



U.S. Department
of Transportation

Federal Highway
Administration

400 Seventh St., SW.
Washington, D.C. 20590

Refer To: HSA-CC67

Mr. Ronald F. Beyer
General Manager, RENCO, Inc
1582 Central Commerce Drive
Pflugerville, TX 78691-0730

Dear Mr. Beyer:

In your May 30 letter you requested the Federal Highway Administration's (FHWA) acceptance of your RENCO RAM 100K truck-mounted attenuator (TMA) as a test level 3 (TL-3) device under the test and evaluation guidelines contained in the National Cooperative Highway Research Program (NCHRP) Report 350. To support your request, you sent copies of two test reports prepared by the Texas Transportation Institute (TTI), one dated July 1998 entitled "Test Level 2 Evaluation of the RENCO Ren-Gard 815 Truck Mounted Attenuator," and one dated May 2000 entitled "Summary of Testing on the RENCO Truck Mounted Attenuator." You also sent copies of a video tape showing the tests contained in the latter report.

The RENCO RAM 100K TMA, as shown in Enclosure 1, is similar in construction to the TL-2 Ren-Gard 815 which was accepted (acceptance letter CC-20A) for use on the National Highway System on September 1, 1998. However, the TL-3 model is 335-cm (132-inches) long and 213-cm (84-inches) wide, compared to the 208 cm x 228 cm (82 inches x 90 inches) dimensions of the TL-2 model. Both units are approximately 57 cm (22.5 inches) deep and have a ground clearance of about 33 cm (13 inches) when lowered into their operating positions. The energy-absorbing properties of both RENCO models are cardboard honeycomb sections housed in a rectangular aluminum box. The RAM 100K model itself weighs 427 kg (940 pounds) and the mounting hardware adds another 72 kg (160 pounds) to its total weight.

Since NCHRP Report 350 recommends a minimum of two tests to certify a TMA as being crashworthy, test 3-50 with an 820-kg car and test 3-51 with a 2000-kg pickup truck were run. Both are head-on tests impacting the TMA at 100 km/h. Although Report 350 requires the support vehicle (usually a dump truck) to be blocked to prevent roll-ahead in test 3-50, the FHWA will accept test 3-50 with the support vehicle braked and in second gear, if test 2-50 (at 70 km/h) is successfully completed with the support vehicle blocked. Since test 2-50 was run on the shorter Ren-Gard 815 model, we will accept this requirement as having been met for the RAM 100K. In all three tests, the weight of the support vehicle was 8849 kg (19,500 pounds).

In reviewing the May 2000 TTI report, I noted that test 3-50 was run twice. In the first test (RNC6) the vehicle under-rode the TMA, resulting in some windshield damage. The occupant impact velocity (11.5 m/s) and subsequent ride-down accelerations (16.6 g's) met Report 350 evaluation criteria. A summary sheet for this test is shown as Enclosure 2. After some internal changes were made to the design, the RAM 100K was re-tested with the small car (RNC7).

This time the vehicle under-ride was lessened, but the occupant impact velocity was 12.3 m/s, slightly higher than the 12.2 m/s that was the upper limit previously accepted by FHWA's Office of Engineering. The ride-down acceleration in the second test was lowered to 13.7 g's, Test results are summarized in Enclosure 3. Based on the results of these two tests, the authors of the TTI report concluded that the RENCO RAM 100K TMA did not satisfy all Report 350 evaluation criteria. Test 3-5 1 (RNC2) with the 2000 kg pickup truck was successfully run and is summarized in Enclosure 4. In this test, the roll-ahead distance of the support vehicle was reported to be 4.3 meters.


Although the occupant impact velocity in test RNC7 was 12.3 m/s, the FHWA, as noted above, has previously accepted at least one device having an impact velocity as high as 12.2 m/s. Since this slight difference is within measurement tolerances, I am willing to accept the RENCO RAM 100K TMA as a Report 350 TL-3 truck mounted attenuator with the following stipulations:

- All production models of the RENCO RAM 100K TMA will be identical in internal construction and external fabrication as the prototype used in test RNC7. You will be expected to certify to users that the product furnished has the same internal and external dimensions and construction as the tested prototype.
- Users will be advised to mount the RENCO RAM 100K TMA to a support vehicle similar in weight to the 8845 kg (19,500 pound) truck used in the certification testing.
- You will establish an informal in-service evaluation system to identify any performance problems relating to vehicle under-ride as noted in test RNC6.

As with similar devices, FHWA acceptance of this TMA is limited to its crash performance characteristics and is not intended to address its mechanical components, its operational features, or its durability. If in-service performance data indicate significant safety concerns, the FHWA reserves the right to modify or revoke this acceptance letter.

Because the REMCO RAM 100K TMA is a proprietary device, its use on Federal-aid projects, except exempt, non-NHS projects, is subject to the conditions listed in Title 23, Code of Federal Regulations, Section 635.411. Enclosure 5 is a copy of this regulation. Please call Mr. Richard Powers at (202) 366-1320 if you have any questions regarding this acceptance letter.

Sincerely yours,



Frederick G. Wright, Jr.
Program Manager, Safety

5 Enclosures

ITEM	QTY	DESCRIPTION
1	1	HYDRAULIC CYLINDER CONTROL UNIT
2	1	TRUCK MOUNT (1/2" PLATE W/BRACKETS)
3	2	SUPPORT BRACKET
4	1	BATTERY & HYDRAULIC PUMP
5	1	HYDRAULIC CYLINDER
6	2	ADJUSTMENT TURN SCREW
7	2	TELSPAR JACKSTAND
8	1	REPLACEABLE CRASH PAD
9	4	TAIL LIGHTS

NOTES

1. TRUCK FRAME IS HIGH CARBON STEEL. TO AVOID CRACKING DO NOT WELD OR APPLY EXCESSIVE HEAT TO BOTTOM FLANGE.
2. DO NOT CUT FRAME CROSS MEMBER WHICH TIES INTO OUTROAD LEAF SPRING HANGERS.
3. DIMENSION (XX.XX) ARE CENTIMETERS.

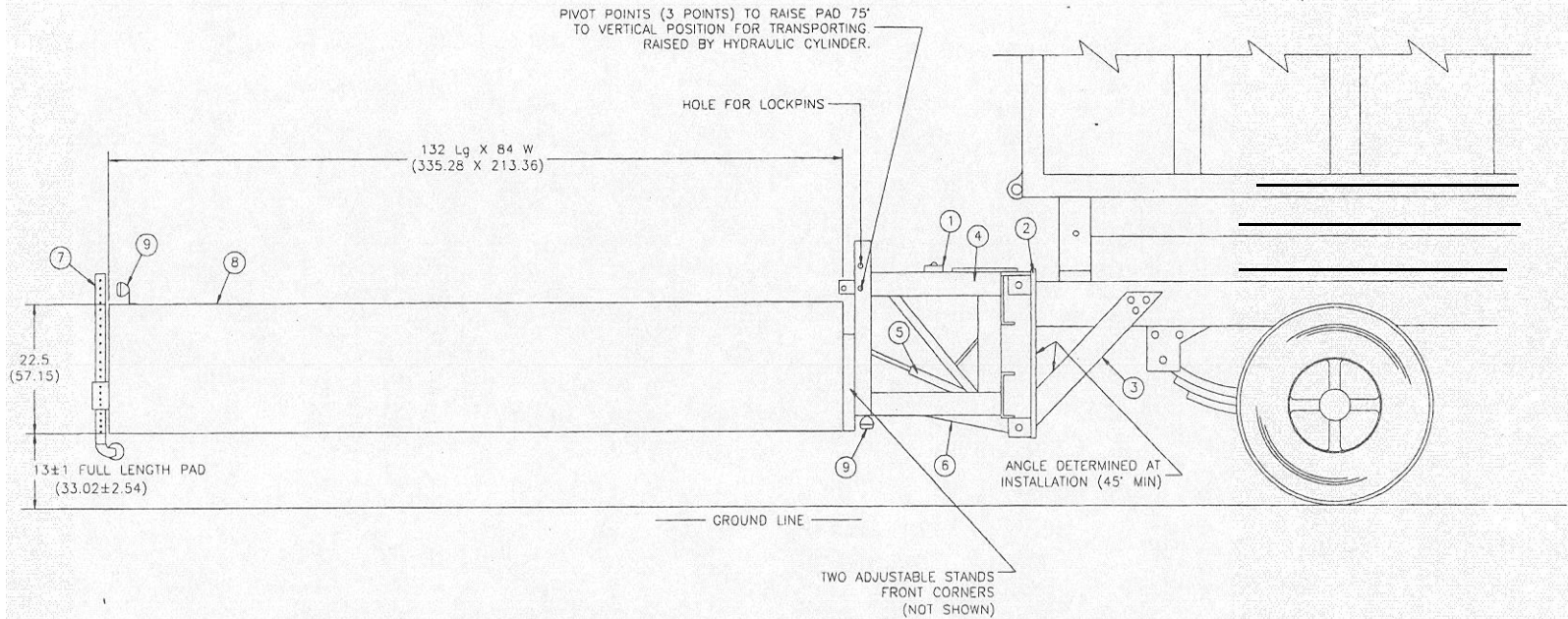
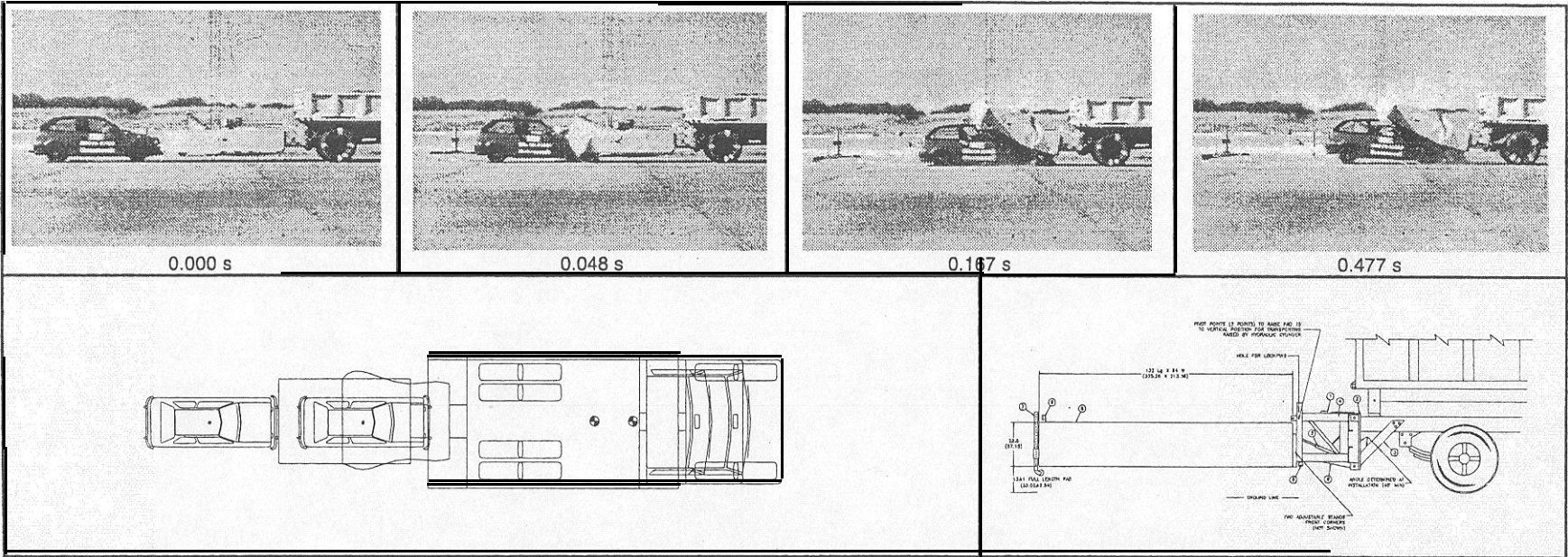


Figure 1. Details of the RENCO RAM 100k TMA.



General Information

Test Agency	Texas Transportation Institute
Test NO.	400001-RNC6
Date	1/30/99
Test Article	
Type	Truck Mounted Attenuator
Name	RENCO RAM-100k TMA
Installation Length (m)	2.1
Material or Key Elements	Cardboard Honeycomb Covered with Aluminum Sheeting
Soil Type and Condition	Concrete Pavement, Dry
Test Vehicle	
Type	Production
Designation	820C
Model	1994 Geo Metro
Mass (kg)	
Curb	766
Test inertial	820
D u m m y	76
Gross Static	896

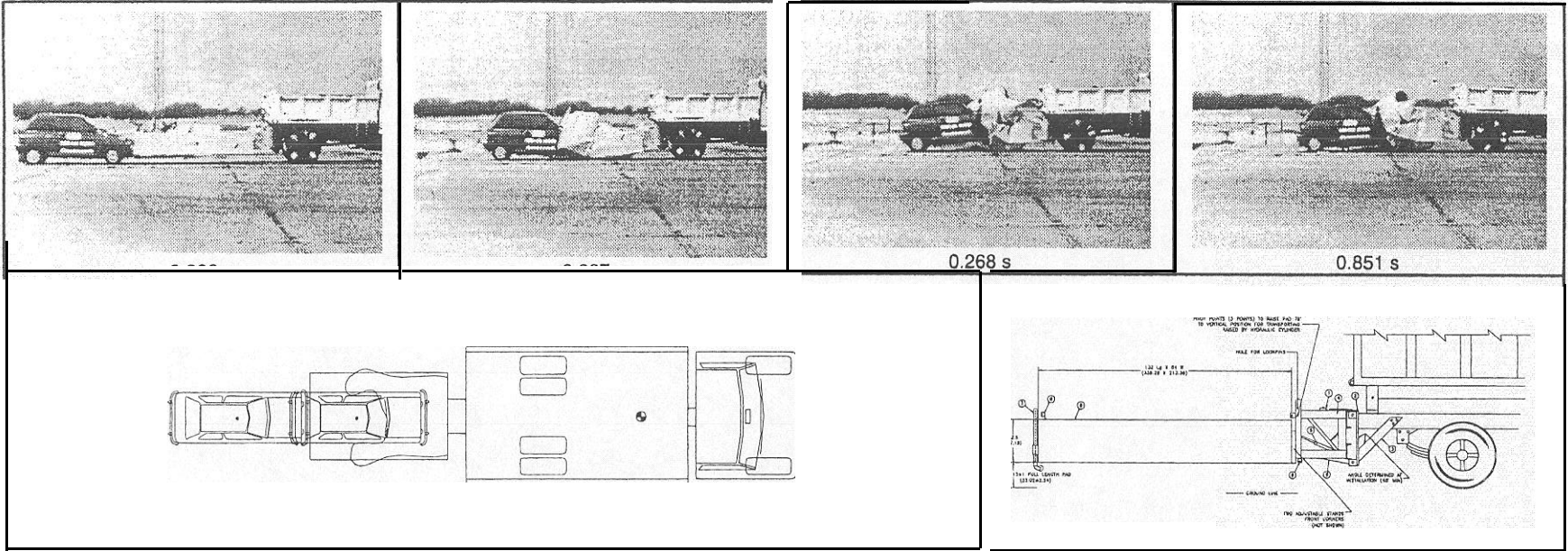
Impact Conditions

Speed (km / h)	95.13
Angle (deg)	0
Exit Conditions	
Speed (km/h)	Stopped
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	11.5
y-direction	0.8
THIV (km/h)	41.5
Ridedown Accelerations (g's)	
x-direction	-16.6
y-direction	-1.6
P H D (g ' s)	16.6
ASI	1.20
Max. 0.050-s Average (g's)	
x-direction	1.4
y - direction	-1.4
z-direction	2.8

Test Article Deflections (m)

Dynamic..	N/A
Permanent	2.6
Vehicle Damage	
Exterior	
VDS	12FD7
CDC	12FDEW6
Maximum Exterior	
Vehicle Crush (mm)	190
Interior	
OCDI	FS0021000
Max. Occ. Compart.	
Deformation (mm)	130
Post-Impact Behavior	
(during 1.0 s after Impact)	
Max. Yaw Angle (deg)	1
Max. Pitch Angle (deg)	-3
Max. Roll Angle (deg)	1

Figure 9. Summary of Results for test 400001-RNC6, NCHRP Report 350 test 3-50.



General Information

Test Agency Texas Transportation Institute
 Test NC. 400001-RNC7
 Date 03/23/00

Test Article

Type Truck Mounted Attenuator
 Name AENCO RAM-100k TMA
 Installation Length(m) 2.1
 Material or Key Elements Cardboard Honeycomb Covered
 with Aluminum Sheeting

Soil Type and Condition Concrete Pavement, Dry

Test Vehicle

Type P r o d u c t i o n
 Designation **820C**
 M o d e l 1991 Ford Festiva
 Mass (kg)
 Curb 854
 Test Inertial 820
 D u m m y 75
 Gross static 895

Impact Conditions

Speed (km/h) 100.2
 Angle (deg) 0

Exit Conditions

Speed (km/h) Stopped
 Angle (deg) N/A

Occupant Risk Values

Impact Velocity (m/s)
 x-direction
 y-direction
 THIV (km/h, 4 4 4)
 Ridedown Accelerations (g's)
 x-direction -13.7
 y-direction 3.2
 PHD (g's) 13.8
 ASI 1.18
 Max. 0.050-s Average (g's)
 x-direction -14.2
 y-direction 1.0
 z-direction 2.4

Test Article Deflections (m)

Dynamic N/A
 Permanent 2.1

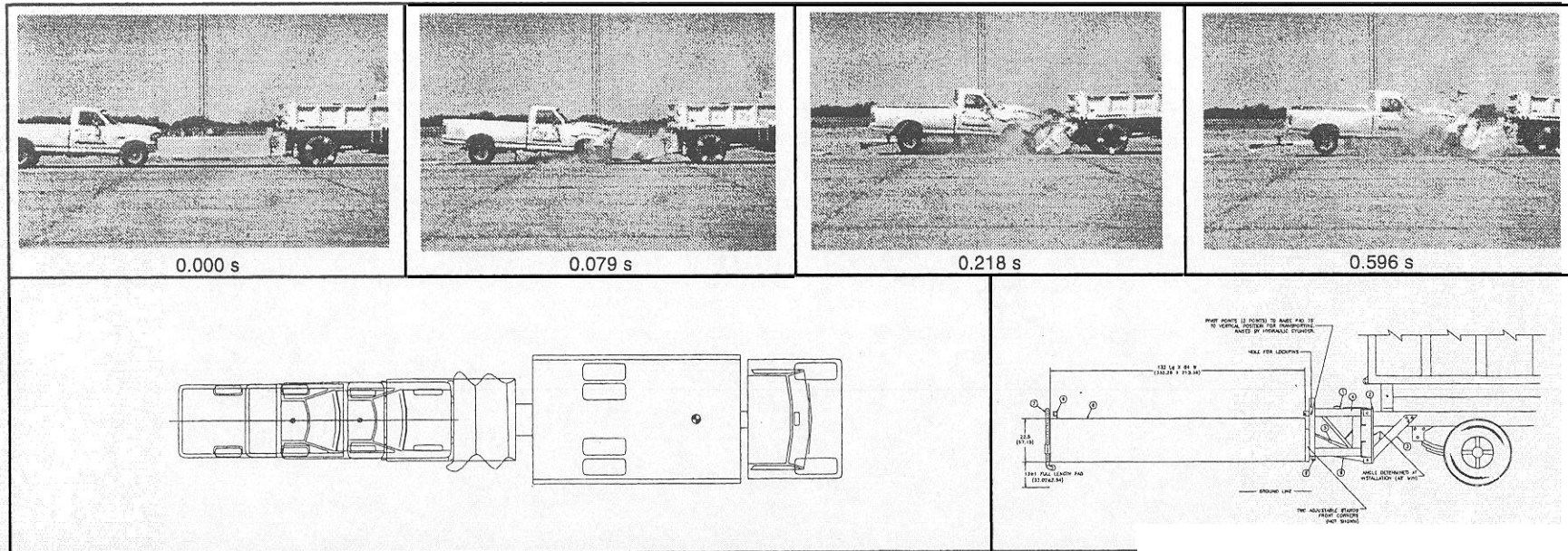
Vehicle Damage

Exterior
 VDS 12FD4
 CDC 12FDEW5
 Maximum Exterior
 Vehicle Crush (mm) 150
 Interior
 ODCI FS0010000
 Max. Occ. Compart.
 Deformation (mm) 42

Post-Impact Behavior

(during 1.0 s after Impact)
 Max. Yaw Angle (deg) 3
 Max. Pitch Angle (deg) . 7
 Max. Roll Angle (deg) -5

Figure 17. Summary of Results for test 400001-RNC7, NCHRP Report 3.50 test 3-50.



General Information

Test Agency	Texas Transportation Institute
Test No.	400001-RNC2
Date	04115199
Test Article	
Type	Truck Mounted Attenuator
Name	RENCO RAM-100 k TMA
installation Length (m)	2.1
Material or Key Elements	Cardboard Honeycomb Covered with Aluminum Sheeting
Soil Type and Condition	Concrete Pavement, Dry
Test Vehicle	
Type	Production
Designation	2000P
Mode,	1994 Ford F-250 Pickup Truck
Mass (kg)	
Curb	2090
Test Inertial	2000
Dummy No	dummy
Gross Static	2000

Impact Conditions

Speed (km/h)	100.3
Angle (deg)	0
Exit Conditions	
Speed (km/h)	Stopped
Angle (deg)	N / A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	11.7
y - d i r e c t i o n	0.9
THIV (km/h)	42.2
Ridedown Accelerations (g's)	
x-direction	-18.3
y-direction	2.6
P H D (g ' s)	18.5
ASI ...	1.26
Max. 0.050-s Average (g's)	
x-direction	-14.7
y - d i r e c t i o n	1.6
z - d i r e c t i o n	5.1

Test Article Deflections (m)

Dynamic..	N/A
Permanent	1.7
Vehicle Damage	
Exterior	
VDS	12FD1
CDC	12FDEW1
Maximum Exterior Vehicle Crush (mm)	250
Interior	
OCDI	F50000000
Max Occ. Compartment Deformation (mm)	nil
Post-Impact Behavior (during 1.0 s after impact)	
Max. Yaw Angle (deg)	.4
Max. Pitch Angle (deg)	-4
M a x . Roll Angle (deg)	7

Figure 25. Summary of Results for test 400001-RNC2, NCHRP Report 350 test 3-5 1.

Sec. 635.411 Material or product selection.

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items; or

(2) The State highway agency certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State highway agency wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State highway agency may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations,

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.