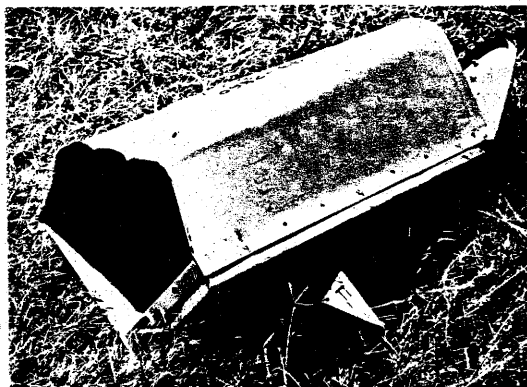
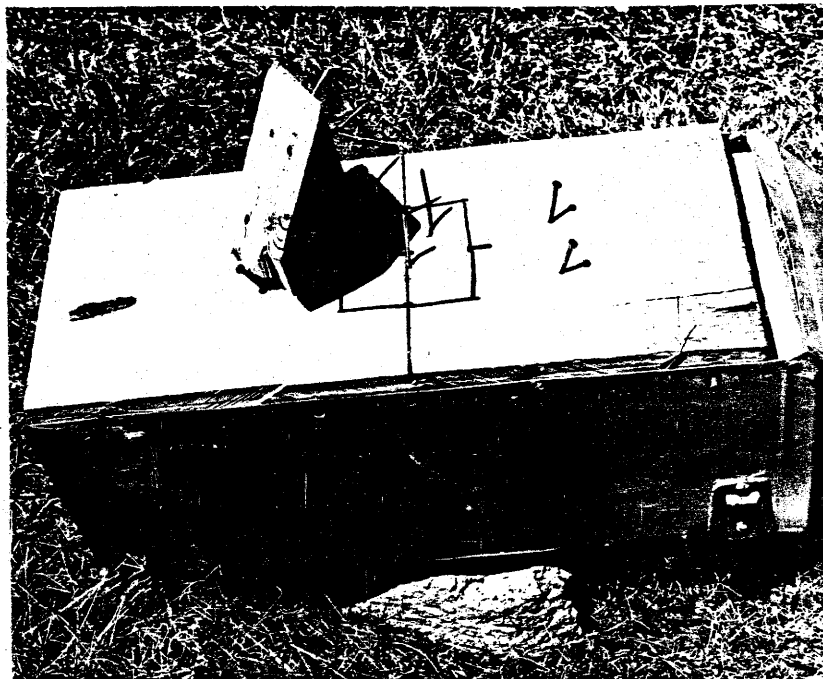


Figure 80. Test 6B Mailbox After Impact.

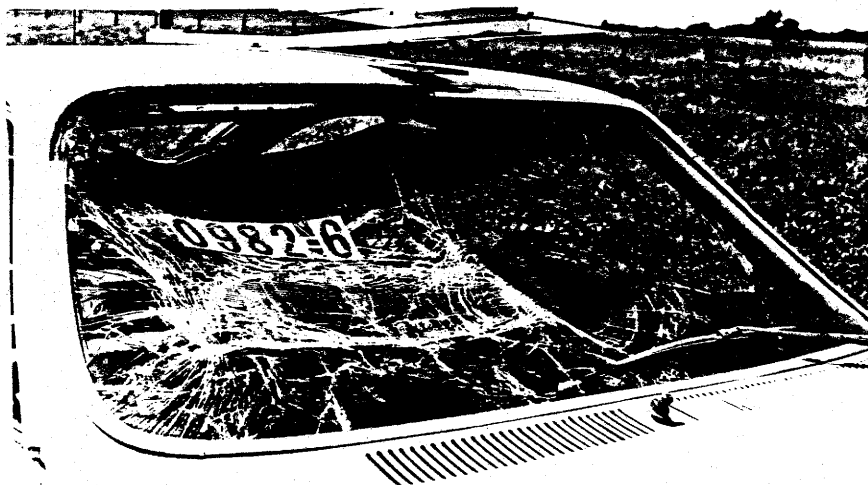
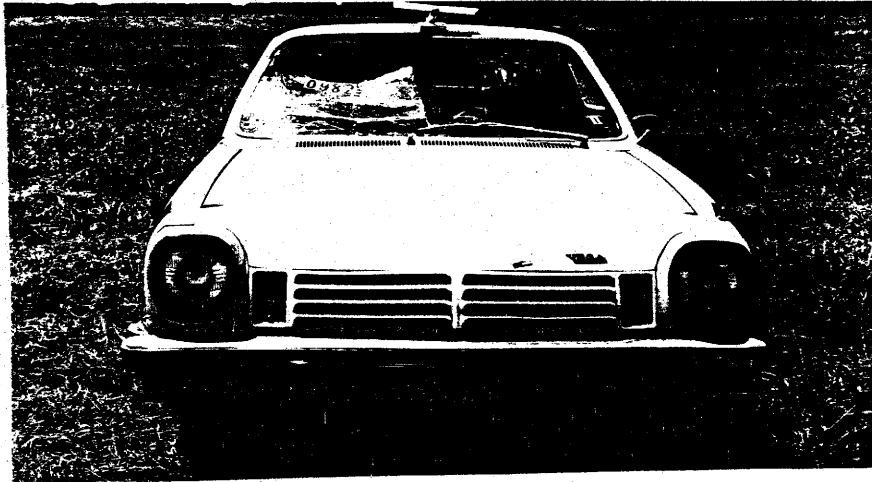


Figure 81. Test 6 Vehicle After Impact.

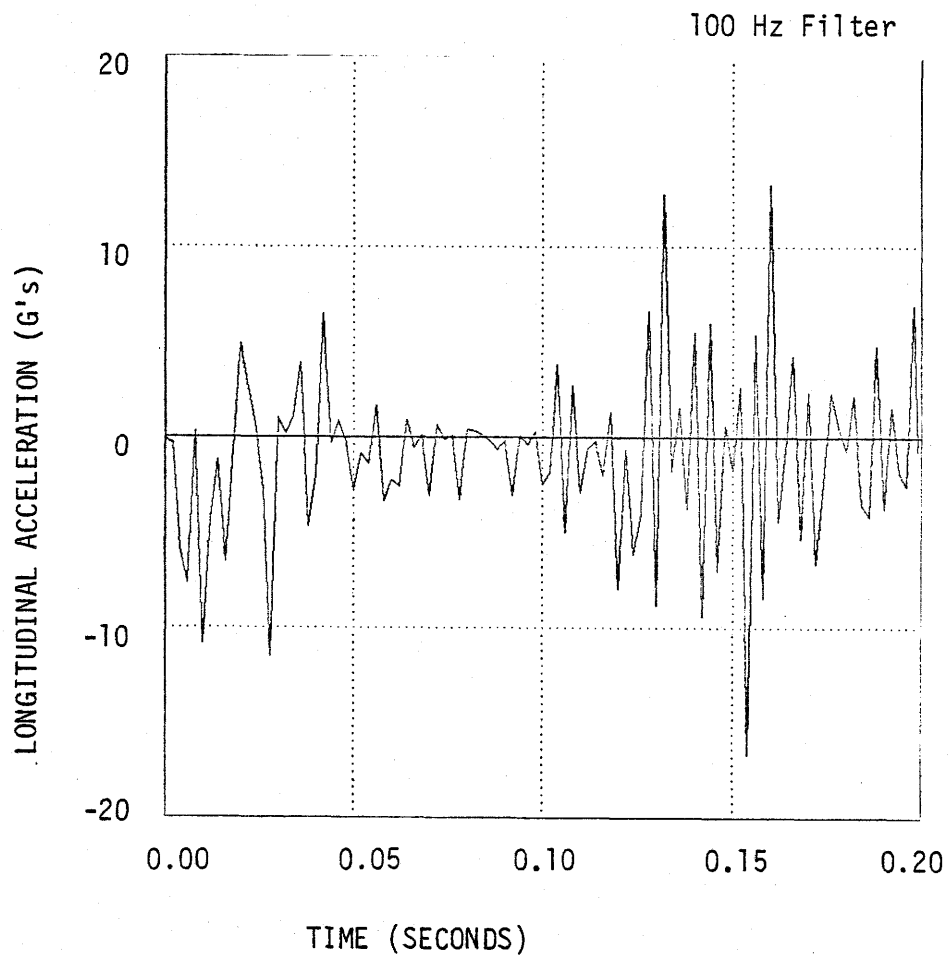


Figure 82. Longitudinal Acceleration from Vehicle's Left B-Pillar Accelerometer for Test 6.

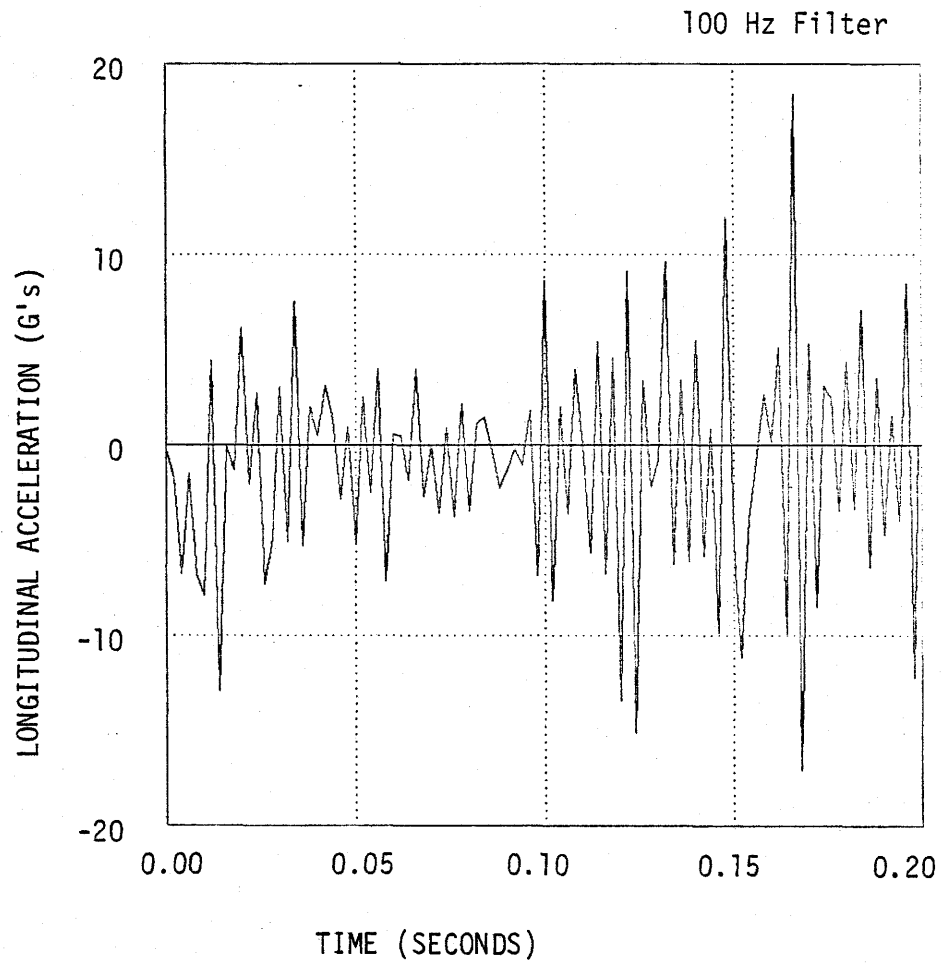


Figure 83. Longitudinal Acceleration from Vehicle's Right B-Pillar Accelerometer for Test 6.