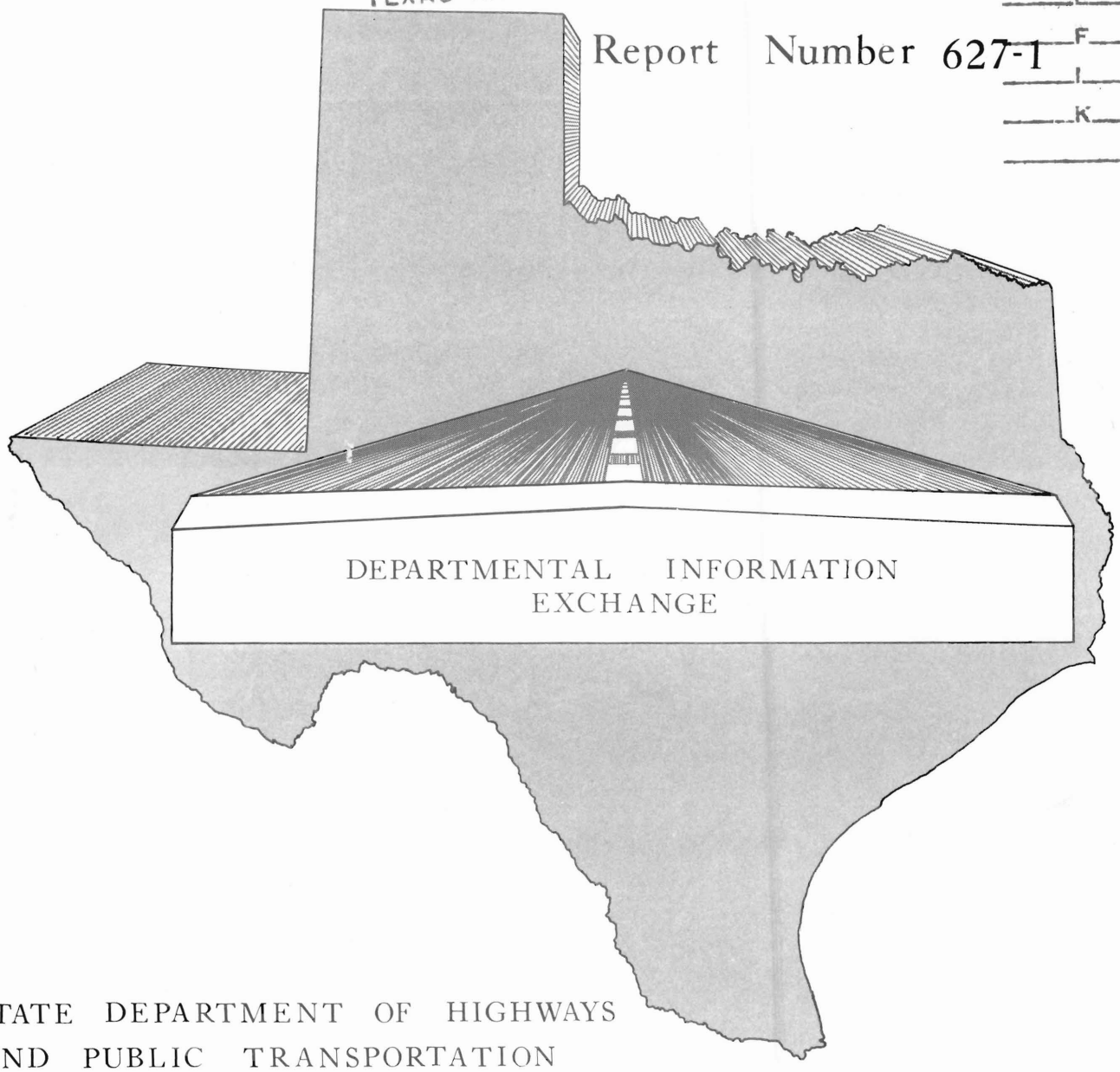
D-9 Sm. Elmore

EXPERIMENTAL PROJECTS

TEST AND EVALUATION OF RURAL MAILBOX SUPPORTS

Report Number 627-1



STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

TEST AND EVALUATION OF RURAL MAILBOX SUPPORTS

by

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Research Report 0969-1

on

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College Station, Texas

DISCLAIMER STATEMENT

The material contained in this report is experimental in nature and is published for informational purposes only. Any discrepancies with official views or policies of the DHT should be discussed with the appropriate Austin Division prior to implementation of the procedures or results.

SUMMARY

Four full-scale vehicular crash tests were conducted to evaluate the impact behavior of five mailbox support designs. Table 1 summarizes those tests and the results therefrom. Details of each test are presented in subsequent pages of this report. All tests were conducted at 60 mph with a 1974 Chevrolet Vega weighing 2320 lb. Impact point on the vehicle was 15 inches either to the right or left of the center of the bumper. Note that two designs were impacted in test 3 (tests 3-1 and 3-2) and in test 4 (tests 4-1 and 4-2). This was done by offsetting the posts relative to the centerline of the bumper (15 inches to the left and 15 inches to the right) and by offsetting the posts relative to the direction of vehicle travel (approximately 10 ft). Note that tests 2 and 4-2 involved a 2 lb/ft delineator post and the only difference in the two tests concerned the orientation of the post. In test 2 the direction of impact was perpendicular to the weak bending axis, and in test 4-2 it was parallel to the weak axis. Each post was embedded in a soil having properties meeting those recommended in Transportation Circular (TRC) No. 191, dated February 1978.

It can be seen that the change in momentum of the vehicle during impact with each design was well below the preferable limit of 750 lb-sec recommended in TRC No. 191. There was no penetration of the passenger compartment by the test article in any test. In fact, the windshield remained unbroken throughout all six tests (same car used in each test). As can be seen in Figure 35, the vehicle sustained only minor damage and was operable at the conclusion of the test program.

Results of these tests are noteworthy for at least three reasons:

1. To date there was no crashworthy support system for multiple mailboxes.

The system evaluated in test 1 proved acceptable for at least four mailboxes.

2. There are now at least six different single-box support designs which have proven to be crashworthy. These include the four designs reported herein and two standard steel pipe designs reported in

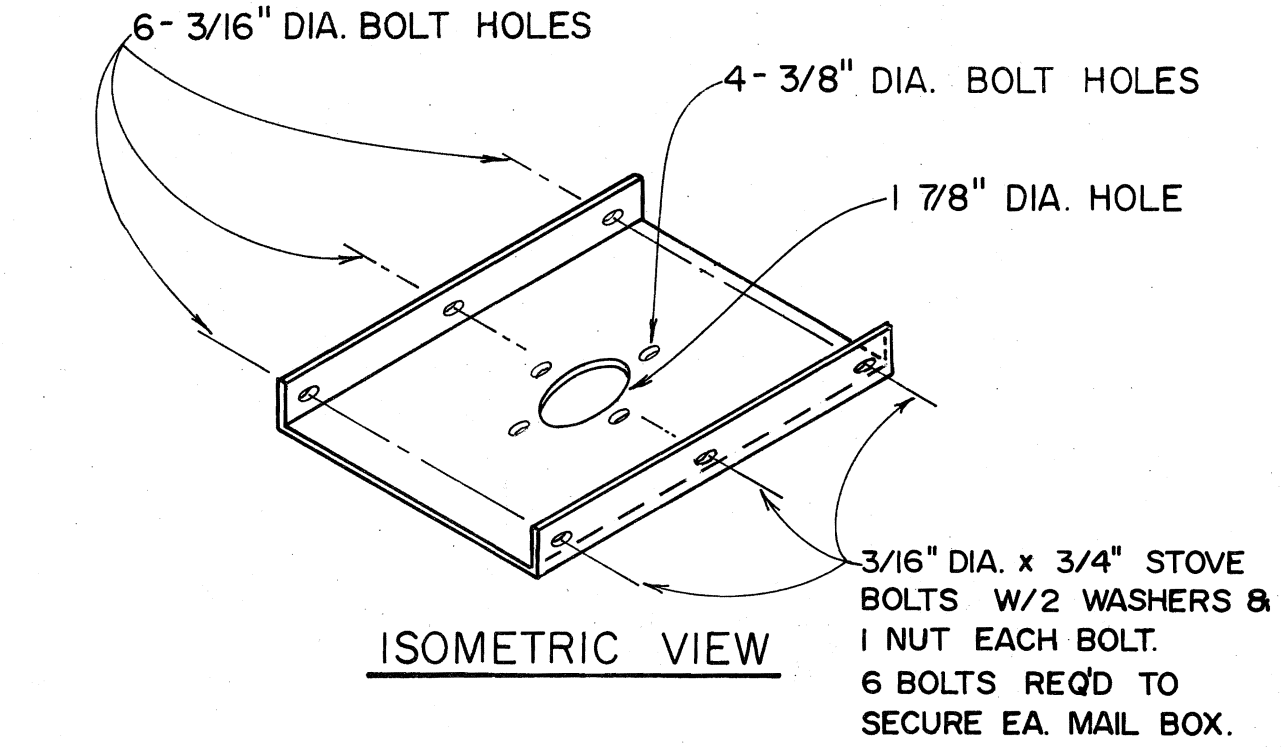
"Crash Tests of Rural Mailbox Installations",
Ross, Hayes E., and Walker, Kenneth C.,
FHWA Report No. RD-80/504, May 1980
Available from:
Federal Highway Administration
Office of Research & Development
Implementation Division
Washington, D.C. 20590

3. All systems reported herein, and the two referred to in item 2 above, are cost effective. Although specific cost analyses were not conducted, it appears that most, if not all, the single-post systems will in general have lower initial and maintenance costs than the widely used wood post support.

TABLE 1. SUMMARY OF MAILBOX CRASH TEST RESULTS.

TEST NO.	1	2	3-1	3-2	4-1	4-2
MAILBOX SUPPORT DATA						
Figure Showing Support Configuration	2	11	18	19	29	30
Support Hardware	2.0" O.D. Formed Steel Tube .070 in. Wall Thickness	2 lb/ft Billet Steel Delinea-tor Post	Plastic Pipe* 1.9" O.D. .190 Wall Thickness	2.5 lb/ft Rail Steel U-Post	1.66"O.D. Thin Wall Steel Tube .047" Wall Thickness	2 lb/ft Billet Steel Delineator Post
Embedment Depth (ft)	1.5	2.0	3.1	3.1	1.5	2.0
Embedment Method	Driven V-Wing Socket	Driven	Driven Base Post	Driven Base Post	Driven V-Wing Socket	Driven
# of Mailboxes	4	1	1	1	1	1
ACCELEROMETER DATA						
Change in Momemtum (lb-sec)	93.7	117.4	25.9	21.6	64.8	71.3
Duration of Event (sec)	.031	.032	.017	.011	.024	.037
Peak Deceleration (g's)	14.78	9.20	16.42	17.95	14.31	9.64
Maximum 50 msec Average Deceleration (g's)	7.53	4.56	6.88	7.88	6.10	5.39
VEHICLE DAMAGE CLASSIFICATION						
TAD	FL-0	FR-0	FL-0	FR-0	FL-0	FL-0
SAE	12-FLMN1	12-FRMN1	12-FLMN1	12-FRMN1	12-FLMN1	12-FLMN1
Was Passenger Compartment Penetrated?	No	No	No	No	No	No
Was Windshield Broken?	No	No	No	No	No	No

*High Density Polyethylene



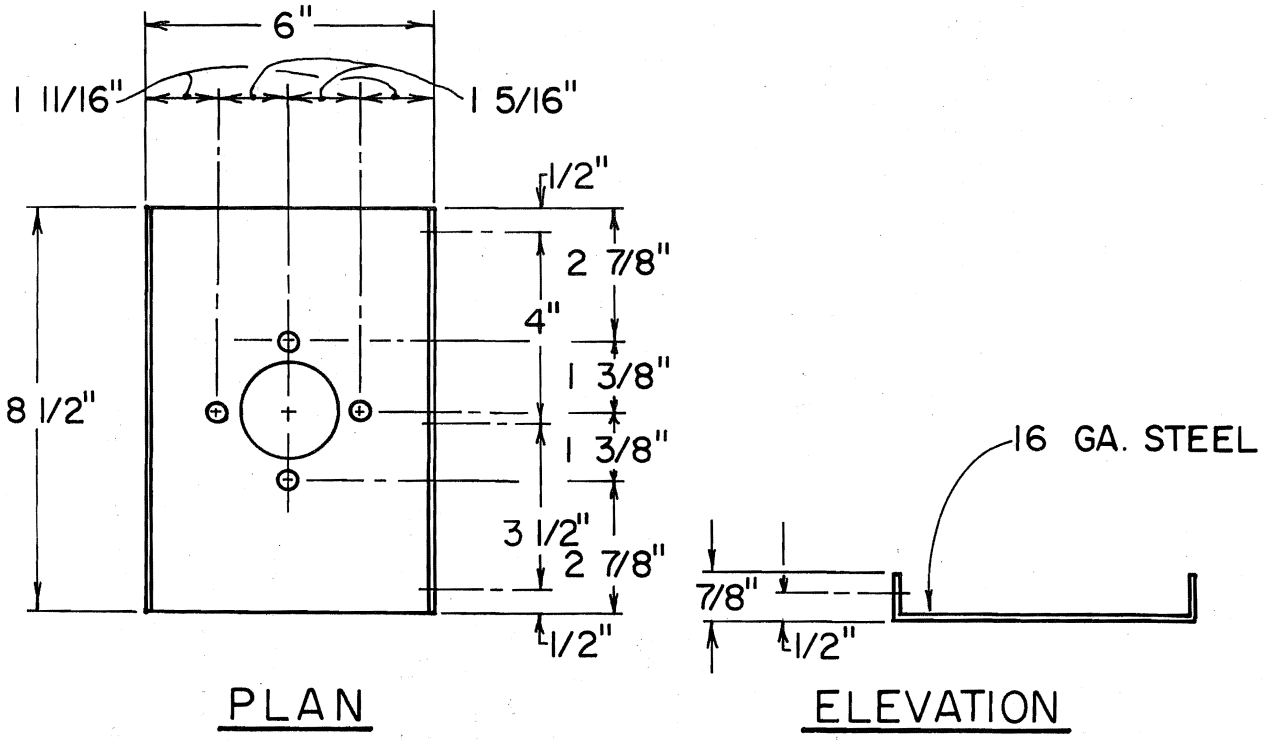


Figure 1. Mailbox Base Attachment for All Tests.

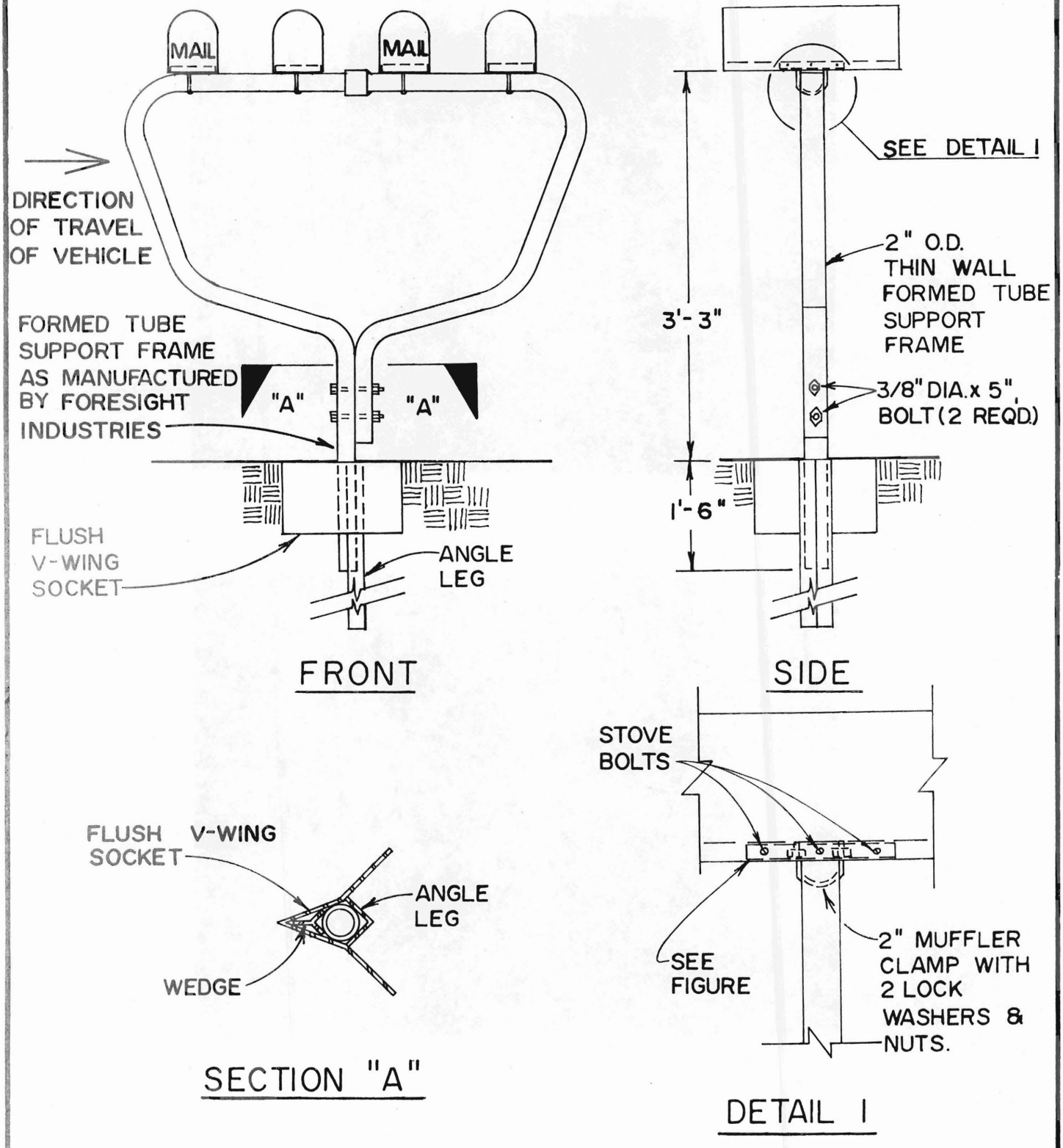


Figure 2. Mailbox Support Configuration for Test 1.

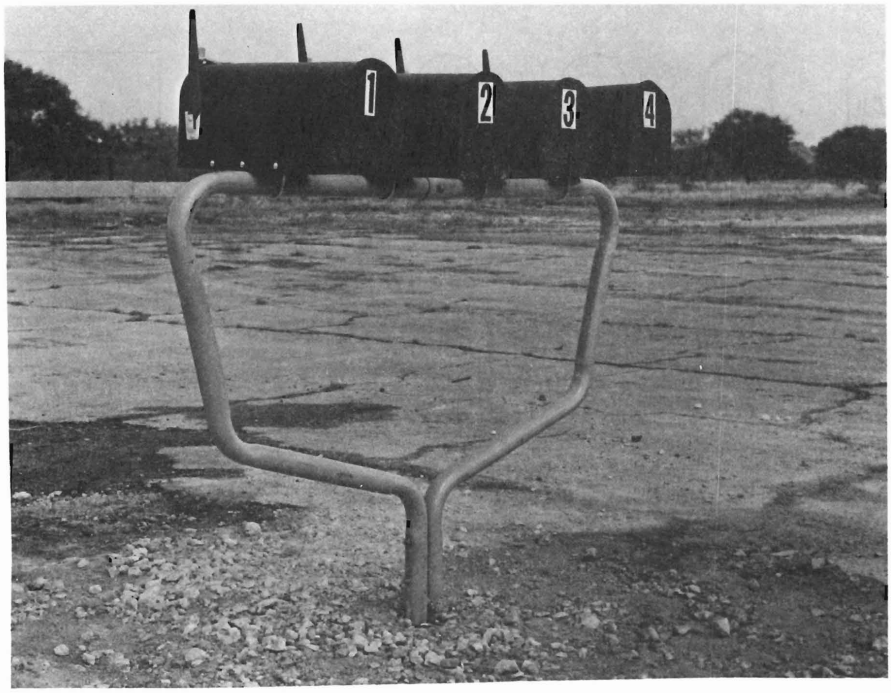
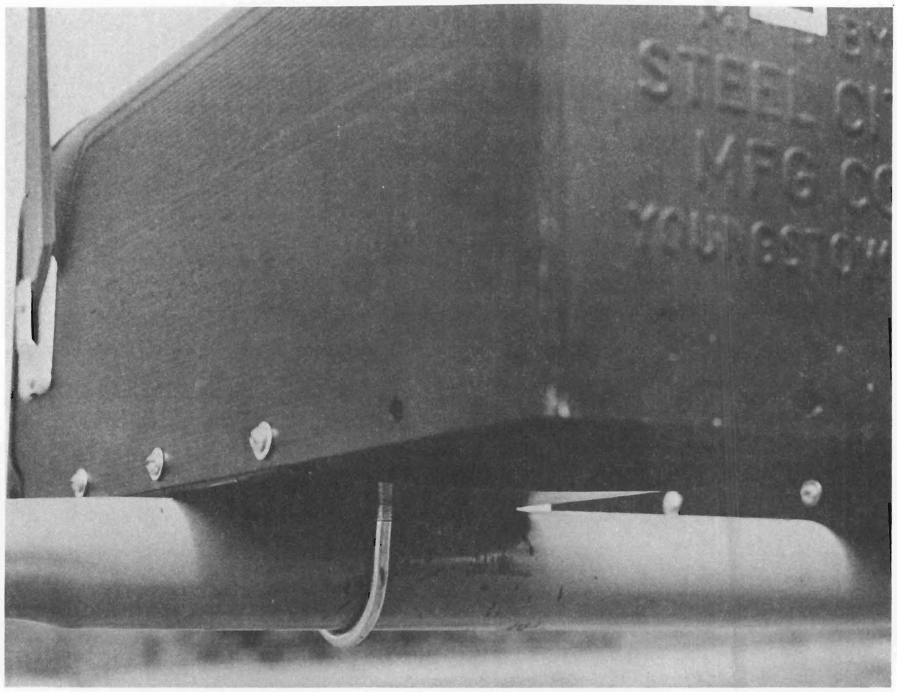


Figure 3. Mailbox Support Before Test 1.



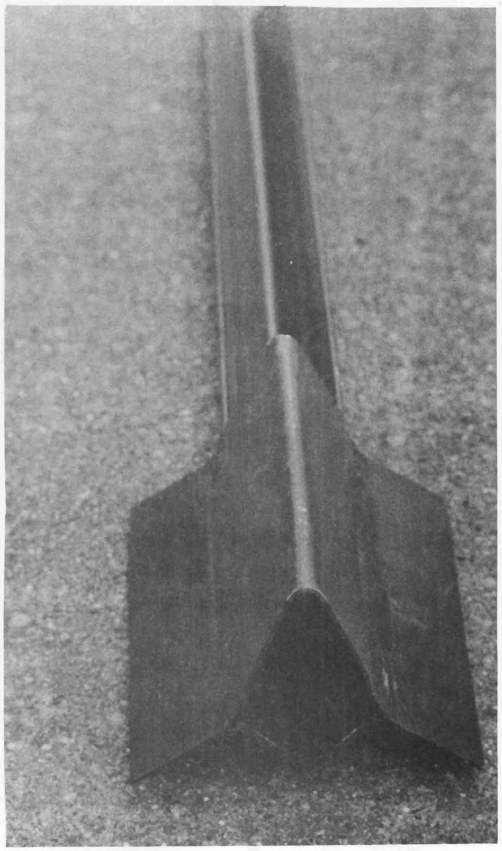
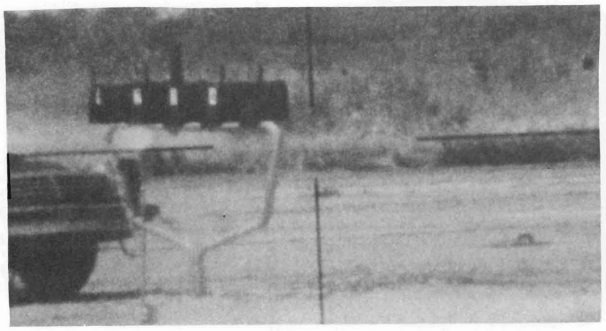
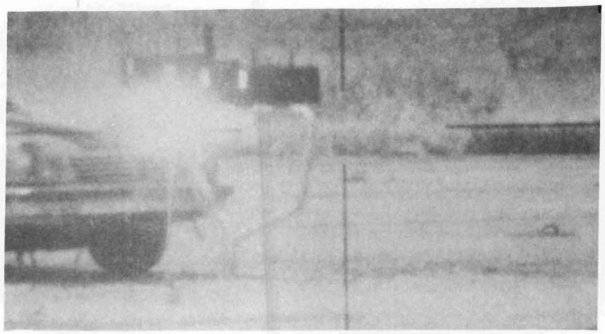


Figure 4. Mailbox Attachment and Support Anchor Before Test 1.

Figure 5. Vehicle Before Test 1.



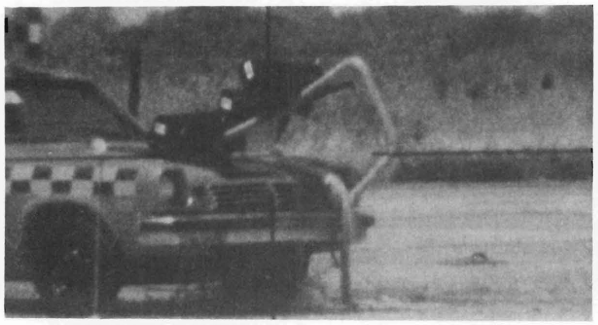
0.000



0.014

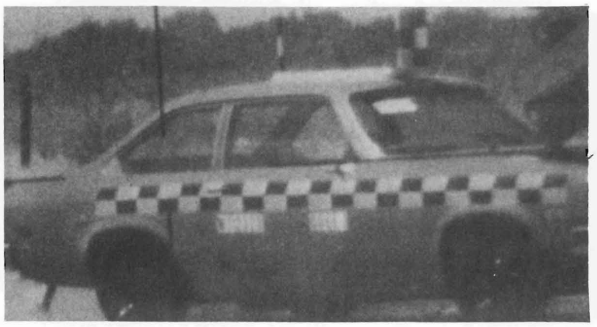
0.037

0.053



0.074

0.129



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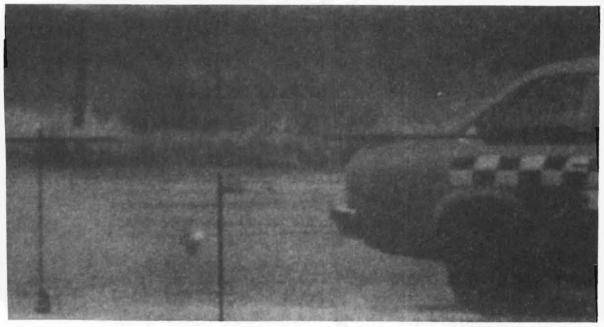
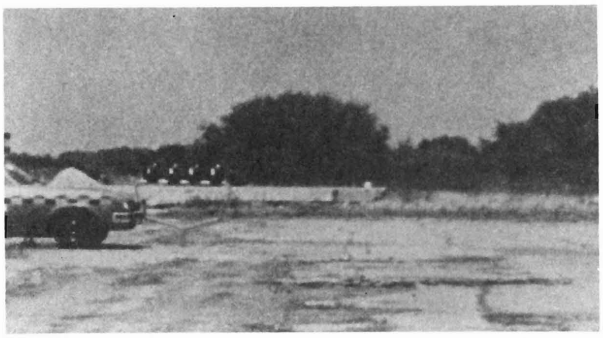
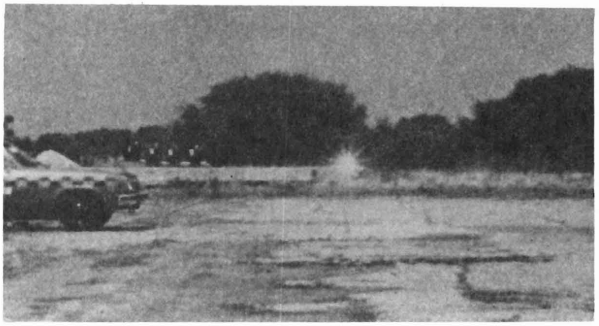


0.292

Figure 6. Sequential Photographs for Test 1 - Closeup View.

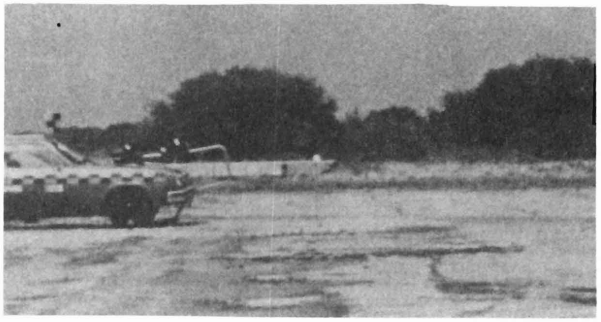


0.000

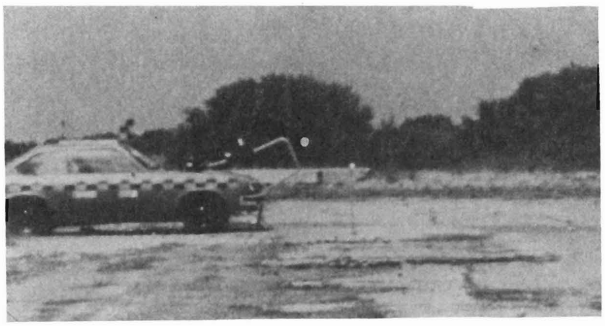


0.014

0.037



0.053



0.074

0.129

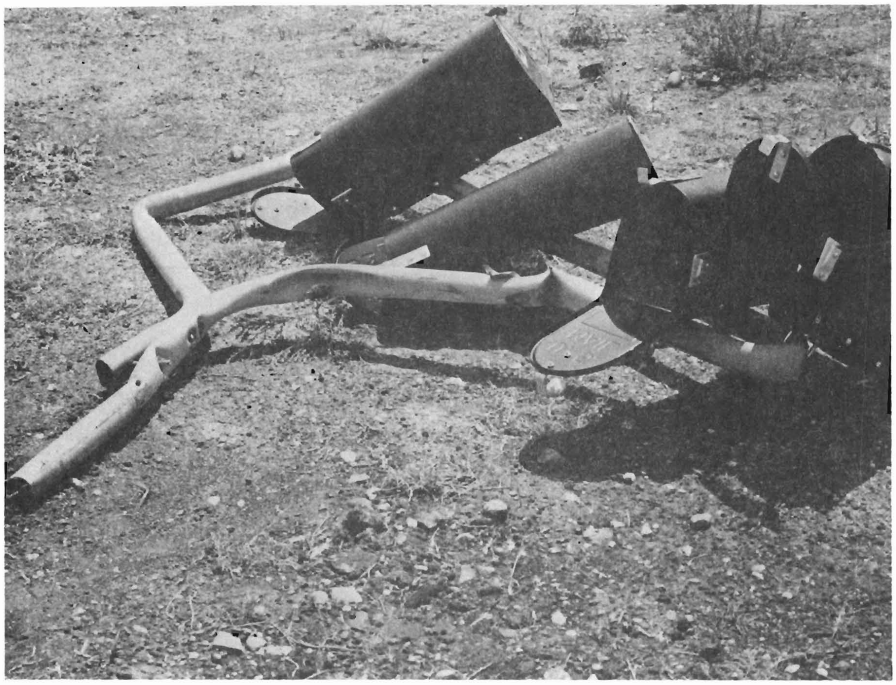
0.212

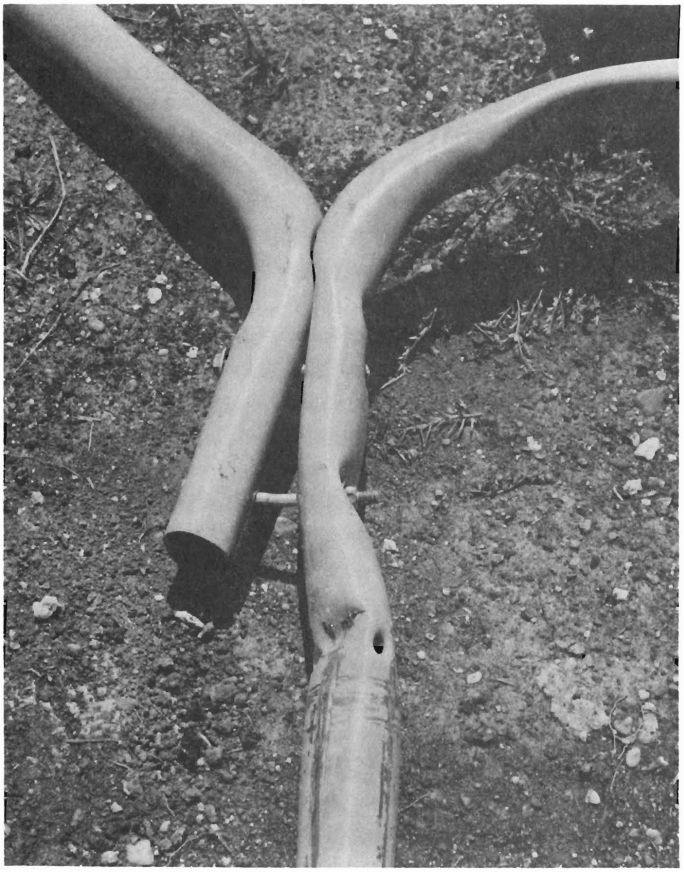
0.292

Figure 7. Sequential Photographs for Test 1 - Side View.

Table 2. Time, Displacement, Event Summary for Test 1.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact
0.014	1.25	Rectangular support begins to collapse
0.037	3.28	Vehicle strikes base of post
0.053	4.69	Mailboxes impact hood of vehicle
0.074	6.54	Base of support is pulled from ground
0.129	11.39	Mailbox support loses contact with vehicle
0.212	18.71	Mailboxes lose contact with vehicle
0.292	25.77	Mailbox assembly flies clear of vehicle





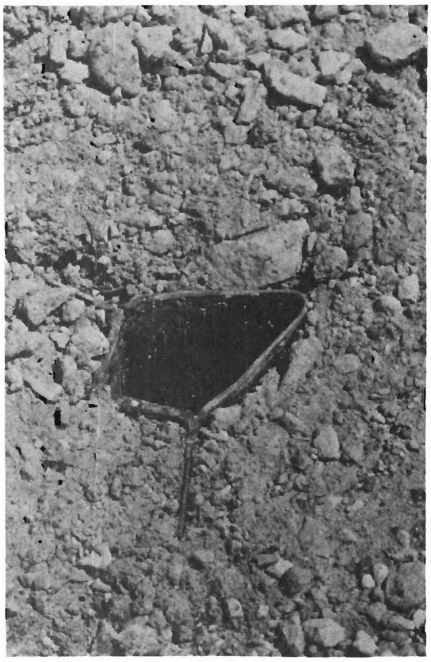


Figure 8. Mailbox Support After Test 1.

Figure 9. Vehicle After Test 1.

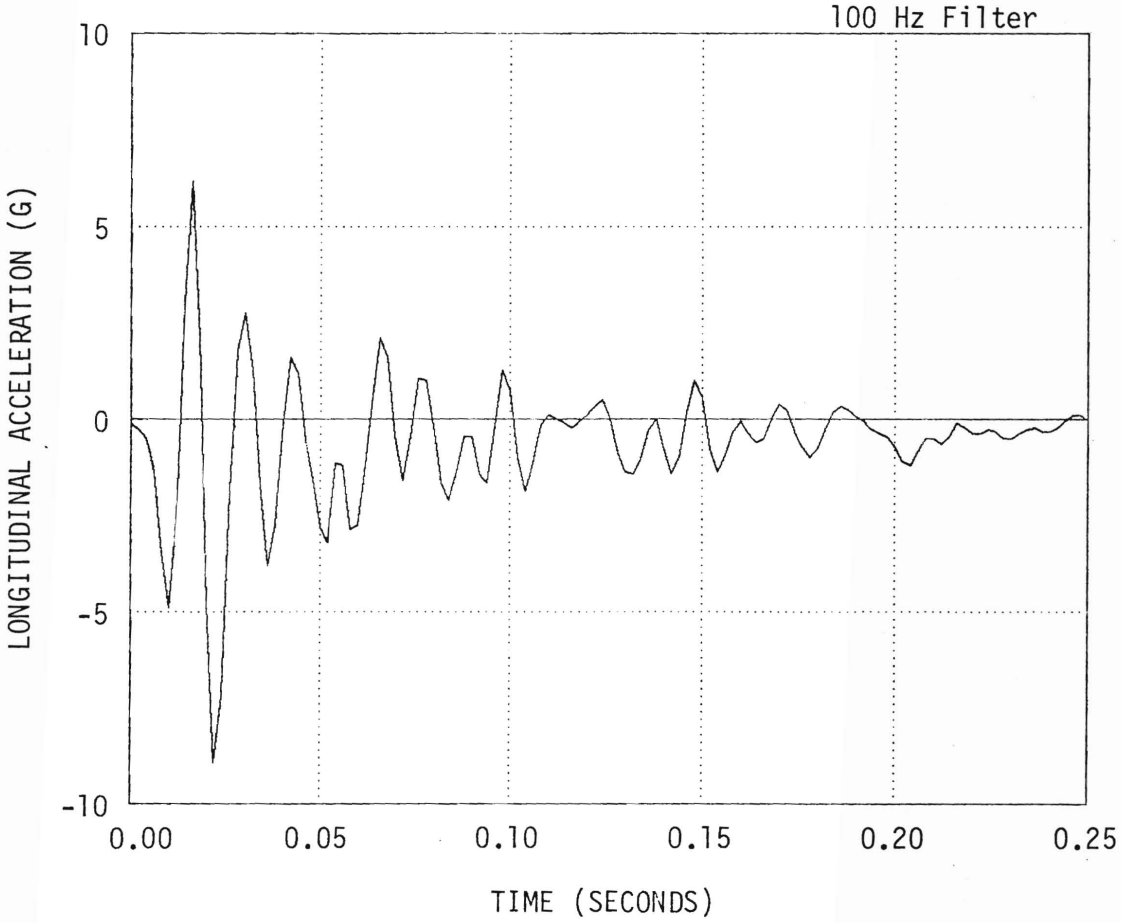


Figure 10. Vehicle Longitudinal Acceleration for Test 1.

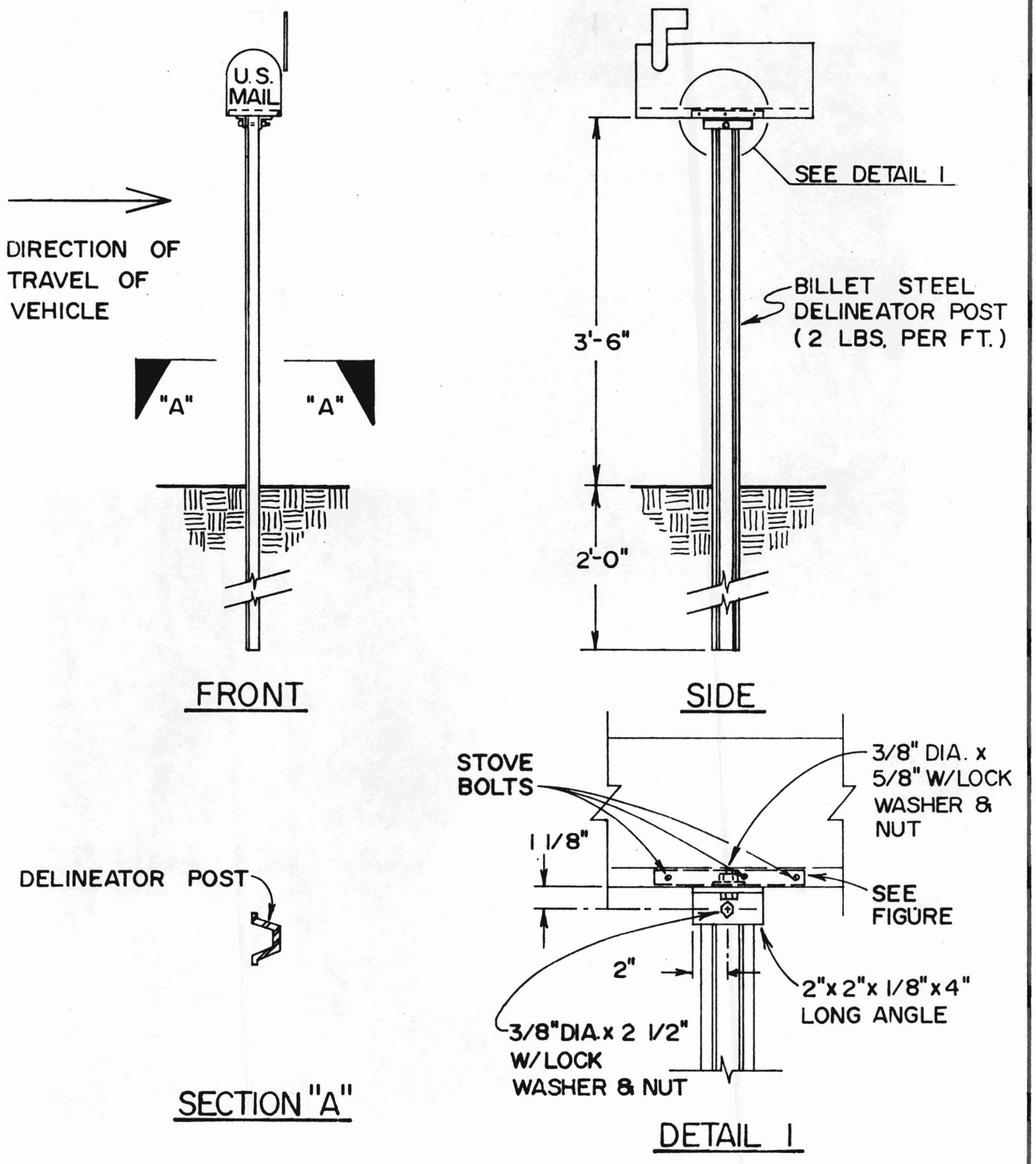


Figure 11. Mailbox Support Configuration for Test 2.

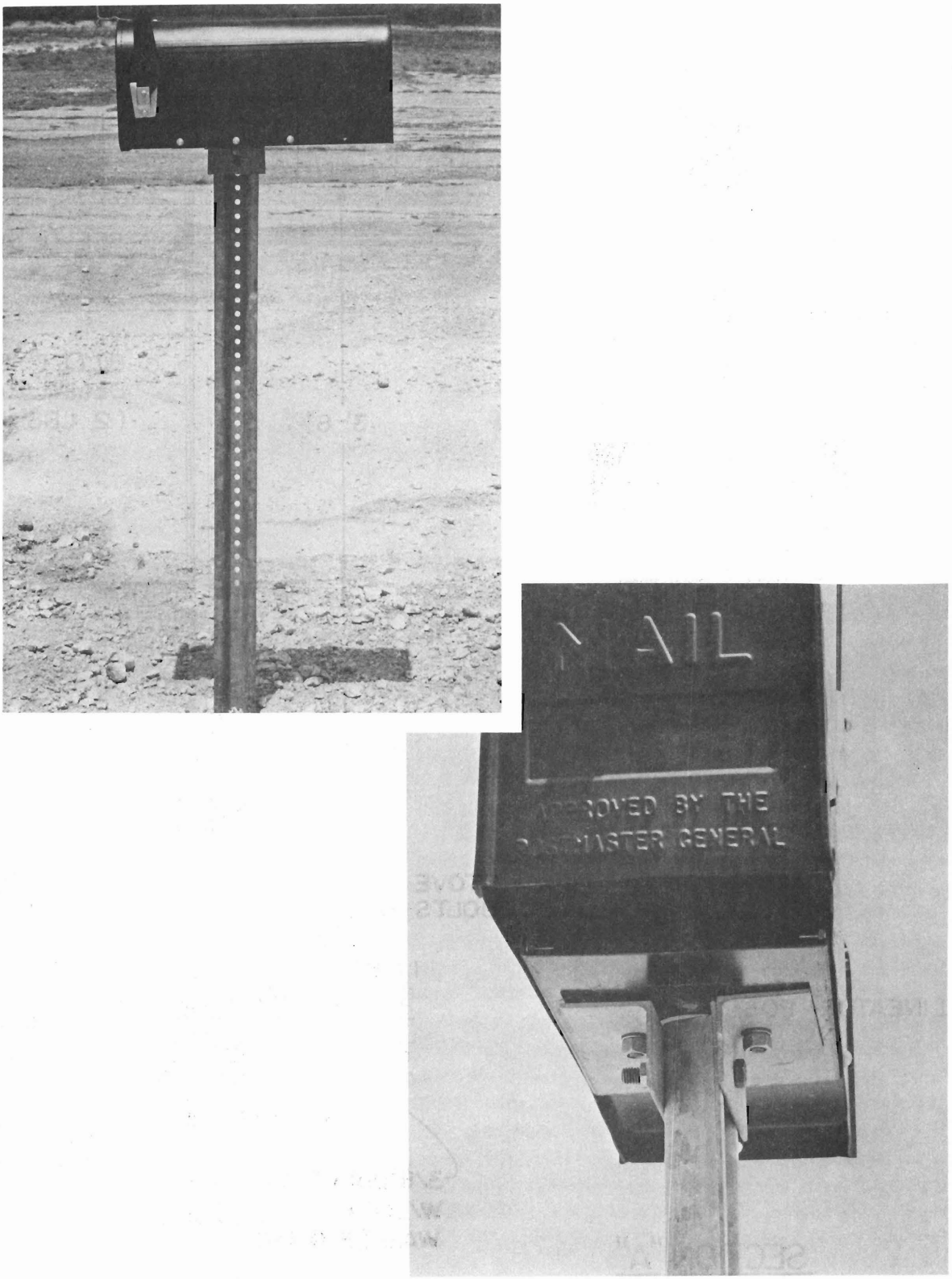
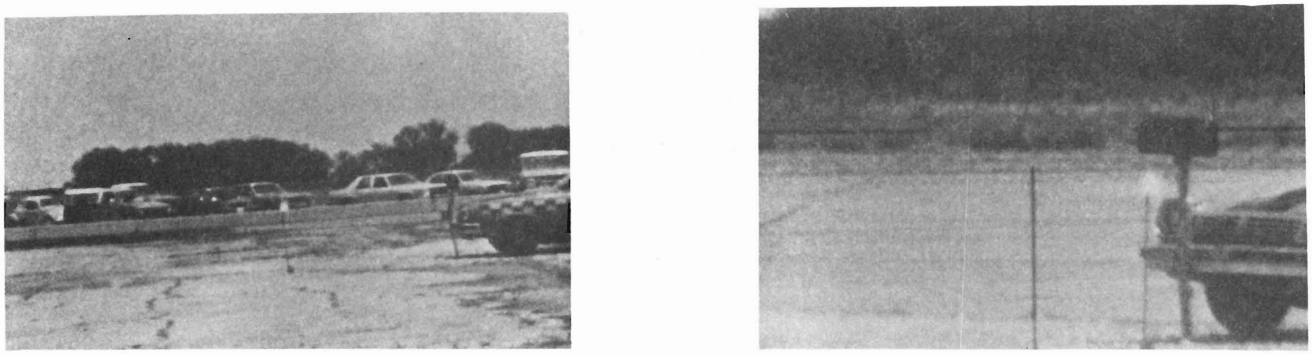
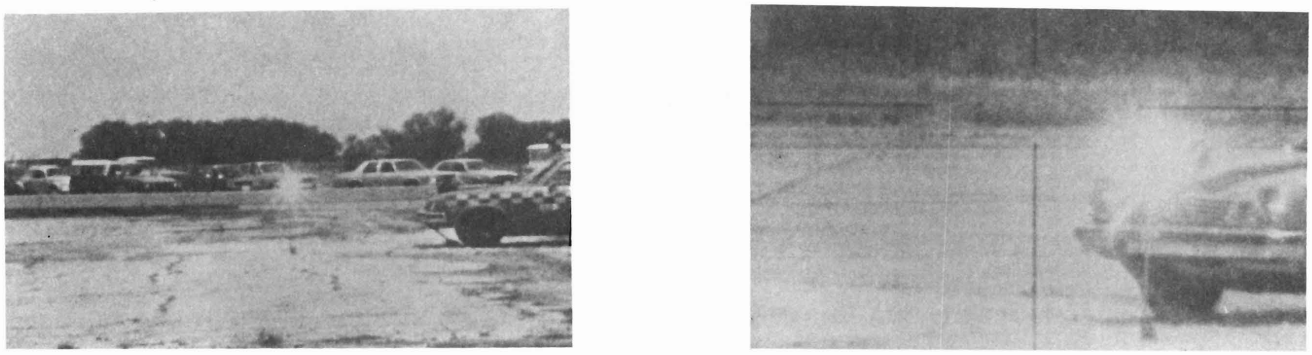


Figure 12. Mailbox Support Before Test 2.

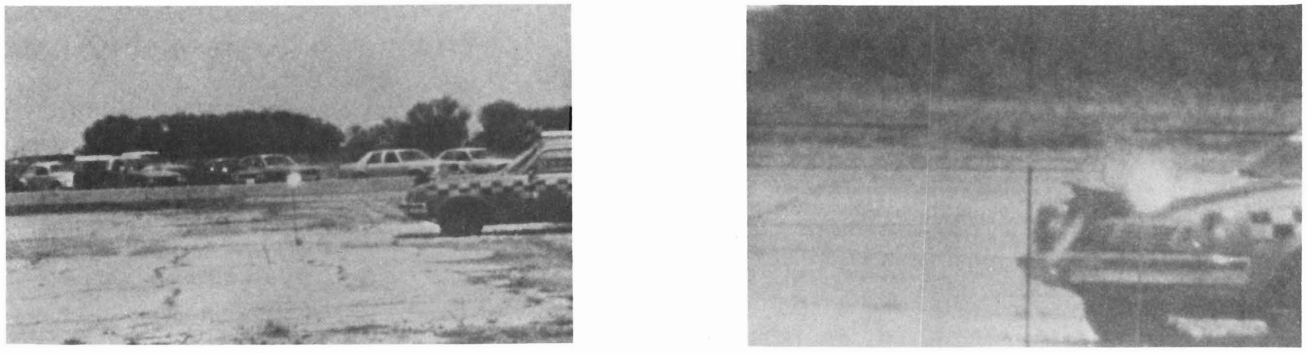
Figure 13. Vehicle Before Test 2.



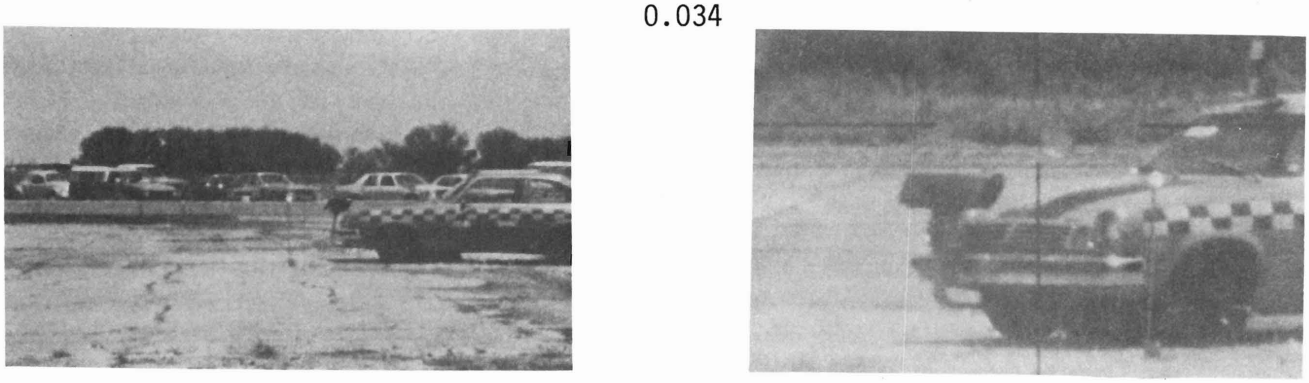
0.000



0.020



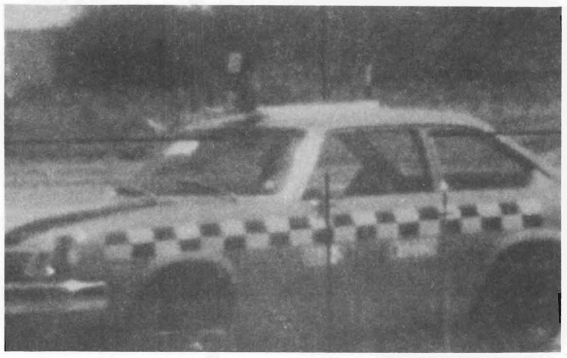
0.034



0.065

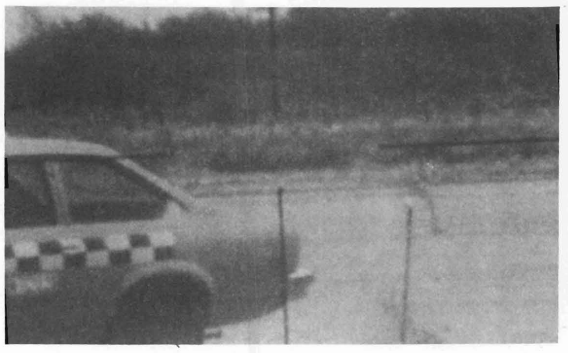
Figure 14. Sequential Photographs for Test 2.

0.118



0.150

0.197



0.237

Figure 14. Sequential Photographs for Test 2. (Cont.)

Table 3. Time, Displacement, Event Summary for Test 2.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact
0.020	1.81	Mailbox strikes hood
0.034	3.06	Support is pulled from ground
0.065	5.83	Mailbox loses contact with vehicle
0.118	10.57	Support falls to ground
0.150	13.43	Assembly is dragged by vehicle
0.197	17.63	Mailbox falls to ground
0.237	21.20	Vehicle rolls over assembly

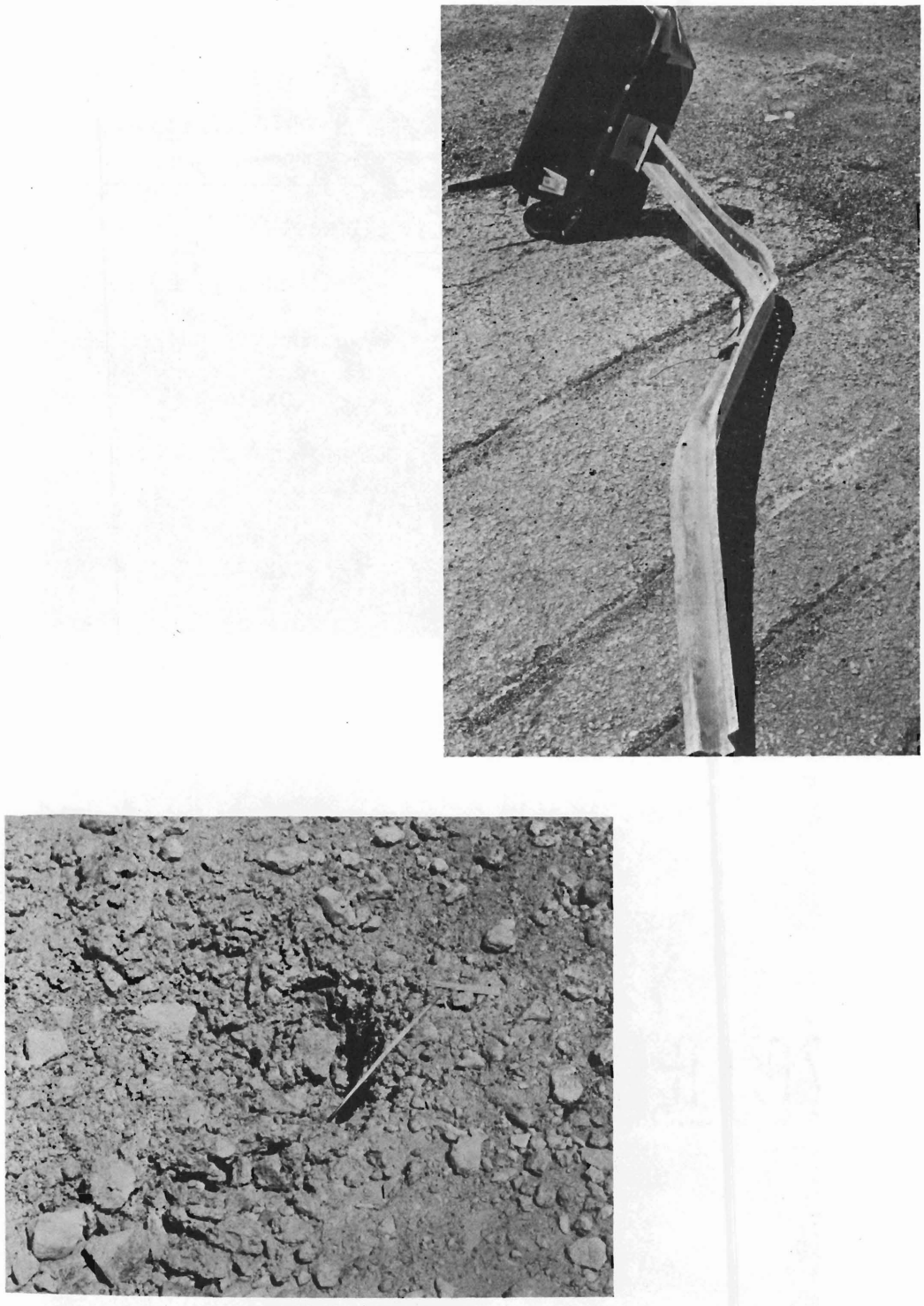


Figure 15. Mailbox Support After Test 2.

Figure 16. Vehicle After Test 2.

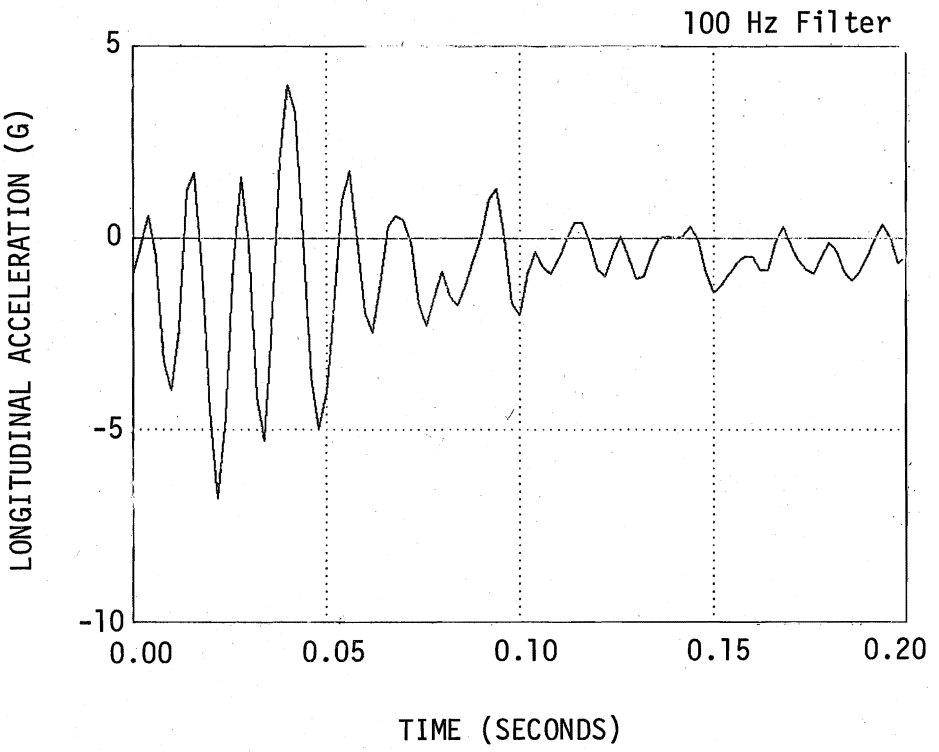


Figure 17. Vehicle Accelerometer Trace for Test 2.

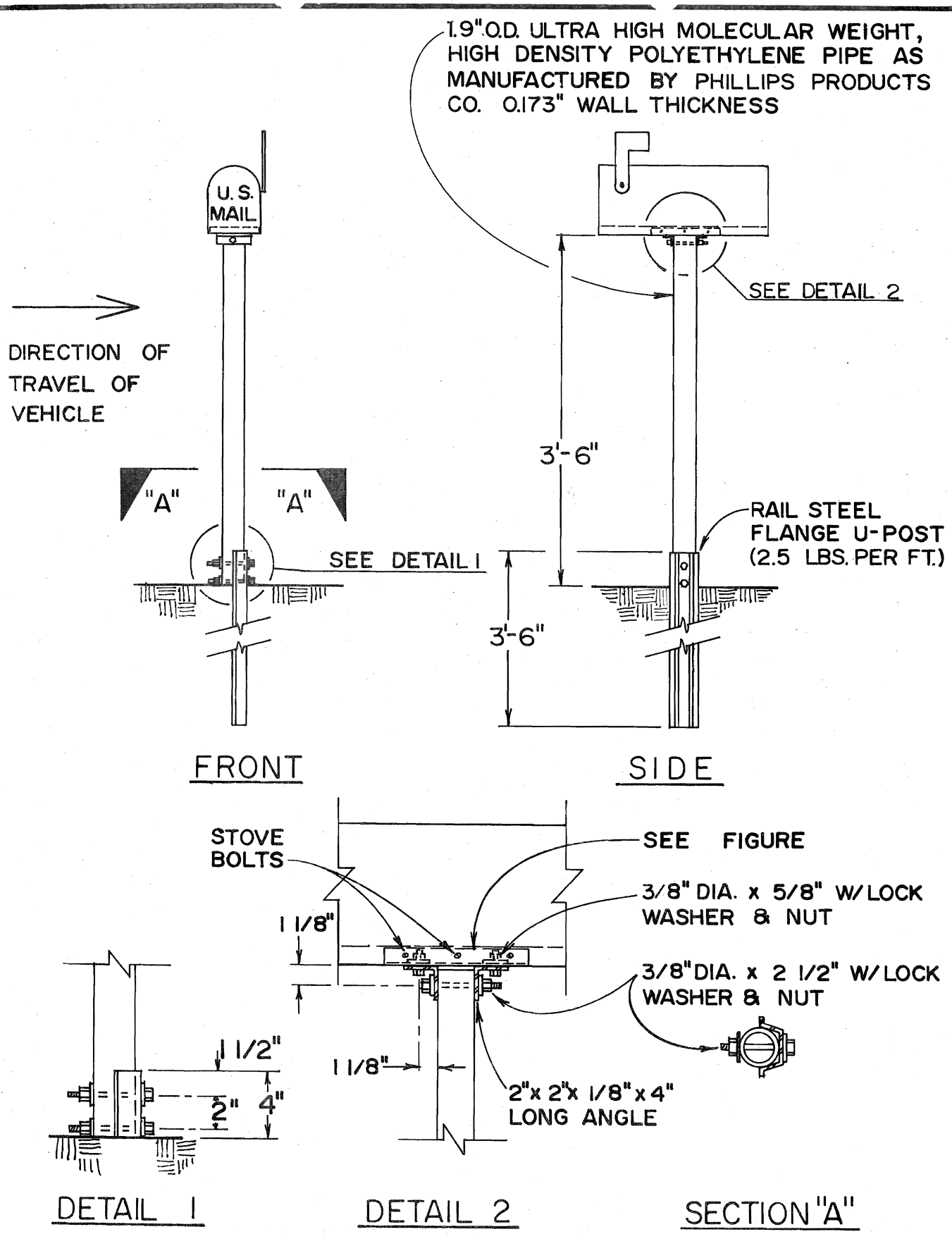


Figure 18. Mailbox Support Configuration for Test 3-1.

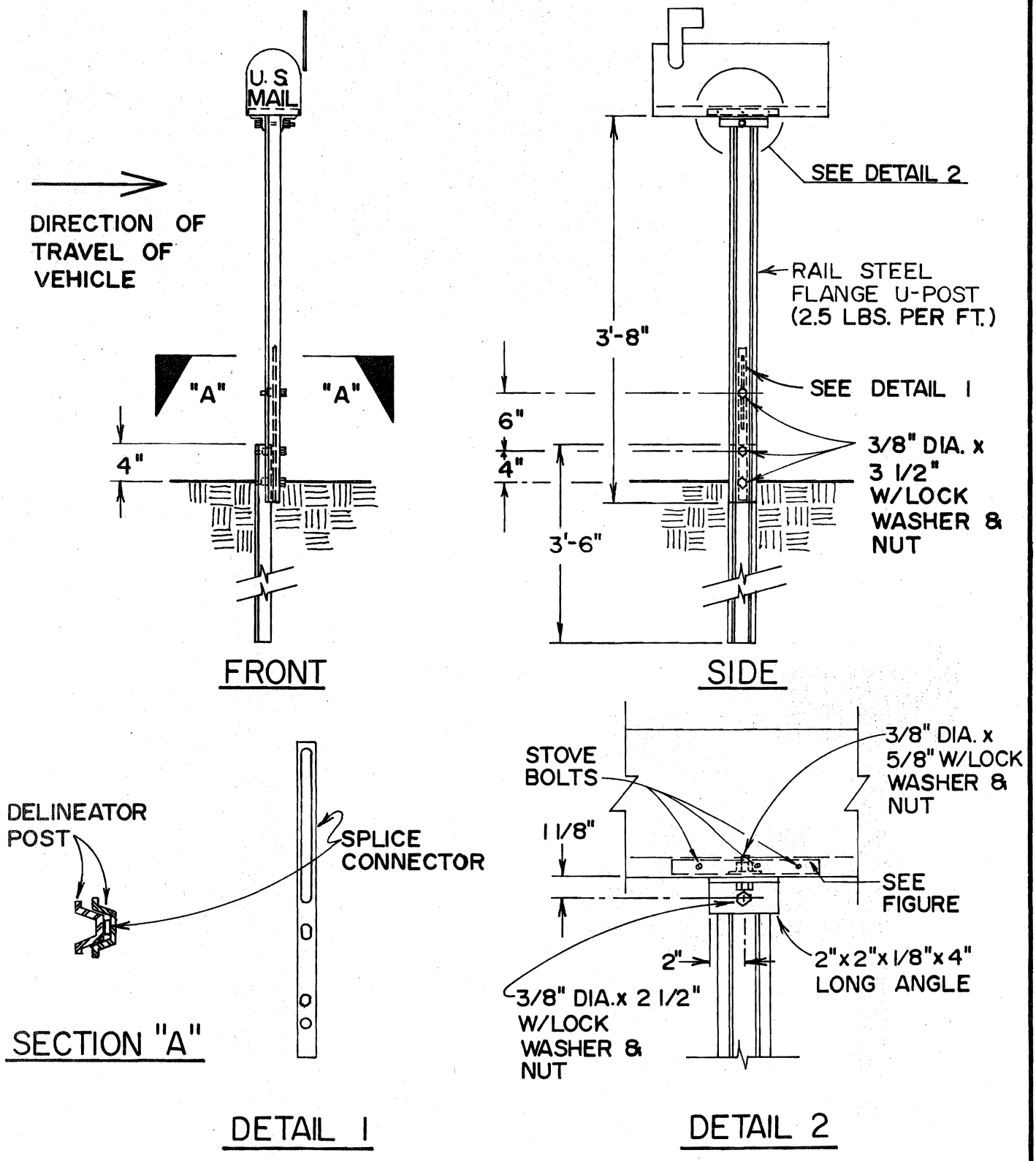
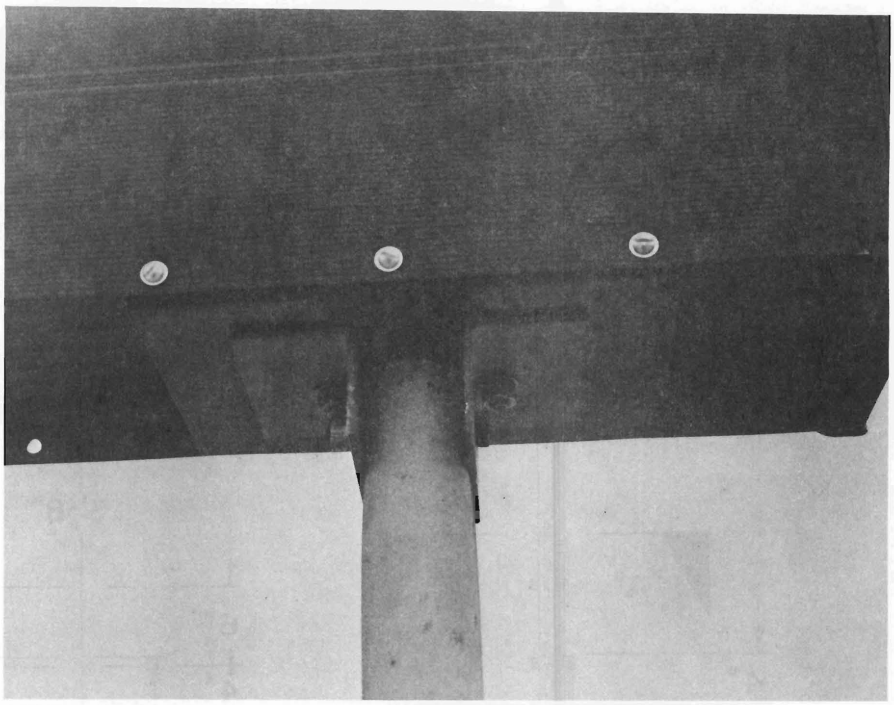


Figure 19. Mailbox Support Configuration for Test 3-2.



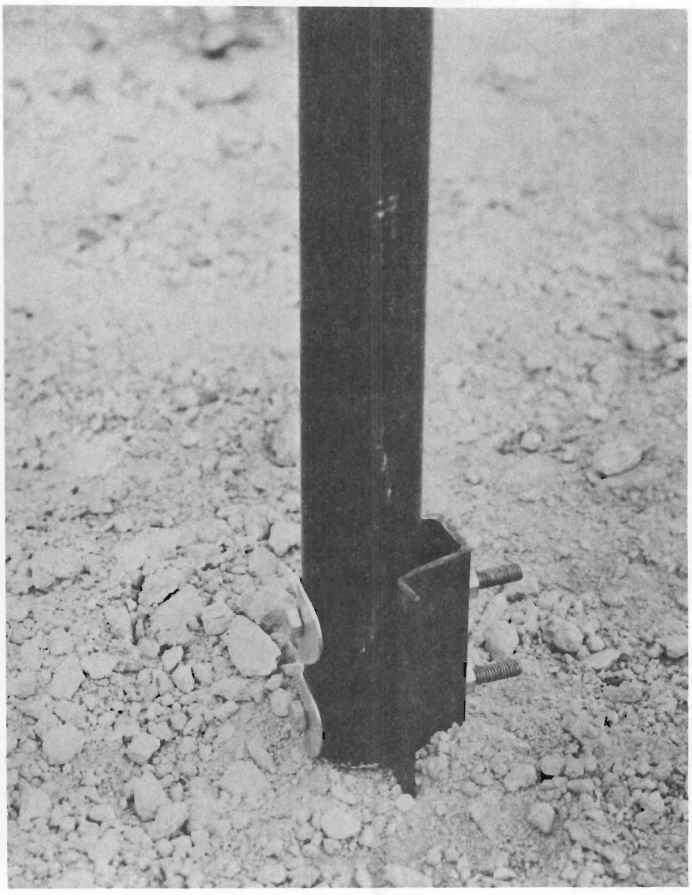


Figure 20. Mailbox Supports Before Tests 3-1 and 3-2.

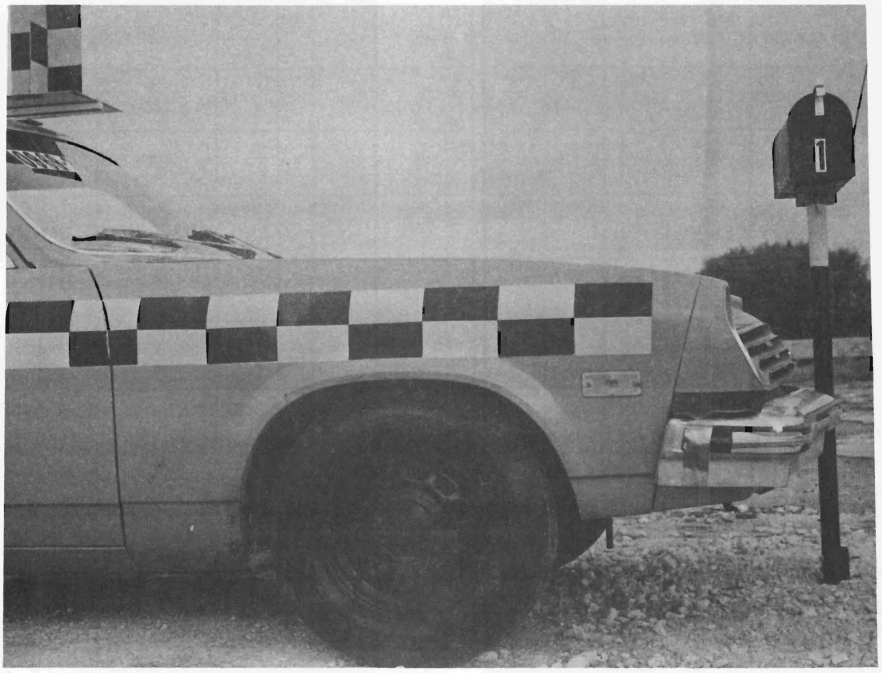


Figure 21. Vehicle Before Tests 3-1 and 3-2.

0.000

0.006

0.022

0.049

0.108

0.121

0.196

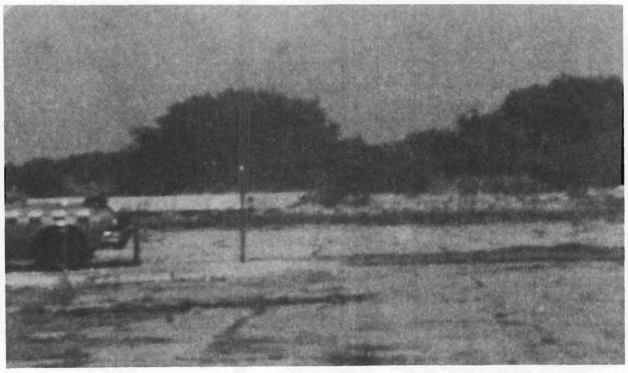
0.274

Figure 22. Sequential Photographs for Tests 3-1 and 3-2 - Close-up View.

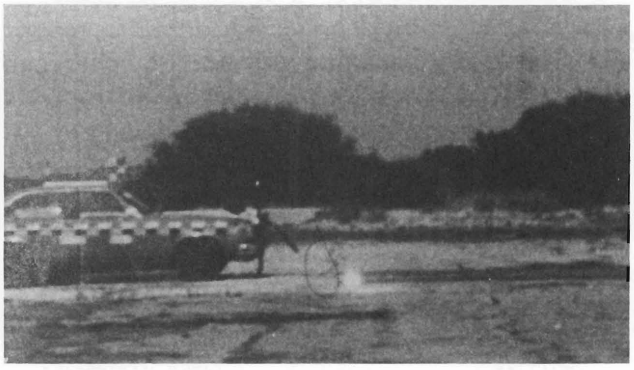
0.000

0.006

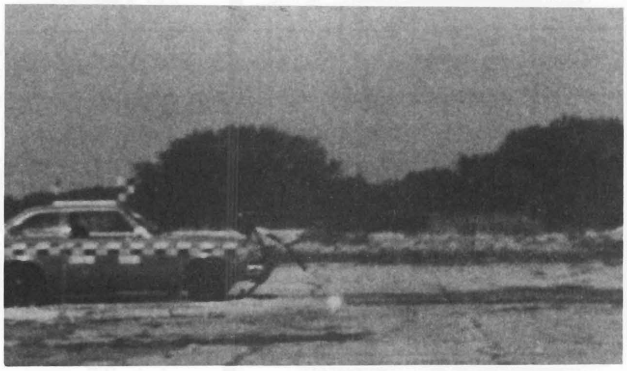
0.022



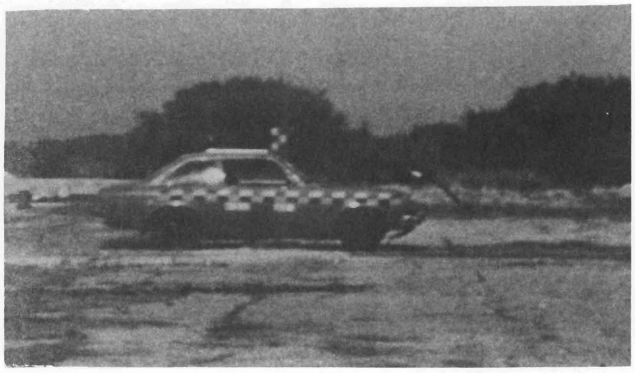
0.049



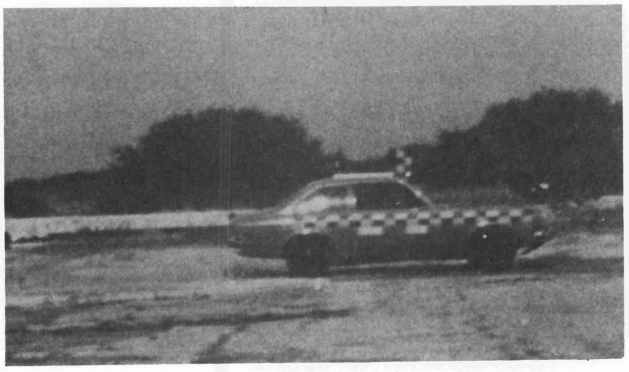
0.108



0.121



0.196



0.274

Figure 23. Sequential Photographs for Tests 3-1 and 3-2 - Side Veiw.

Table 4. Time, Displacement, Event Summary for Tests 3-1 and 3-2.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with first installation
0.006	0.54	Mailbox strikes hood
0.022	1.98	Plastic pipe breaks
0.049	4.41	Plastic pipe springs back
0.108	9.71	First installation loses contact with car; impact with second installation
0.121	10.87	Mailbox strikes hood again
0.196	17.61	Support breaks
0.274	24.57	Assembly is carried away by vehicle

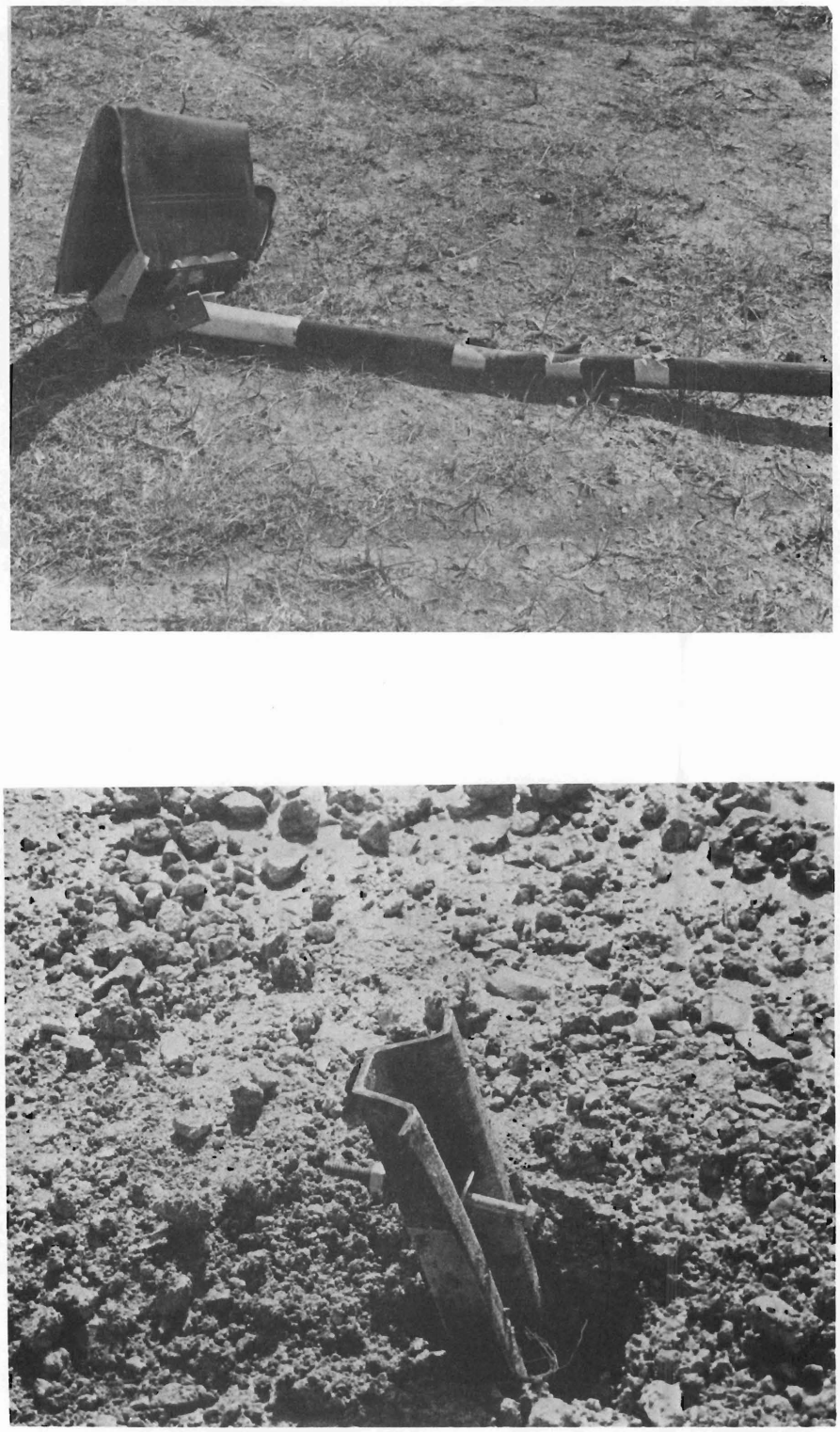


Figure 24. Mailbox Support After Test 3-1.

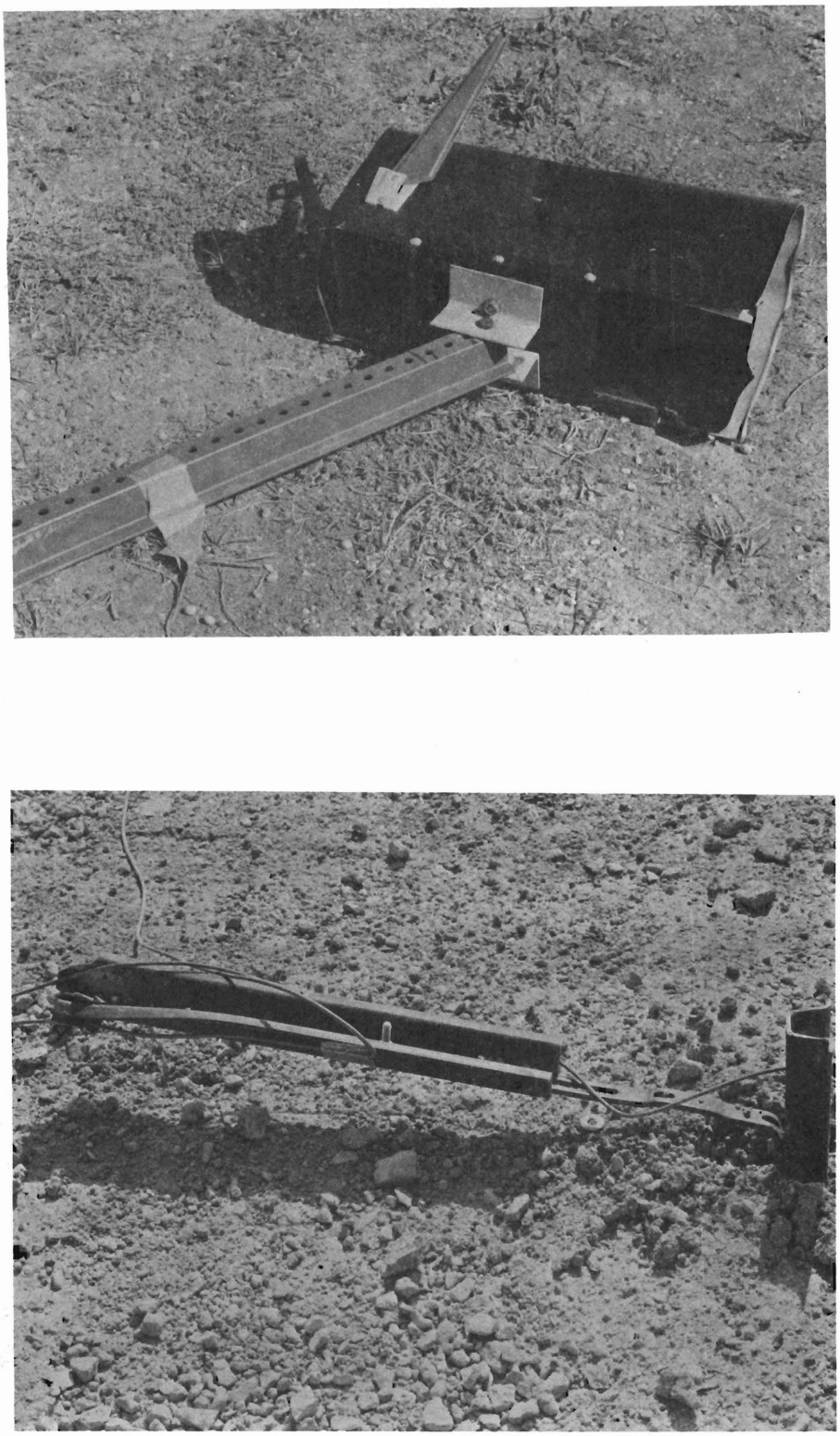


Figure 25. Mailbox Support After Test 3-2.

Figure 26. Vehicle After Tests 3-1 and 3-2.

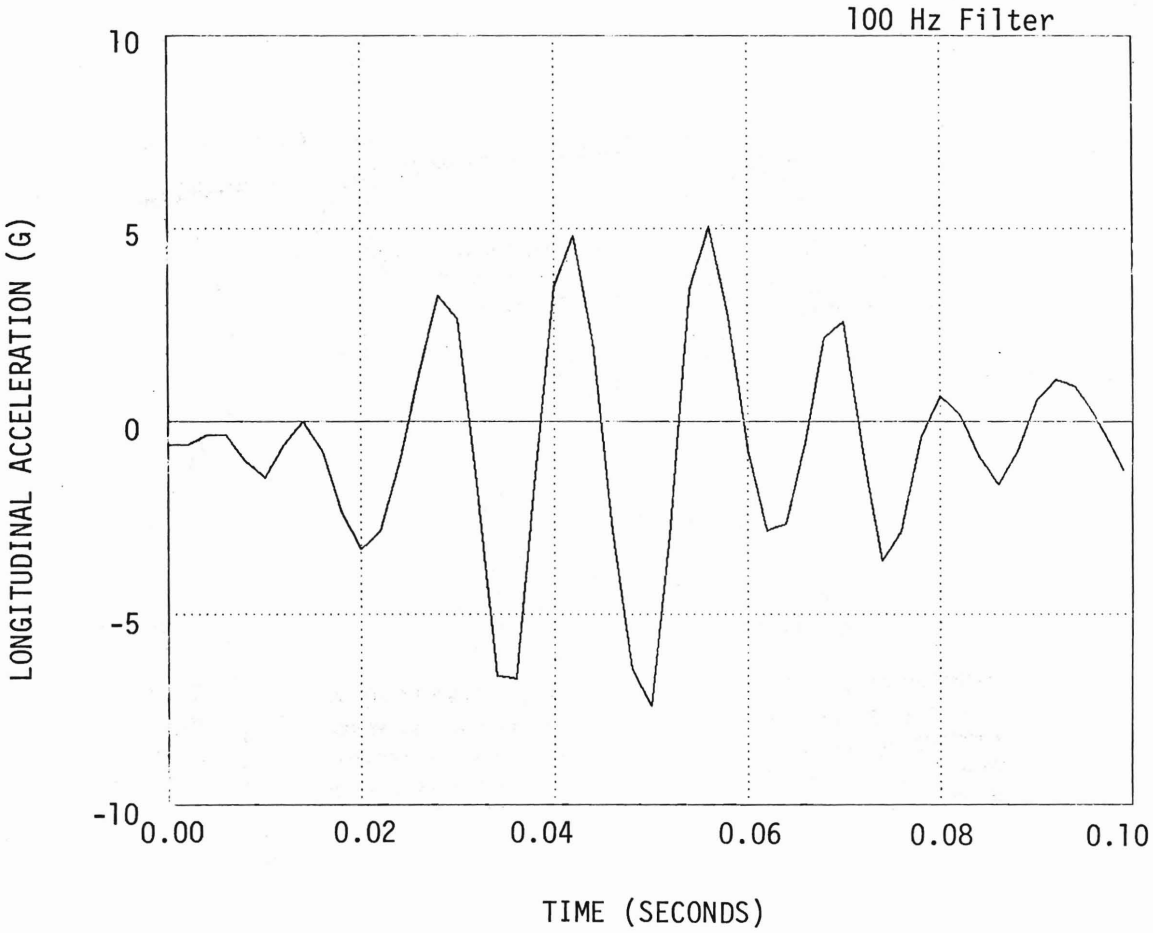


Figure 27. Vehicle Accelerometer Trace for Test 3-1.

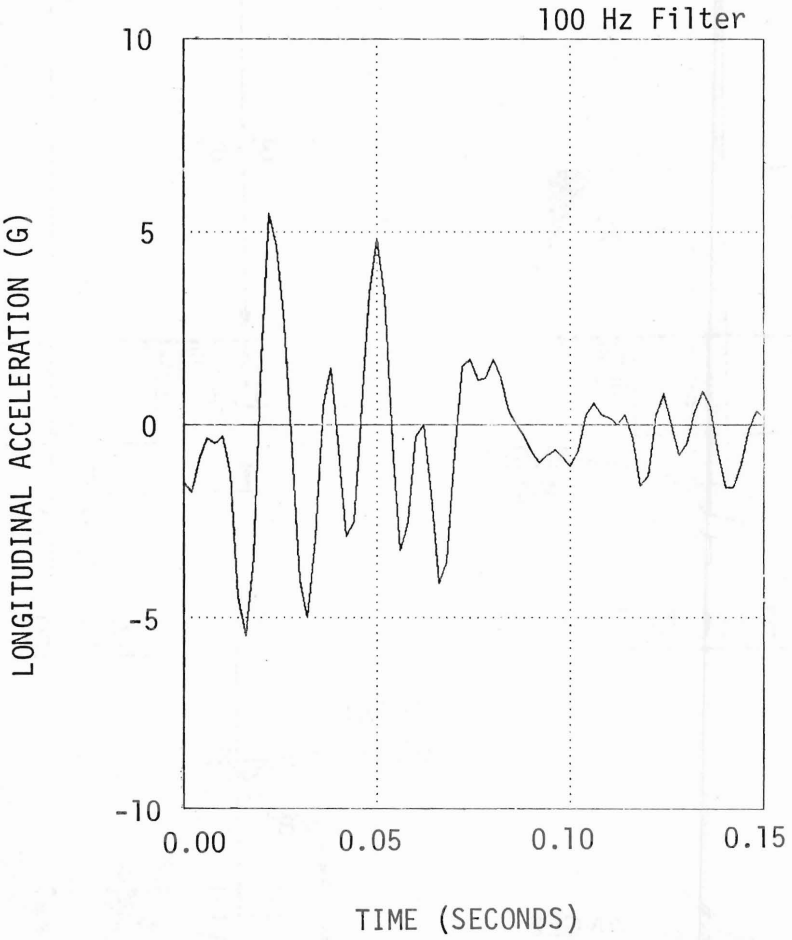


Figure 28. Vehicle Accelerometer Trace for Test 3-2.

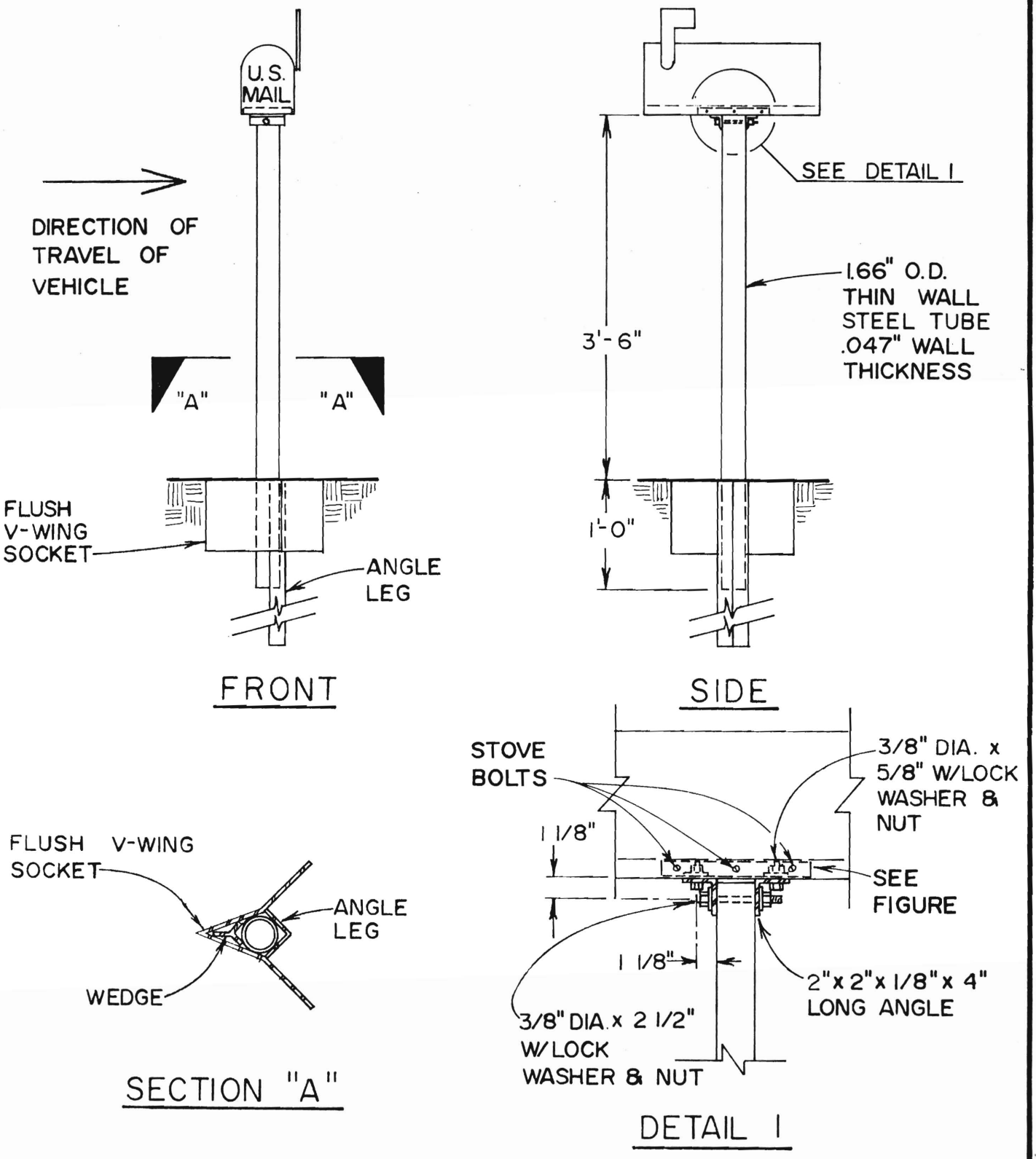


Figure 29. Mailbox Support Configuration for Test 4-1.

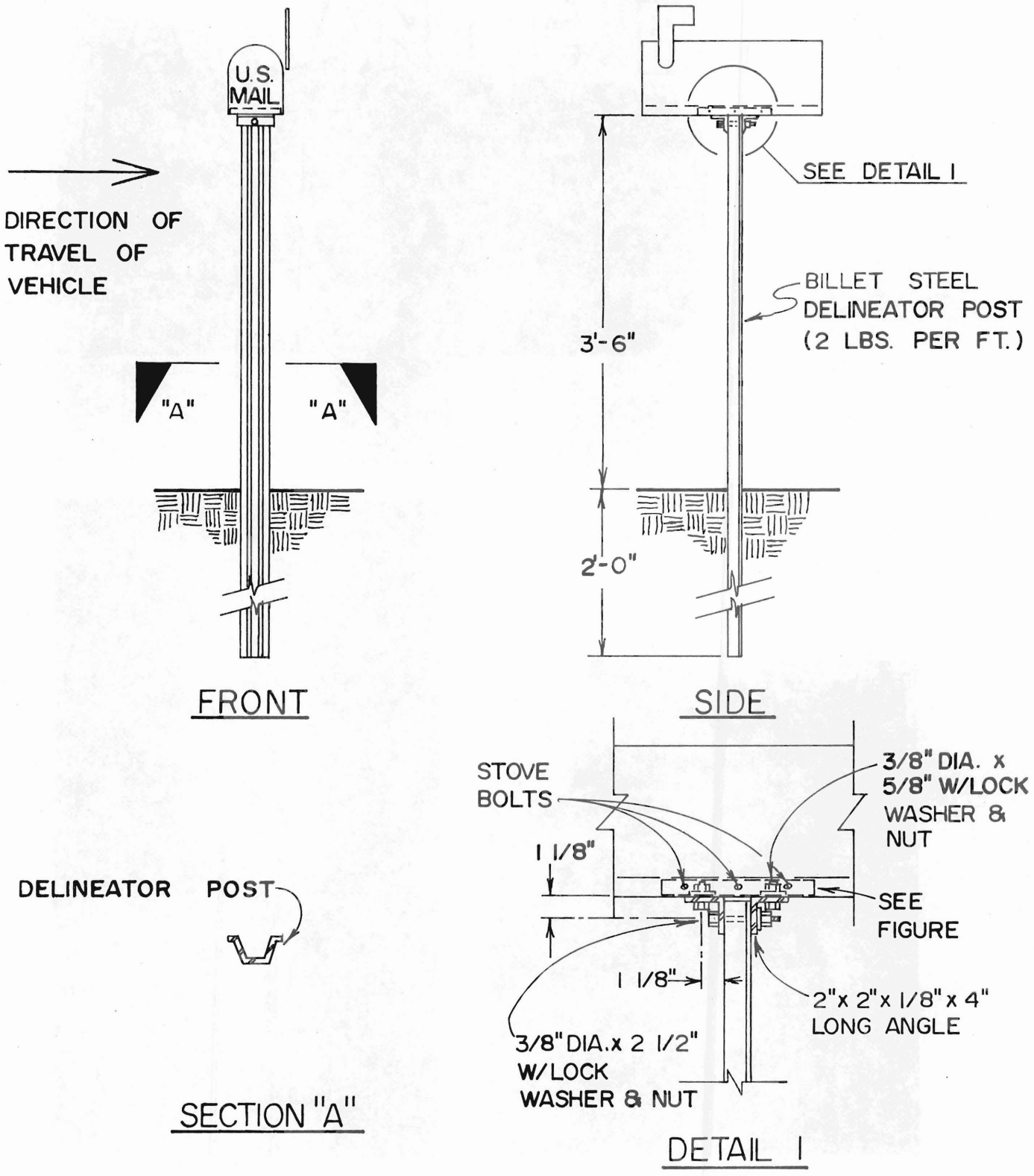
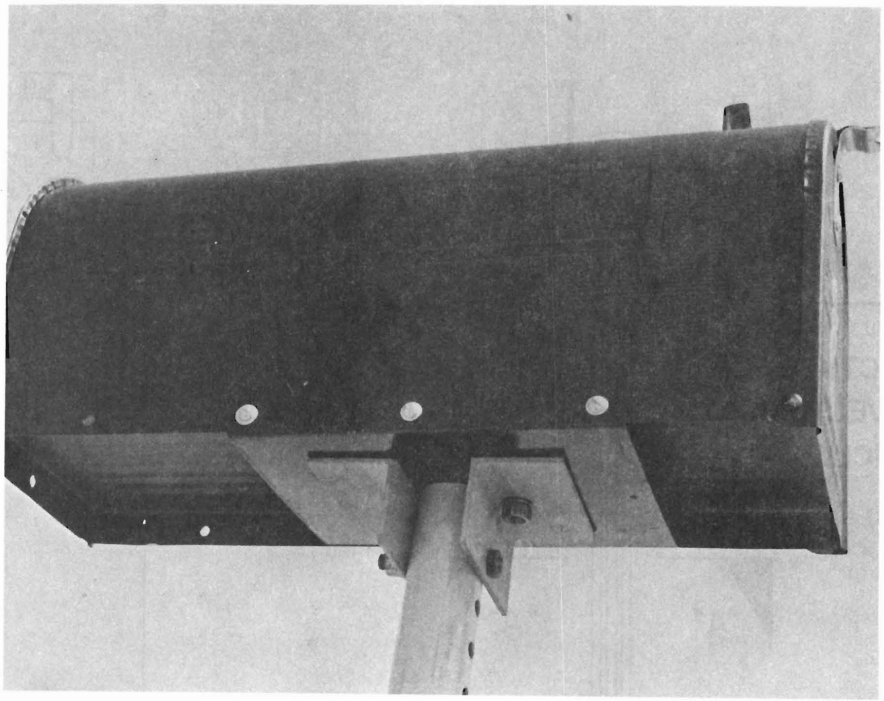


Figure 30. Mailbox Support Configuration for Test 4-2.



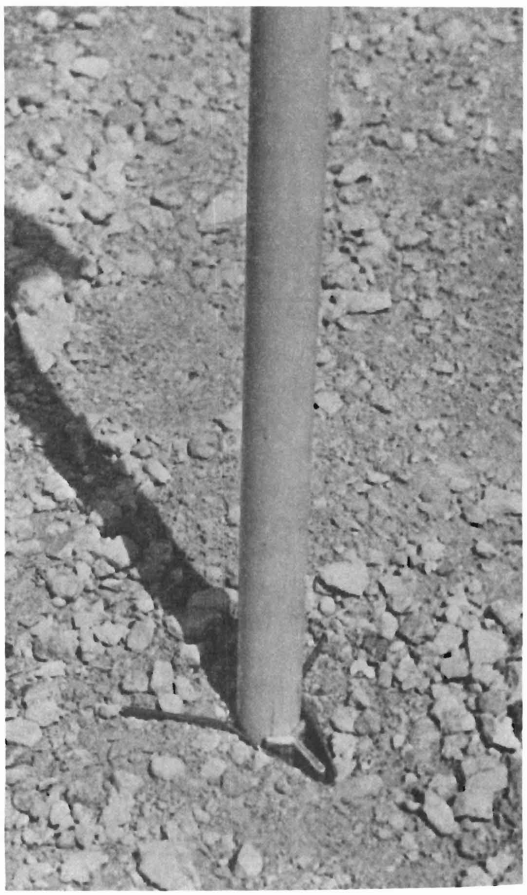


Figure 31. Mailbox Supports Before Tests 4-1 and 4-2.

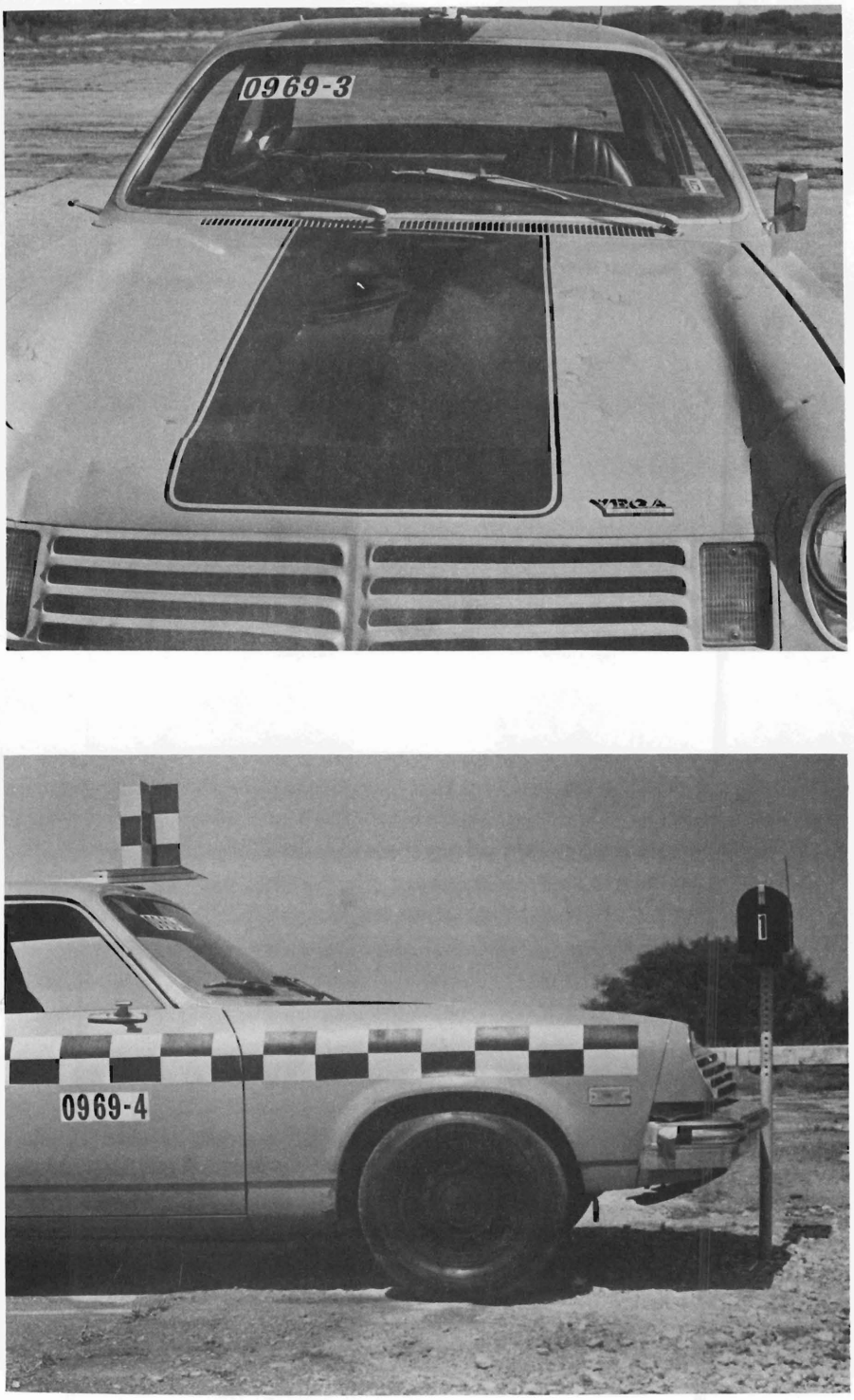
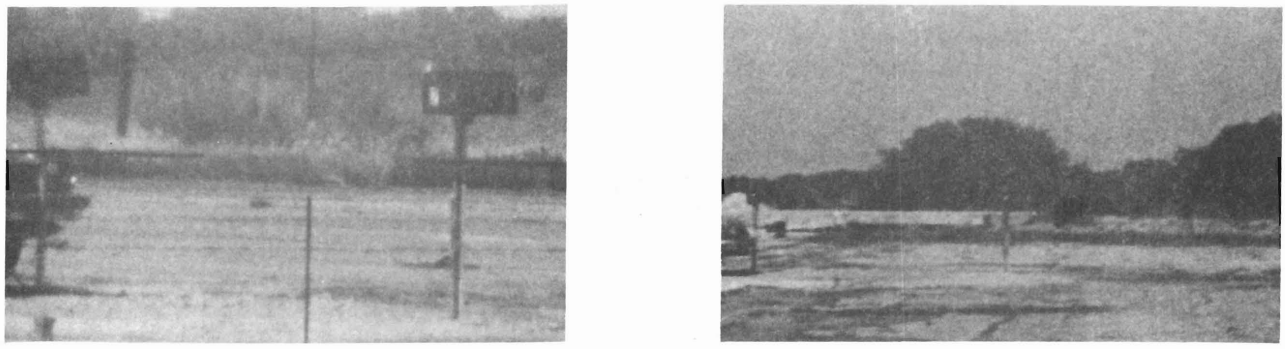
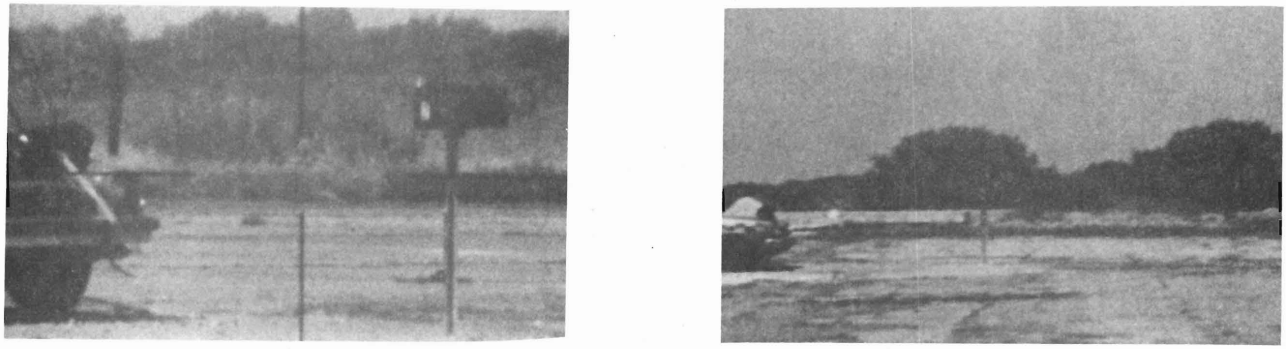


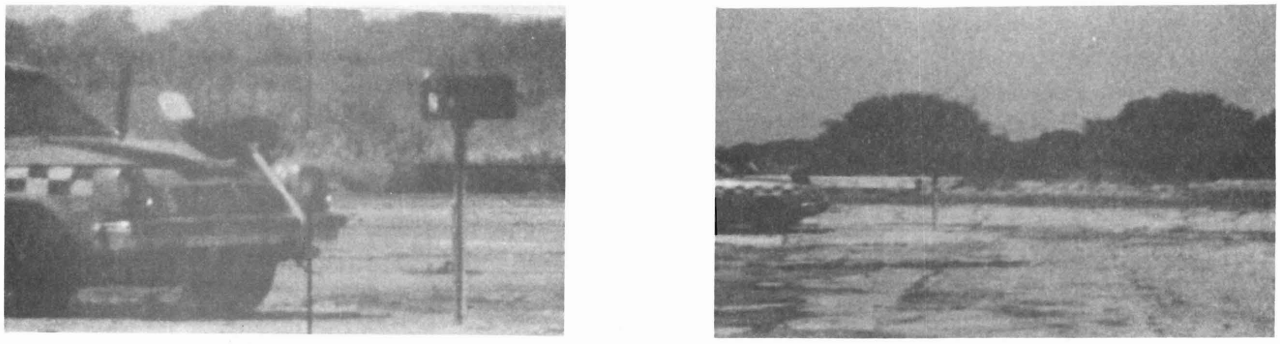
Figure 32. Vehicle Before Tests 4-1 and 4-2.



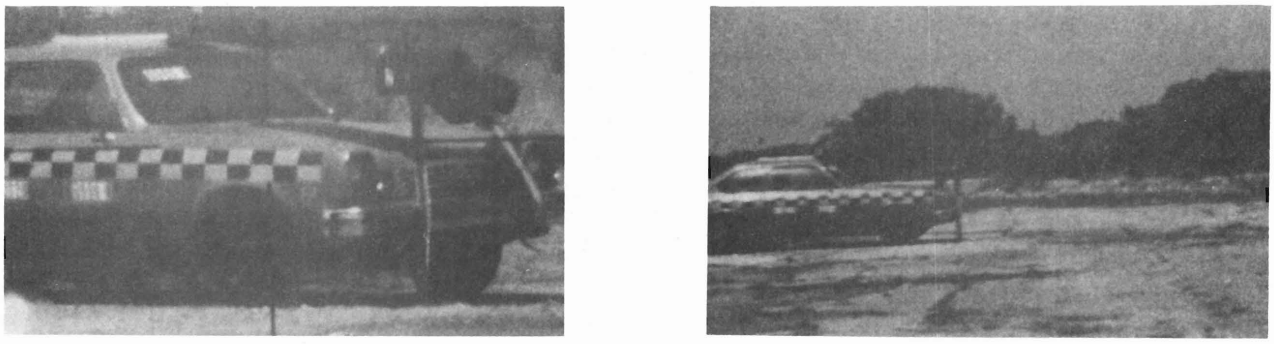
0.000



0.022

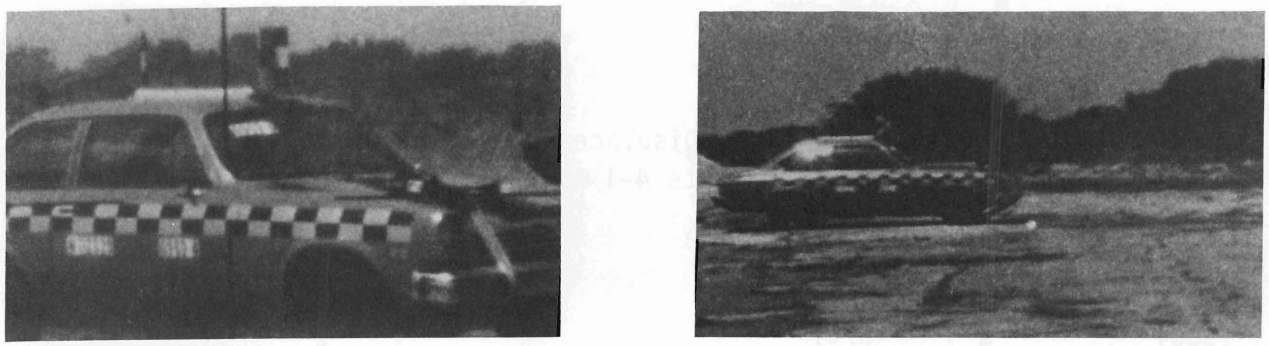


0.071

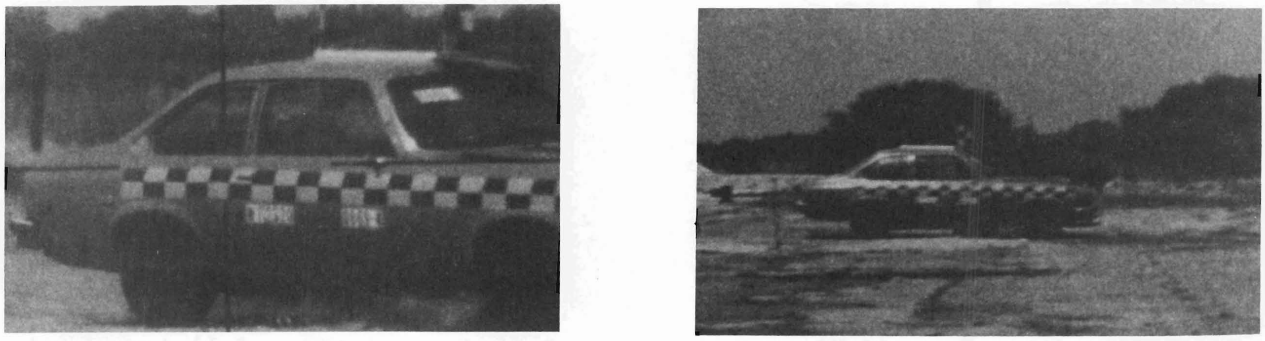


0.141

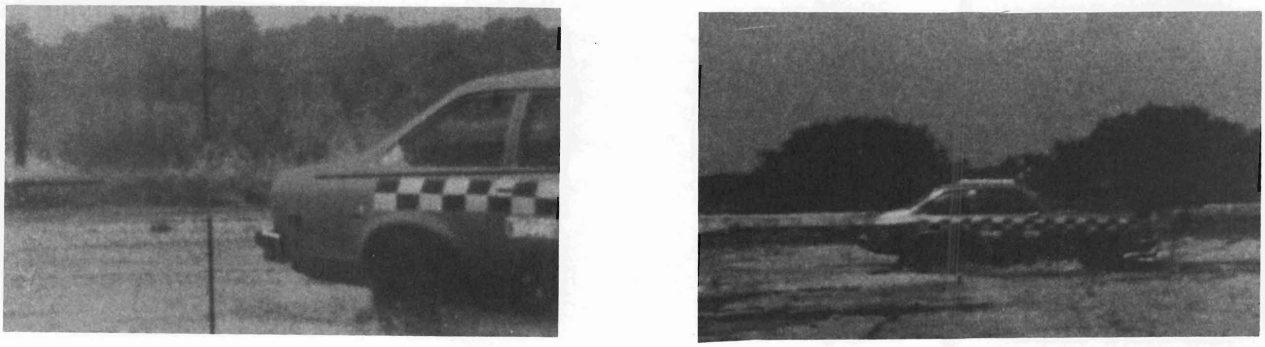
Figure 33. Sequential Photographs for Tests 4-1 and 4-2.



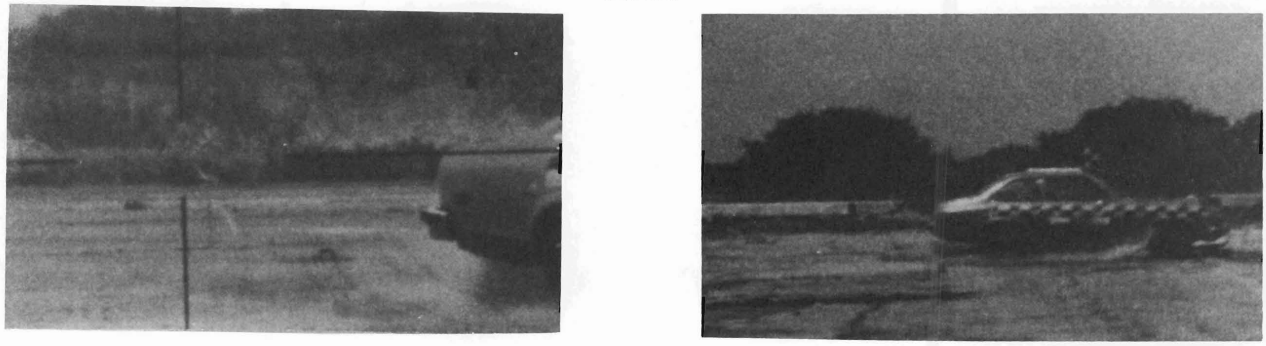
0.175



0.224



0.295

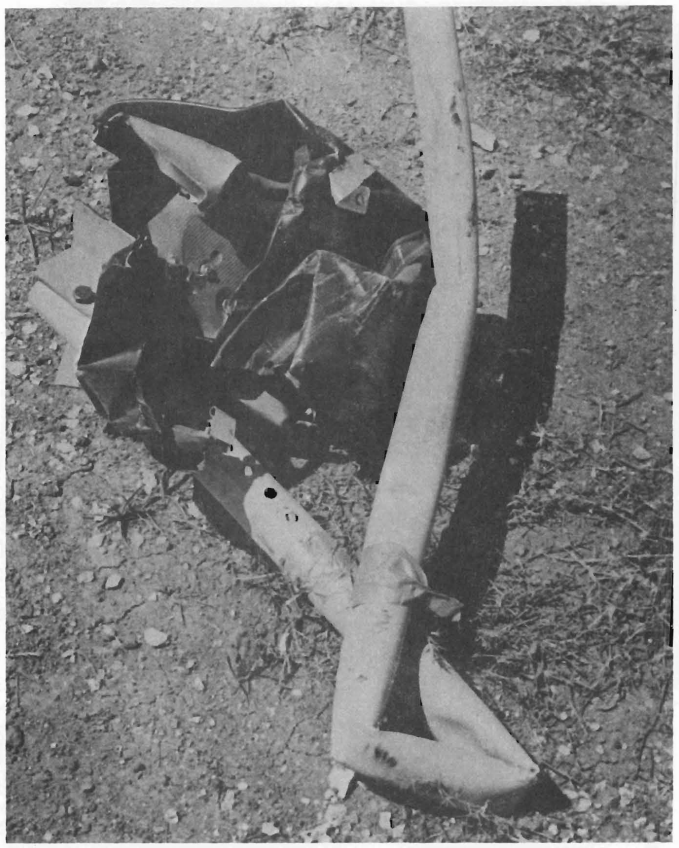


0.344

Figure 33. Sequential Photographs for Tests 4-1 and 4-2 (Continued).

Table 5. Time, Displacement, Event Summary for Tests 4-1 and 4-2.

TIME (sec)	NOMINAL VEHICLE DISPLACEMENT (ft)	EVENT
0.000	0.00	Impact with first installation
0.022	1.95	Mailbox strikes hood
0.071	6.25	Support is pulled from ground
0.141	12.58	Impact with second installation
0.175	15.56	Mailbox strikes hood
0.224	19.82	Support breaks
0.295	26.00	Both installations fall to ground
0.344	30.26	Vehicle rolls over mailbox supports



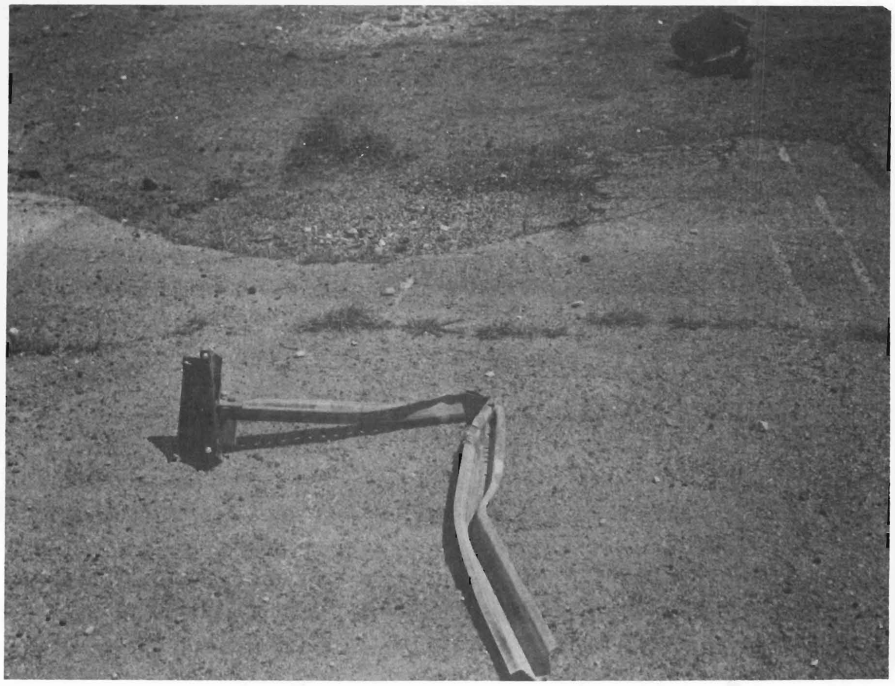


Figure 34. Mailbox Supports After Tests 4-1 and 4-2.

Figure 35. Vehicle After Tests 4-1 and 4-2.

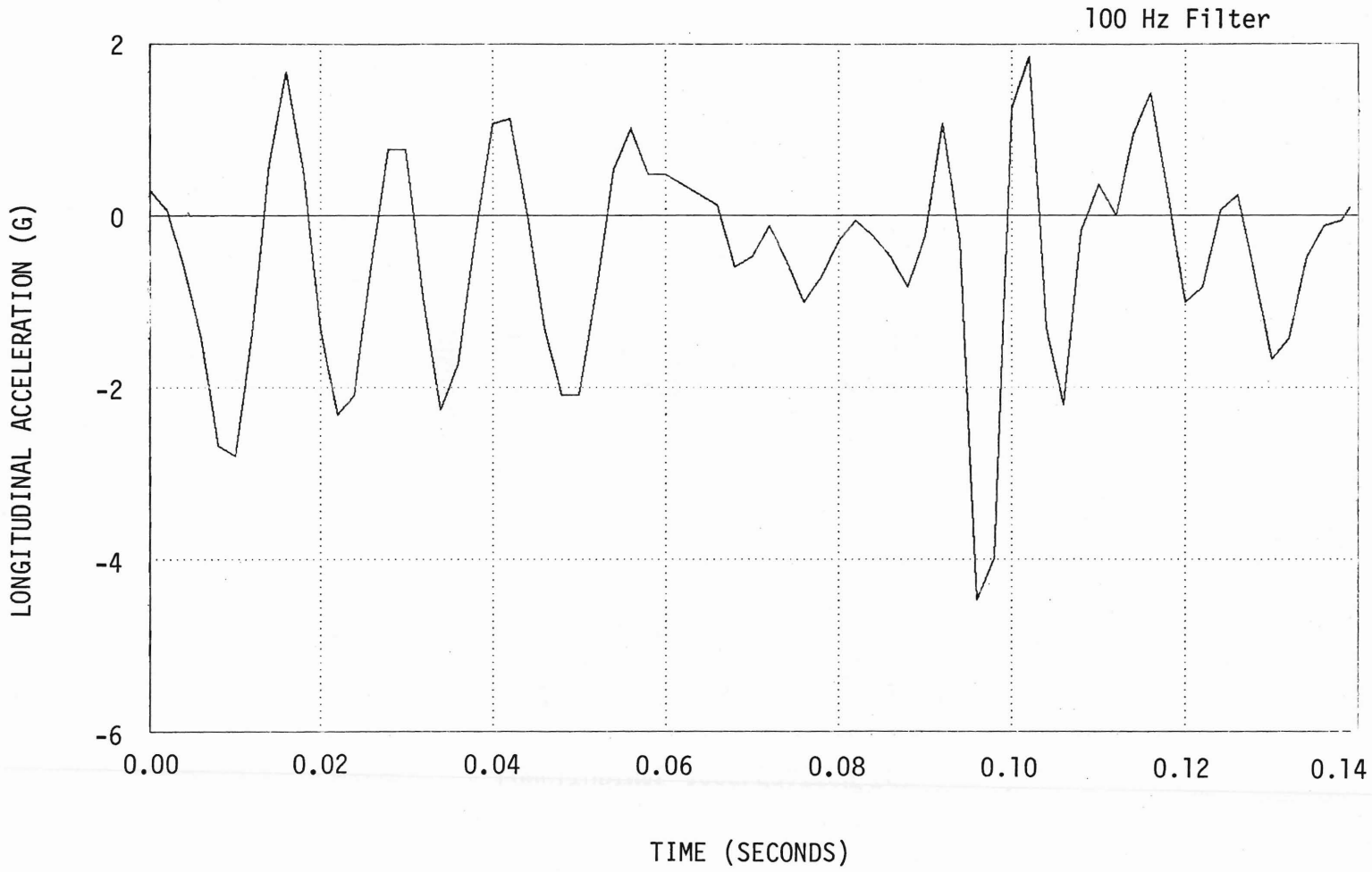


Figure 36. Vehicle Accelerometer Trace for Test 4-1.

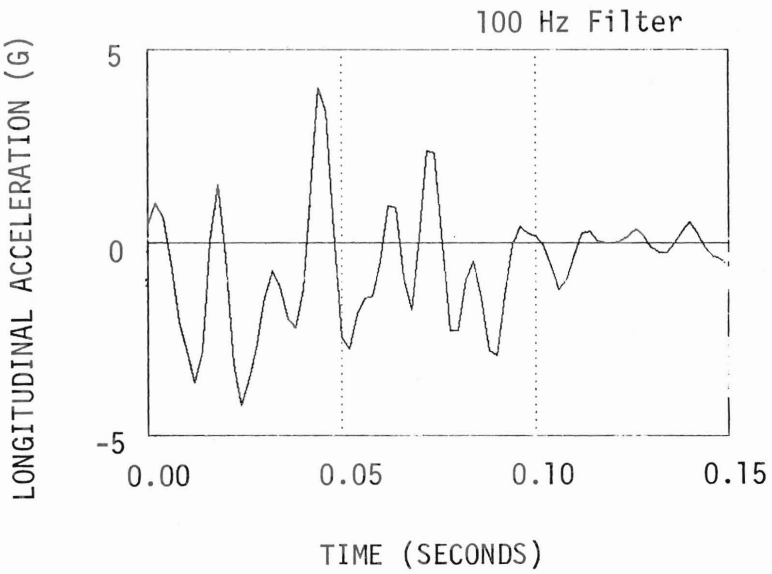


Figure 37. Vehicle Accelerometer Trace for Test 4-2.