U.S. Department
of Transportation
**Federal Highway
Administration**

JUN 17 1997

400 Seventh St., S.W.
Washington, D.C. 20590

Refer to: HNG-14

John F. Carney, III, Ph.D., P.E.
Provost and Vice President for
Academic Affairs
Worcester Polytechnic Institute
100 Institute Road
Worcester, Massachusetts 01609-2280

Dear Dr. Carney:

Mr. Seppo Sillan's August 27, 1996, letter to you accepted the Vanderbilt Truck Mounted Attenuator (VTMA) as a National Cooperative Highway Research Program (NCHRP) Report 350 test level 2 (TL-2) attenuator rather than as a TL-3 device as you requested. Although both TMA tests prescribed in the NCHRP Report 350 had been run at the TL-3 speed of 100 km/h, the ridedown acceleration in test 3-51 exceeded the recommended maximum value of 20 G's by 1.48 G.

In an effort to qualify the VMTA as a TL-3 TMA, you modified the original design by replacing the two center restraining chains and eyelets with a loop of 25-mm galvanized plow steel cable. The 6700-mm long cable was threaded through holes 190 mm in from each end of a 910-mm long by 76-mm wide by 6-mm thick steel strap on the outside of each side of the cylinder that forms the outer wall of the device and through matching holes in the outer wall. The cable was clamped together with five drop forged wire rope clips spaced 127 mm on centers and torqued to 1550 kPa. All other design features remained as described in our August 27 acceptance letter. Enclosure 1 contains drawings of the modified VTMA.

The modified design was then retested and the test reports transmitted with your June 6 letter to the Federal Highway Administration's (FHWA) Director of the Office of Engineering requesting acceptance of the VTMA as a TL-3 device.

We have reviewed the data in the Texas Transportation Institute's January 1997 report, entitled "NCHRP Report 350 Test 3-51 on the Vanderbilt Truck Mounted Attenuator", and in its May 1997 report, entitled "NCHRP Report 350 Test 3-50 on the Modified Vanderbilt Truck Mounted Attenuator." Enclosure 2 consists of summary sheets for both tests. We note that the ridedown acceleration in the new Test 3-51, run on December 9, 1996, was 20.3 G's. Although this value exceeds the recommended NCHRP Report 350 limit of 20 G's, we will consider this a passing test based on the following considerations:

1. NCHRP 350 implies that the 20 G limit is a "rounded" value, since no decimal is given.

2. All other evaluation criteria were met. Vehicle response was stable and there was no significant intrusion into the occupant compartment.

3. Performance of the VTMA with the 820-kg car at 100 km/h was good, even with the support truck blocked to prevent forward movement.

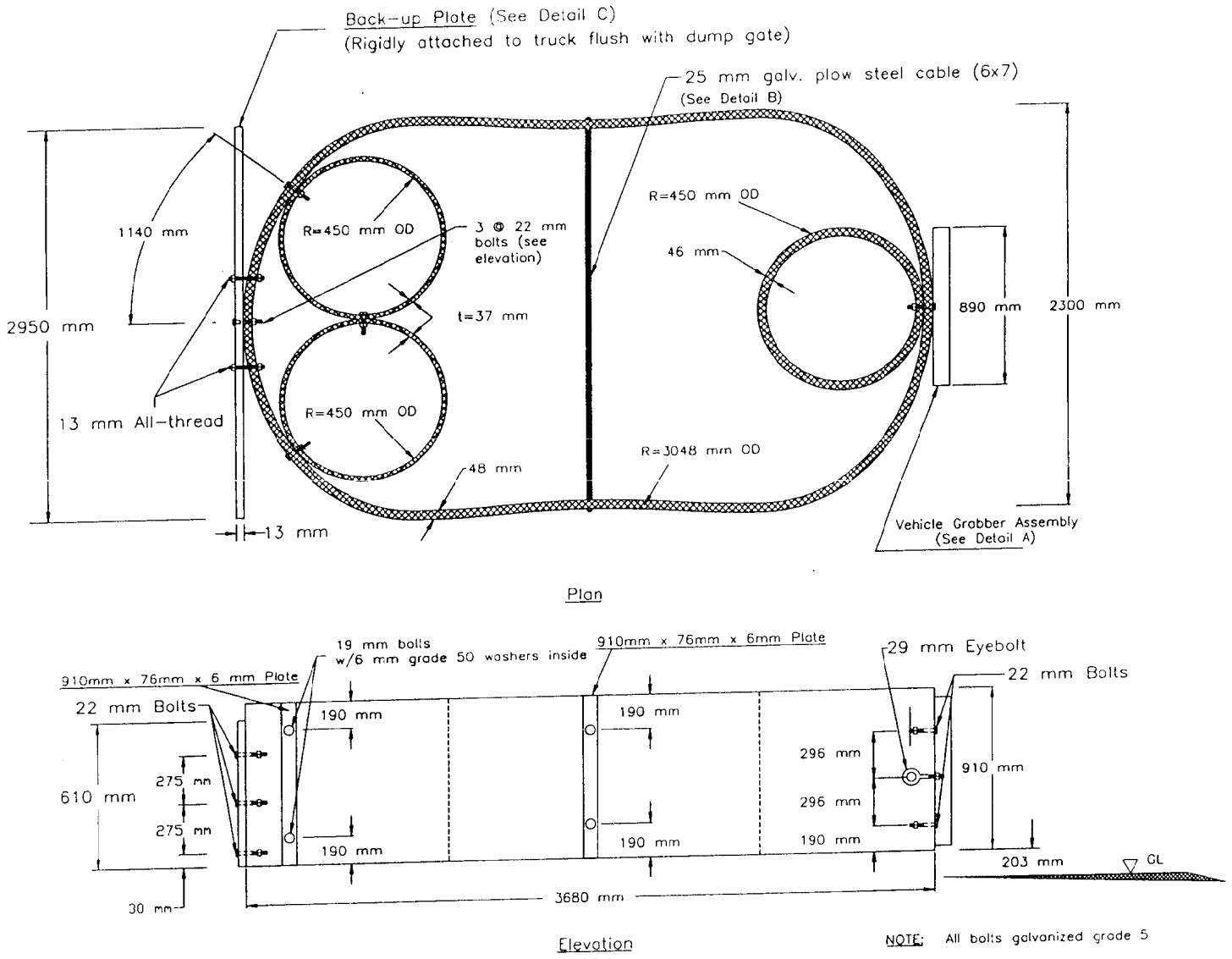
Based on the above, we consider the modified VTMA as described above to be acceptable for use as a TL-3 truck-mounted attenuator in work zones on the National Highway System, if acceptable to the responsible highway agency, provided the support vehicle used with the VTMA does not exceed 9,000 kg, the weight of the support vehicle used in the crash test.

Sincerely yours,

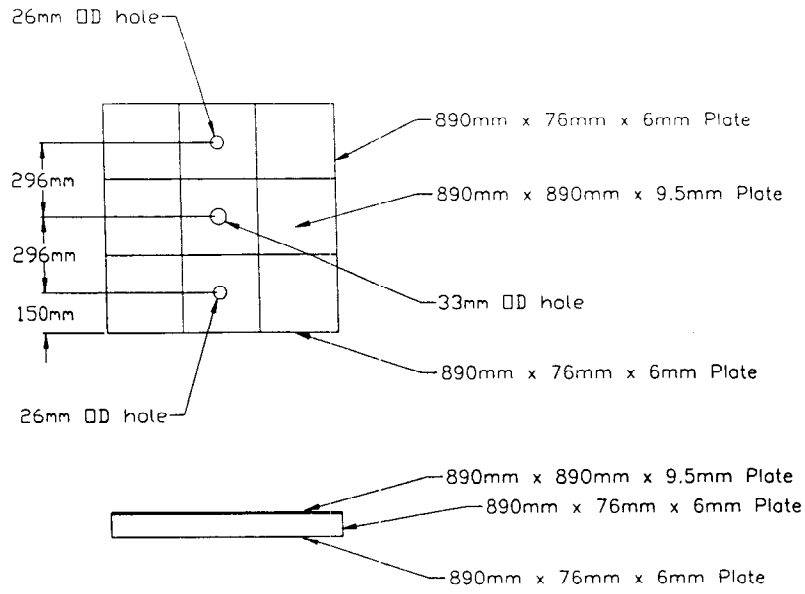
David A. Price

for Dwight A. Horne, Chief
Federal-Aid and Design Division

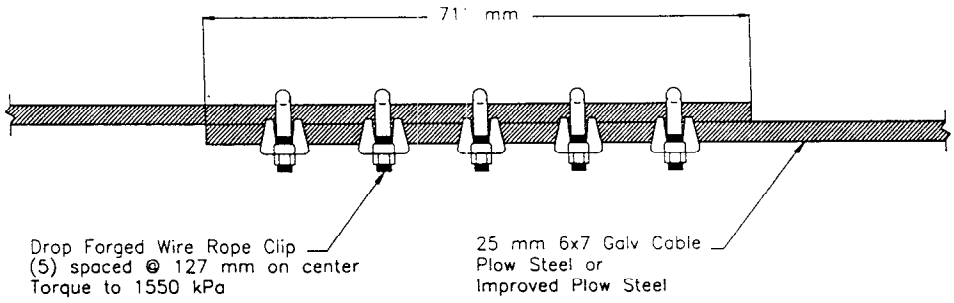
2 Enclosures



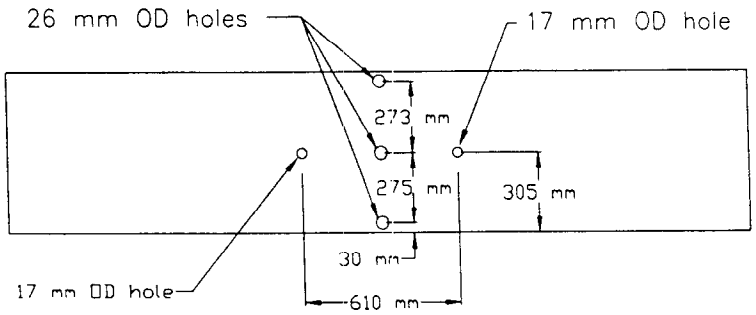
Preliminary Fabrication Plans for the VTMA.



Detail A

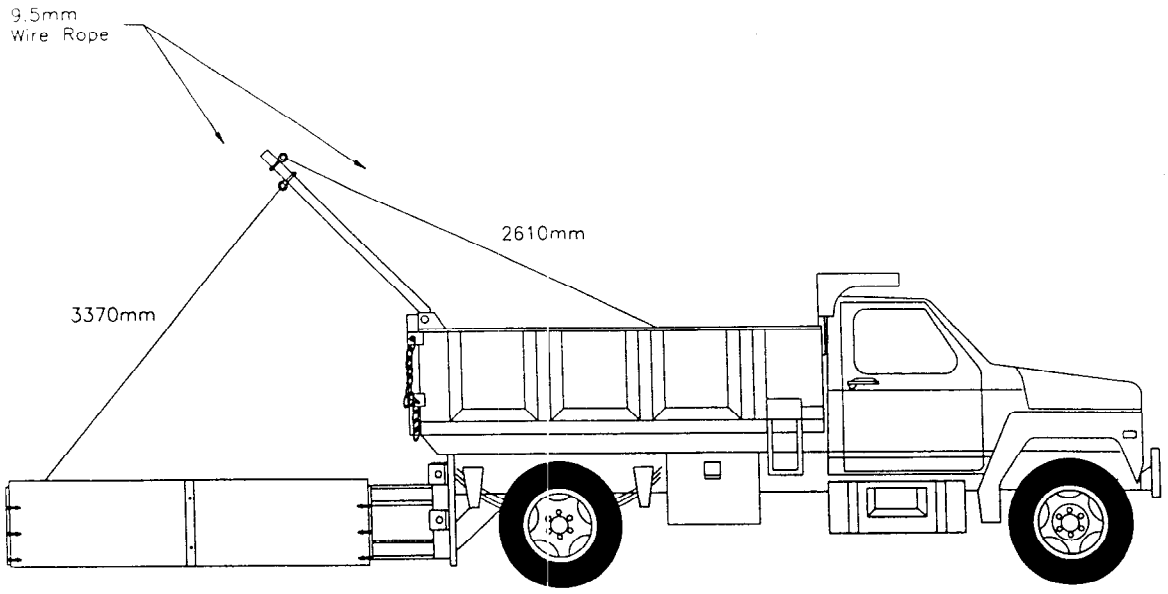


Detail B

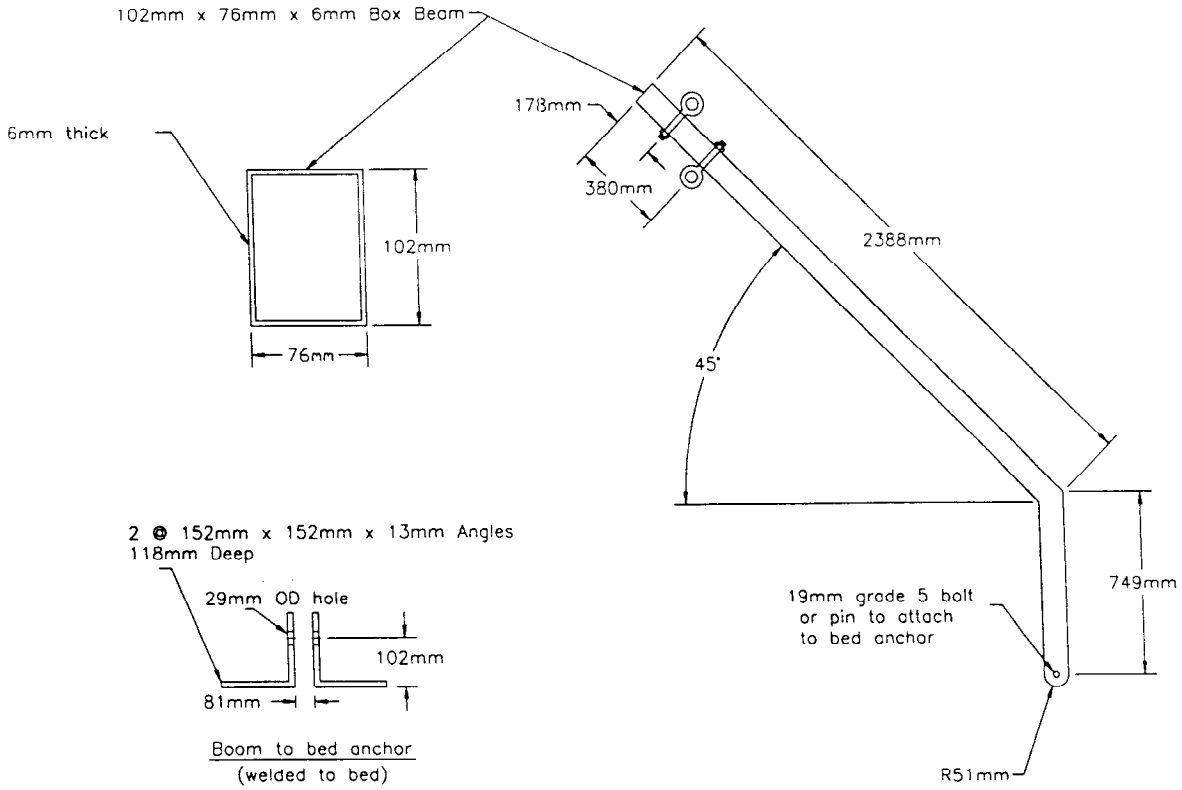


Detail C

Preliminary Fabrication Plans for the VTMA.

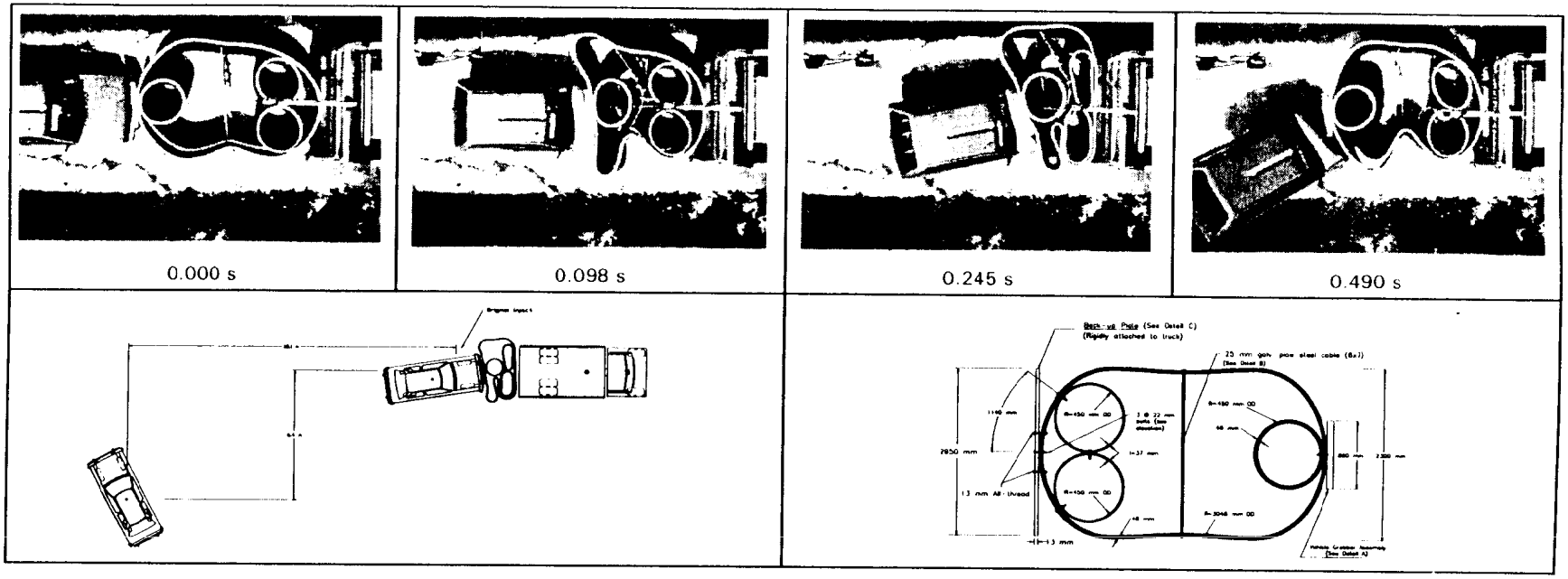


VTMA attachment to Support Vehicle



Boom Detail

Preliminary Fabrication Plans for the VTMA.



General Information

Test Agency	Texas Transportation Institute
Test No.	400001-VTM2
Date	05/12/97

Test Article

Type	Truck Mounted Attenuator
Name	Vanderbilt TMA
Installation Length (m)	3.68
Size and/or dimension and material of key elements	4 each Polyethylene Cylinders of various sizes and densities
Soil Type and Condition	Concrete pavement, dry

Test Vehicle

Type	Production
Designation	820C
Model	1991 Ford Festiva
Mass (kg) Curb	846
Test Inertial	820
Dummy	75
Gross Static	895

Impact Conditions

Speed (km/h)	98.40
Angle (deg)	0.0

Exit Conditions

Speed (km/h)	31.61
Angle (deg)	30.90

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	10.34
y-direction	2.22
Ridedown Accelerations (g's)	
x-direction	19.99
y-direction	-4.05
Max. 0.050-s Average (g's)	
x-direction	-19.18
y-direction	-3.17
z-direction	4.32

Test Article Deflections (m)

Dynamic	2.29
Permanent	0.28

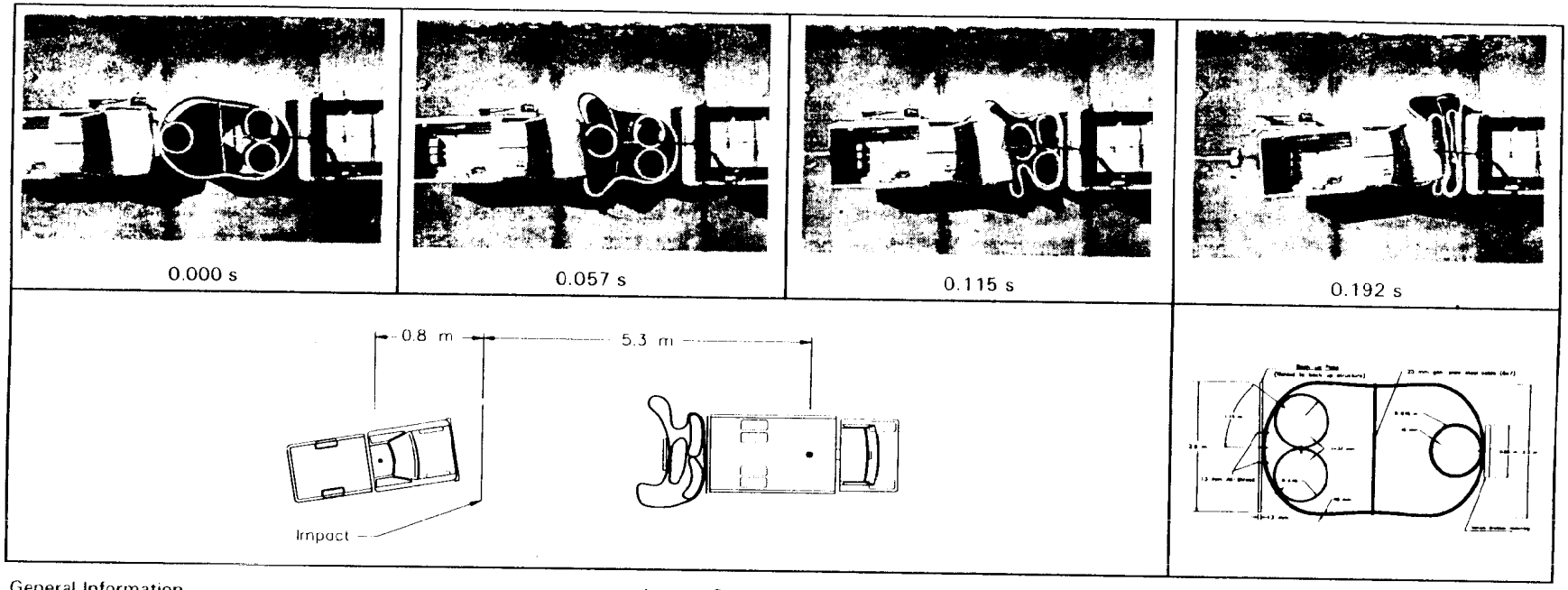
Vehicle Damage

Exterior	
VDS	12FD5
CDC	12FDEW4
Maximum Exterior Vehicle Crush (mm)	300
Interior	
OCDI	FS0010000
Max. Occ. Compart. Deformation (mm)	55

Post Impact Behavior (during 1.0 s after impact)

Max. Roll Angle (deg)	-6
Max. Pitch Angle (deg)	26
Max. Yaw Angle (deg)	-40

Figure 11. Summary of results for test 400001-VTM2.



General Information
- Test Agency . . . . . Texas Transportation Institute
- Test No. 400001-VTM1
- Date 12/09/96

Test Article
- Type . . . . . Truck Mounted Attenuator
- Name . . . . . Vanderbilt TMA (VTMA)
- Installation Length (m) 3.96
- Size and/or dimension and material of key elements . . . . . 4 each Polyethylene Cylinders of various sizes and densities

Soil Type and Condition . . . . . Concrete pavement, dry

Test Vehicle
- Type . . . . . Production
- Designation 2000P
- Model . . . . . 1990 Chevrolet 2500 Pickup
- Mass (kg) Curb 2115
- Test Inertial 2000
- Dummy . . . . . No dummy
- Gross Static 2000

Impact Conditions
- Speed (km/h) 98.06
- Angle (deg) 0

Exit Conditions
- Speed (km/h) . . . . . N/A
- Angle (deg) 24.86

Occupant Risk Values
- Impact Velocity (m/s)
  - x-direction 9.60
  - y-direction 0.21
  - Support vehicle x-direction . . 5.01
- Ridedown Accelerations (g's)
  - x-direction . . . . . -20.32
  - y-direction . . . . . -7.04
  - Support vehicle x-direction . . -1.94
- Max. 0.050-s Average (g's)
  - x-direction . . . . . -17.70
  - y-direction . . . . . -2.69
  - z-direction 3.97
  - Support vehicle x-direction . . 4.38

Test Article Deflections (m)
- Dynamic 3.12
- Permanent 1.65

Vehicle Damage
- Exterior
  - VDS 12FD5
  - CDC 12FDEW4
- Maximum Exterior Vehicle Crush (mm) 550
- Interior
  - OCDI FS0000000
- Max. Occ. Compart. Deformation (mm) 0

Post-Impact Behavior (during 1.0 s after impact)
- Max. Roll Angle (deg) . . . . -7.04
- Max. Pitch Angle (deg) . . . . -7.24
- Max. Yaw Angle (deg) 28.16

Figure 11. Summary of results for test 400001-VTM1.