



U.S. Department
of Transportation

Federal Highway
Administration

May 29, 1998

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

Refer to: HNG-14

Mr. Ron Jones
Vice President
Woudenberg Enterprises
P.O. Box 60550
Phoenix, Arizona 85082-0550

Dear Mr. Jones:

This is in reply to your February 4 letter regarding your company's "MSi Durastem™ vertical panel barricade." You requested that we inform other departments or agencies of the successful crash testing of this product. Our method for doing that is by writing, if appropriate, a "letter of acceptance" finding the device(s) acceptable for use on the National Highway System (NHS) by virtue of their passing the crash test requirements of the National Cooperative Highway Research Program (NCHRP) Report 350. Copies of our acceptance letters are sent to each of our regional offices so that they may be informed of our action.

Accompanying your letter were copies of a report and a video on the crash testing conducted by E-Tech Testing Services, Inc., and other documentation. The MSi Durastem™ vertical panels are plastic, three-piece systems consisting of a recycled rubber base, a polypropylene stem, and reflective sheeting on a polyethelene panel. Additional details are included on the enclosed drawing and data sheet. The MSi Durastem™ can also be equipped with an optional warning light.

Full-scale automobile testing was conducted on the MSi Durastem™ vertical panels with attached WLI ToughLite^(R) 2000 warning lights to assess their crashworthiness according to the criteria in the NCHRP Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Safety Features. Two devices were impacted in one test conforming to the NCHRP Report 350 test designation 3-71 (820 C vehicle, 100 km/h speed, zero degree angle of impact.) Because the devices are free-standing and have a mass of less than 45 kg, measurement of occupant impact velocities and ridedown accelerations are not required. The primary purposes of testing devices of this nature are to assess the potential for occupant compartment intrusion and the test vehicle's post-impact trajectory.

In the test the two devices were struck sequentially, the first being in the conventional position and the second in a perpendicular orientation 6 m downstream of the first. The tests were conducted on smooth, dry concrete pavement. A summary of the test results is presented in the table below.

E-Tech Test Number	06-8322-001
Test Item	MSi Durastem™ Vertical Panel
Mass:MSi Durastem™ system	Approximately 13.5 kg
Rubber Base	Approximately 9.3 kg
Plastic Stem	Approximately 0.9 kg
Plastic Panels (2)	Approximately 2.0 kg
WLI ToughLite ^(R) 2000, bolt, and batteries	Approximately 1.3 kg
Vehicle Mass	769 kg
Impact Speed (C**)	100.28 km/h
Velocity Change (C)	0.74 km/h (0.2 m/s)
Impact Speed (P**)	99.54 km/h
Velocity Change (P)	0.74 km/h (0.2 m/s)

*There was no ballast added to the rubber bases, however the developer recommends that a single 25-pound (12-kg) bag of sand may be placed on the base when needed to resist overturning from high winds.

**C and P refer to the Conventional and Perpendicular orientations of the device. Because the two vertical panels (one C and one P) struck during the same test were separated longitudinally, the test vehicle slowed slightly prior to striking the second vertical panel.

In the first impact, the MSi Durastem™ “stem” portion separated from the base, and a small portion of the top of the stem broke off with the warning light. In the impact with the device mounted 90 degrees from normal, the stem broke at a point just below the bumper (394 mm above the base). The light and panel remained attached to the upper portion of the device. The majority of the vehicle damage was limited to the bumper and the hood. No parts of the test articles showed potential for penetrating the occupant compartment. The warning light and a small part of its support bracket broke from the top of the stem and skimmed off the

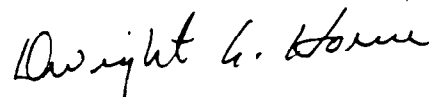
hood in the first test but did not impact the windshield. The upper portion of the second device hit caused a small dent in the vehicle hood but again, there was no contact with the windshield. See the enclosed test description for additional details on damage to the device and the test vehicle, and extent of debris that was thrown downstream during the impact test.

Tests with the 2000P vehicle were not conducted because, from a study of the front profile of the pick-up truck and small car in relation to the geometry of the test articles, it is apparent that there was less potential for an element of one of the test articles penetrating the occupant compartment of the pick-up truck than the small car. We concur in these judgements.

Because the results of the full-scale testing met the Federal Highway Administration (FHWA) velocity change and vehicle trajectory requirements, and they caused no passenger compartment intrusion, your company's MSi Durastem™ vertical panels are acceptable for use in work zones on the NHS, within the range of conditions tested with or without a warning light attached (of approximately 1.3 kg or less), when accepted by the responsible transportation agency. Our acceptance is limited to the breakaway characteristics of these devices and does not cover their structural features, nor does it cover conformity with the Manual on Uniform Traffic Control Devices. Presumably, you will supply potential users with sufficient information on design and installation requirements to ensure proper performance. We anticipate that the States will require certification from you that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as those used in the crash testing, and that they will meet the FHWA change in velocity requirements.

Temporary proprietary work zone hardware is usually selected by a contractor to meet general requirements for the management of traffic through work zones. As such, the hardware can be assumed to be exempt from the requirements for the use of patented or proprietary products covered in 23 CFR 635.411. However, if such products are specifically specified by a highway agency for use on a Federal-aid highway project, except exempt non-NHS projects, the requirements of 23 CFR.411 must be met. A copy of this section of the Code of Federal Regulations is enclosed for your information.

Sincerely yours,



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

2 Enclosures

✓
DuraStem Barricade Test 06-8322-001
(NCHRP 350 Test 3-71)

Impact Conditions/Vehicle Behavior

E-TECH Test 06-8322-001 is summarized in Figure 1. Details of the test article installation are given in Section II.A.2. and Appendix D of this report. The purpose of this test was to evaluate the risks to occupants of a small car impacting both normal and perpendicular orientations of the DuraStem Barricade in a head-on impact condition at 0 deg relative to the installation centerline. The separation distance between the normal and perpendicular test articles was 6.0 m.

The test was run using a red, 1988 Ford Festiva. The pre-test photographs are shown in Figure 2. The curb mass of the vehicle was 769 kg and the final test inertial mass was 836 kg. The actual impact conditions were 100.28 and 99.54 km/h in the normal and perpendicular orientations respectively. Impacts occurred at 0 deg for an impact severity of 324.29 and 319.6 kJ respectively. Impact severity for both impacts was within the NCHRP 350 recommended tolerance of 316.4 (-24.8 / +25.8) kJ.

The first impact took place on the normally orientated DuraStem. The vehicle bumper engaged the barrier Panel approximately 470 mm above the Base. The Stem separated from the Base within the first 20 ms of the impact. The Base remained flat against the pavement and aligned with the impact centerline coming to rest 1.2 m forward of the point of impact. The Panels remained attached to the Stem and were pushed ahead of the vehicle. The combined mass of the Panels and Stem was 3.0 kg. The Panels and Stem nicked the side of the downstream test article and were flung 40.0 m downstream and 2.4 m to the right from the point of impact. The top portion of the Stem, along with the attached L.E.D. warning light, broke loose within the first 10 ms of impact, skimmed off the vehicle hood, traveled over the roof, and eventually came to rest alongside the Panel and Stem. The mass of the warning light and Stem portion was 1.6 kg. No portion of the barricade assembly contacted the windshield. The vehicle exit speed from the first impact was 99.54 km/h.

The vehicle proceeded along a straight line for the second impact into the perpendicular DuraStem. The vehicle bumper engaged the barrier Panels approximately 470 mm above the Base. Within the first 10 ms of impact the Stem broke in two approximately 394 mm above the base. The lower portion of the Stem with the Base was drug along for a distance under the vehicle eventually coming to rest 41.1 m downstream and 2.4 m to the right of

the point of impact. The mass of the Stem portion and base was 10.0 kg. The upper portion of the Stem, the Panels, and the warning light remained attached to one another. The mass of the upper portion of the barricade was 4.1 kg. The upper portion of the barricade rotated back, glanced off the hood and over the roof, and was flung 38.1 m downstream and 1.2 m to the right of the point of impact. The warning light slightly dented the hood but no portion of the barricade contacted the windshield. The vehicle exit speed from the second impact was 98.80 km/h.

The vehicle was brought to a stop by an onboard braking system subsequent to the second impact. The final position of the vehicle was 71.5 m downstream and 1.5 m to the right of the first point of impact.

Test Article Damage/Debris Pattern

The final position and condition of the test articles is shown in the post test photographs of Figure 3. The normal orientation DuraStem Barricade separated from the Base. The 9.5 mm bolts and washers that attach the Stem to the rubber Base pulled through the Base but remained attached to the Stem and in tact. The upper portion of the Stem broke off at the top of the panels and cracked around the warning light attachment bolt. The warning light separated from the Stem. The Panels and Base sustained superficial damage and were judged reusable but the Stem could not be repaired. The warning light did not work after the impact.

The Stem of perpendicular barricade broke in two at the lower Panel bolt. The Panels and Base sustained superficial damage and were judged reusable but the Stem could not be repaired. The warning light did not work after the impact.

Vehicle Damage

The vehicle damage is shown in Figure 4. The test vehicle sustained minor scrapes, scratches, and dents exclusively to the front bumper and hood. The hood had a slight imprint from impacting the plastic light of the perpendicular barricade. The test articles did not contact the windshield. The minor damage to the test vehicle from the both the normal and perpendicular impacts was categorized as FC-0 on the Vehicle Damage Scale (VDS scale) and as 12FCEN1 on the Collision Deformation Classification Scale (CDC scale). (2)(3) Based upon deformation measurements of the occupant compartment following the second impact, the Occupant Compartment Deformation Index (OCDI) was categorized as AS0000000. There was no occupant compartment intrusion or deformation observed. The pre-test vehicle geometries are shown in Figure 5.

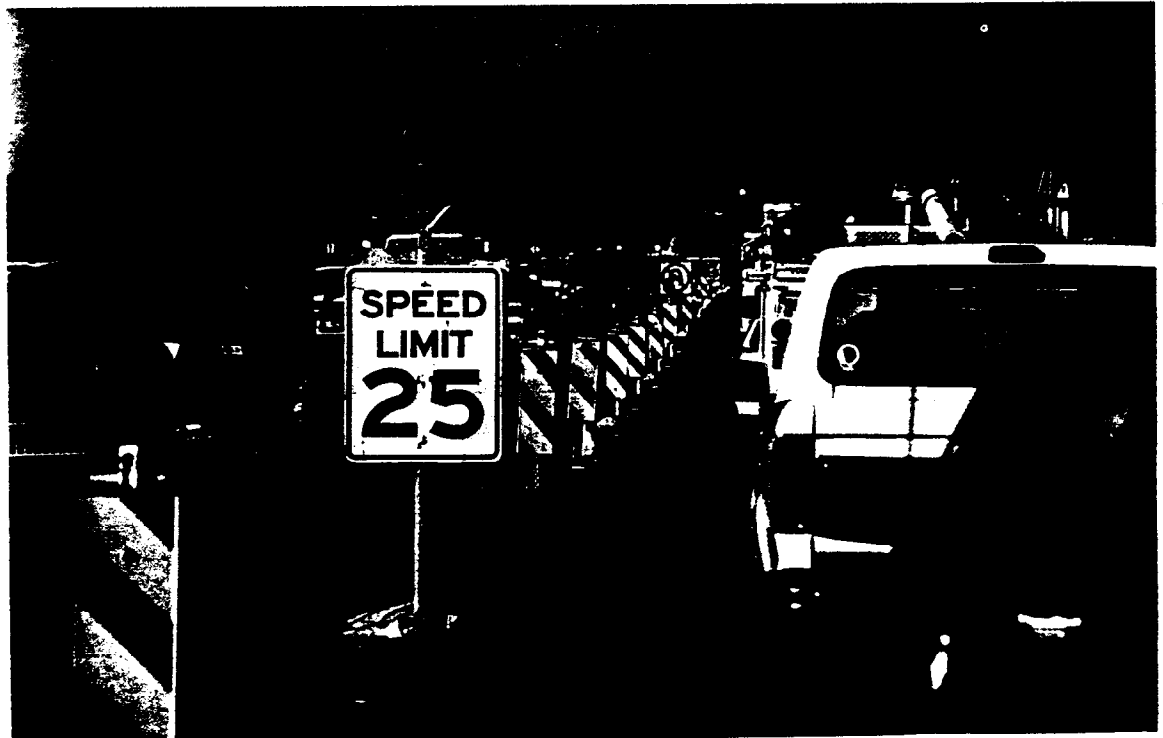
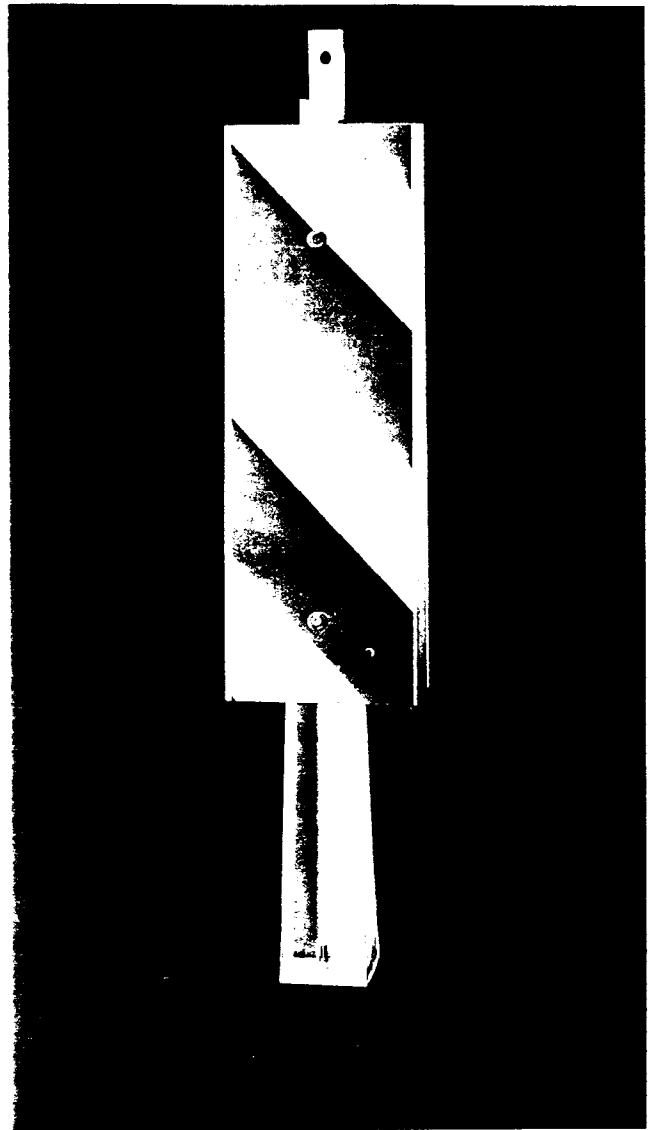
MSi

DURASTEM™

Recycled Vertical Panel Barricade

MSi's patented DuraStem vertical panel barricade is one of the most durable and economical traffic control devices that meets the MUTCD. Whether you are channeling traffic, dividing opposing lanes of traffic, or dividing traffic lanes flowing in the same direction, DuraStems make better use of limited space than either barricades or barrels.

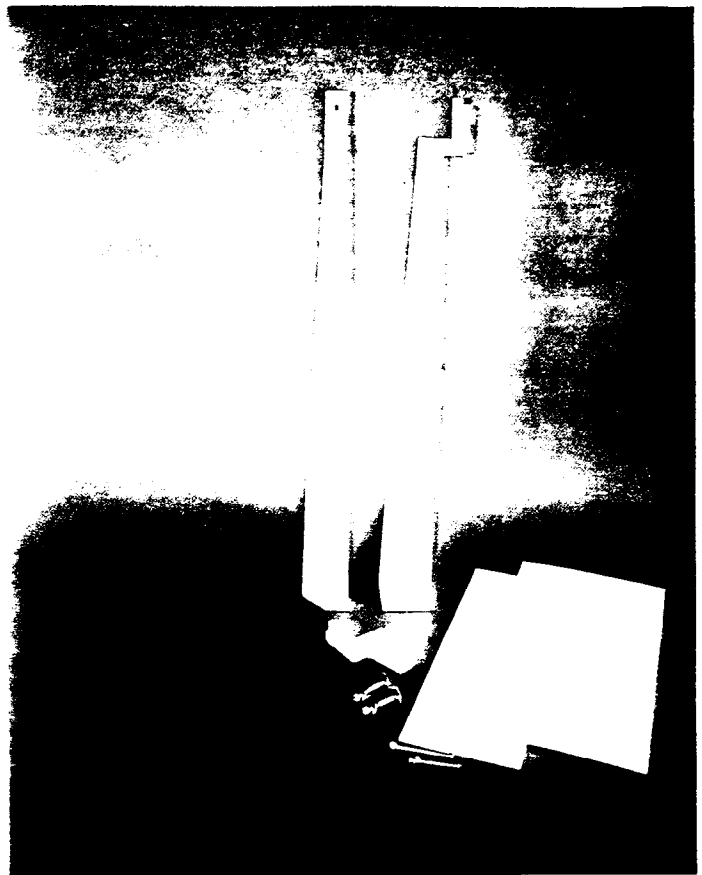
U.S. Patent # 5,869,455



Features:

Patented design withstands repeated vehicular hits.

- Durable, plastic panels & stems can be reused multiple times.
- 100% recycled rubber base helps grip the road.
- Center or side striping engineer, super engineer or high intensity sheeting.
- Built-in light holder for type A or C lights.
- Replacement light brackets available.



Replacement parts available separately.

Specifications - Panel: Height 24", width 8" or 12", thickness .290 in., made from a single section of white, extruded polyethylene sheeting, 25% recycled material.

Specifications - Stem: Height 40.50", width 1.5" on top end tapering to 4" on bottom end, made from high-impact, UV-stabilized, white polypropylene.

Specifications - Base: Height 1.75", approximate width 15", approximate weight 20 lbs., made from 100% reclaimed tire rubber with 6" square recessed area in center .25" deep.

Approximate assembled total weight 28 lbs.

Assembly must conform to current manual on Uniform Traffic Control Devices as revised.

Above specifications are for vertical barricade assembly only (barricade sheeting excluded).

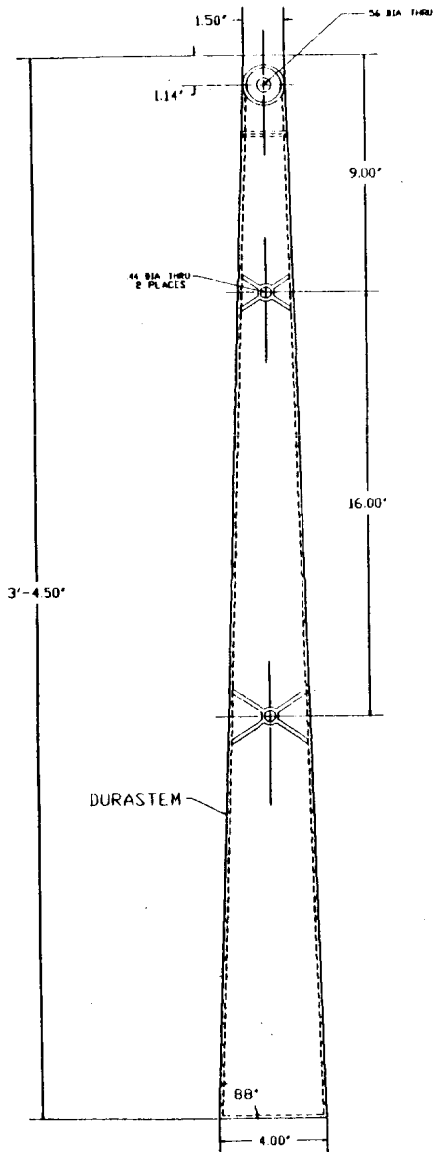
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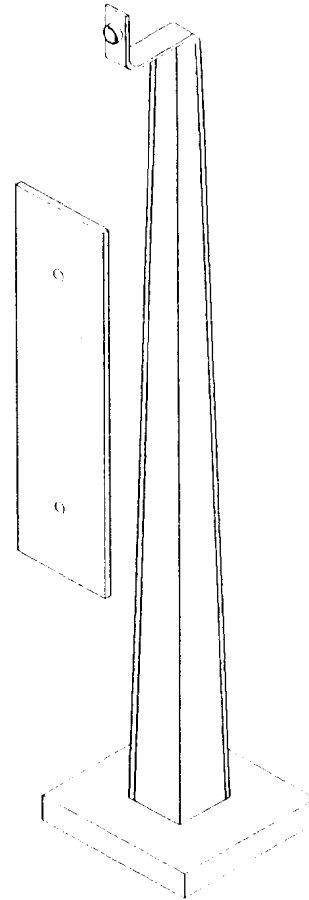
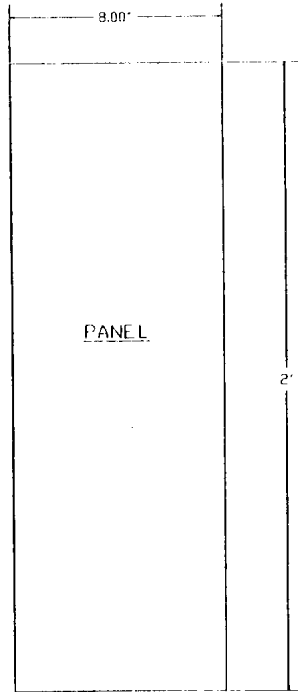
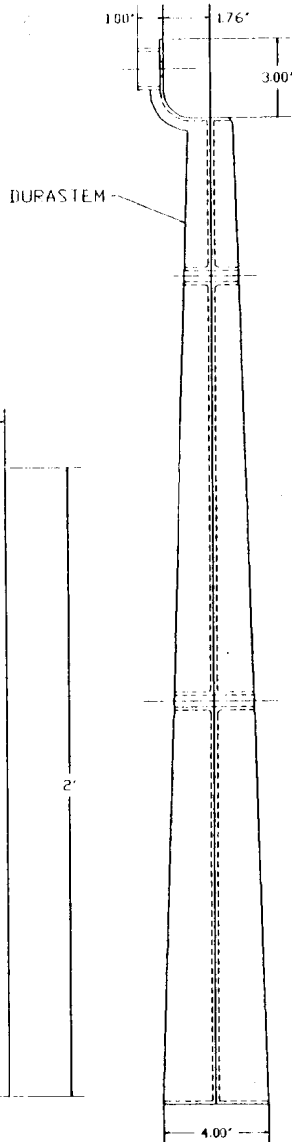
P.O. Box 60550
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DURASTEM

FRONT VIEW



SIDE VIEW

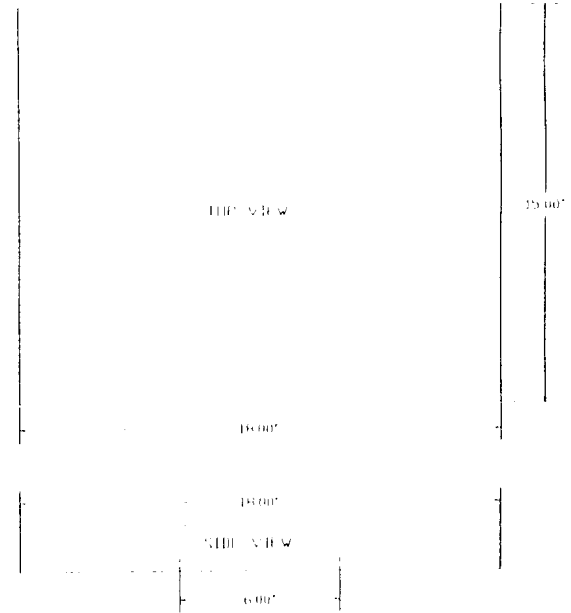


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BASE



the request. The RFHWA will have approval authority on the request.

(3) Requests for waivers may be made for specific projects, or for certain materials or products in specific geographic areas, or for combinations of both, depending on the circumstances.

(4) The denial of the request by the RFHWA may be appealed by the State to the Federal Highway Administrator (Administrator), whose action on the request shall be considered administratively final.

(5) A request for a waiver which involves nationwide public interest or availability issues or more than one FHWA region may be submitted by the RFHWA to the Administrator for action.

(6) A request for waiver and an appeal from a denial of a request must include facts and justification to support the granting of the waiver. The FHWA response to a request or appeal will be in writing and made available to the public upon request. Any request for a nationwide waiver and FHWA's action on such a request may be published in the FEDERAL REGISTER for public comment.

(7) In determining whether the waivers described in paragraph (c)(1) of this section will be granted, the FHWA will consider all appropriate factors including, but not limited to, cost, administrative burden, and delay that would be imposed if the provision were not waived.

(d) Standard State and Federal-aid contract procedures may be used to assure compliance with the requirements of this section.

[48 FR 53104, Nov. 25, 1983, as amended at 49 FR 18821, May 3, 1984; 58 FR 38975, July 21, 1993]

EDITORIAL NOTE: For a waiver document affecting § 635.410, see 60 FR 15478, Mar. 24, 1995.

§ 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 com-

petitive 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.

§ 635.413 Warranty clauses.

The SHA may include warranty provisions in National Highway System (NHS) construction contracts in accordance with the following:

(a) Warranty provisions shall be for a specific construction product or feature. Items of maintenance not eligible for Federal participation shall not be covered.

(b) All warranty requirements and subsequent revisions shall be submitted to the Division Administrator for advance approval.

(c) No warranty requirement shall be approved which, in the judgment of the Division Administrator, may place an undue obligation on the contractor for items over which the contractor has no control.

(d) A SHA may follow its own procedures regarding the inclusion of war-

ranty provisions in non-NHS Federal-aid contracts.

[60 FR 44274, Aug. 25, 1995]

§ 635.417 Convict produced materials.

(a) Materials produced after July 1, 1991, by convict labor may only be incorporated in a Federal-aid highway construction project if such materials have been:

(1) Produced by convicts who are on parole, supervised release, or probation from a prison or

(2) Produced in a qualified prison facility and the cumulative annual production amount of such materials for use in Federal-aid highway construction does not exceed the amount of such materials produced in such facility for use in Federal-aid highway construction during the 12-month period ending July 1, 1987.

(b) *Qualified prison facility* means any prison facility in which convicts, during the 12-month period ending July 1, 1987, produced materials for use in Federal-aid highway construction projects.

[53 FR 1923, Jan. 25, 1988, as amended at 58 FR 38975, July 21, 1993]

APPENDIX A TO SUBPART D—SUMMARY OF ACCEPTABLE CRITERIA FOR SPECIFYING TYPES OF CULVERT PIPES

Type of drainage installation	Alternatives required			AASHTO designations to be included with alternatives	Application	Remarks
	Yes	No	Number			
Cross drains under high-type pavement. ¹		X			Statewide	Any AASHTO-approved material ²
Other cross-drain installations.	X		3 minimum	M-170 and M-190.	do	Do ²
Side-drain installations.	X		do	M-38	do	Do ²
Special installation conditions.		X			Individual installation.	Specified to meet special conditions.
Special drainage systems (storm sewers, inverted siphons, etc.).		X			do	Specified to meet site requirements.

¹High-type pavement is generally described as FHWA construction type codes I, J, K, L, and plant mix and penetration macadam segments, respectively shown in the right-hand columns of type codes G and H having a combined thickness of surface and base of 7 in or more (or equivalent) or that are constructed on rigid bases.

²Types not included in currently approved AASHTO specifications may be specified if recommended by the State with adequate justification and approved by FHWA.

Subpart E—Interstate Maintenance Guidelines

SOURCE: 45 FR 20793, Mar. 31, 1980, unless otherwise noted.

§ 635.501 Purpose.

To prescribe Interstate maintenance guidelines and establish the policy and procedures to insure that the condition of Interstate routes is maintained at the level required by the purposes for which they were designed.