



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

1200 New Jersey Ave., SE  
Washington, D.C. 20590

February 22, 2012

In Reply Refer To:  
HSST/CC-93B

Jesper Sorensen  
Safence, Inc.  
1557 N.W. Ballard Way  
Seattle Washington, 98107

Dear Mr. Sorensen,

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

|                              |  |
|------------------------------|--|
| Name of system:              | Safence TL-3 End Terminal with 2 m post spacing    |
| Type of system:              | Three or Four cable wire rope barrier end terminal |
| Test Level:                  | NCHRP Report 350 Test Level3                       |
| Evaluation conducted by:     | Force Technology                                   |
| Task Force 13 Designator:    | SEC09  |
| Date of request:             | December 29, 2010                                  |
| Date initially acknowledged: | February 7, 2011                                   |
| Date of completed package:   | December 5, 2011                                   |

**Decision:**

The following device is eligible, with details provided in your December 29, 2010 request, attached as an integral part of this letter:

- Safence TL-3 three or four cable wire rope End Terminal with 2 m post spacing

Based on a review of the analysis submitted by the manufacturer certifying the device described herein meets the crashworthiness criteria of the National Cooperative Highway Research Program (NCHRP) Report 350, the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

**Requirements**

Roadside safety devices should meet the guidelines contained in the National Cooperative Highway Research Program (NCHRP) Report 350 or the American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH).

FHWA: HSST: NArtimovicht: sf: x61331:3/29/12  
File: s://directory folder/HSST/Artimovich/CC-93B  
\_Safence\_2mspacing\_terminal.docx  
cc: HSST (NArtimovich; JDewar)

**Description:**

The Safence four cable wire rope end terminal was the subject of the FHWA letters CC-93 and CC93A dated 8/16/2005 and 12/28/2006, respectively. The posts in the terminal section were spaced 1 meter apart. Your present request is to increase that spacing to 2 meters for the length of the terminal. The test-by-test engineering analysis conducted by Force Technologies, enclosed for reference, shows that increasing the post spacing is not expected to have any adverse affect on the crash performance of the terminal. This modification may be used with three cable barrier terminals as well.

**Findings**

Therefore, the system described and detailed in the attached form is eligible for reimbursement and may be installed under the range of conditions tested.

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

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line 'Guide to Standardized Highway Barrier Hardware' currently referenced in AASHTO Roadside Design Guide.
- This finding of eligibility is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence the crashworthiness of the system will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- 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 the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the crashworthiness requirements of the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of eligibility is designated as number CC-93B and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The finding of eligibility is limited to the crashworthiness characteristics of the candidate system, 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.

- The Safence cable barriers and terminals are patented products and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects: (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the 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.

Sincerely yours,

**Signed by/ Michael S. Griffith**

Michael S. Griffith  
Director, Office of Safety Technologies  
Office of Safety

Enclosures

Blue Systems AB  
Hällefjordregatan 24  
426 58 Västra Frölunda  
Sverige

2011-12-05

Your ref.:

Our ref.:

L-210-22787-03 Rev. 1 Draft

Attn. Mats Heinevik

## Evaluation – Post spacing in Safence 350 TL3 Terminal

Blue Systems have performed full-scale tests on its wire rope safety fence terminal, Safence 350 TL3 Terminal. The results from the tests were acceptable according to NCHRPR 350. The post spacing in the terminal was 1.0 meters in the performed full-scale test, ref test report 56671, 56672, 56673 and 56674.

Force Technology has been performed an evaluation of the results for each test if the post spacing is increased from 1 to 2 meters.

The results from this evaluation are that Safence 350 TL3 Terminal with increased post spacing from 1.0 to 2.0 meter fulfils the requirement of NCHRPR 350. The performed evaluation:

Evaluation of test 3-39: See page 2

Evaluation of test 3-34: See page 3

Evaluation of test 3-30: See page 4

Evaluation of test 3-35: See page 5

Sincerely yours  
FORCE Technology

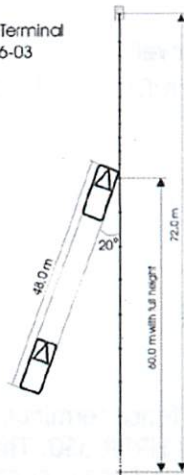


Fredrik Sangö  
Project Manager  
Calculation

Pictures are from the test report

Test setup

Blue Systems Safety Barrier Terminal  
 NCHRPR 350 Date: 2005-06-03  
 Terminal Test 3-39



Impact sequence



Undeformed terminal



Deformed terminal



Evaluation of increasing the post space from 1 to 2 meter

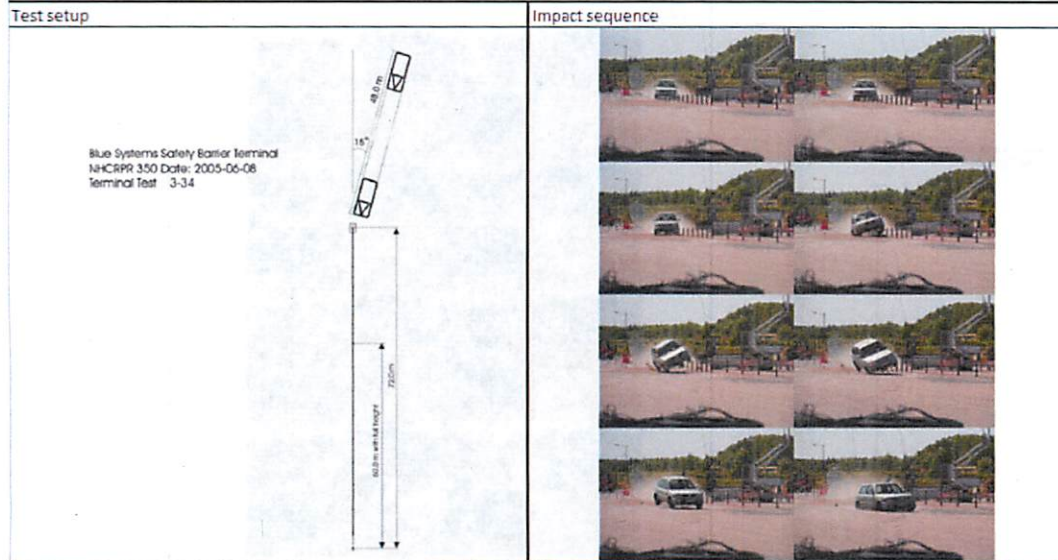
- 1) The dynamic deflection will approximately increase from 0.85 m with 1/3 to 1.15 m (ref. L-209-20767-03 with assumption same increase factor as for 3-11 test)
- 2) The contact length approximately increase from 10.3 to 11.3 meter.
- 3) It is no tendency in the test that the vehicle front tire will pass under the wires. The risk for a tire going under the wires with this smaller change of the terminal is evaluated as very small.
- 4) Evaluation criteria according to NCHRPR 350:
  - C. Article shows acceptable performance: Pass (no change compared to the full-scale test)
  - D. No passenger compartment intrusion. Very minor amount of debris, no undue hazard to other road users. Pass (no increase compared to the full-scale test)
  - F. The vehicle did remain upright: Pass (no increased risk for roll-over)
  - K. Vehicle controlled by terminal. Does not cross adjacent traffic lines: Pass (Approximately same vehicle trajectory)
  - L. Occupant impact velocity longitudinally less than 12 m/s.  
Occupant ride down acceleration longitudinally less than 20 g: Pass (Softer terminal gives generally lower values)
  - M. Exit angle maximum 9°, which is 45 % of impact angle 20°.  
Car yaws later towards terminal, reducing exit angle: Pass (Approximately same vehicle trajectory)
  - N. Acceptable vehicle trajectory behind test article: Pass (Approximately same vehicle trajectory)

Conclusions from the evaluation of increasing the post space from 1 to 2 meter

The modified terminal pass the mandatory requirements of NCHRPR 350 test 3-39 in all respects listed above based on this evaluation.



Pictures are from the test report



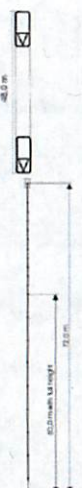
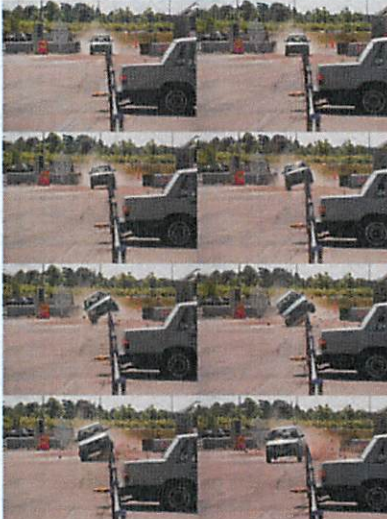
Evaluation of increasing the post space from 1 to 2 meter


- 1) The lift of the vehicle will probably not be change (may be some decrease of the lift of the vehicle).
- 2) The contact length will be approximately the same as in the full-scale test (3.5 meter).
- 3) It is no tendency in the test that the vehicle will not going over the terminal. The risk that the vehicle do not going over the terminal with this smaller change of the terminal is evaluated as very small.
- 4) Evaluation criteria according to NCHRP 350:
  - C. Article shows acceptable performance: Pass (Approximately same as in the full-scale test)
  - D. No passenger compartment intrusion. Very minor amount of debris, no undue hazard to other road users. Pass (Approximately same as in the full-scale test)
  - F. The vehicle did remain upright: Pass (Approximately same as in the full-scale test)
  - H. Occupant Impact Velocities lower than 12 m/s. Pass (Approximately same as in the full-scale test - very low values)
  - I. Occupant Ridedown Accelerations lower than 20 g. Pass (Approximately same as in the full-scale test - very low values)
  - J. (Optional, not performed)
  - K. Vehicle trajectory into adjacent traffic lanes controlled by terminal. Acceptable: Pass (Approximately same vehicle trajectory as in the full-scale test)
  - N. Acceptable vehicle trajectory behind test article. Pass. (Approximately same vehicle trajectory as in the full-scale test)

Conclusions from the evaluation of increasing the post space from 1 to 2 meter

The modified terminal pass the mandatory requirements of NCHRP 350 test 3-34 in all respects listed above based on this evaluation.

Pictures are from the test report

|   |   |
|---|---|
| <p>Blue Systems Safety Barrier Terminal<br/>NCHRP 350 Date: 2005-06-14<br/>Terminal Test 3-30</p>  | <p>Impact sequence</p>  |
|---|---|

|   |  |
|---|--|
| <p>Undeformed terminal</p>  | <p>Deformed terminal</p>  |
|---|--|

Evaluation of increasing the post space from 1 to 2 meter

- 1) The lift of the vehicle will probably not be change (may be some decrease of the lift of the vehicle).
- 2) The contact length will be approximately the same as in the full-scale test (22 meter).
- 3) The behaviour of the vehicle will be approximately the same as in the full-scale test (In a rolling movement the car passes the terminal and ends up along the guardrail, with no tendency to roll over).
- 4) Evaluation criteria according to NCHRP 350:
  - C. Article shows acceptable performance: Pass (Approximately same as in the full-scale test)
  - D. No passenger compartment intrusion. Very minor amount of debris, no undue hazard to other road users. Pass (Approximately same as in the full-scale test)
  - F. The vehicle did remain upright: Pass (Approximately same as in the full-scale test)
  - H. Occupant Impact Velocities lower than 12 m/s. Pass (Approximately same as in the full-scale test - very low values)
  - I. Occupant Ridedown Accelerations lower than 20 g. Pass (Approximately same as in the full-scale test - very low values)
  - J. (Optional, not performed)
  - K. Vehicle trajectory into adjacent traffic lanes controlled by terminal. Acceptable. (Approximately same vehicle trajectory)
  - N. Acceptable vehicle trajectory behind test article: Pass (Approximately same vehicle trajectory)

Conclusions from the evaluation of increasing the post space from 1 to 2 meter

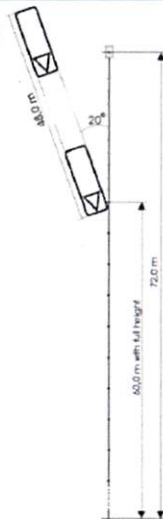
The modified terminal pass the mandatory requirements of NCHRP 350 test 3-30 in all respects listed above based on this evaluation.



Pictures are from the test report

Test setup

Blue Systems Safety Barrier Terminal  
NCHRPR 350 Date: 2005-06-16  
Terminal Test 3-35



Impact sequence



Undeformed terminal



Deformed terminal



Evaluation of increasing the post space from 1 to 2 meter

- 1) The dynamic deflection will approximately the same as in the full-scale test 1.67 m (maybe some increase of the dynamic deflection)
- 2) The contact length approximately the same as in the full-scale test 23.1 -m
- 3) It is no tendency in the test that the vehicle will pass over / under the wires. Approximately same as in the test.
- 4) Evaluation criteria according to NCHRPR 350:
  - A. Vehicle contained ad redirected. Pass (Approximately same as in the full-scale test)
  - C. Article shows acceptable performance: Pass (Approximately same as in the full-scale test)
  - D. No passenger compartment intrusion. Minor amount of debris, no undue hazard to other road users. Pass (Approximately same as in the full-scale test)
  - F. The vehicle did remain upright: Pass (Approximately same as in the full-scale test)
  - K. Vehicle trajectory into adjacent traffic lanes controlled by terminal. Acceptable. (Approximately same vehicle trajectory)
  - L. Occupant impact velocity longitudinally less than 12 m/s.  
Occupant ride down acceleration longitudinally less than 20 g: Pass (Approximately same as in the full-scale test - very low values)
  - M. Exit angle maximum 4.5°, which is 22.5 % of impact angle 20°.  
Car yaws later towards terminal, reducing exit angle: Pass (Approximately same vehicle trajectory)
  - N. Acceptable vehicle trajectory behind test article: Pass (Approximately same vehicle trajectory)

Conclusions from the evaluation of increasing the post space from 1 to 2 meter

The modified terminal pass the mandatory requirements of NCHRPR 350 test 3-35 in all respects listed above based on this evaluation.