August 16, 2011

Barry D. Stephens, P.E.
Sr. Vice President Engineering
Energy Absorption Systems, Inc.
3617 Cincinnati Avenue
Rocklin, CA 95678

Dear Mr. Stephens:

This letter is in response to your request for Federal Highway Administration (FHWA) acceptance of a roadside safety device for use on the National Highway System (NHS).

Name of device/system: REACT 350® II
Type of device/system: Redirective non-gating impact attenuator
Test Level: NCHRP Report 350 Test Level 3 (TL-3)
Testing conducted by: E-TECH Testing Services
Date of request: December 10, 2010
Date initially acknowledged: December 22, 2010
Date final package received: July 22, 2011
Task Force 13 Designator: SCI 16c

You requested that we find this device acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHR) Report 350 “Recommended Procedures for the Safety Performance Evaluation of Highway Features.”

Requirements

Decision
The following device was found acceptable, with details provided below:

• REACT 350® II Redirective Non-gating Impact Attenuator
Description
The REACT 350® II Redirective Non-gating Impact Attenuator (REACT 350® II) uses an array of different energy absorbing cylinders with varying wall thicknesses to dissipate impact energy as per FHWA acceptance letters CC-26 (dated March 3, 1995) and CC-26I (dated April 18, 2008). The current design presented in this submission requests FHWA review and acceptance of a shorter six cylinder system which is a self-restoring, redirective, non-gating crash cushion that can be used in temporary or permanent installations for both single-direction and bi-directional traffic applications when appropriately transitioned and anchored. The six-cylinder design includes slightly thicker cylinders in the front and additional internal energy absorbing segments in the first and last two cylinders creating a more robust design as per NCHRP 350 compliance report prepared by E-TECH Testing Services, Inc. The crash test report describes the REACT 350® II as well as the two full-scale crash tests conducted on this new attenuator. Design details are provided as enclosure to this correspondence.

Crash Testing
To validate a shorter design, full-scale NCHRP 350 crash testing was conducted on the following two tests. The crash test summaries are enclosed for reference.

A. NCHRP 350 Test 3-30: This test utilizes a 820C vehicle (100KPH/0 deg/ w/4 offset). The purpose of this test was to evaluate occupant risk and vehicle trajectory criteria for a small 820C passenger vehicle under a head-on centered, one quarter vehicle width offset, impact on the test article. The curb mass of the vehicle was 827 kg, and the final test inertial mass was 827 kg. The actual impact conditions were 97.7 km/h (60.7 mph) and 0 deg. the impact severity was 304.3 kJ which was within the NCHRP 350 recommended tolerance of 316.4 (-24.8/ +25.8) kJ. The maximum dynamic deflection of the test article was 2.4 meters (7.9 feet) and the post-test deflection was 0.8-meter (2.6 feet).

B. NCHRP 350 Test 3-31: This test is a capacity test utilizing a 2000P vehicle (100KPH/0 deg). The purpose of this test was to evaluate the occupant risk and vehicle trajectory criteria for a large 2000P passenger vehicle under a head-on centered impact aligned with the nose of the system. The curb mass of the vehicle was 2063 kg (4548 lbs.) and the final test inertial mass was 2021 kg (4674 lbs.). The actual impact conditions were 97.0 km/h (60.7 mph) and 0 deg. the impact severity was 733.7 kJ which was within the NCHRP 350 recommended tolerance of 771.7 (-60.4 / +62.9) kJ. The maximum dynamic deflection of the test article was 4.0 meters (13.1 feet) and the post-test deflection was 1.0-meter (3.3 feet) immediately after the test.

In addition, other required testing is hereby requested to be waived, as follows:

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Level</th>
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<tbody>
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<td>TL3</td>
<td>Not necessary since Test 3-30 considered worst case because in 3-32 car yaws quickly, resulting in lower ORV values</td>
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**Findings**

Based upon the successful completion of the provided NCHRP 350 tests and consideration of requested waiver of testing, we concur the six cylinder TL-3 REACT 350® II self restoring, redirective, non-gating crash cushion can be used in temporary or permanent installations for both unidirectional and bidirectional traffic applications when appropriately transitioned and anchored. Therefore, the system as described above may be used on the NHS when such use is acceptable to the contracting authority.

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

- This acceptance 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 acceptance is limited to the crashworthiness characteristics of the devices/systems 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/system 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/system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our 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 it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
• To prevent misunderstanding by others, this letter of acceptance is designated as number CC-26J 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.

• The REACT 350® II is a patented product and considered proprietary. If proprietary devices/systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, they: (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 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.

• This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device/system for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate device/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.

Sincerely yours,

Michael S. Griffith
Director, Office of Safety Design
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Enclosures
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Sincerely yours,

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

Enclosures
Figure 6. Summary of Results - REACT 350 II Test 01-1670-001
Summary of results for test 270687-VAN9.
Summary of results for test 472380-8.
## General Information

<table>
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<tr>
<th>Test Agency</th>
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<td>Test Designation</td>
<td>NCHRP 350 Test 3-30</td>
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<tr>
<td>Test No</td>
<td>01-1670-002</td>
</tr>
<tr>
<td>Date</td>
<td>10/25/10</td>
</tr>
</tbody>
</table>

### Test Article
- **Type**: Energy Absorption System
- **Installation Length**: REACT 350 II 5.5 m (6 cylinder array, effective length)
- **Material and key elements**: (6) 915 mm OD HDPE energy absorbing cylinders
- **Foundation Type and Condition**: Portland Cement Concrete, clean and dry, unanchored

### Test Vehicle
- **Type**: Production Model
- **Designation**: 820C
- **Model**: 1990 Ford Festiva
- **Mass (kg)**
  - Curb: 827
  - Test inertial: 827
  - Dummy: 75
  - Gross Static: 902

### Impact Conditions
- **Speed (km/h)**: 97.7
- **Angle (deg)**: 0
- **Impact Severity (kJ)**: 304.3

### Exit Conditions
- **Speed (km/h)**: N/A
- **Angle (deg - veh. c.g.)**: N/A

### Occupant Risk Values
- **Impact Velocity (m/s - absolute value)**: 11.0
- **Impact Velocity (g) - x-direction**: 0.9
- **Ridedown Acceleration (g's - absolute value)**: 15.4
- **Ridedown Acceleration (g's - x-direction)**: 4.2

### European Committee for Normalization (CEN) Values
- **THHV (km/h)**: 40.0
- **PIHD (g's)**: 15.6
- **ASI**: 1.3

### Post-Impact Vehicular Behavior (deg - rate gyro)
- **Maximum Roll Angle**: -24.9
- **Maximum Pitch Angle**: -47.2
- **Maximum Yaw Angle**: -249.9

### Test Article Deflections (m)
- **Dynamic**: 2.4
- **Permanent**: 0.8

### Vehicle Damage (Primary Impact)
- **Exterior**: VDS - FD-3
- **CDG**: 12FDEW3
- **Interior**: VCDI
- **Maximum Deformation (mm)**: AS0000000
- **Maximum Deformation (mm)**: Negligible

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**Figure 1. Summary of Results - REACT 350 II Test 01-1670-002**