U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Avenue, SE.
Washington, DC 20590

November 5, 2007

In Reply Refer To: HSSD-1/CC-102



Mr. Owen Denman, PE
President, Barrier Systems Inc.
180 River Road
Rio Vista, CA 94571-1208

Dear Mr. Denman:

Thank you for your letter of August 2, 2007, requesting the Federal Highway Administration (FHWA) acceptance of tangent, flared, and median versions of the X-Tension™ Technology End Terminals for use on the National Highway System (NHS). The original system, the X-350™ Guardrail Terminal was developed by Armorflex, Ltd., and accepted by FHWA in our July 9, 2005, letter CC-91. Barrier Systems, Inc. has since acquired the rights to use the X-350™ Guardrail technology and has developed it further. Accompanying your letter were reports of crash testing conducted by Holmes Solutions, an approved test laboratory which was formerly a facility of the University of Canterbury in Christchurch, New Zealand, and DVD video of the tests. You requested that we find the terminals acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

**Introduction**

The FHWA guidance on crash testing of roadside safety hardware is contained in a memorandum dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features." The original Armorflex X350 tangent terminal for use with strong-post W-beam guardrail includes an impact head through which two anchor cables are threaded, breakaway line posts, a slider/slider bracket assembly, a cable anchor bracket, and a foundation anchor. For side impacts to the rail, tension is transferred via the cables to the foundation anchor to provide containment and redirection. For head-on and angled impacts directly at the end, friction between the cables and a convolution in the impact head dissipates crash energy. The slider/slider bracket assembly allows the first W-beam rail segment to slide back along the second segment and away from the impacting vehicle.

Your present request is for: 1) modifications to the original tangent version, 2) a flared version, and 3) a median version, using the name X-Tension™ Technology Guardrail End Terminals. The enclosed chart "National Cooperative Highway Research Program Report 350 Test Matrix – X-Tension Testing Program" details the original matrix of tests used to validate the Armorflex X350 design, a Test Requirement Analysis of the needed impacts to validate the Flared Offset Configuration and the Median Terminal, and a Component Modification Analysis.

**Testing**
You discussed the proposed test matrix with Mr. Nicholas Artimovich of my staff and reached agreement on the tests detailed in the enclosed testing program chart mentioned above. The following tests were conducted and the test data summary sheets are enclosed for reference:

NCHRP Report 350 test 3-30 for the flared configuration.
NCHRP Report 350 tests 3-31 and 3-32 for the median configuration.

We concur that these tests are satisfactory to show NCHRP Report 350 compliance with the following:

- The modified tangent, flared, and median configurations using either wood (CRT) or steel line posts (first two posts crimped near the ground line) as shown in the enclosed drawings.
- The tangent, flared and median configurations use a small "kit" of key components that are used in conjunction with standard W-beam guardrail, wood or composite block-outs, steel line posts or CRT wood posts and standard guardrail component hardware to make up any of the noted configurations noted in the enclosed drawings.
- The amount of offset for flared applications can be between the tangent position (no offset) and the fully flared (1.2 m offset) as tested.
- Recognition of the redirective capability of the system from the first post. Therefore, the system qualifies as a "Redirective, Non-Gating" Terminal under the definitions in NCHRP Report 350.

**Findings**
The results of the testing met the FHWA requirements and, therefore, the devices described in the various requests above and detailed in the enclosed drawings are acceptable for use on the NHS under the range of conditions tested, when proposed by a highway agency.

Please note the following standard provisions that apply to the FHWA letters of acceptance:

- Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that they will meet the crashworthiness requirements of FHWA and NCHRP Report 350.

- To prevent misunderstanding by others, this letter of acceptance, designated as number CC-102 shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The X-Tension™ products are patented devices and considered "proprietary." The use of proprietary devices *specified by a highway agency* for use on Federal-aid projects must meet one of the following criteria: (a) it must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that it is essential for synchronization with existing highway facilities or that no equally suitable alternative exists or; (c) it 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.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate device, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

George E. Rice, Jr.
Acting Director, Office of Safety Design
Office of Safety

Enclosures

## National Cooperative Highway Research Program Report 350 Test Matrix

## X-Tension Testing Program

### X-Tension Guardrail Terminal - Tangent Configuration (FHWA Approval Letter HAS-10/CC-91)

| Test | Vehicle | Speed | Angle | Results | Test Requirement Analysis |
|---|---|---|---|---|---|
| 3-30 | 816.5 | 99.7 | 0 | Pass | Required |
| 3-31 | 2025 | 99.5 | 0 | Pass | Required |
| 3-32 | 817.5 | 101.3 | 14.6 | Pass | Required |
| 3-33 | 1975 | 101.5 | 14.4 | Pass | Required |
| 3-34 | N/A | N/A | N/A | N/A | Test 3-37 proved CIP and LON are at the same location, slightly after post 1, making 3-34 & 3-35 redundant (Ref FHWA Letter HAS-10/CC-91) |
| 3-35 | N/A | N/A | N/A | N/A | |
| 3-37 | 1988.5 | 98.9 | 20.2 | Pass | Required |
| 3-39 | 1988 | 98.3 | 19.8 | Pass | Required |

### X-Tension Guardrail Terminal - Flared Offset Configuration

| Test | Vehicle | Speed | Angle | Results | Test Requirement Analysis |
|---|---|---|---|---|---|
| 3-30* | 837 | 98.7 | 0 | Pass | Required - This test was modified in accordance with FHWA discussions to create the most severe impact condition. The vehicle was offset toward the traffic lane and the occupant mass was moved to the inside to maximize the yaw rate and see potential for intrusion into the side of the vehicle. |
| 3-31 | | | | N/A | Test 3-31 on this system in the flared configuration is less severe than the impacting characteristics of tests 3-32 & 3-33 on the system in the tangent configuration. |
| 3-32 | | | | N/A | Test 3-32 & 33 were not required because they were run on the system in the tangent configuration. The performance of the system under test 3-32 & 33 conditions while the system is in the flared configuration is not significantly different than what was tested in the tangent configuration. The modified test 3-30 accurately demonstrates the impacting characteristics of frontal impacts with the greatest potential for failure. |
| 3-33 | | | | N/A | |
| 3-34 | | | | N/A | Because the analysis of 3-37 below holds true, and the analysis of 3-34 & 35 hold true for the system in the tangent configuration, tests 3-34 & 35 in the flared configuration are redundant. |
| 3-35 | | | | N/A | |
| 3-37 | | | | N/A | Test 3-37 was performed in the tangent configuration. Discussions with FHWA determined this test was unnecessary. |
| 3-39 | | | | N/A | The severity of test 3-39 in the flared configuration is less than that of the system in the tangent configuration because the angle of impact is lower. |

### X-Tension Median Terminal

| Test | Vehicle | Speed | Angle | Results | Test Requirement Analysis |
|---|---|---|---|---|---|
| 3-30 | | | | N/A | Test 3-32 demonstrates the performance of the system during frontal impacts with the greatest potential for binding the system and causing failure. Because the design does not introduce any additional energy absorbing components to the standard X-Tension (tangent or flared) system and the additional mass is minimal, Test 3-30 was determined to be unnecessary. |
| 3-31 | 2005 | 99.3 | 0 | Pass | Because the design does not introduce any additional energy absorbing components to the standard X-Tension (tangent or flared) system and the additional mass is minimal, Test 3-31 was determined to be unnecessary. However, this test was run to verify crimped posts 1 & 2 and unweakened posts 3-6 does not effect ride down acceleration. |
| 3-32 | 843 | 103.6 | 15 | Pass | Required |
| 3-33 | | | | N/A | Because the design does not introduce any additional energy absorbing components to the standard X-Tension (tangent or flared) system and the additional mass is minimal, Test 3-33 was determined to be unnecessary. |
| 3-34 | | | | N/A | Because the analysis of 3-37 below holds true, and the analysis of 3-34 & 35 hold true for the system in the tangent configuration, tests 3-34 & 35 on the X-Tension Median terminal are redundant. |
| 3-35 | | | | N/A | |
| 3-37 | | | | N/A | The X-Tension Median Terminal is stronger than the X-Tension tangent system as the additional rail components on the back of the system add to the section rigidity and do not reduce the structural capacity of the tangent system tested. The redirective capacity of the system is equal to or greater than the tangent system that was successfully tested under 3-37 conditions. This test was determined to be unnecessary. |
| 3-39 | | | | N/A | Because this test was successfully tested on the X-Tension tangent system, it is redundant. The X-Tension median terminal does not introduce any changes to the components interfacing with the vehicle in this test. Also, the structural components are not reduced in capacity. This test was determined to be unnecessary. |

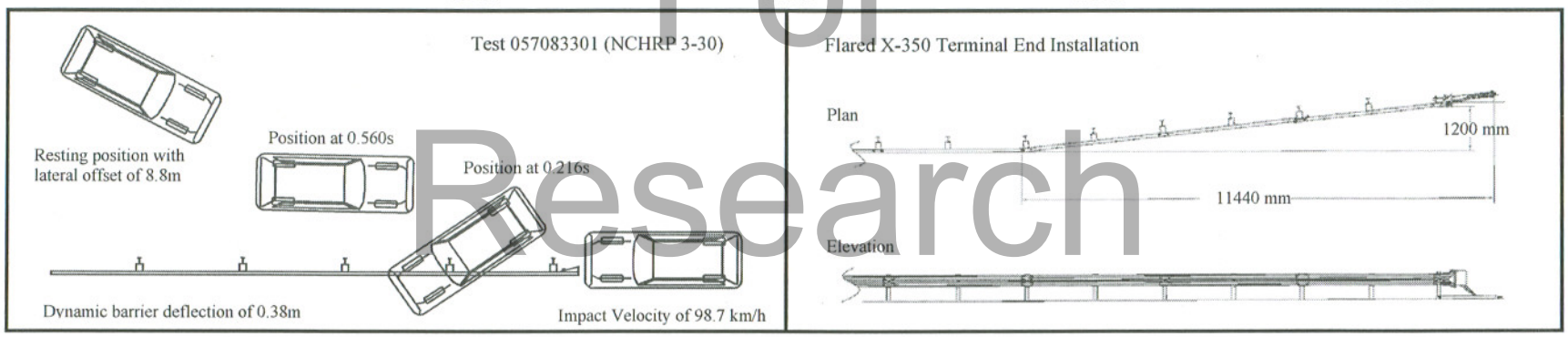
* = Modified Test

### Component Modification Analysis

Analysis of changes made to components of the X-Tension system following original NCHRP 350 testing of Tangent System

| Test | System | Part No. | Description | Component Modification Analysis |
|---|---|---|---|---|
| 3-30, 31, 32, 33, 34, 35, 37, 39 | Tangent | | Posts | All X-Tension testing on the Tangent configured system used steel wide flange posts notched at ground level. The system is approved to use timber CRT posts as well. Reference FHWA letter HAS 10/CC-91 for system details. |
| 3-30* | Offset | B061099, B061100 | Post 1 (top), Post 2, Post 3 | The flanges of Post 1, 2, and 3 were "crimped" at ground level to weaken the post for head on impacts with light vehicles. The weakened posts perform similar to those tested during the original X-Tension Tangent testing (notched steel posts or timber crt posts). The lateral strength of the post is equal to or stronger than what was tested in the X-Tension tangent matrix. All other posts on the system were standard wide flange steel posts, unweakened. |
| 3-32 | Median | B061099, B061100 | Post 1 (top), Post 2 | The flanges of Post 1, 2, and 3 were "crimped" near ground level as in test 3-30*. The crimps on Post 1 were lowered to allow the post to fold closer to the ground. Post 2 was also notched on the reverse side at the blockout/panel attachment hole. This was only on the reverse side and does not effect the system as previously tested in tangent or offset configurations. |
| 3-32 | Median | B061098 | Post 1 (bottom) | The bottom reciever channel for Post 1 was modified to allow Post 1 to fold lower to the ground and reduce the possibility of interaction with the floor pan of light vehicles. The modification removed a portion of the back side of the receiving channel. The channel was made thicker and reinforced to facilitate driving the post. The modification does not effect the lateral strength of the post and only benefits the longitudinal break-away function of Post 1. |
| 3-31 | Median | | Posts | In this test, only Posts 1 and 2 were crimped and all other posts were standard wide flange steel posts unweakened. Posts used are Wide Flange Guardrail posts in accordance with Roadside Hardware Specification PWE01. The crimps were removed from Post 3 because the light car was proven to not significantly interact with post 3. |


0.000s 0.216s 0.484s 0.560s 0.858s




**General Information**

| | |
|---|---|
| Test Agency | Holmes Solutions Limited |
| Test Designation | NCHRP 350 Test 3-30 |
| Test No. | 057083301 |
| Date | 13th December 2006 |

**Test Article**

| | |
|---|---|
| Type | Flared Guardrail Terminal End |
| Name or Manufacturer | Armorflex Ltd |
| Installation Length | 38 m |
| Material or Key Elements | AASHTO SGR04a-b Guardrail with Armorflex X350 Terminal End |
| **Soil Type and Condition** | AASHTO 'standard' soil M147-64 (1990) |

**Test Vehicle**

| | |
|---|---|
| Type | Production Model |
| Designation | 820C |
| Model | 1997 Toyota Starlet |
| Mass (kg) | |
| Curb | 873.0 |
| Test Inertial | 837.0 |
| Dummy | 75.0 |
| Gross Static | 912.0 |

**Impact Conditions**

| | |
|---|---|
| Speed (km/h) | 98.7 |
| Angle (deg) | 0 |

**Exit Conditions**

| | |
|---|---|
| Speed (km/h) | 27.5 |
| Angle (deg) | n/a |

**Occupant Risk Values**

| | |
|---|---|
| Impact Velocity (m/s) | |
| x-direction | 9.4 |
| y-direction | -0.8 |
| THIV (km/h) | 34.9 |
| Ridedown Accelerations (g's) | |
| x-direction | -18.8 |
| y-direction | 7.0 |
| PHD (g's) | 19.5 |
| ASI | 1.09 |
| Max. 0.050-s Average (g's) | |
| x-direction | -13.0 |
| y-direction | -4.0 |
| z-direction | 7.3 |

**Test Article Deflections**

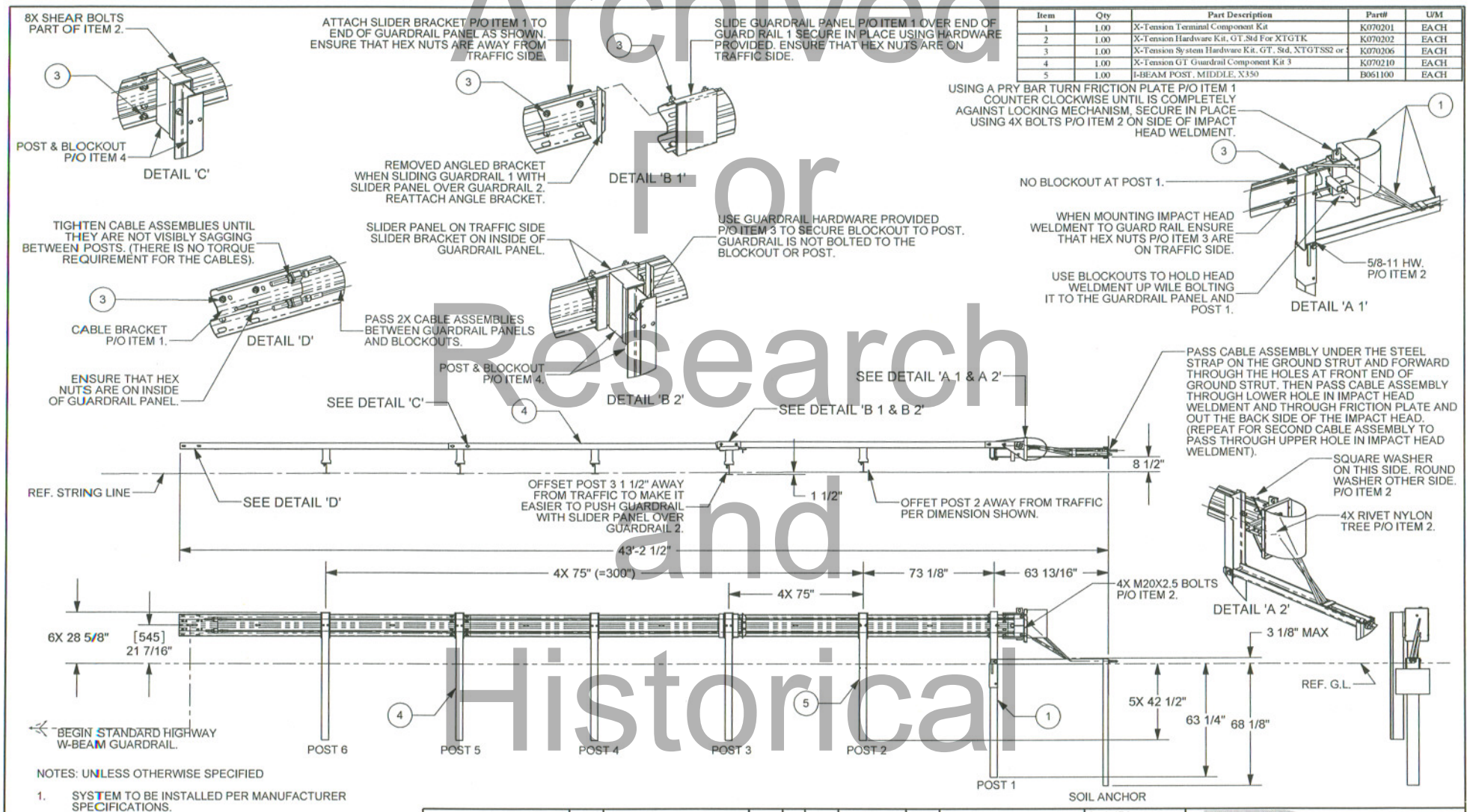
| | |
|---|---|
| Dynamic (m) | 0.38 |
| Permanent (m) | 0.34 |

**Vehicle Damage**

| | |
|---|---|
| Exterior | |
| VDS | 12-FC-5 |
| CDC | 12FLEN2 |
| Maximum Exterior Vehicle Crush (mm) | 300 |
| Interior | |
| OCDI | AS0000000 |
| Max. Occ. Compartment. Deformation (mm) | 30 |

**Post-Impact Behaviour**

| | |
|---|---|
| Max. Yaw Angle (deg) | 497.1 |
| Max. Pitch Angle (deg) | 47.0 |
| Max Roll Angle (deg) | 27.7 |




| Item | Qty | Part Description | Part# | U/M |
|---|---|---|---|---|
| 1 | 1.00 | X-Tension Terminal Component Kit | K070201 | EACH |
| 2 | 1.00 | X-Tension Hardware Kit, GT,Std For XTGTK | K070202 | EACH |
| 3 | 1.00 | X-Tension System Hardware Kit, GT, Std, XTGTSS2 or 3 | K070206 | EACH |
| 4 | 1.00 | X-Tension GT Guardrail Component Kit 3 | K070210 | EACH |
| 5 | 1.00 | I-BEAM POST, MIDDLE, X350 | B061100 | EACH |

NOTES: UNLESS OTHERWISE SPECIFIED

1. SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE NUTS AT THE CABLE BRACKET (SEE DETAIL 'D'). DO NOT TIGHTEN THE CABLES AT THE FRONT OF THE GROUND ANCHOR.
3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING TO THE TOP OF THE POST.



| REV. | CHANGES | DATE | BY | REQ'D | NEXT ASSY. | ITEM |
|---|---|---|---|---|---|---|
| B | SEE ECN# 942 | 8/31/07 | AEM | | | |
| A | SEE ER# 531 | 8/08/07 | AEM | | | |

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| | DATE | INIT. |
|---|---|---|
| DRAWN BY | 08/06/07 | AEM |
| APPR'D BY | | |

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX= ± .010
Dec .XX= ± .030

TITLE:
X-TENSION GUARDRAIL TERMINAL SYSTEM
STEEL POST WITH COMPOSIT BLOCKOUT

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

| SHEET | DRAWING NUMBER | REV |
|---|---|---|
| 1 OF 1 | XTGTSS3 | B |


| Item | Qty | Part Description | Part# | U/M |
|---|---|---|---|---|
| 1 | 1.00 | HEAD UNIT WELDMENT, NON-E.A. TERMINAL | B061214 | EACH |
| 2 | 1.00 | TRIGGER HEAD WELDMENT, NON-E.A TERMINAL | B061222 | EACH |
| 3 | 1.00 | BOTTOM POST WELDMENT, X350 | B061098 | EACH |
| 4 | 1.00 | SOIL ANCHOR WELDMENT, X350 | B061104 | EACH |
| 5 | 1.00 | GROUND STRUT WELDMENT, X350 | B061094 | EACH |
| 6 | 1.00 | I-BAEM POST, TOP, X350 | B061099 | EACH |
| 7 | 1.00 | NOSE PIECE, NON-E.A. GUARDRAIL TERMINAL | B070237 | EACH |
| 8 | 1.00 | SLIDER BRACKET WELDMENT, X350 | B061079 | EACH |
| 9 | 1.00 | SLIDER PANEL WELDMENT, W-BEAM, X350 | B061088 | EACH |
| 10 | 5.00 | BLOCKOUT, TIMBER BLOCK GUARDRA | B061117 | EACH |
| 11 | 1.00 | I-BEAM POST, MIDDLE, X350 | B061100 | EACH |
| 12 | 3.00 | W-Beam Guardrail RWMO2b | 4002018 | EACH |
| 13 | 4.00 | Rivet Nylon Tree Push-In 25/64 | 4002305 | EACH |
| 14 | 8.00 | SHEAR BOLT, US, X-TENSION | A070426 | EACH |
| 15 | 24.00 | Guardrail Bolt 5/8-11x1 1/4 MG | 2001642 | EACH |
| 16 | 1.00 | C-Scr HH 5/8-11x1 1/2 Gr5 MGal | 2001626 | EACH |
| 17 | 2.00 | C-Scr HH 3/4-10x2 1/2 Gr5 MGal | 2001633 | EACH |
| 18 | 41.00 | Wshr 5/8 F436 Struct MGal | 2001636 | EACH |
| 19 | 4.00 | Wshr SAE 3/4 HD MGal | 2001630 | EACH |
| 20 | 2.00 | Nut HN 3/4-10 HVY Gr2 MGal | 2001631 | EACH |
| 21 | 41.00 | Nut HN 5/8-11 Gr8 MGal | 2001632 | EACH |
| 22 | 1.00 | CABLE ASSY, NON-E.A. GUARDRAIL TERMINAL | B070236 | EACH |
| 23 | 1.00 | WASHER, POLYETHYLENE, HTCB | B061119 | EACH |
| 24 | 1.00 | WASHER, CABLE ASSY, HIGH TENS | B061118 | EACH |
| 25 | 1.00 | WASHER, CABLE ASSY, HIGH TENS | B061112 | EACH |
| 26 | 5.00 | Bolt CH 5/8-11x10 Gr5 MGal | 2001635 | EACH |
| 27 | 4.00 | I-BEAM POST, MIDDLE, X350 | B070164 | EACH |



| REV. | CHANGES | DATE | BY | REQ'D | NEXT ASSY. | ITEM |
|---|---|---|---|---|---|---|
| C | SEE ECN# 871 | 4/23/07 | AEM | | | |
| B | SEE ECN# 834 | 2/13/07 | AEM | | | |
| A | SEE ECN# 821 | 1/25/07 | AEM | | | |
| 0 | NEW DRAWING | 12/04/06 | AEM | | | |

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| | DATE | INIT. |
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| DRAWN BY | 12/04/06 | AEM |
| APPR'D BY | | |

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX= ± .010
Dec .XX= ± .030

TITLE: SYSTEM, NON-ENERGY ABSORBING GUARDRAIL TERMINAL

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

| SHEET | DRAWING NUMBER | REV |
|---|---|---|
| 1 OF 1 | B061226 | C |

NOTES: UNLESS OTHERWISE SPECIFIED

1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
2. SYSTEM SHOWN USING STEEL WIDE FLANGE POST (PWE01) WITH TIMBER BLOCKOUTS (ROUTED, PDB01b). IF STEEL WIDE FLANGE POSTS ARE USED, POST 2 MUST BE A BREAKAWAY STYLE POST CRIMPED (AS SHOWN), TIMBER CRT POST, OR EQUIVALENT.
3. SYSTEM MAY ALSO USE TIMBER CRT POSTS (PDE09) WITH TIMBER BLOCKOUTS (PDB01a).
4. SYSTEM MAY ALSO USE COMPOSITE OR PLASTIC BLOCKOUTS.


| Item | Qty | Part Description | Part# | U/M |
|---|---|---|---|---|
| 1 | 1.00 | GROUND STRUT WELDMENT, X350 | B061094 | EACH |
| 2 | 1.00 | SOIL ANCHOR WELDMENT, X350 | B061104 | EACH |
| 3 | 1.00 | BOTTOM POST WELDMENT, X350 | B061098 | EACH |
| 4 | 1.00 | I-BEAM POST, TOP, X350 | B061099 | EACH |
| 5 | 1.00 | HEAD UNIT WELDMENT, X350 | B061072 | EACH |
| 6 | 3.00 | W-Beam Guardrail RWMO2b | 4002018 | EACH |
| 7 | 1.00 | I-BEAM POST, MIDDLE, X350 | B061100 | EACH |
| 8 | 1.00 | SLIDER PANEL WELDMENT, W-BEAM, X350 | B061088 | EACH |
| 9 | 1.00 | SLIDER BRACKET WELDMENT, X350 | B061079 | EACH |
| 10 | 1.00 | CABLE BRACKET WELDMENT, X350 | B061083 | EACH |
| 11 | 2.00 | CABLE ASSEMBLY, X350 | B061109 | EACH |
| 12 | 1.00 | CABLE FRICTION PLATE, HEAD UNIT | B061058 | EACH |
| 13 | 1.00 | NOSE PIECE, X350 | B061105 | EACH |
| 14 | 5.00 | W-Beam Timber Blockout PDB1b 8 | 4002337 | EACH |
| 15 | 4.00 | Rivet Nylon Tree Push-In 25/64 | 4002305 | EACH |
| 16 | 8.00 | SHEAR BOLT, US, X-TENSION | A070426 | EACH |
| 17 | 20.00 | Guardrail Bolt 5/8-11x1 1/4 MG | 2001642 | EACH |
| 18 | 1.00 | C-Scr HH 5/8-11x1 1/2 Gr5 MGal | 2001626 | EACH |
| 19 | 4.00 | C-Scr HH M20-2.5x75mm Gr 5.8 M | 2001615 | EACH |
| 20 | 1.00 | C-Scr HH 3/4-10x8 Gr5 MGal | 2001653 | EACH |
| 21 | 2.00 | Wshr 5/8 F436 Struct MGal | 2001636 | EACH |
| 22 | 2.00 | Wshr SAE 3/4 HD MGal | 2001630 | EACH |
| 23 | 1.00 | Nut HN 3/4-10 HVY Gr2 MGal | 2001631 | EACH |
| 24 | 33.00 | Guardrail Nut Recessed 5/8-11 | 4001116 | EACH |
| 25 | 5.00 | Bolt CH 5/8-11x10 Gr5 MGal | 2001635 | EACH |
| 26 | 4.00 | Wide Flange Guardrail Post PWE | 4002338 | EACH |
| 27 | 5.00 | Wshr 5/8 Rd Galv AASHTO Spec F | 4002056 | EACH |
| 28 | 1.00 | Nut HN 5/8-11 Gr8 MGal | 2001632 | EACH |



| REV. | CHANGES | DATE | BY | REQ'D | NEXT ASSY. | ITEM |
|---|---|---|---|---|---|---|
| C | SEE ECN# 871 | 1/25/07 | AEM | | | |
| B | SEE ECN# 840 | 2/21/07 | AEM | | | |
| A | SEE ECN# 821 | 1/25/07 | AEM | | | |

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| | DATE | INIT. |
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| DRAWN BY | 10/26/06 | AEM |
| APP'D BY | | |

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX= ± .010
Dec .XX= ± .030

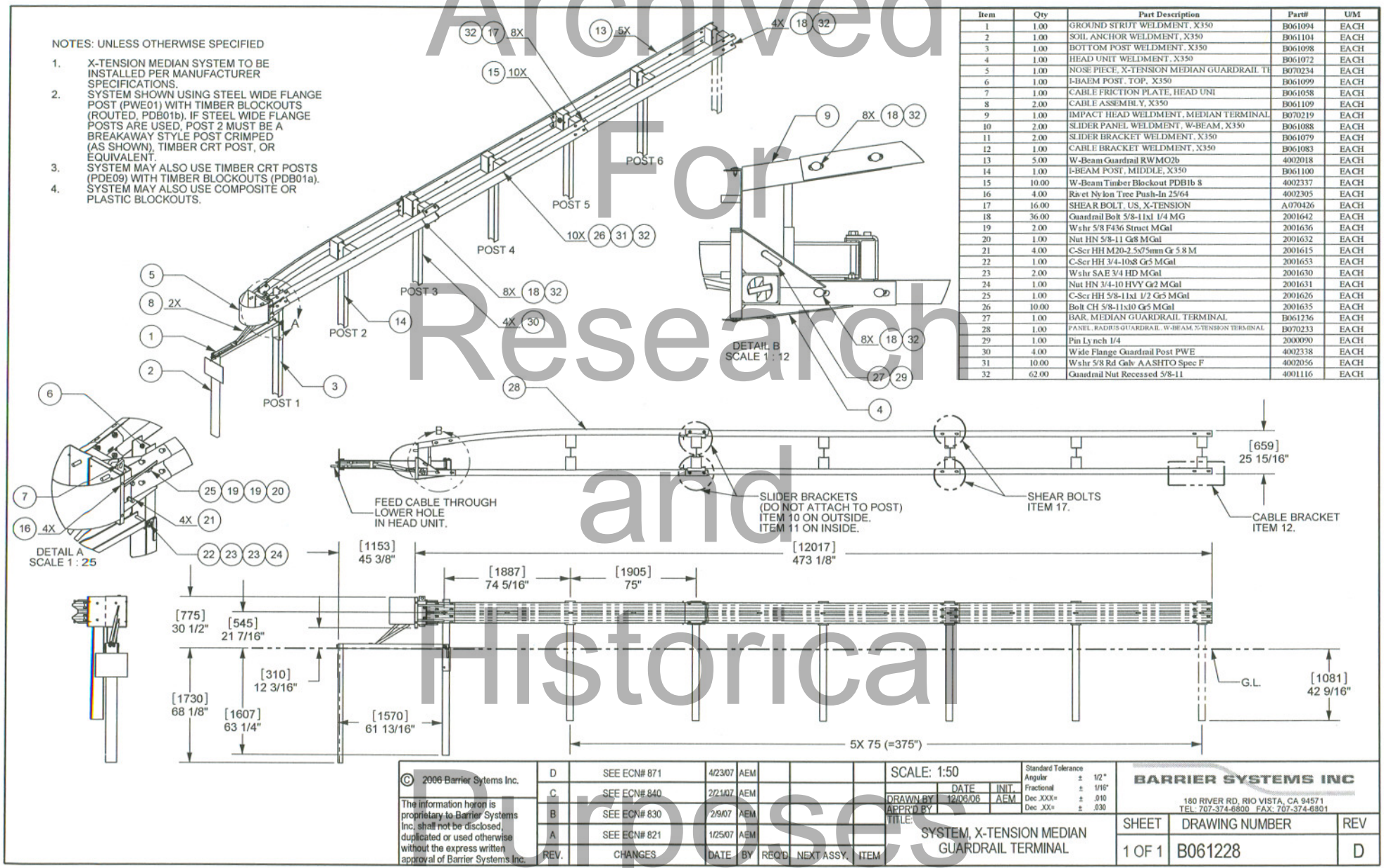
TITLE: SYSTEM, X-TENSION GUARDRAIL TERMINAL

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

| SHEET | DRAWING NUMBER | REV |
|---|---|---|
| 1 OF 1 | B061113 | C |

NOTES: UNLESS OTHERWISE SPECIFIED

1. X-TENSION MEDIAN SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
2. SYSTEM SHOWN USING STEEL WIDE FLANGE POST (PWE01) WITH TIMBER BLOCKOUTS (ROUTED, PDB01b). IF STEEL WIDE FLANGE POSTS ARE USED, POST 2 MUST BE A BREAKAWAY STYLE POST CRIMPED (AS SHOWN), TIMBER CRT POST, OR EQUIVALENT.
3. SYSTEM MAY ALSO USE TIMBER CRT POSTS (PDE09) WITH TIMBER BLOCKOUTS (PDB01a).
4. SYSTEM MAY ALSO USE COMPOSITE OR PLASTIC BLOCKOUTS.




| Item | Qty | Part Description | Part# | U/M |
|---|---|---|---|---|
| 1 | 1.00 | GROUND STRUT WELDMENT, X350 | B061094 | EACH |
| 2 | 1.00 | SOIL ANCHOR WELDMENT, X350 | B061104 | EACH |
| 3 | 1.00 | BOTTOM POST WELDMENT, X350 | B061098 | EACH |
| 4 | 1.00 | HEAD UNIT WELDMENT, X350 | B061072 | EACH |
| 5 | 1.00 | NOSE PIECE, X-TENSION MEDIAN GUARDRAIL TI | B070234 | EACH |
| 6 | 1.00 | I-BAEM POST, TOP, X350 | B061099 | EACH |
| 7 | 1.00 | CABLE FRICTION PLATE, HEAD UNI | B061058 | EACH |
| 8 | 2.00 | CABLE ASSEMBLY, X350 | B061109 | EACH |
| 9 | 1.00 | IMPACT HEAD WELDMENT, MEDIAN TERMINAL | B070219 | EACH |
| 10 | 2.00 | SLIDER PANEL WELDMENT, W-BEAM, X350 | B061088 | EACH |
| 11 | 2.00 | SLIDER BRACKET WELDMENT, X350 | B061079 | EACH |
| 12 | 1.00 | CABLE BRACKET WELDMENT, X350 | B061083 | EACH |
| 13 | 5.00 | W-Beam Guardrail RWMO2b | 4002018 | EACH |
| 14 | 1.00 | I-BEAM POST, MIDDLE, X350 | B061100 | EACH |
| 15 | 10.00 | W-Beam Timber Blockout PDB1b 8 | 4002337 | EACH |
| 16 | 4.00 | Rivet Nylon Tree Push-In 25/64 | 4002305 | EACH |
| 17 | 16.00 | SHEAR BOLT, US, X-TENSION | A070426 | EACH |
| 18 | 36.00 | Guardrail Bolt 5/8-11x1 1/4 MG | 2001642 | EACH |
| 19 | 2.00 | Wshr 5/8 F436 Struct MGal | 2001636 | EACH |
| 20 | 1.00 | Nut HN 5/8-11 Gr8 MGal | 2001632 | EACH |
| 21 | 4.00 | C-Scr HH M20-2.5x75mm Gr 5.8 M | 2001615 | EACH |
| 22 | 1.00 | C-Scr HH 3/4-10x8 Gr5 MGal | 2001653 | EACH |
| 23 | 2.00 | Wshr SAE 3/4 HD MGal | 2001630 | EACH |
| 24 | 1.00 | Nut HN 3/4-10 HVY Gr2 MGal | 2001631 | EACH |
| 25 | 1.00 | C-Scr HH 5/8-11x1 1/2 Gr5 MGal | 2001626 | EACH |
| 26 | 10.00 | Bolt CH 5/8-11x10 Gr5 MGal | 2001635 | EACH |
| 27 | 1.00 | BAR, MEDIAN GUARDRAIL TERMINAL | B061236 | EACH |
| 28 | 1.00 | PANEL, RADIUS GUARDRAIL W-BEAM, X-TENSION TERMINAL | B070233 | EACH |
| 29 | 1.00 | Pin Lynch 1/4 | 2000090 | EACH |
| 30 | 4.00 | Wide Flange Guardrail Post PWE | 4002338 | EACH |
| 31 | 10.00 | Wshr 5/8 Rd Galv AASHTO Spec F | 4002056 | EACH |
| 32 | 62.00 | Guardmil Nut Recessed 5/8-11 | 4001116 | EACH |



| REV. | CHANGES | DATE | BY | REQ'D | NEXT ASSY. | ITEM |
|---|---|---|---|---|---|---|
| D | SEE ECN# 871 | 4/23/07 | AEM | | | |
| C | SEE ECN# 840 | 2/21/07 | AEM | | | |
| B | SEE ECN# 830 | 2/9/07 | AEM | | | |
| A | SEE ECN# 821 | 1/25/07 | AEM | | | |

SCALE: 1:50

| | DATE | INIT. |
|---|---|---|
| DRAWN BY | 12/06/06 | AEM |
| APPR'D BY | | |

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX= ± .010
Dec .XX= ± .030

TITLE: SYSTEM, X-TENSION MEDIAN GUARDRAIL TERMINAL

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

| SHEET | DRAWING NUMBER | REV |
|---|---|---|
| 1 OF 1 | B061228 | D |