June 25, 1997

Refer to: HNG-10

Mr. E. Scott Walter
President
Roadway Safety Services, Inc.
80 Remington Boulivard
Ronkonkoma, New York 11779

Dear Mr. Walter:

Your May 22 letter to Mr. James Hatton requested the Federal Highway Administration's acceptance of the REACT 350 for temporary use in work zones as a Test Level 3 (TL-3) device. It had been previously accepted as a temporary barrier at the TL-2 level based on limited crash testing. In support of your new request, you provided us with copies of a May 1997 test report prepared by the Texas Transportation Institute and entitled "NCHRP Report 350 Test 3-38 of the REACT 350 Anchored in Asphalt". Since the 9-cylinder REACT 350 had been previously accepted as a TL-3 permanent attenuator and the attenuator itself remained unchanged (except for a re-designed backup assembly, which you have indicated will now be the standard in all versions of the REACT 350), only test 3-38 was run to verify the adequacy of your temporary anchoring system. You determined that this test would produce the maximum loading of the anchorage system. The anchorage used was identical to that for a permanent installation except for the replacement of concrete expansion bolts with 19.1-mm x 203-mm AREA (American Railroad Engineering Association) Washer-Head Timber Drive Spikes and the addition of twelve 75-mm x 7.4 kg/m x 915-mm C channel anchors driven adjacent to the front cable anchor plates, the support angle rails, and the backup assembly base plate as shown in Enclosure 1. The re-designed backup assembly, a 406 mm x 203 mm x 13 mm structural tube on a 19-mm thick base plate, was connected to a free-standing concrete barrier with standard w-beam terminal connectors and a special connection piece made from 6.4-mm thick plate steel. For the test, the REACT 350 unit was set on a 50-mm thick asphalt surface over a 254-mm thick base course compacted to 97% density. The test results are shown in Enclosure 2.

Based on our review of the information you presented, we consider the REACT 350 to be acceptable for use as a TL-3 temporary attenuator on the National Highway System (NHS) when it is anchored as tested and when its use is acceptable to the responsible highway agency.

On a related matter, you will recall that my December 19, 1996, letter to you expressed concern over the transition designs between the rear anchor assembly of the REACT 350 and the barrier end it shields. Those concerns applied to permanent installations as well as to temporary units shielding work zone barriers. Although NCHRP Report 350 tests do not directly address this issue in the test matrix for terminals and crash cushions, we pointed out that, in the design you presented, it was possible for a vehicle to strike the rear anchor assembly or concrete barrier without coming into significant contact with the polyethylene cylinders themselves. Your subsequent re-design of the rear anchorage assembly, the addition of transition hardware, and the tapering the bottom sloped face of the first CMB section have substantially alleviated these

concerns. However, we do remain concerned that snagging can occur at the back of the unit in a reverse-direction, rear-corner hit for median installations either when using the transition hardware or when using the proposed offset design without a physical connection. We accept your assertion that the rear cylinder will deform upon impact. However, we remain unconvinced, in the absence of a corroborating crash test, that this will prevent unacceptable snagging. It is our belief that a much greater offset or a major redesign of the transition between the approach barrier and the back of the crash cushion will be needed to prevent snagging in reverse direction impacts. Therefore, without testing to show their acceptable performance, your designs for CMB Median Applications (Options #1 and #2) and for Guardrail Median Applications will not be acceptable for use on the NHS *at sites where reverse direction hits are probable*. On the other hand, we could accept, without testing, an unyielding transition design with a crashworthy face that would shield the back of the REACT 350 from a 20-degree, reverse-direction impact where the vehicle's near side passes through the intersection of a plane along the side of the crash cushion tangent to its cylinders and a plane at right angles to that plane passing through the interface between the front of the rear anchor assembly and the back of the last crash cushion cylinder.

Enclosure 3 shows the layout configurations that we consider acceptable at present. Please address any questions you may have regarding our determination to Mr. James Hatton of my staff at (202) 366-1329.

Sincerely yours,

(original signed by David A. Price)

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

3 Enclosures
Acceptance Letter CC-26E

U.S. Department
of Transportation
Federal Highway Administration

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

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Sincerely yours,

David A. Price

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

3 Enclosures

FHWA:HNG-14:RPowers:sr:61320:6-24-97
cc: Files HPD-1 HNG-1 HNG-10 HNG-14
Reader 3128 RAs HFL-1 HHS-10
HNG-20 HSR-20

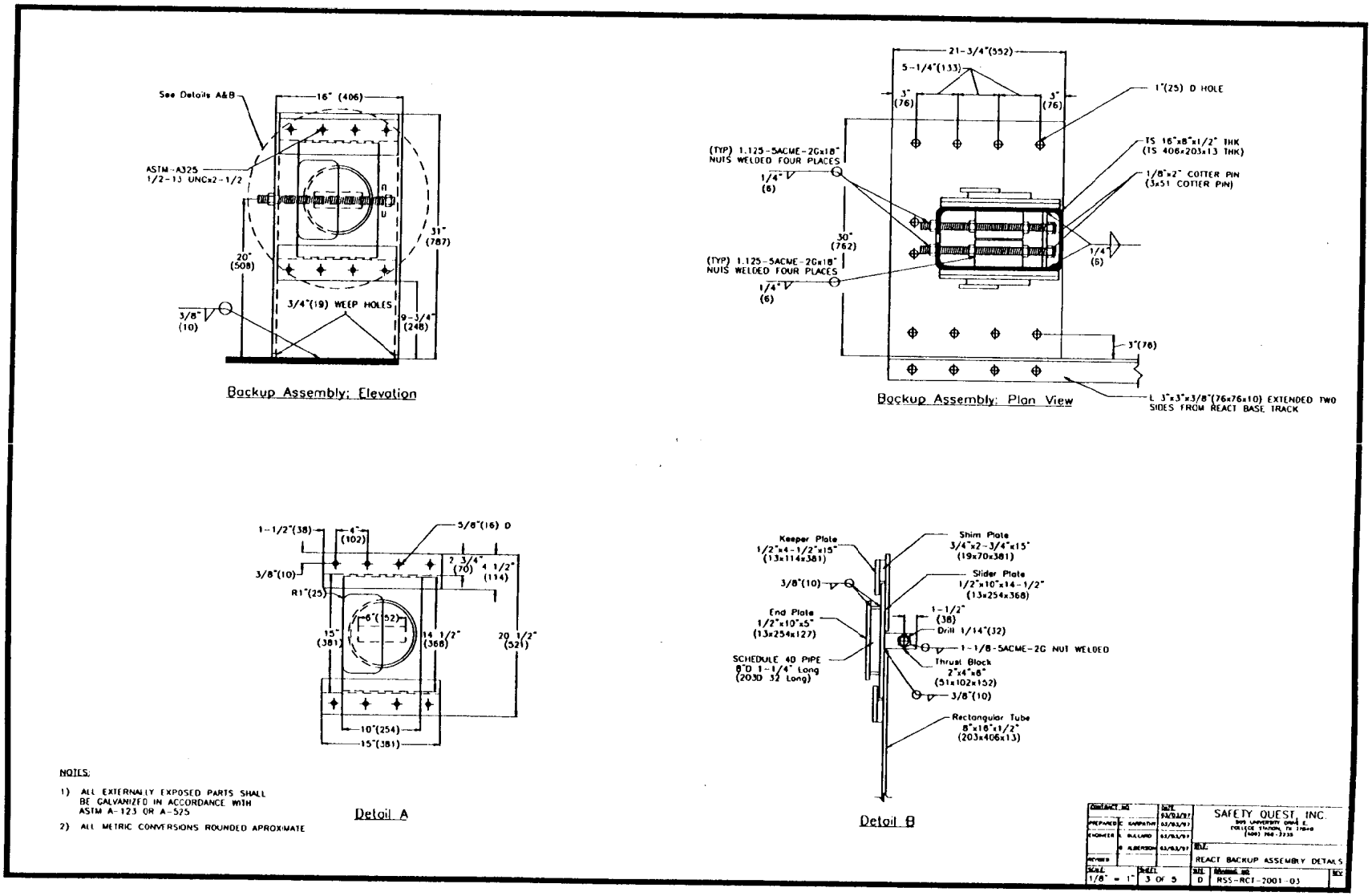


Figure 1. Details of the REACT 350 backup assembly.

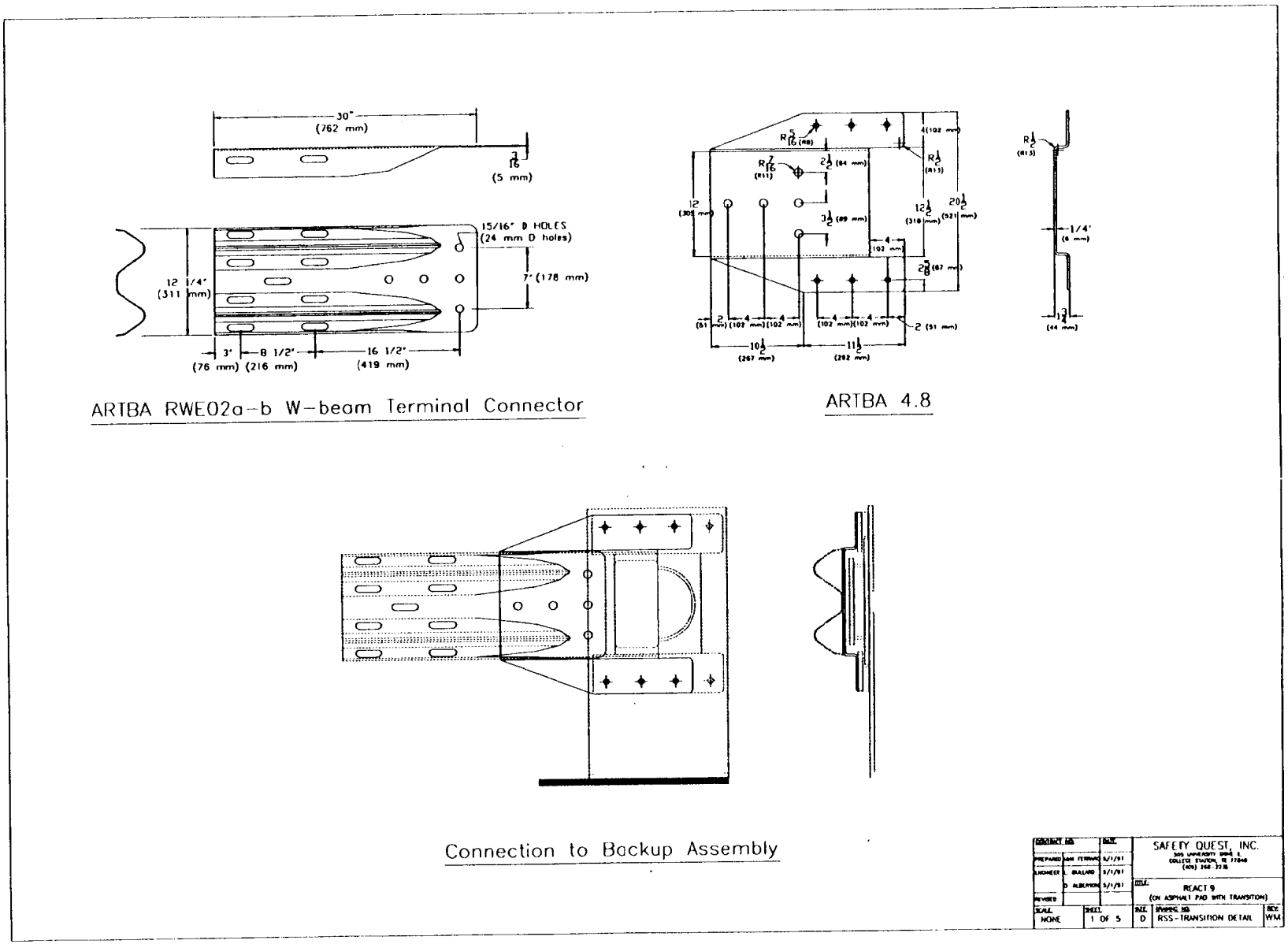


Figure 2. Details of the REACT 350 transition section.

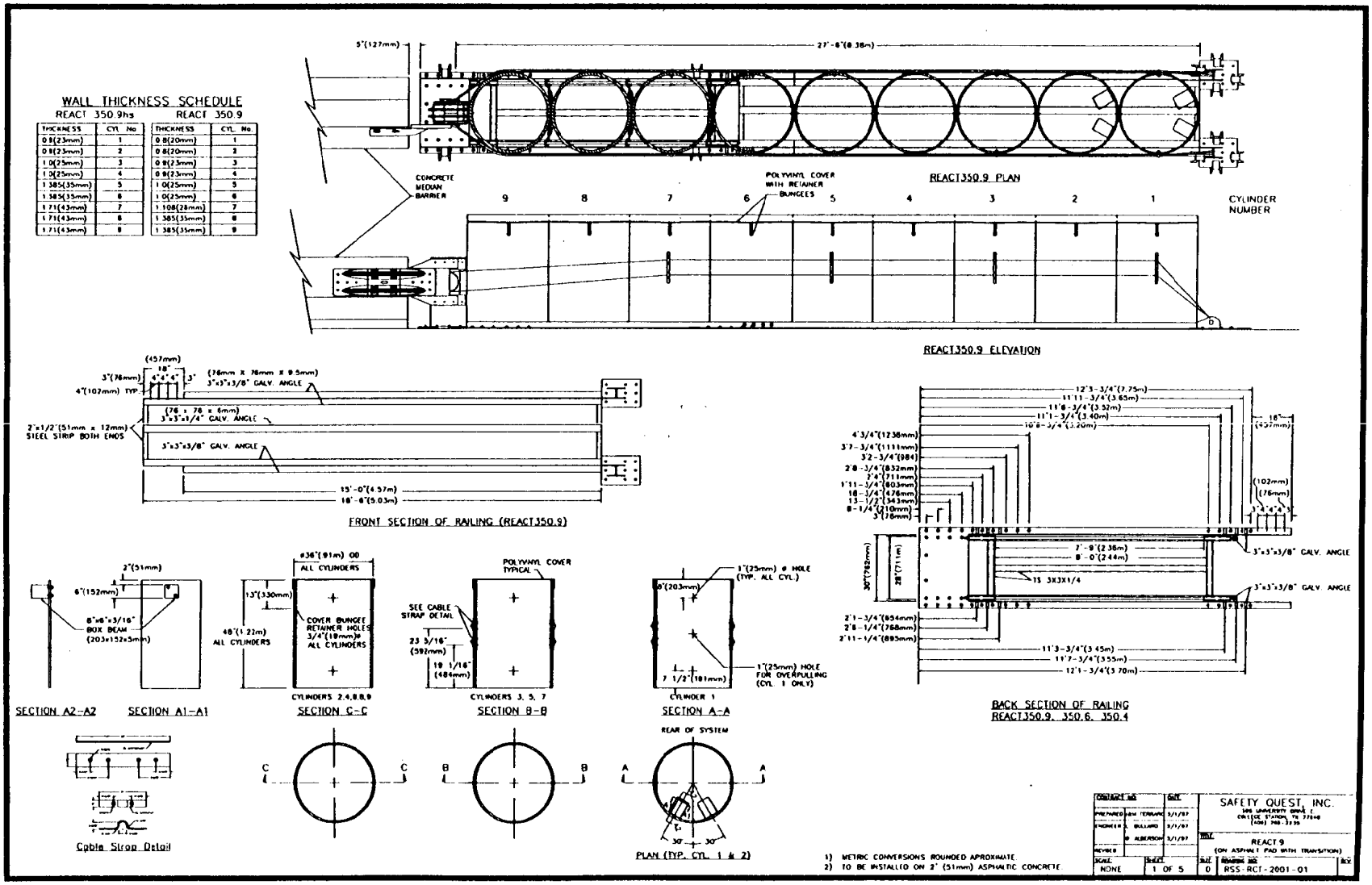
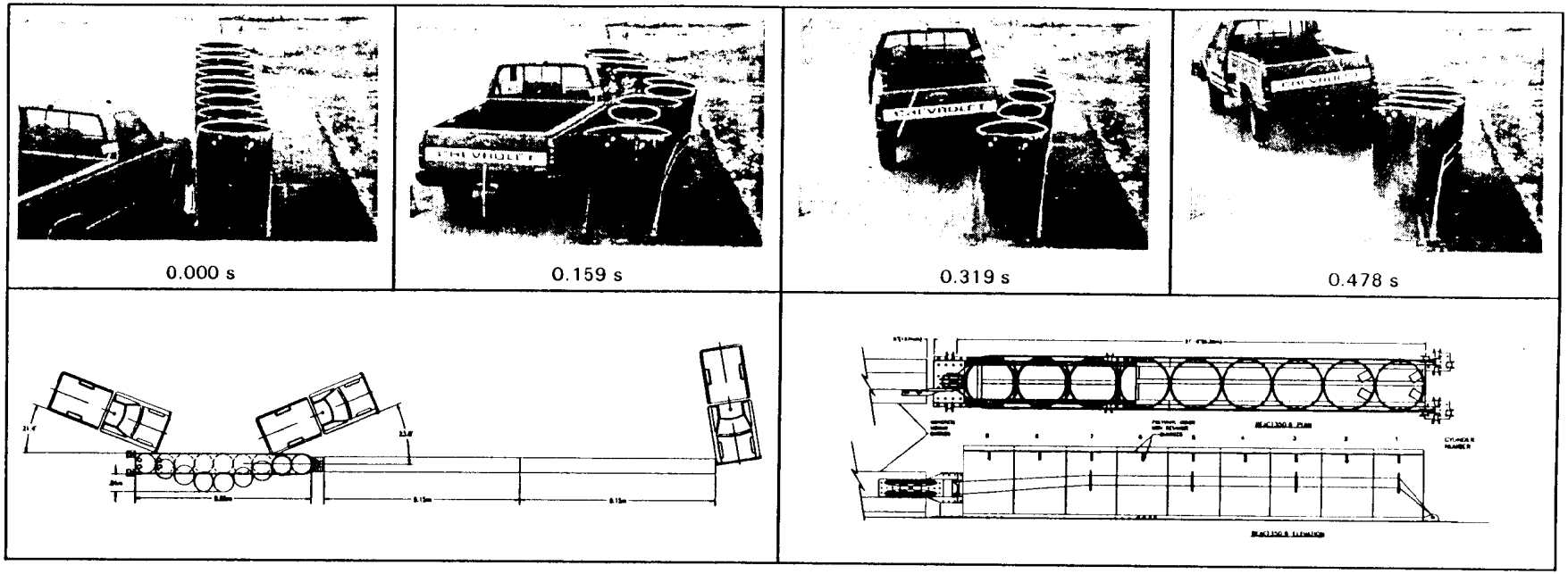


Figure 3. Details of the REACT 350 system.



General Information
- Test Agency ..... Texas Transportation Institute
- Test No. 400001-RSS2
- Date 04/24/97

Test Article
- Type ..... Crash Cushion
- Name ..... REACT 350 in asphalt
- Installation Length (m) 8.1
- Size and/or dimension and material of key elements ..... Nine polyethylene cylinders 1.22 m tall by 0.91 m dia
- Soil Type and Condition ..... Texas Standard Asphalt, dry

Test Vehicle
- Type ..... Production
- Designation 2000P
- Model ..... 1990 Chevrolet 2500 pickup
- Mass (kg) Curb 1929
  - Test Inertial 2000
  - Dummy ..... No dummy
  - Gross Static 2000

Impact Conditions
- Speed (km/h) 98.16
- Angle (deg) 21.40

Exit Conditions
- Speed (km/h) 44.09
- Angle (deg) 23.00

Occupant Risk Values
- Impact Velocity (m/s)
  - x-direction 8.54
  - y-direction 4.84
- Ridedown Accelerations (g's)
  - x-direction ..... -13.54
  - y-direction ..... -16.24
- Max. 0.050-s Average (g's)
  - x-direction ..... -9.76
  - y-direction ..... -8.82
  - z-direction 5.92

Test Article Deflections (m)
- Dynamic 0.84
- Permanent 0.10

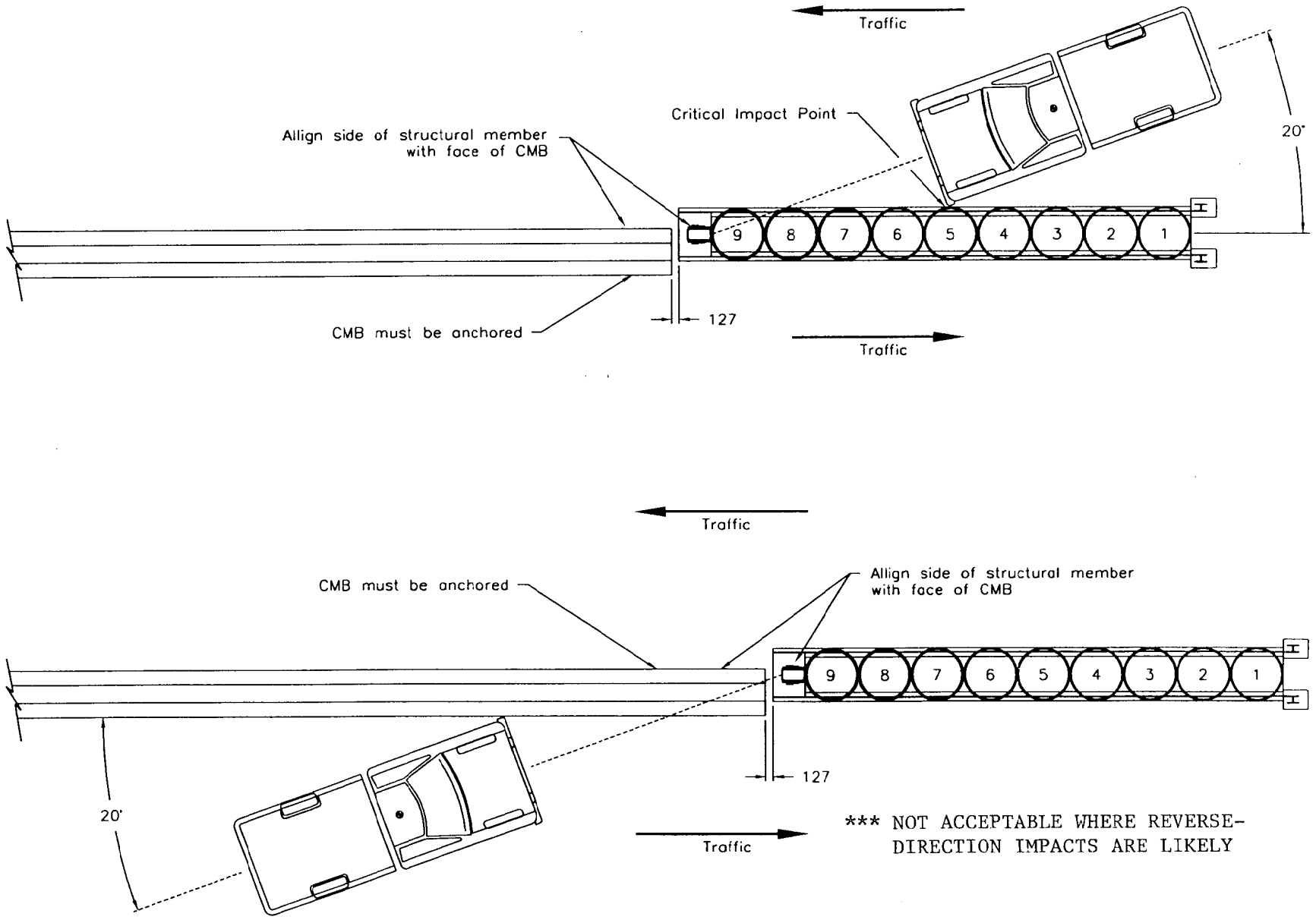
Vehicle Damage
- Exterior
  - VDS 01RFQ4
  - CDC ..... 01FZEK3 & 01RYEW3
- Maximum Exterior Vehicle Crush (mm) 580
- Interior
  - OCDI RF0002000
- Max. Occ. Compart. Deformation (mm) 28

Post-Impact Behavior (during 1.0 s after impact)
- Max. Roll Angle (deg) .... -8
- Max. Pitch Angle (deg) .... -4
- Max. Yaw Angle (deg) .... -53

Figure 15. Summary of results for test 400001-RSS2.

CMB MEDIAN APPLICATIONS

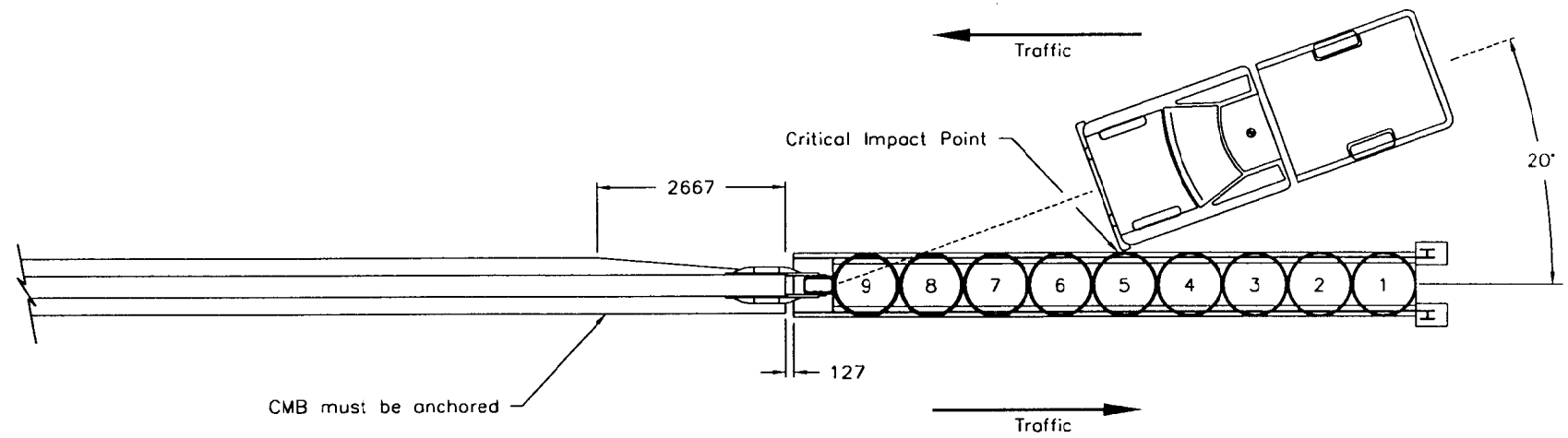
OPTION #1 OFFSET SOLUTION ***

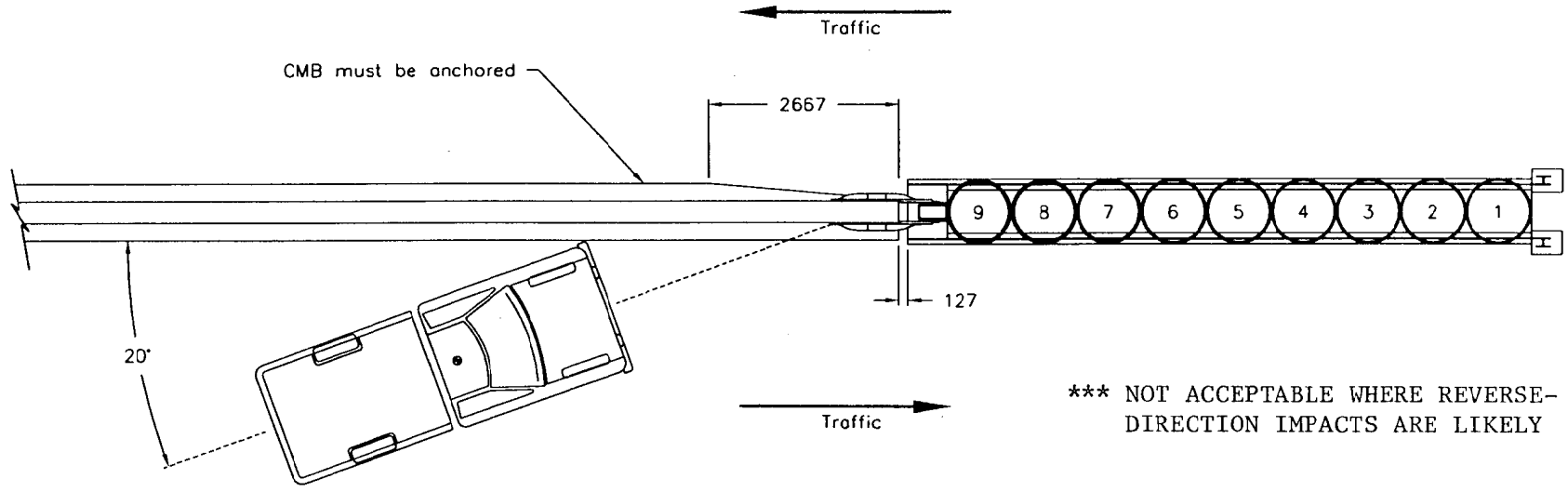


*** NOT ACCEPTABLE WHERE REVERSE-DIRECTION IMPACTS ARE LIKELY

CMB MEDIAN APPLICATIONS

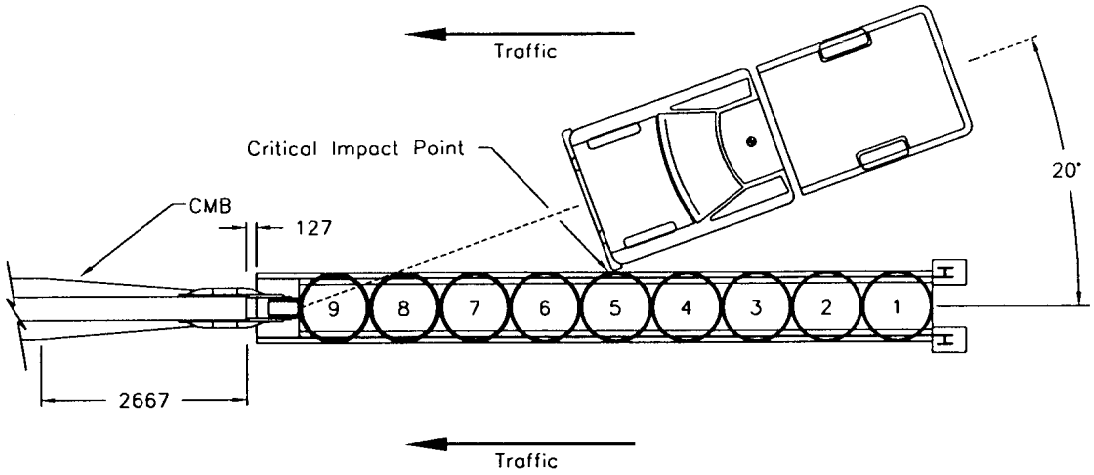
OPTION #2 WITH TRANSITION HARDWARE ***

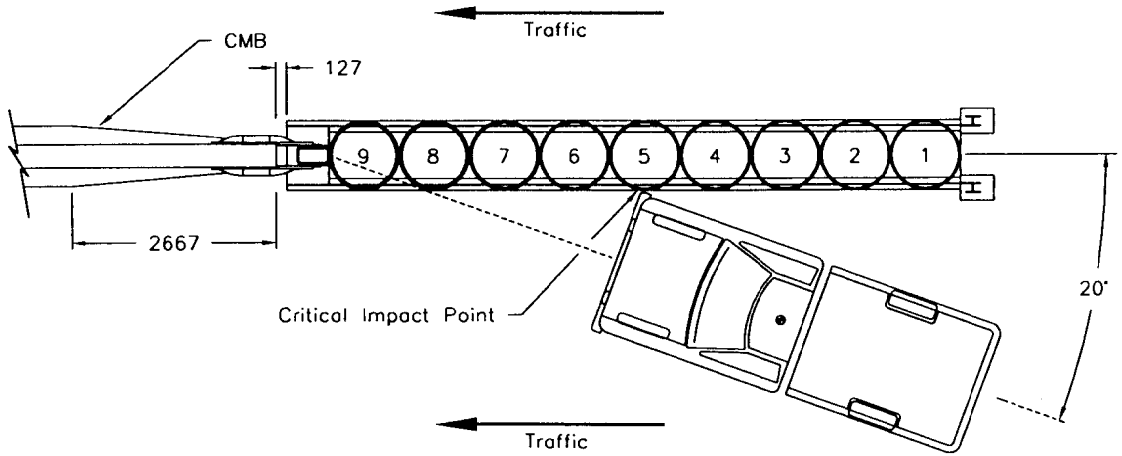




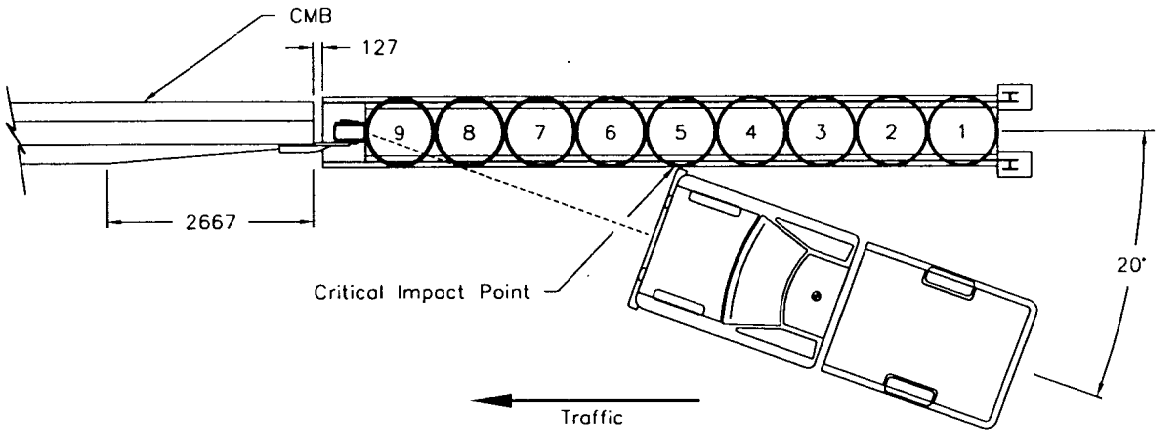
*** NOT ACCEPTABLE WHERE REVERSE-DIRECTION IMPACTS ARE LIKELY

CMB GORE APPLICATIONS





CMB SHOULDER APPLICATIONS



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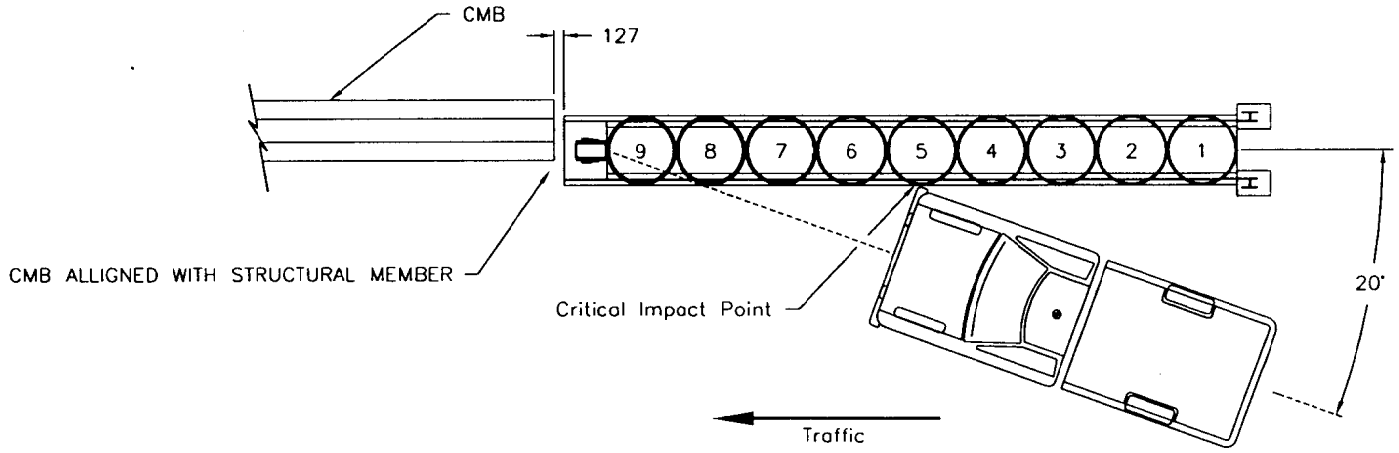
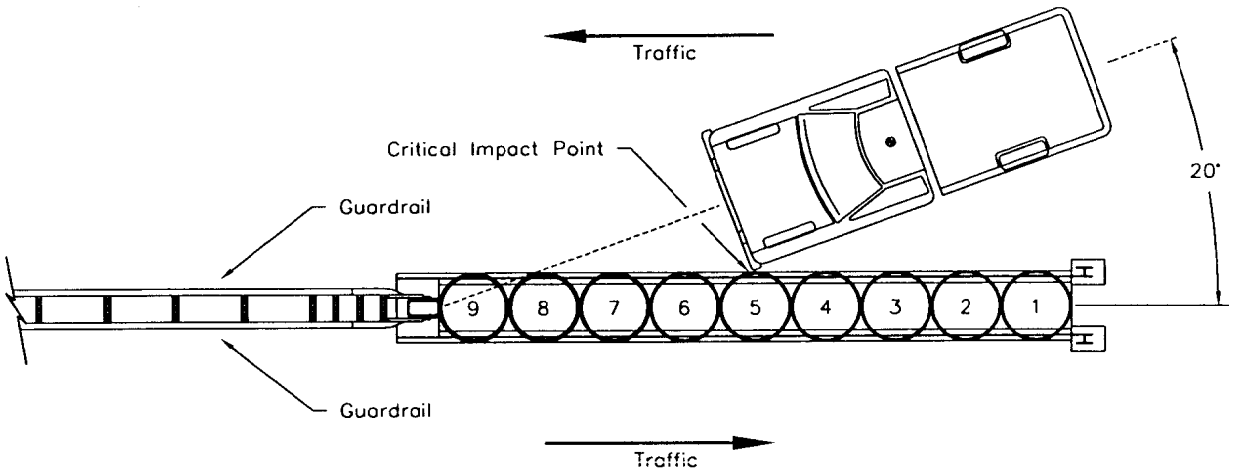
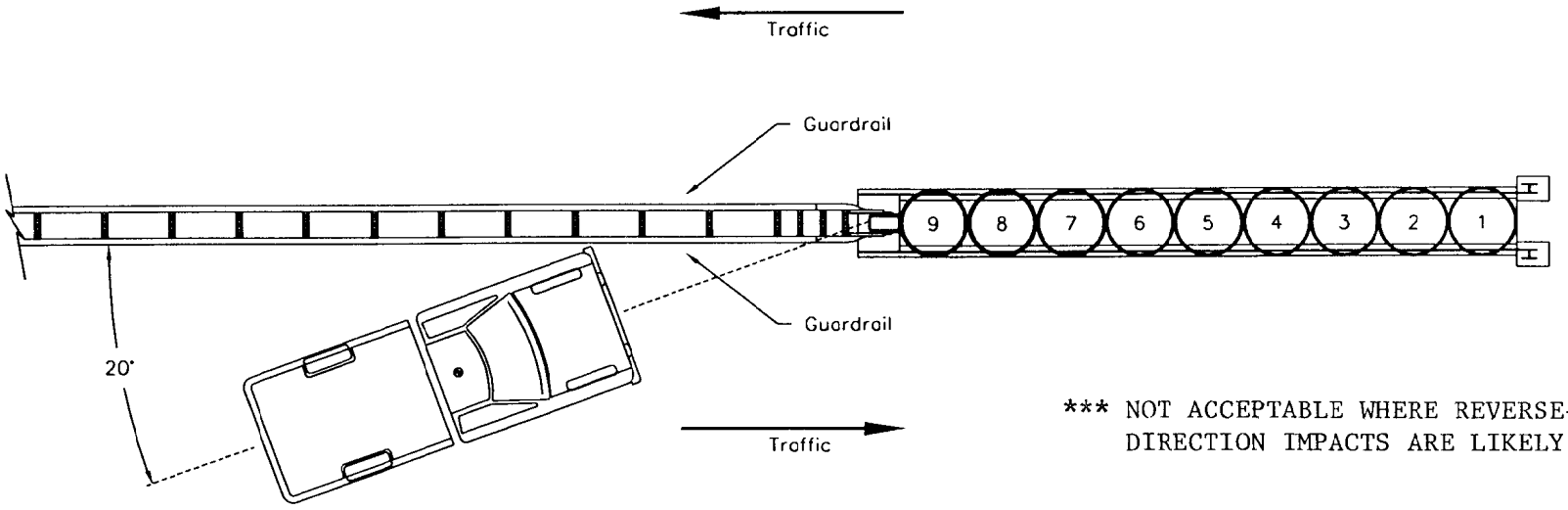


OPTION #1 OFFSET

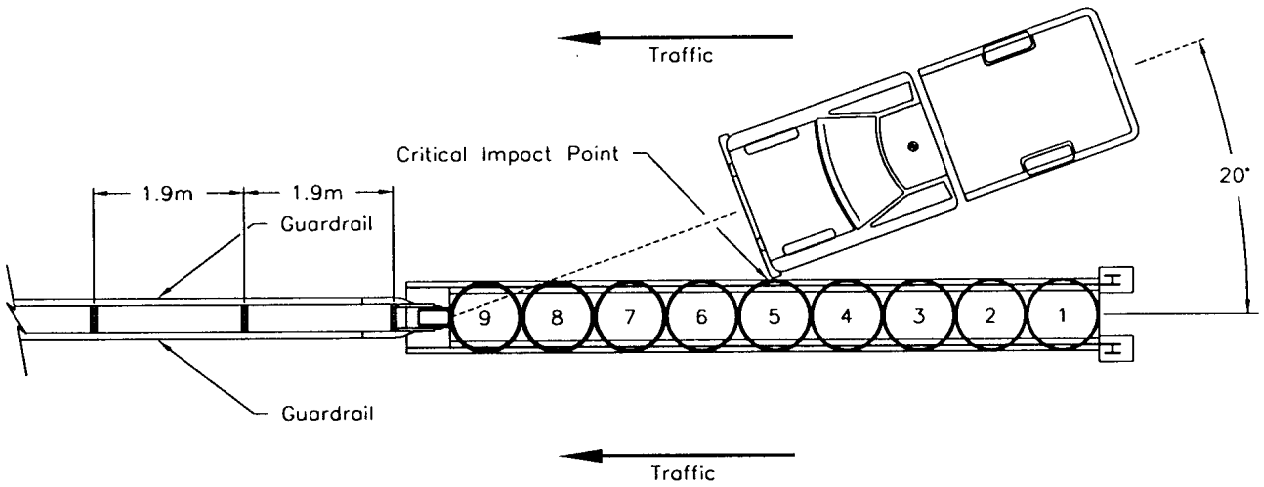
GUARDRAIL MEDIAN APPLICATIONS ***

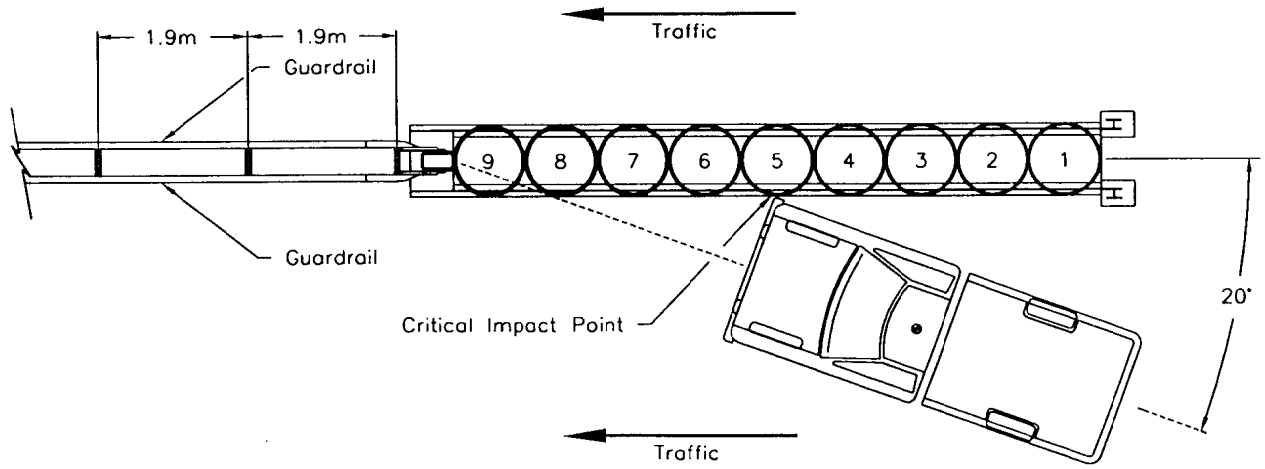




*** NOT ACCEPTABLE WHERE REVERSE-DIRECTION IMPACTS ARE LIKELY

GUARDRAIL GC _ APPLICATIONS





GUARDRAIL SHOULDER APPLICATIONS