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

November 23, 1998

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

Refer to: HNG-14

Ms. Christine Cash
Bent Manufacturing Company
17211 Nichol Street
Huntington Beach, California 92647-5721

Dear Ms. Cash:

Thank you for your letters of June 8 and August 10 requesting Federal Highway Administration's (FHWA) acceptance of your company's work zone traffic control devices as meeting the crashworthiness guidelines contained in the National Cooperative Highway Research Program Report 350. Accompanying your letters were copies of the crash test reports by E-Tech Testing Services, Inc., color photographs, and video documentation of the crash tests. You requested that we find the tested devices, as well as lighter or smaller devices of similar design, acceptable for use on the National Highway System (NHS). Additional information we requested was received from E-Tech Testing Services dated October 5.

The FHWA guidance on crash testing of work zone traffic control devices is contained in two memorandums. The first, dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features," established four categories of work zone devices: Category I devices were those lightweight items which could be self-certified by the vendor, Category II devices were other lightweight devices which needed individual crash testing, Category III devices were barriers and other fixed or massive devices also needing crash testing, and Category IV devices were trailer mounted lighted signs, arrow panels, etc. The second guidance memorandum was issued on August 28 and is titled "INFORMATION: Crash Tested Work Zone Traffic Control Devices." This recent memorandum lists devices that are acceptable under Categories I, II, and III.

Details of test articles, lights and fastener hardware are enclosed.

I. June 8 Request:

The items you listed in your June 8 letter are all "Category II" devices. The results of the tests are summarized in the enclosed table. In each test, two devices were impacted by an 820 kg automobile. The first was positioned normal to the edge of the traveled way, and the second was perpendicular to the first and placed approximately 6 meters downstream. Details of the tests are shown in the following table:

Device Name (No model numbers were assigned)	Type II plywood panel barricade	Universal Plastic panel barricade	T-Top vertical panel	Superdome plastic drum
Mass of device*	13.2 kg	11.4 kg	3.6 kg	7.3 kg
Mass of ballast	none	none	12.3 kg	16.8 kg
Height**	940 mm	940 mm	1067 mm	1115 mm
Width	914 mm	914 mm	305 mm	457 mm
Light attached?	Yes	Yes	Yes	Yes
Test #	98-0398-001	98-0398-002	98-0398-003	98-0398-004
Impact Speeds***	102.47/100.35	103.20/101.05	100.35/99.67	103.94/101.76
Exit Speeds***	100.35/98.23	101.05/98.9	99.67/98.99	101.76/99.58
Delta V, m/s	0.59/0.59	0.60/0.60	0.19/0.19	0.61/0.61

*Mass includes light but not ballast, if any. Lights were ToughLite 2000 by WLI Industries, Inc., attached with standard tamper-resistant hardware.

**Height does not include light.

***Impact speeds in kilometers per hour. First speed given is for contact with first test article, second speed is speed for impact with the second.

On the test of the Superdome Plastic Drum the vehicle windshield was broken by the warning light on the second (90 degree out of position) drum. However, there were no significant intrusions into the occupant compartment and the damage was judged not to interfere with driver visibility. There was no damage to the vehicle windshield during any of the other tests, and only minor damage to the bumpers and/or hoods were evident.

There was no test article debris detached during the test series that would penetrate or show potential for penetrating the occupant compartment or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. The results of the full-scale testing also met the FHWA velocity change and vehicle trajectory requirements.

II. August 10 Request:

The items you listed in your August 10 letter are all "Category II" devices. The results of the tests are summarized in the enclosed table. In each test, two devices were impacted by an 820 kg automobile. The first was positioned normal to the edge of the traveled way, and the second was perpendicular to the first and placed approximately 6 meters downstream. Details of the tests are shown in the following table:

Device Name	Type III barricade	Masterflex Post	T-Top Delineator
Mass of device*	40.0 kg	2.1 kg	2.7 kg
Mass of ballast	two x 22.7 kg	none	10 kg
Height**	914 mm	1067 mm	1067 mm
Width	2438 mm	305 mm	203 mm
Light attached?	Yes, two	No	Yes
Test #	09-0498-001	09-0498-002	09-0498-003
Impact Speeds***	102.48/95.74	102.48/102.48	101.76/100.35
Exit Speeds***	95.74/89.00	102.48/102.2	100.35/98.94
Delta V, m/s	1.87/1.87	0.00/0.08	0.39/0.39

*Mass includes light(s) but not ballast, if any. Lights were ToughLite 2000 by WLI Industries, Inc., attached with standard tamper-resistant hardware.

**Height does not include light.

***Speeds in kilometers per hour. First speed given is for contact with first test article, second speed is speed for impact with the second.

On the test of the Type III plywood panel barricade the vehicle windshield was broken by the warning sign on the first (normal position) barricade. The windshield deformation was 64 mm but it remained intact. The damage was judged by the researchers to only partially restrict driver visibility, however it still causes us some concern. There is no standardized criteria for acceptable windshield deformation in marginal cases such as this. While we endeavor to establish such criteria we will withhold action on the Type III barricade with sign. Tests of similar barricades without signs have been successful and we believe that your barricade is similarly acceptable without a rigid sign. There was no damage to the vehicle windshield during any of the other tests, and only minor damage to the bumpers and/or hoods were evident.

There was no test article debris detached during the test series that would penetrate or show potential for penetrating the occupant compartment or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. The results of the full-scale testing also met the FHWA velocity change and vehicle trajectory requirements

III Summary:

Your company's devices listed below meet the crash test requirements of the FHWA and are acceptable for use on the National Highway System, in the range of conditions tested, when proposed by a State. Lights, if used, shall be a maximum of 1.2 kg, batteries included, and be attached with standard tamper-resistant hardware. In addition, the same devices in smaller configurations of the same family of product will also be acceptable for use.

Type II plywood or plastic panel barricade, with or without lights;
Universal Plastic panel barricade, with or without lights;
T-Top vertical panel, with or without lights;
Superdome plastic drum, with or without lights;
Type III barricade, without rigid sign, and with or without lights;
Masterflex Post (a vertical panel), without light;
T-Top Delineator, with or without lights;

Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity of the devices 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 Bent Manufacturing Company that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance. To prevent misunderstanding by others, this letter of acceptance shall not be reproduced except in full.

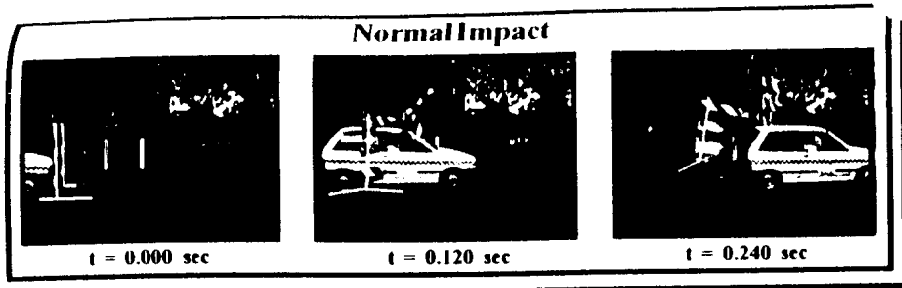
If any of these devices is a patented product, it will be considered "proprietary." To be used in Federal-aid projects, except exempt, non-NHS projects, proprietary products: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed.

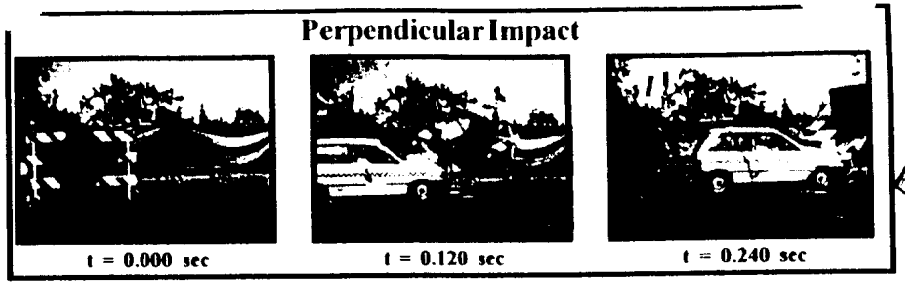
Sincerely yours,

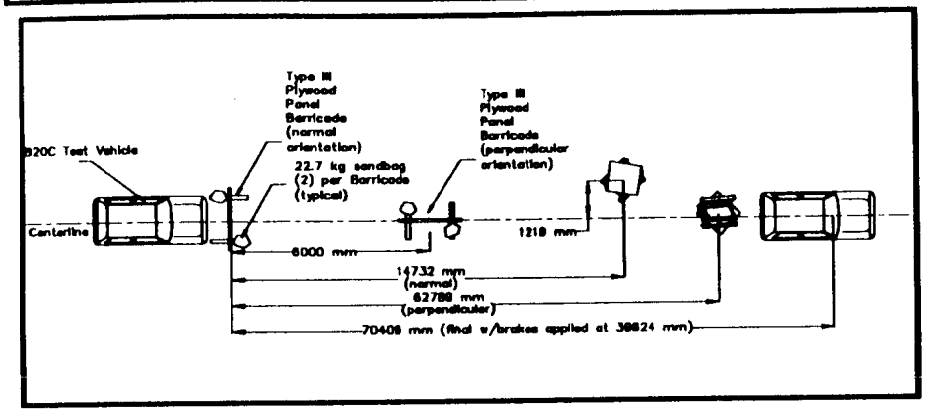
Dwight A. Horne

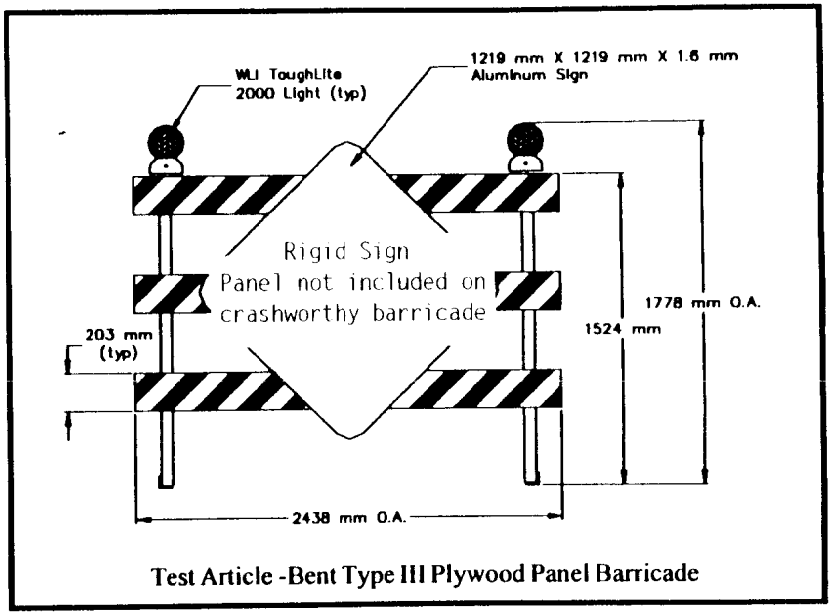
Dwight A. Horne
Chief, Federal-Aid and Design Division

Enclosure







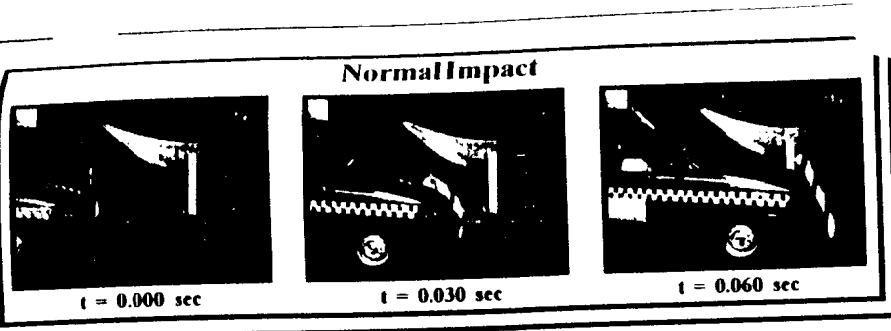


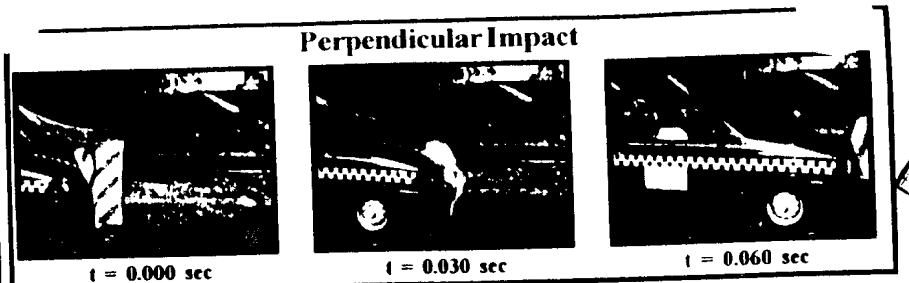
Test Article -Bent Type III Plywood Panel Barricade

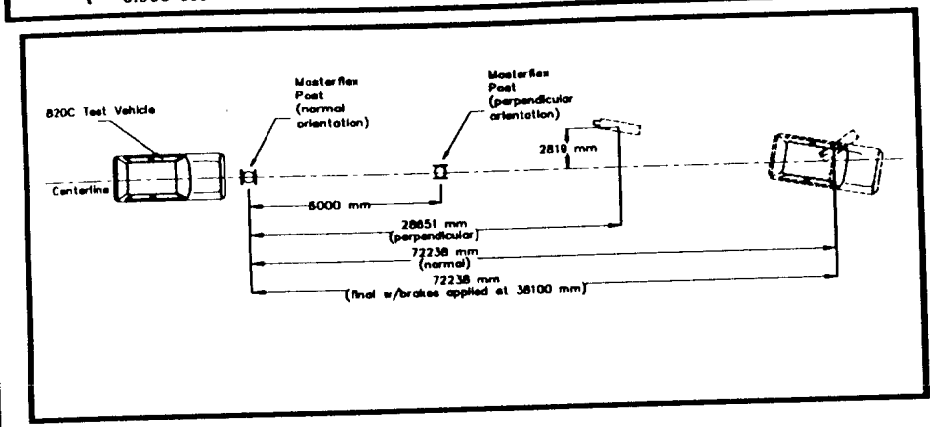
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0498-001
Date	6/17/98
Test Article	
Type	Bent Manufacturing Company
	Type III Plywood Pnl. Barricade
	w/ToughLite 2000 lights
Impact Orientation	Normal and Perpendicular
Size and/or dimension and material of key elements	Height - 1524 mm (w/o light)
	Width - 2438 mm (panel)
	Mass - 40.1 kg (total)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1987 Ford Festiva
	Hatchback
Mass (kg)	
Curb	781.0
Test inertial	824.4
Dummy	75.0
Gross Static	899.4

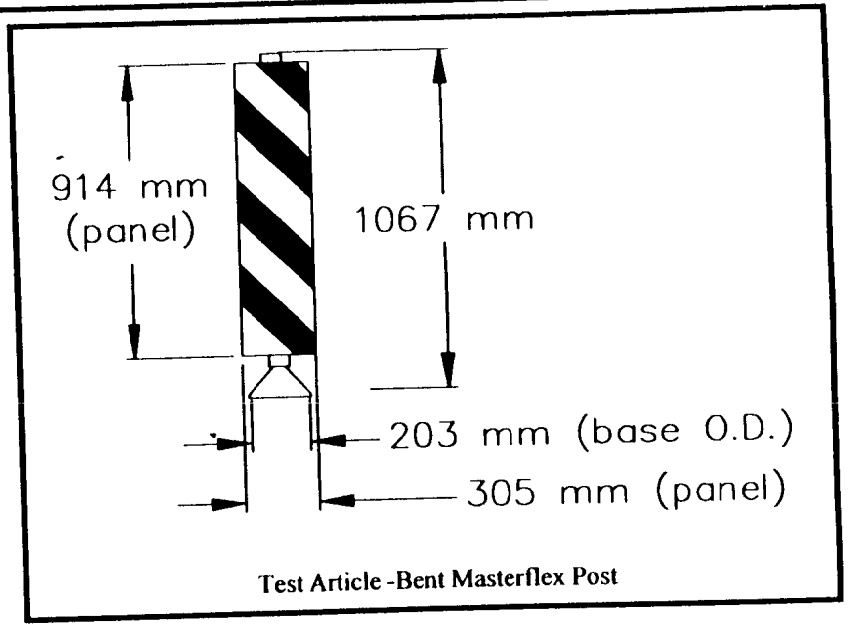
Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	102.48 / 95.74
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	334.10 / 291.66
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	95.74 / 89.00
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-1 / FC-1
CDC	12FCEW1 / 12FCEN1
Interior	
OCDI	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350 Test 3-71	Pass / Pass

Figure 1. Summary of Results - Bent Type III Plywood Panel Barricade Test 09-0498-001





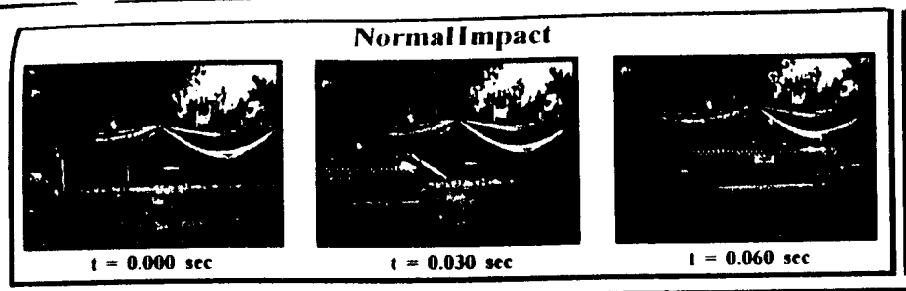


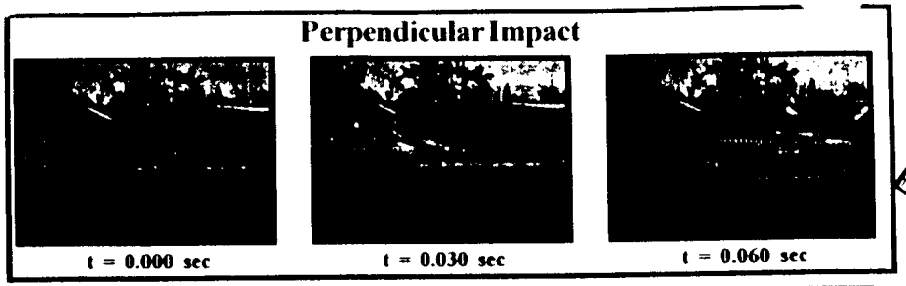


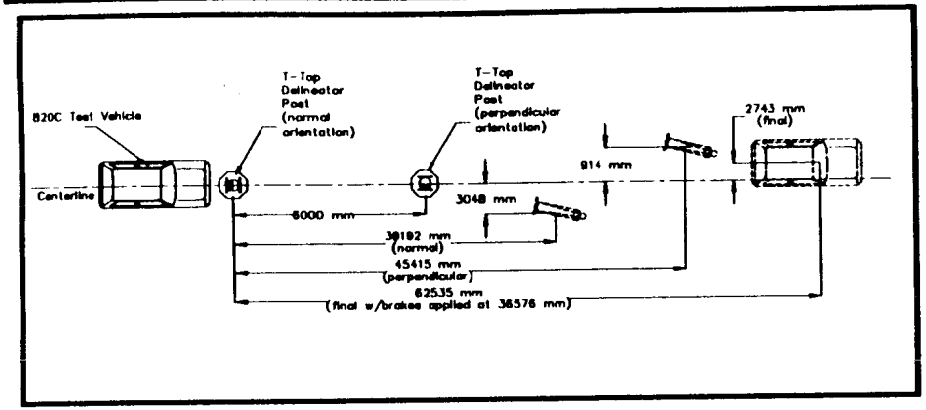
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0498-002
Date	6/18/98
Test Article	
Type	Bent Manufacturing Company Masterflex Post w/plastic vertical panels
	Normal and Perpendicular
Impact Orientation	
Size and/or dimension and material of key elements	Height - 1067 mm (post) Width - 305 mm (panel) Mass - 2.1 kg (total)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva Hatchback
Mass (kg)	
Curb	822.8
Test inertial	843.6
Dummy	75.0
Gross Static	918.6

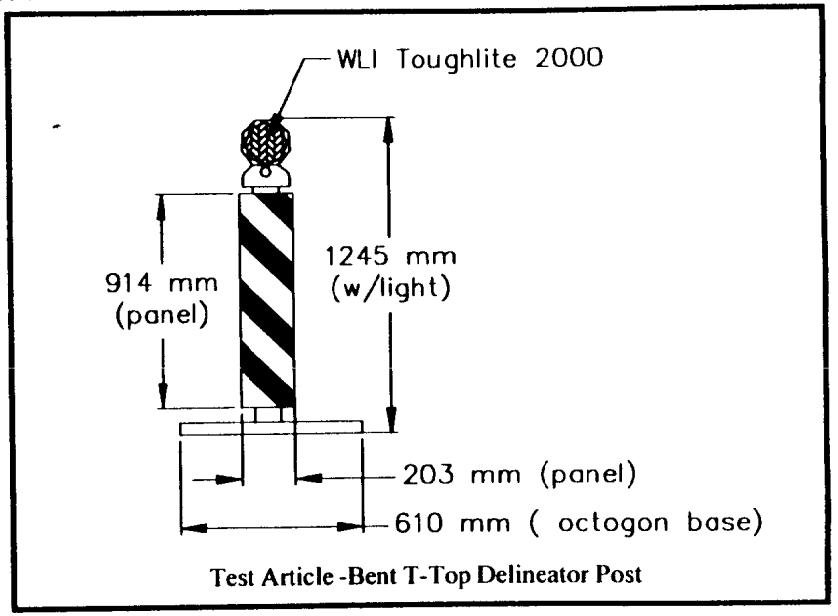
Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	102.48 / 102.48
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	341.89 / 341.89
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	102.48 / 102.20
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-0 / FC-0
CDC	N/A
Interior	
OCDI	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350	Pass / Pass

Figure 6. Summary of Results - Bent Masterflex Post Test 09-0498-002









Test Article -Bent T-Top Delineator Post

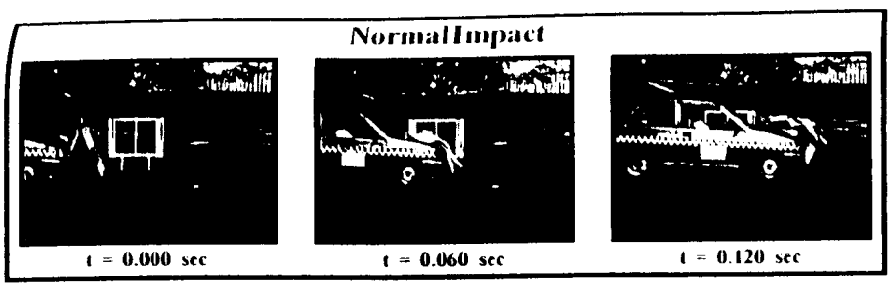
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0498-003
Date	6/18/98
Test Article	
Type	Bent Manufacturing Company
	T-Top Delineator Post
	w/plastic vertical panels
Impact Orientation	Normal and Perpendicular
Size and/or dimension and material of key elements	Height - 1245 mm (w/light)
	Width - 203 mm (panel)
	Mass - 12.7 kg (total)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	822.8
Test inertial	843.6
Dummy	75.0
Gross Static	918.6

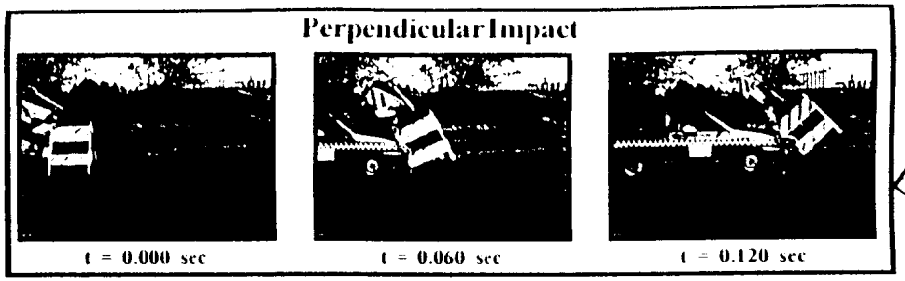
Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	101.76 / 100.35
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	337.10 / 327.86
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	100.35 / 98.94
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-1 / FC-1
CDC	12FCEN1 / 12FCEN1
Interior	
OCDI	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350	Pass / Pass

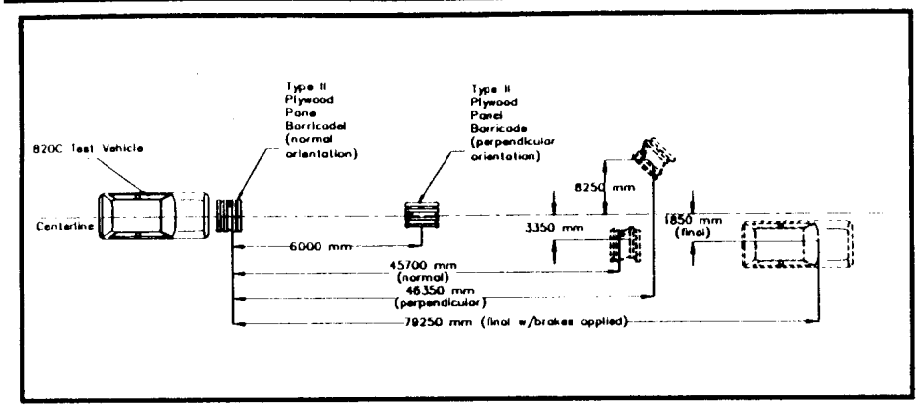
Figure 11. Summary of Results - Bent T-Top Delineator Post Test 09-0498-003

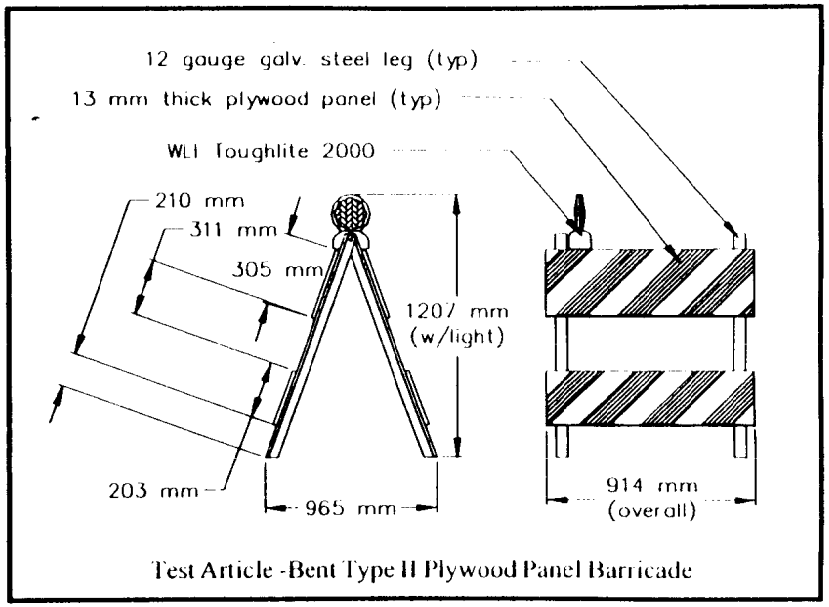
Table 3. Test Results Evaluation Summary

Table 3. Test Results Evaluation					
NCHRP 350 Evaluation Criteria	Test 09-0498-001 Type III Barricade (NCHRP 350 Test 3-71)	Test 09-0498-002 Masterflex Post (NCHRP 350 Test 3-71)	Test 09-0498-003 T-Top Delineator (NCHRP 350 Test 3-71)		
********** Structural Adequacy**********					
A. Test article should contain and redirect the vehicle; the vehicle should not penetrate, underride, or override the installation although controlled lateral deflection of the test article is acceptable.	N/A	N/A	N/A		
B. Test article should readily activate in a predictable manner by breaking away, fracturing, or yielding.	Passed	Passed	Passed		
C. Acceptable test article performance may be by redirection, controlled penetration, or controlled stopping of the vehicle.	N/A	N/A	N/A		
********** Occupant Risk**********					
D. Detached elements, fragments or other debris from the test article should not penetrate or show potential for penetrating the occupant compartment, or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. Deformations of, or intrusions into, the occupant compartment that could cause serious injuries should no be permitted.	Passed	Passed	Passed		
F. The vehicle should remain upright during and after collision although moderate roll, pitching, and yawing are acceptable.	Passed	Passed	Passed		
H. Occupant impact velocities (longitudinal) should satisfy the following; Preferred: 9 m/s, Maximum: 12 m/s	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)		
I. Occupant ridedown accelerations (longitudinal and lateral) should satisfy the following; Preferred: 15 g, Maximum: 20 g	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)		
********** Vehicle Trajectory**********					
K. After collision it is preferable that the vehicle's trajectory not intrude into adjacent traffic lanes.	Passed	Passed	Passed		
L. The occupant impact velocity in the longitudinal direction should not exceed 12 m/s and the occupant ridedown accelerations in the longitudinal direction should not exceed 20 g's.	N/A	N/A	N/A		
M. The exit angle from the test article preferably should be less than 60 percent of the test impact angle, measured at time of vehicle loss of contact with test device.	N/A	N/A	N/A		
N. Vehicle trajectory behind the test article is acceptable.	Passed	Passed	Passed		







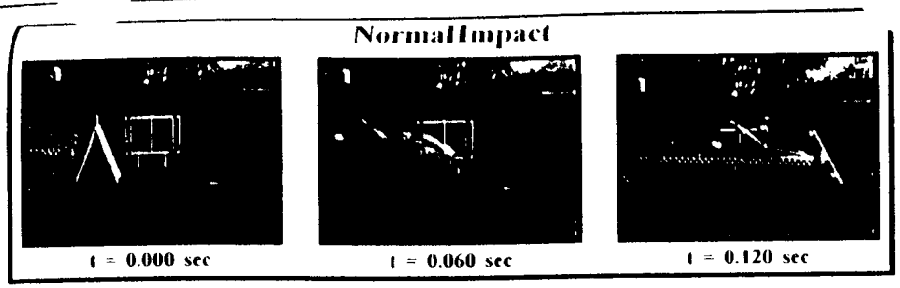


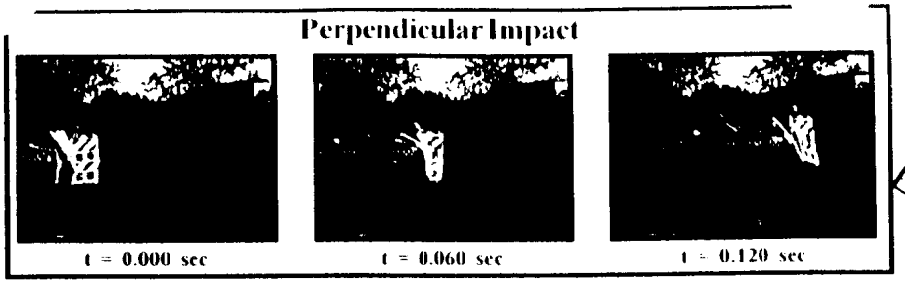
Test Article -Bent Type II Plywood Panel Barricade

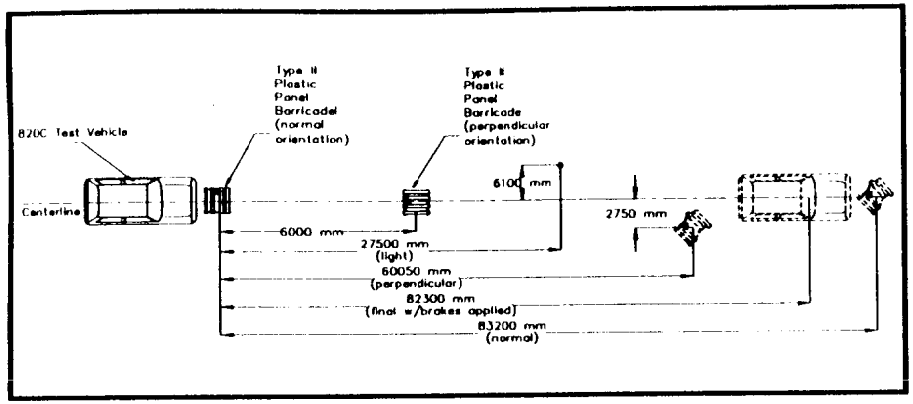
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0398-001
Date	4/28/98
Test Article	
Type	Bent Manufacturing Company
	Type II Plywood Panel Barricade
	w/ToughLite 2000 light
Impact Orientation	Normal and Perpendicular
Size and/or dimension and material of key elements	Height - 1207 mm (w/light)
	Width - 914 mm (panel)
	Mass - 13.2 kg (approx)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	750.6
Test inertial	815.6
Dummy	75.0
Gross Static	890.6

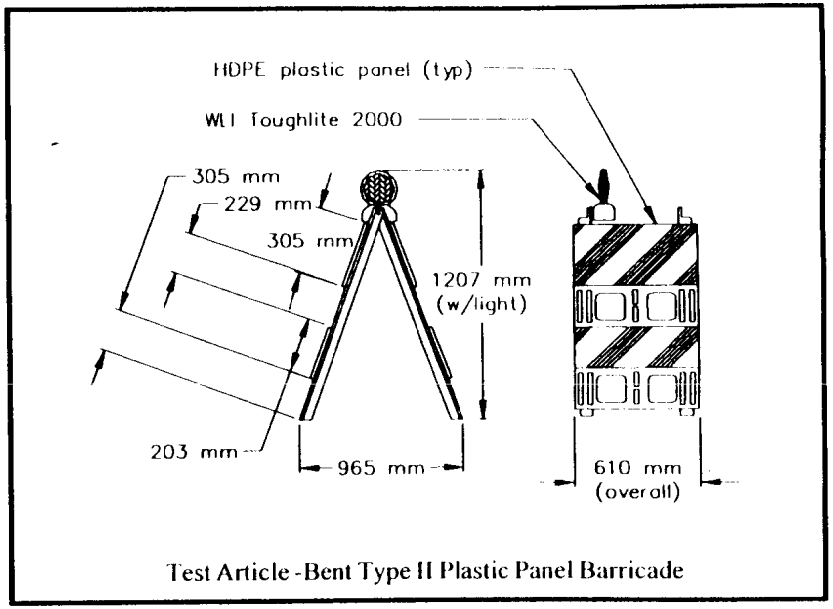
Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	102.47 / 100.35
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	330.42 / 316.89
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	100.35 / 98.23
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-1 / FC-1
CDC	12FCEN1 / 12FCEN1
Interior	
OCDI	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350	Pass / Pass

Figure 1. Summary of Results - Bent Type II Plywood Panel Barricade Test 09-0398-001







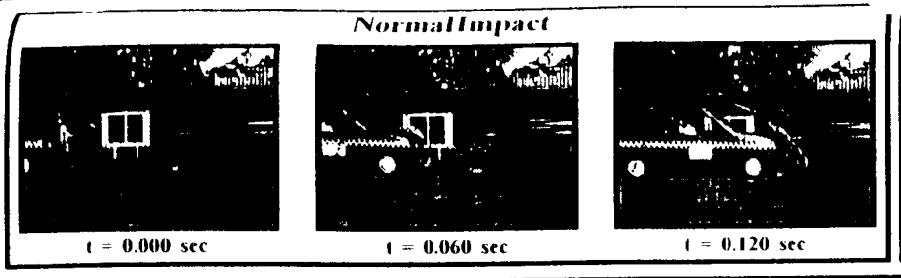


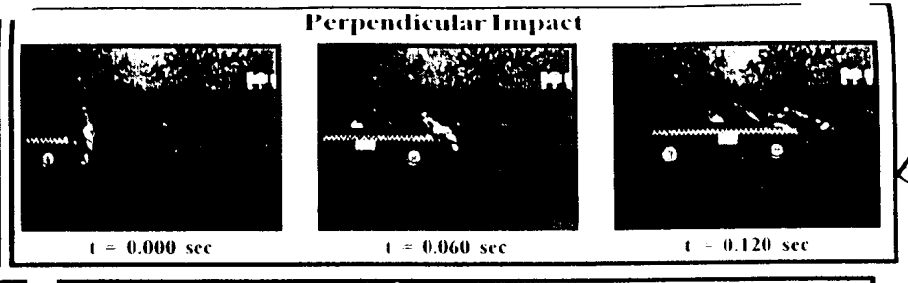
Test Article -Bent Type II Plastic Panel Barricade

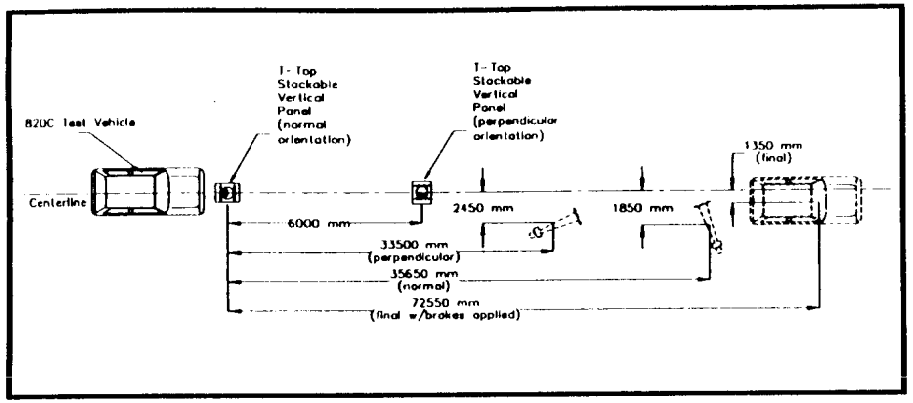
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0398-002
Date	4/28/98
Test Article	
Type	Bent Manufacturing Company
	Type II Plastic Panel Barricade
	w/ToughLite 2000 light
Impact Orientation	Normal and Perpendicular
Size and/or dimension and material of key elements	Height - 1232 mm (w/light)
	Width - 610 mm (panel)
	Mass - 11.4 kg (approx)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	784.6
Test inertial	811.2
Dummy	75.0
Gross Static	886.2

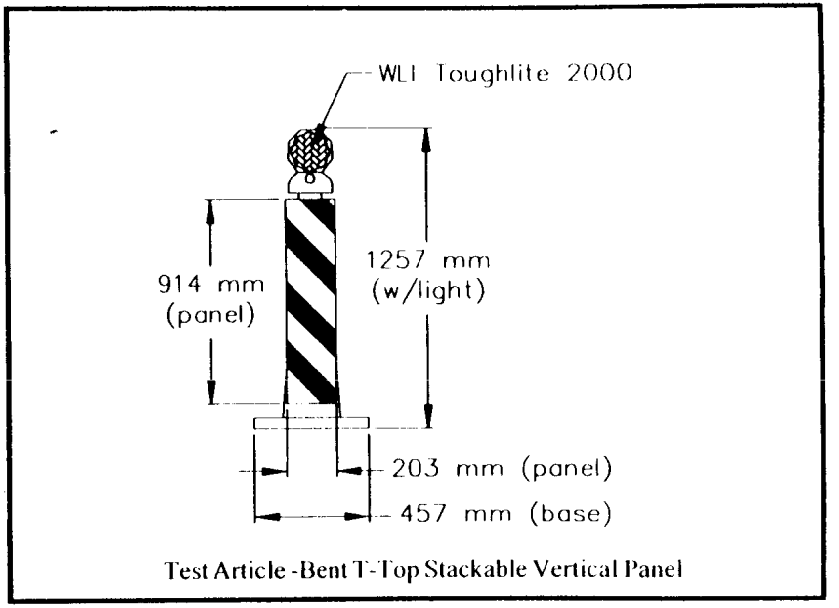
Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	103.20 / 101.05
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	333.31 / 319.58
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	101.05 / 98.90
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-1 / FC-1
CDC	12FCEN1 / 12FCEN1
Interior	
OCDI	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350	Pass / Pass

Figure 6. Summary of Results - Bent Type II Plastic Panel Barricade Test 09-0398-002







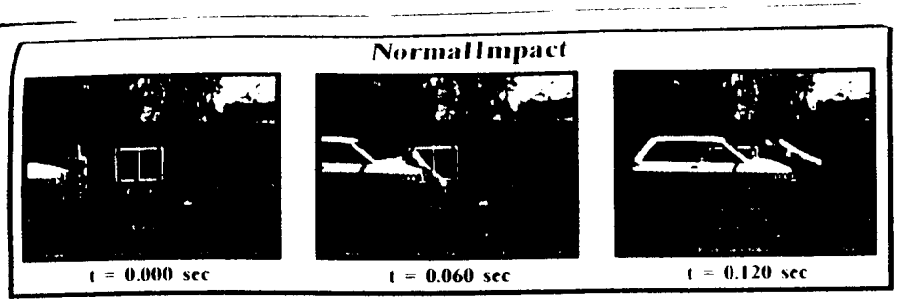


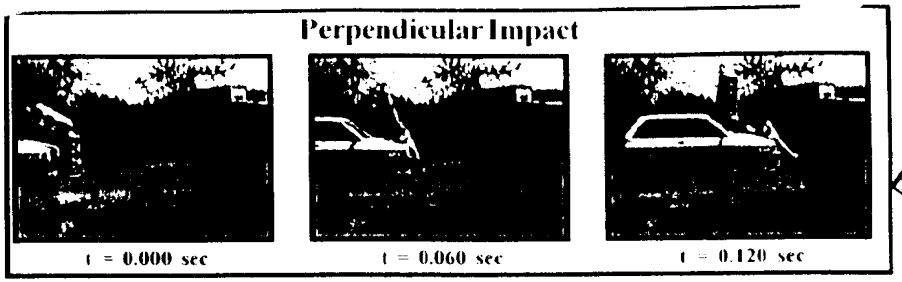
Test Article -Bent T-Top Stackable Vertical Panel

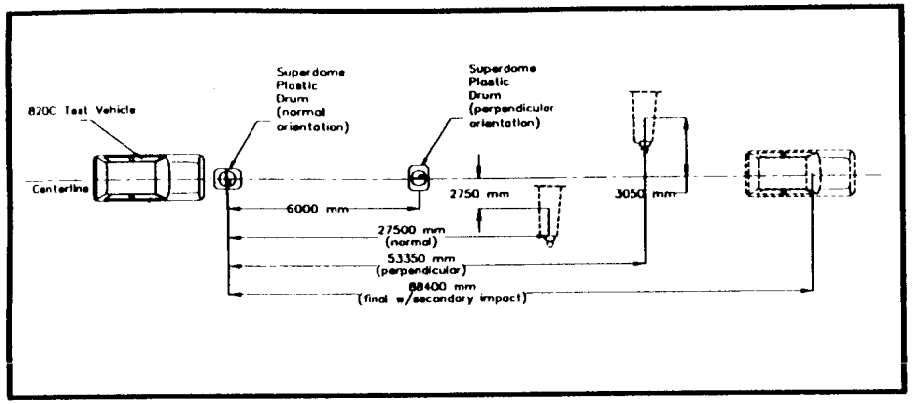
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0398-003
Date	4/29/98
Test Article	
Type	Bent Manufacturing Company
	T-Top Stackable Vertical Panel
	w/ToughLite 2000 light
Impact Orientation	Normal and Perpendicular
Size and/or dimension and material of key elements	Height - 1257 mm (w/light)
	Width - 203 mm (panel)
	Mass - 15.9 kg (w/base)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1989 Ford Festiva
	Hatchback
Mass (kg)	
Curb	787.2
Test inertial	829.6
Dummy	75.0
Gross Static	904.6

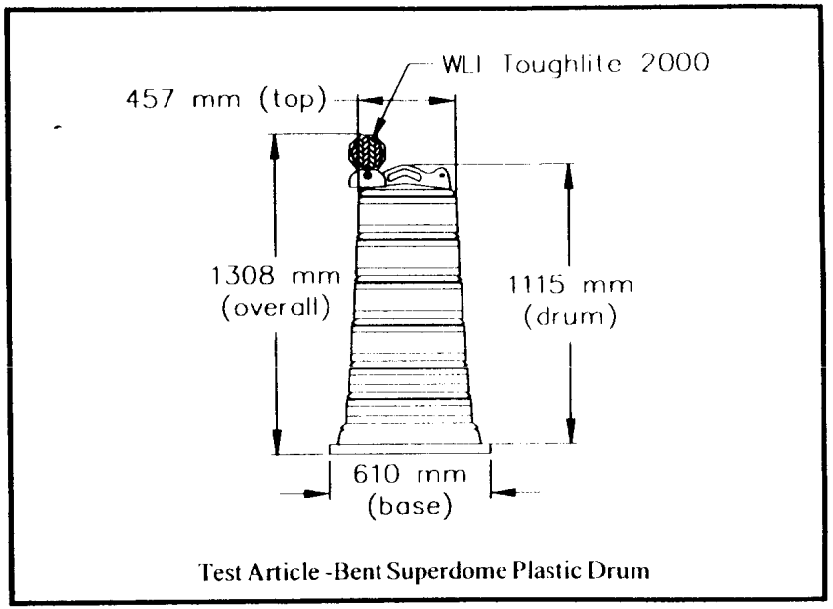
Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	100.35 / 99.67
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	322.33 / 317.92
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	99.67 / 98.99
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-1 / FC-1
CDC	12FCEN1 / 12FCEN1
Interior	
OCDI	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350	Pass / Pass

Figure 11. Summary of Results - Bent T-Top Stackable Vertical Panel Test 09-0398-003









Test Article -Bent Superdome Plastic Drum

General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-71
Test No.	09-0398-004
Date	4/29/98
Test Article	
Type	Bent Manufacturing Company
	Superdome Plastic Drum
	w/ToughLite 2000 light
Impact Orientation	Normal and Perpendicular
Size and/or dimension and material of key elements	Height - 1308 mm (w/light)
	Width - 584 mm (max drum)
	Mass- 24.1 kg (w/base)
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	820.0
Test inertial	827.0
Dummy	75.0
Gross Static	902.0

Impact Conditions (Normal/Perpendicular)	
Speed (km/h)	103.94 / 101.76
Angle (deg)	0.0 / 0.0
Impact Severity (kJ)	344.68 / 330.37
Exit conditions (Normal/Perpendicular)	
Speed (km/h)	101.76 / 99.58
Angle (deg)	0.0/0.0
Vehicle Damage (Normal/Perpendicular)	
Exterior	
VDS	FC-0 / FC-0
CDC	12FCEN1 / 12FCGN6
Interior	
OCD1	AS0000000 / AS0000000
Performance Evaluation (Normal/Perpendicular)	
NCHRP 350	Pass / Pass

Figure 16. Summary of Results - Bent Superdome Plastic Drum Test 09-0398-004

Table 3. Test Results Evaluation Summary

Table 3. Test Results Evaluation					
NCHRP 350 Evaluation Criteria	Test 09-0398-001 Plywood Panel Barricade (NCHRP 350 Test 3-71)	Test 09-0398-002 Plastic Panel Barricade (NCHRP 350 Test 3-71)	Test 09-0398-003 T-Top Vertical Panel (NCHRP 350 Test 3-71)	Test 09-0398-004 Superdome Plastic Drum (NCHRP 350 Test 3-71)	
********** Structural Adequacy**********					
A. Test article should contain and redirect the vehicle, the vehicle should not penetrate, underride, or override the installation although controlled lateral deflection of the test article is acceptable.	N/A	N/A	N/A	N/A	
B. Test article should readily activate in a predictable manner by breaking away, fracturing, or yielding.	Passed	Passed	Passed	Passed	
C. Acceptable test article performance may be by redirection, controlled penetration, or controlled stopping of the vehicle.	N/A	N/A	N/A	N/A	
********** Occupant Risk**********					
D. Detached elements, fragments or other debris from the test article should not penetrate or show potential for penetrating the occupant compartment, or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. Deformations of, or intrusions into, the occupant compartment that could cause serious injuries should no be permitted.	Passed	Passed	Passed	Passed	
F. The vehicle should remain upright during and after collision although moderate roll, pitching, and yawing are acceptable.	Passed	Passed	Passed	Passed	
H. Occupant impact velocities (longitudinal) should satisfy the following; Preferred: 9 m/s, Maximum: 12 m/s	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	
I. Occupant ridedown accelerations (longitudinal and lateral) should satisfy the following; Preferred: 15 g, Maximum: 20 g	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	N/A (Test article less than 45 kg)	
********** Vehicle Trajectory**********					
K. After collision it is preferable that the vehicle's trajectory not intrude into adjacent traffic lanes.	Passed	Passed	Passed	Passed	
L. The occupant impact velocity in the longitudinal direction should not exceed 12 m/s and the occupant ridedown accelerations in the longitudinal direction should not exceed 20 g's.	N/A	N/A	N/A	N/A	
M. The exit angle from the test article preferably should be less than 60 percent of the test impact angle, measured at time of vehicle loss of contact with test device.	N/A	N/A	N/A	N/A	
N. Vehicle trajectory behind the test article is acceptable.	Passed	Passed	Passed	Passed	

WLI Industries, Inc.

WLI Industries, Inc.
880 N. Addison Road
P.O. Box 7050
Villa Park, IL 60181-7050

Phone: 630 932 4600
FAX: 630 932 7611
email: sales@wli-industries.com

Facsimile

To: Christine Cash 714 842-0600
@Fax: 714 842 2959
From: Thomas P Boyce
Date: Thursday, November 5, 1998 @ 8:23PM
Re: Toughlite 2000 Specifications
Pages: 1, including this

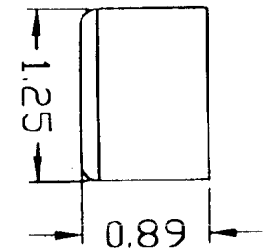
Christine:

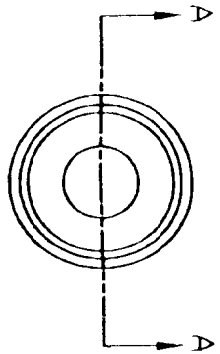
As you requested, following are detailed specifications regarding the ToughLite 2000 LED warning light, using four D cell battteries:

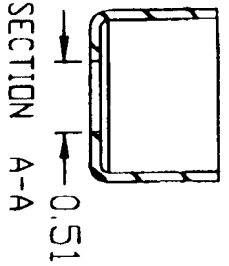
- the battery case housing is molded of a block copolymer
- the weight of the light with four D cell batteries and mounting bolt is 2.818#
- the weight of the light with batteries and no bolt is 2.63#
- the weight of the light without batteries or bolt is 1.352#
- the lens is molded of polycarbonate
- the bolt is a C10 10 low carbon steel equal to a Grade 2 hardness with dimensions of 1/2" x 3 1/2" long, cadmium plated

Please let me know if you have any other questions.

Thanks







Bolt Protector
Approximate weight – 1 ounce

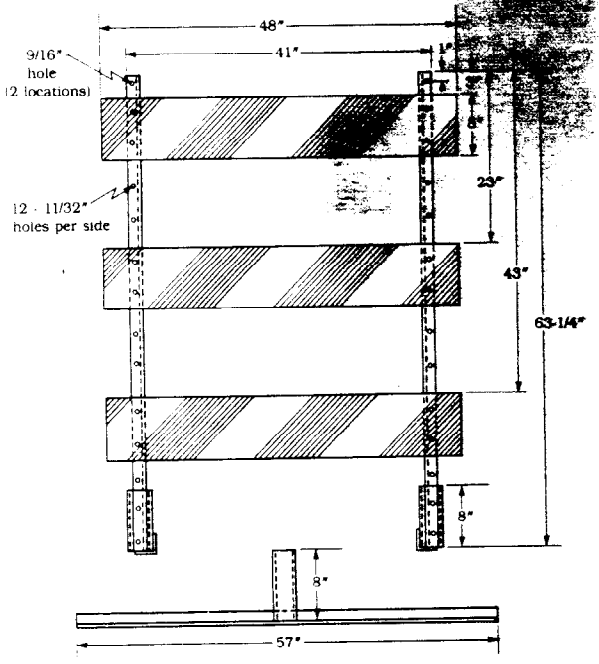
Empco-Lite's bolt protector is made of

FEATURES

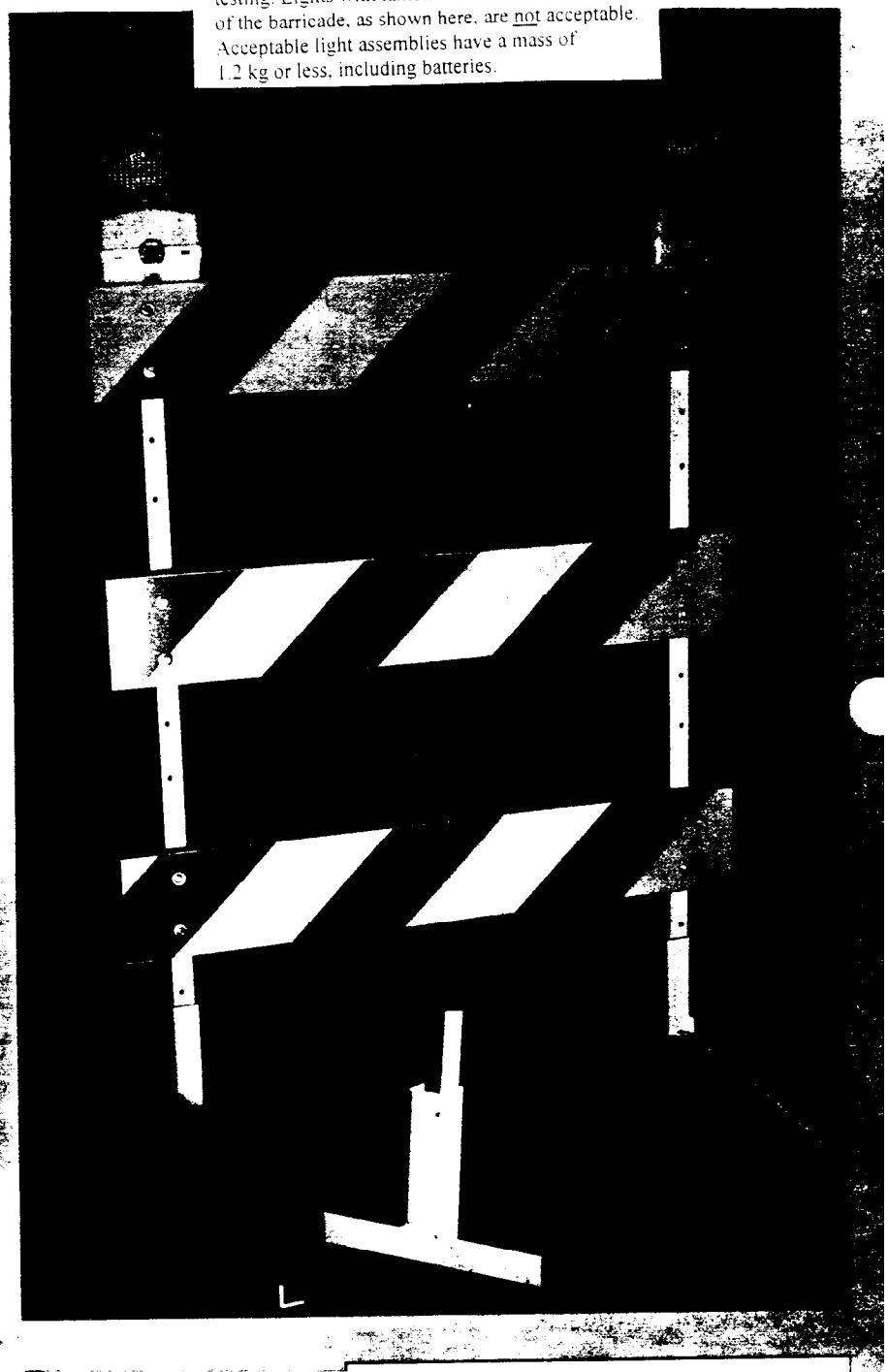
Durable, hot rolled high carbon steel construction with universal mounting holes
Easy to assemble, bolt together, very portable
Unique base design allows for short term or permanent securing
Engineered to accommodate two flashing lights
- Weather resistant baked enamel paint
- Accommodates reflective sheeting on both sides of panels
- Design allows multiple barricades to be joined in series for extended length
- Type III Barricades may be hinged in series to provide perimeter protection
- High wind stability

SPECIFICATIONS

- Material:
  Hot rolled high carbon steel
- Dimensions:
  Panel height (top) ..... 5'
  Panel height (center) ..... 3'4"
  Panel height (bottom) ..... 2'8"
  Panel width (plywood) ..... 8"
  (Douglas fir) ..... 8"
  Panel length (standard) ..... 4', 5', 8'
  (custom lengths available)
  Panel thickness (ACX plywood) ..... 3/4"
  (Douglas fir) .....
  Steel upright frame with universal mounting holes . 1-1/2"x1-1/2"x 1/8" c63"
  Steel base stand . . 1-1/2"x1-1/2"x 1/8" c60"
  with 2"x2"x8" square tubing receiver
- Weight:
  66 pounds



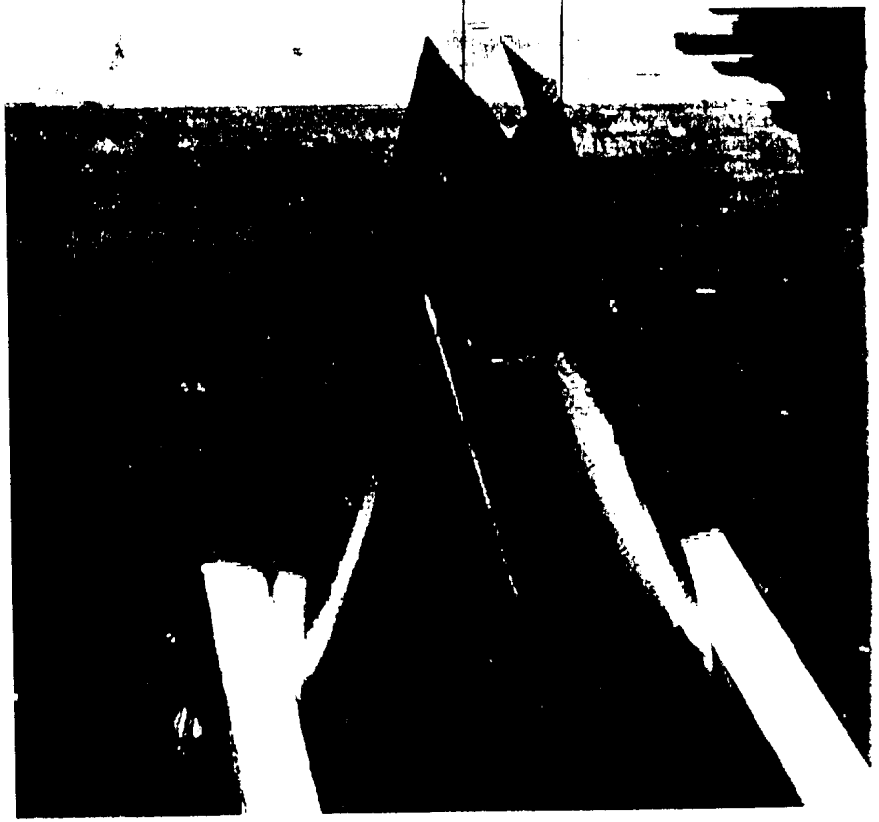
The warning light assemblies illustrated here are larger and heavier than those used in the acceptance testing. Lights with lantern batteries mounted on top of the barricade, as shown here, are not acceptable. Acceptable light assemblies have a mass of 1.2 kg or less, including batteries.



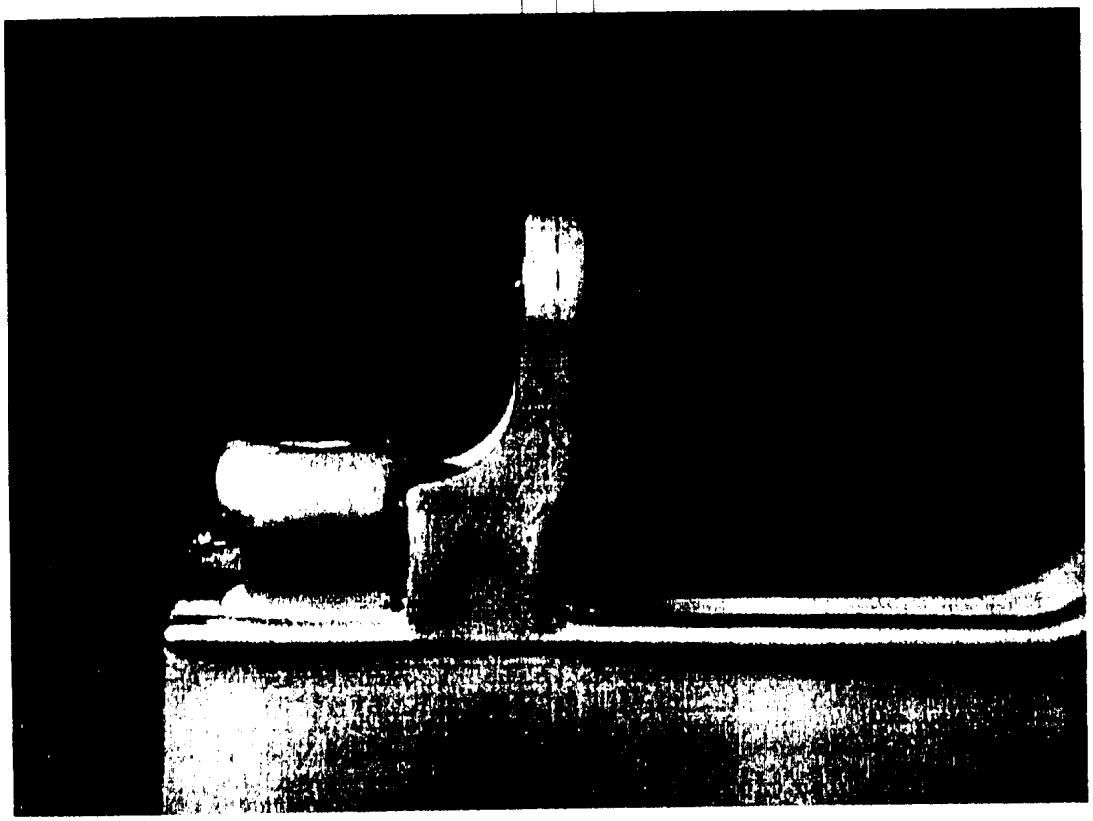
BENT MANUFACTURING CO.
17311 NICHOLS ST.
HUNTINGTON BEACH, CA 92647-5721
(714) 842-0600 FAX (714) 842-2959

DRUM
DIMENSIONS;
LIGHT BRACKET

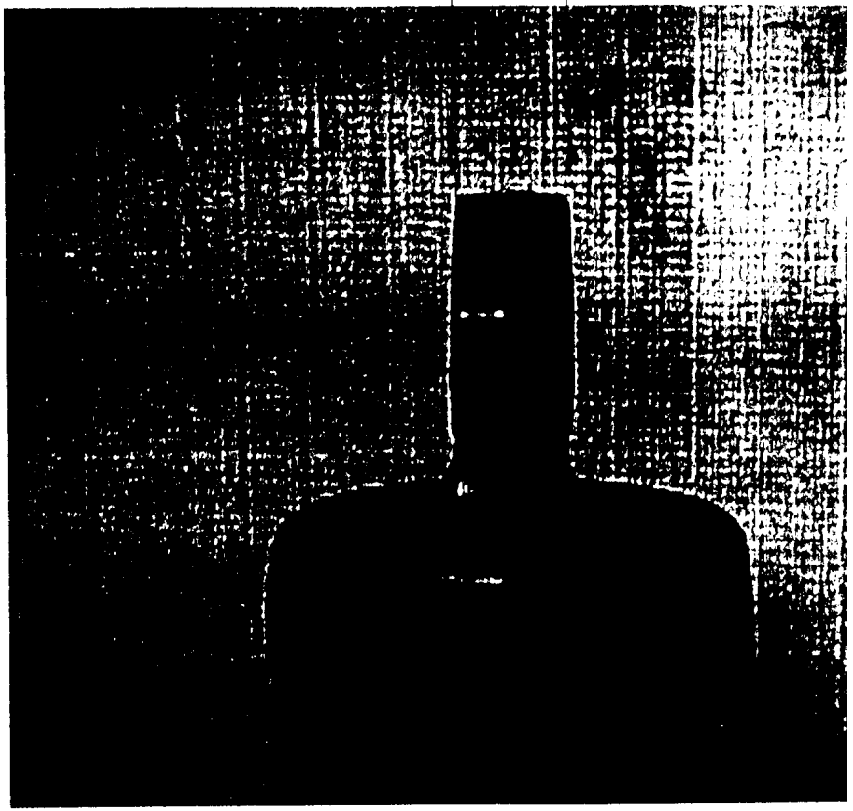
BARRICADE LEG
DIMENSIONS; LIGHT
ATTACHMENT



UNICADE DIMENSIONS; LIGHT BRACKET



T-CONE & T-POST DIMENSIONS; LIGHT BRACKET



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 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.

§ 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 warranty provisions in non-NHS Federa aid contracts.

[60 FR 44274, Aug. 25, 1995]

§ 635.417 Convict produced materials

(a) Materials produced after July 1991, by convict labor may only be i corporated in a Federal-aid highwa construction project if such materia have been:

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

(2) Produced in a qualified prison f cility and the cumulative annual pr duction amount of such materials f use in Federal-aid highway constru tion does not exceed the amount such materials produced in such fac ity for use in Federal-aid highway co struction during the 12-month peri ending July 1, 1987.

(b) *Qualified prison facility* means a prison facility in which convicts, du ing the 12-month period ending July 1987, produced materials for use in Fe eral-aid highway construction projec

[53 FR 1923, Jan. 25, 1988, as amended at 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-ap proved materi
Other cross-drain installations.	X	.....	3 minimum	M–170 and M–190.	.....do	Do.[2]
Side-drain installations	X	.....	.....do	M–36	.....do	Do.[2]
Special installation conditions.	.....	X	.....	.....	Individual installation.	Specified to mee special condi tions.
Special drainage systems (storm sewers, inverted siphons, etc.).	.....	X	.....	.....	.....do	Specified to mee site require ments.

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

[2] Types not included in currently approved AASHTO specifications may be specified if recommended by the State with quate 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 maintenar guidelines and establish the policy a procedures to insure that the conditi of Interstate routes is maintained the level required by the purposes which they were designed.