June 1, 2008

In Reply Refer To: HSSD/CC-88A

Dean Sicking, Ph.D., P.E.
Director, Midwest Roadside Safety Facility
University of Nebraska – Lincoln
527 Nebraska Hall
Lincoln, NE 68588-0529

Dear Dr. Sicking:

This is in response to your letter dated February 28, 2007, requesting Federal Highway Administration (FHWA) acceptance of the Sequential Kinking Terminal (SKT) and the FLared Energy Absorbing Terminal (FLEAT) using wood posts when connecting to the Midwest Guardrail System (MGS). FHWA Acceptance Letter CC-88, dated March 8, 2005, accepted these combinations based on testing with steel posts. You requested that we find these modified devices acceptable for use on the National Highway System (NHS) under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 “Recommended Procedures for the Safety Performance Evaluation of Highway Features.” We provided an informal opinion accepting this device on March 15, 2007, and have been working with you to finalize the drawings for this final acceptance package.

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.”

Two different anchor designs were used in the original MGS testing, a two post, ground line strut design and a large single post with a soil plate alternative. The upper parts of these designs were identical and Test 3-34 was conducted on the FLEAT with both anchor designs. Test FLEAT-5 used the two post and strut alternative while test FLEAT -7 used the single post anchor system. Videos, photos and reports on these tests were submitted with your original request for approval. At your request we only included the double post design in its approval letter.

Our original letter also indicated that both steel and wood post options were acceptable but you did not provide a drawing of the wood post option.
Findings

Based on prior testing discussed above we find the following terminal designs as shown in the enclosed drawings acceptable for use on the NHS under the range of conditions tested, when proposed by a State:

1) SKT terminal for the MGS, steel and wood post options.
2) FLEAT terminal for the MGS, steel and wood post options.
3) SKT with two post anchor with ground strut.
4) FLEAT with two post anchors with ground strut.

Please note the following standard provisions that apply to 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-88A 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 SKT and FLEAT w-beam guardrail terminals 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,

[Signature]

David A. Nicol
Director, Office of Safety Design
Office of Safety

Enclosures
GENERAL NOTES:
1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The lower sections of the posts shall not protrude more than 4" above the ground (measured along a 5° cord). Site grading may be necessary to meet this requirement.
5. The lower section of the hinged posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
6. When rock is encountered, a 10° or post hole, 20" into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2.5" deep to provide drainage. Posts 1 & 2 can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
7. The breakaway cable assembly must be fused. A locking device (vite grip or channel lock clips) should be used to prevent the cable from twisting when tightening nuts.
8. A site evaluation should be considered if there is less than 25° between the outlet side of the terminal and any adjacent driving lane.

OPTIONAL FLARED INSTALLATION
25:1 maximum flare rate
TRAFFIC

PLAN

ELEVATION

POST #1 CONNECTION DETAILS

IMPACT HEAD CONNECTION DETAIL

SECTION B-B

Posts 3 thru 7

GENERAL NOTES:
1. Breakaway posts are required with the FLEAT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The foundation tubes shall not protrude more than 4 in above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
4. When rock is encountered, a 12' Ø post hole, 20 in into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2.5' deep to provide drainage. The soil tubes can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
5. The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.
6. The soil tubes may be driven with an approved driving head. They shall not be driven with the post in the tube.
7. The wood blockouts should be "tie-nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.

RST
Road Systems, Inc.

Metric Height
Universal Wood Posts

FLEAT Terminal

Sheet 1

Date 04/24/2008

1

FLMW UP

NONE

JRR
GENERAL NOTES:
1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The SKT can be fielded at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The lower sections of the posts shall not protrude more than 4" above the ground (measured along a 5" cord). Site grading may be necessary to meet this requirement.
5. The lower section of the hinged posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
6. When rock is encountered, a 10" Ø post hole, 20" into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2.5" deep to provide drainage. Posts 1 & 2 can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
7. The breakaway cable assembly must be taut. A blocking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.
8. A site evaluation should be considered if there is less than 25' between the outlet side of the terminal and any adjacent driving lane.

OPTIONAL FLARED INSTALLATION
25:1 maximum flare rate
GENERAL NOTES:
1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors, and bearing plates shall be galvanized.
3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The foundation tubes shall not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
5. When rock is encountered, a 12"Ø post hole, 20" into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2.5' deep to provide drainage. The soil tubes can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
6. The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.
7. A site evaluation should be considered if there is less than 25' between the outlet side of the terminal and any adjacent driving lane.
8. The soil tubes may be driven with an approved driving head. They shall not be driven with the post in the tube.
9. The wood blockouts should be "low-capped" to the rectangular wood posts to prevent them from turning when the wood shrinks.

ELEVATION

OPTIONAL FLARED INSTALLATION
25:1 maximum flare rate

SECTION A-A
Post #2

SECTION B-B
Posts 3 thru 6

Sequential Kinking Terminal
SKT UFE - Assembly
Midwest Guardrail System
Universal Wood Posts
GENERAL NOTES:
1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The lower sections of the posts shall protrude more than 4' above the ground (measured along a 5° cord). Site grading may be necessary to meet this requirement.
5. The lower section of the hinged posts should not be driven with the upper post attached. The post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
6. When rock is encountered, a 10' Ø post hole, 20' into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2.5' deep to provide drainage. Posts 1 & 2 can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
7. The breakaway cable assembly must be baulked. A locking device (wire groove or channel lock pins) should be used to prevent the cable from tearing when lightening nuts.
8. A site elevation should be considered if there is less than 25' between the outlet side of the terminal and any adjacent driving lane.

OPTIONAL FLARED INSTALLATION
25:1 maximum flare rate

R-S-T
Road Systems, Inc.
Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP

Sequential Kinking Terminal
SKT LITE Metric Height
Steel Post System
Hinged and Welded Options

SKT-MUTLE-6 UP
GENERAL NOTES:
1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The foundation tubes shall not protrude more than 4" above the ground (measured along a 5" cord). Site grading may be necessary to meet this requirement.
5. When rock is encountered, a 12" Ø post hole, 20" into the rock surface may be used if approved by the engineer. Gravel material will be placed in the bottom of the hole, approximately 2.5" deep to provide drainage. The soil tube can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
6. The breakaway cable assembly must be taut. A locking device (vise grips or channel lock pliers) should be used to prevent the cable from unseating when tightening nuts.
7. A site evaluation should be considered if there is less than 25' between the outlet side of the terminal and any adjacent driving lane.
8. The soil tubes may be driven with an approved driving head. They shall not be driven with the post in the tube.
9. The wood blockouts should be "tie-nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.

OPTIONAL FLARED INSTALLATION
25:1 maximum flare rate
NOTE:
All hole locations should reference the top of the post.
NOTE:
All holes locations should reference the bottom of the post.