U.S. Department of Transportation
Federal Highway Administration

400 Seventh St., S.W.
Washington, DC 20590

May 8, 2007

In Reply Refer To:
HSSD/B-85E

Mr. Steven L. Brown
Trinity Highway Products, LLC
P.O. Box 568887
Dallas, TX 75356-8887

Dear Mr. Brown:

Thank you for your letter of January 25, 2007, requesting the Federal Highway Administration's (FHWA) acceptance of your company's Modified King Block for use on National Highway System (NHS) with test level 3 (TL-3) Strong Post W-Beam Guardrail under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features". The Modified King Block was accepted by the FHWA for use on the NHS with TL-3 Strong Post W-Guardrail in its acceptance letter HSA-10/B-85D of March 22, 2006, based on the results of pendulum testing. You now request the acceptance of essentially the same product with revised material composition based on full-scale crash testing. Accompanying your letter was a report on crash testing of your company's Modified King Block conducted by Southwest Research Institute and test videos.

Requirements
Longitudinal barriers should meet the guidelines contained in the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". FHWA Memorandum "Action: Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements for longitudinal barriers.

Product description
The Modified King Block consists essentially of an upper and a lower cylinder connected by additional structure that includes locations for bolt placement. A drawing of the Modified King Block is provided in Enclosure 1.

The Modified King Block used in full-crash testing underwent only one revision to the previously approved Modified King Block - material composition. Whereas the Modified King Block used in pendulum testing was composed of 68.5 percent recycled High Density Polyethylene (HDPE), 30 percent ground recycled rubber, 0.5 percent blowing agent and 1 percent color concentrate, the Modified King Block used in full-scale crash testing was composed of 70 percent recycled HDPE, 28.7 percent ground recycled rubber, 0.3 percent blowing agent and 1 percent color concentrate.

Test article installation
The test article was a longitudinal barrier with conventional G4-1S W-Beams mounted on conventional strong posts. The 38.1 m (125 ft) long length-of-need section consisted of l2-gage W-Beams mounted directly to 21 conventional W6 x 8.5 steel posts with Modified King-Block blockouts. The 10 guardrail panels between the end anchors were each 3.81 m (12.5 ft) long, the posts were spaced at l.9l m (6.25 ft), and the nominal height of the top of the guardrail was 0.702 m (27.6 in). The barrier system was terminated at either end with a standard BCT end anchor, without blockouts. Including the extended end anchors, the entire longitudinal barrier spanned 25 posts, with the G4-1S longitudinal barrier (length-of-need) section mounted from post 3 through post 23. The total length of the longitudinal barrier, including the end anchors, was 45.7 m (150 ft).

Testing
The purpose of testing was to evaluate the performance of a Modified King Block mounted on a TL-3 Strong Post W-Beam Guardrail system. You selected the NCHRP Report 350 Test 3-11 with 2000P vehicle as a more critical test than test 3-10 for that purpose. Also, test inertial mass of the test vehicle was 2088 kg, exceeding the standard NCHRP 350 mass, however, I agree that this test vehicle better represents the current truck fleet and can be accepted for the NCHRP Report 350 Test 3-11.

The results of this test are summarized in Enclosure 2. The test vehicle impacted the longitudinal barrier 1.30 m (4.25 ft) downstream of post 10 at 23.4 degrees, and laterally deflected the barrier 1.04 m (3.4 ft) (dynamically). Impact velocity of the test vehicle was 107.8 km/hr. A comparison of the test results with the evaluation criteria set forth in the NCHRP Report 350 indicates compliance with all recommended criteria for the test that was performed.

The exit angle in the test was 16 degrees, slightly higher than the required limit of 60 percent of the test impact angle; however, I agree that this deviation is acceptable. I also agree that despite the fact that the impact angle and speed somewhat deviated from the NCHRP Report 350 nominal values, the actual impact severity of 147.2 kJ was within the tolerance of the nominal impact severity and therefore the test can be qualified as a standard NCHRP 350 Test 3-11.

Posts 12 through 15 bent over with the bend occurring at ground level, the guardrail released from these posts and the blockouts also released from the guardrail and posts. Some posts were directly contacted by the test vehicle and those were damaged and would require replacement. None of the W-Beams failed and all of the splice joints remained fastened together. One W-Beam did experience some damage on the bottom edge with the cause of the damage undetermined. I agree that the performance of the barrier and its damages are acceptable and were not adversely affected by the Modified King Block.

In summary, I agree that your company's Modified King Block, as described above, meets the appropriate evaluation criteria for a NCHRP 350 TL-3 device and may be used with TL-3 Strong Post W-Beam Guardrail at all appropriate locations on the NHS when selected by the contracting

authority, subject to the provisions of Title 23, Code of Federal Regulations, Section 635.411 as they pertain to proprietary products. This acceptance is limited to the use with the Strong Post W-Beam Guardrail on conventional W6 x 8.5 steel (or equal) posts. Further, I am assuming that production models will be identical to the prototype test units.

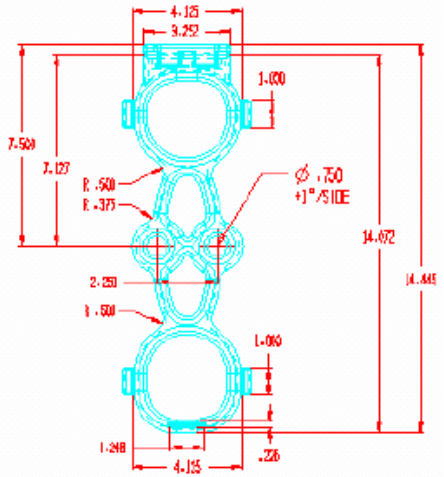
Standard provisions
Please note the following standard provisions that apply to the FHWA letters of acceptance:

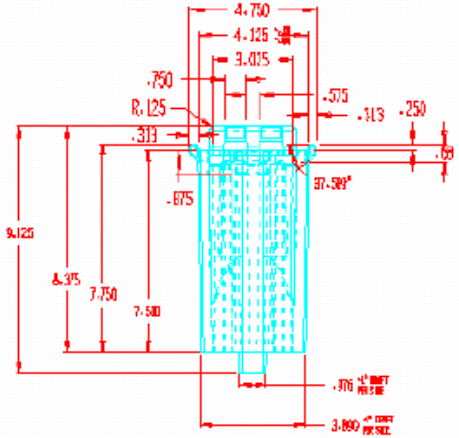
- Our acceptance is limited to the crashworthiness characteristics of the devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals 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 the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number B-85E shall not be reproduced except in full. As this letter and the documentation which support it become public information, it will be available for inspection at our office by interested parties.
- The Modified King Block is a patented product and is considered "proprietary." The use of proprietary devices specified on Federal-aid projects, except exempt, non-NHS projects: (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 accompanied earlier correspondence.

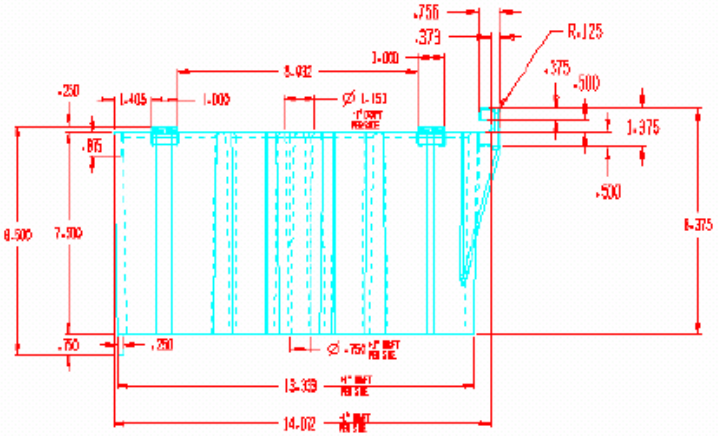
Sincerely yours,

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

Enclosures







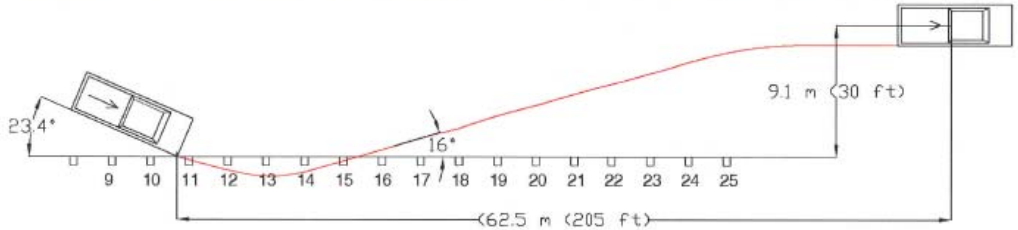
NOTE:
1. UNIFORM WALL THICKNESS OF .375
2. UNSPECIFIED CORNERS TO BE MIN .062 RADIUS
3. UNSPECIFIED TOLERANCES TO BE ±.250
4. ALL DRAFT ANGLES TO BE 1° MAX
5. ANY DIM. LESS THAN .25 TOLERANCE WILL BE ±.050

REV	DATE	DESCRIPTION	BY
E			
D			
C			
B			
A	10/13/05	DIMENSIONED	SLK

REVISIONS

TITLE: Guardrail Block

DATE:	DRAWN BY:	DRAWING NO.:	SCALE:
10/13/05	S.KELLY	KING-FUTURE2	1/4" = 1"



General Information
- Test Agency ..... Southwest Research Institute
- Test Number X06
- Test Date 11/29/2006
- Test Category 3-11

Test Article
- Type ..... Longitudinal Barrier
- Installation Length ..... 45.7 m (150 ft)
- Nom. Barrier Height ..... 702 mm (27.6 in)
- Type of Primary Barrier .. G4-1S Longitudinal Barrier

Soil Stable, Moist – "Standard" Soil

Test Vehicle
- Type ..... 3/4 Ton Pickup
- Designation 2000P
- Model ..... 1998 Chevrolet C2500
- Mass (kg) 2088
- Inertial Mass (kg) 2088
- Dummy Mass (kg) ..... NA
- Gross Static Mass (kg) 2088

Impact Conditions
- Speed (km/hr) 107.8
- Angle (degrees) 23.4

Exit Conditions
- Speed (km/hr) 52
- Angle (degrees) 16

Occupant Risk Values
- Impact Velocity (m/s)
  - x-direction 5.3
  - y-direction 4.7
- Ridedown Accelerations (g's)
  - x-direction ..... -12.2
  - y-direction ..... -13.1

Post Impact Vehicular Behavior (limited to events <1.000 seconds)
- Maximum Roll Angle (degrees) ..... 6.1 @ 0.461 sec.
- Maximum Pitch Angle (degrees) ..... -11.9 @ 0.741 sec.
- Maximum Yaw Angle (degrees) ..... -42.7 @ 0.750 sec.

Test Article Deflection
- Dynamic ..... 1.04 m (3.4 ft)
- Permanent ..... 0.69 m (2.25 ft)

Vehicle Damage

Exterior
- CDC 01RFEW5
- VDS 1-RFQ-3

Interior
- OCDI LF0000000
- Max. Deform. (mm) 0

Title 23, Code of Federal Regulations,
§ 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 transportation department 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 transportation department 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 transportation department 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.

(f) In the case of a design-build project, the following requirements apply: 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 Request for Proposals document unless the conditions of paragraph (a) of this section are applicable.

[41 FR 36204, Aug. 27, 1976, as amended at 67 FR 75926, Dec. 10, 2002]