Mr. Kaddo Kothmann  
President  
Road Systems, Incorporated  
3616 Howard County Airport Road  
Big Spring, Texas  79720

Dear Mr. Kothmann:

On December 20, 2004, you requested Federal Highway Administration (FHWA) acceptance of modified versions of your original Sequential Kinking terminal (SKT), your reduced-length Sequential Kinking Terminal (SKT-LITE), and your Flared Energy Absorbing Terminal (FLEAT). The modifications were needed to match these terminals, which were originally tested as standard W-beam terminals, to the higher Midwest Guardrail System (MGS) which was formally accepted as an National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3) barrier on March 1, 2005 (acceptance letter B-133). To verify continued crashworthiness of the new designs, the Midwest Roadside Safety Facility (MwRSF) conducted the following four tests:

- Report 350 test 3-30 with the FLEAT-MGS terminal (Test FLEAT-8)  
- Report 350 test 3-31 with the SKT-MGS terminal (Test SMG-1)  
- Report 350 test 3-34 with the FLEAT-MGS terminal (Test FLEAT-6)  
- Report 350 test 3-35 with the FLEAT-MGS terminal (Test FLEAT-5)

To match the MGS barrier design, similar modifications were made to the original SKT, SKT-LITE, and FLEAT designs. These were the following:

- The nominal height to the top of the rail increases from 700 mm (27-5/8 inches) to 787 mm (31 inches). For the anchor posts 1 and 2, the upright posts are increased to 804-mm (31.65 inches) and 842 mm (33.4 inches), respectively. The stub posts to which posts 1 and 2 are bolted are 1829-mm (72-inches) long and must be driven full-depth to provide adequate anchorage.  
- All breakaway posts after posts 1 and 2 can be the same configuration as those originally tested, but are driven only 1019 mm (40 inches) deep to match the increased rail height noted above.
• The initial W-beam rail element is increased in length from 3.81 m (12.5 feet) to 4.79 m (15.625 feet) so all rail splices within the terminals fall at mid-span between adjacent posts as with the MGS barrier proper.
• Non-routed wood spacer blocks throughout the terminal are increased from 203 mm (8 inches) to 305 mm (12 inches), again to match the offset blocks used with the MGS barrier.

The NCHRP Report 350 requires up to seven crash tests to determine the adequacy of a traffic barrier terminal at TL-3. However, since the original designs for attachment to standard W-beam guardrail remain crashworthy, only those tests that are likely to be affected by the design changes noted above are considered necessary. You successfully completed test 3-31 (head-on into the SKT-MGS with the 2000-kg pickup truck) and test 3-35 (20-degree impact with the pickup truck at post 3 with a FLEAT terminal). Also with a FLEAT terminal, you conducted the small car head-on test and the Critical Impact Point (CIP) test. Summary sheets for each of these tests are shown in Enclosure 1 to this letter. English-unit drawings for steel-post versions of each of the tested applications are shown in Enclosure 2. I understand that corresponding drawings for wood-post designs are available from you upon request, as well as metric-unit drawings for each of the design configurations.

The modifications to the SKT and FLEAT terminals described above are acceptable and both terminals remain TL-3 designs that can be used on the National Highway System (NHS) when connected to the MGS barrier. While the barrier itself is non-proprietary, your terminals are proprietary and remain subject to the conditions stated in Title 23, Code of Federal Regulations, Section 635.411 when used on Federal-aid highway projects, except exempt, non-NHS projects.

Sincerely yours,

/Original Signed by/

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

2 Enclosures
<table>
<thead>
<tr>
<th>Test Number</th>
<th>FLEAT-8 (3-30)</th>
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<tr>
<td>Date</td>
<td>2/27/04</td>
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<tr>
<td>Test Article Type</td>
<td>FLEAT-MGS End Terminal</td>
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<tr>
<td>Key Elements</td>
<td>FLEAT impact head</td>
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<tr>
<td>Orientation</td>
<td>1/4 point offset to the center of post no.1</td>
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<tr>
<td>Soil Type</td>
<td>Grading B - AASHTO M 147-65 (1990)</td>
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<tr>
<td>Vehicle Model</td>
<td>1998 Suzuki Swift</td>
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<tr>
<td>Curb</td>
<td>799 kg (1,762 lbs)</td>
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<tr>
<td>Test Inertial</td>
<td>821 kg (1,811 lbs)</td>
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<tr>
<td>Gross Static</td>
<td>899 kg (1,977 lbs)</td>
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<td>Vehicle Speed</td>
<td>Impact ........... 98.7 km/h</td>
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<tr>
<td></td>
<td>Exit ............. 0.0 km/h</td>
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<td>Vehicle Angle</td>
<td>Impact (trajectory) .... -0.83 deg</td>
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<tr>
<td></td>
<td>Exit (trajectory) .... NA</td>
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<td>Vehicle Stability</td>
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</tr>
<tr>
<td>Occupant Ridedown Deceleration (10 msec avg.)</td>
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</tr>
<tr>
<td></td>
<td>Longitudinal ........ 12.24 g’s &lt; 20 g’s</td>
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<tr>
<td></td>
<td>Lateral ............ 6.58 g’s &lt; 20 g’s</td>
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<tr>
<td>Occupant Impact Velocity</td>
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<tr>
<td></td>
<td>Longitudinal ........ 7.79 m/s &lt; 12 m/s</td>
</tr>
<tr>
<td></td>
<td>Lateral ............ 0.27 m/s &lt; 12 m/s</td>
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<tr>
<td>Vehicle Damage</td>
<td>TAD$^{13}$ ........ 12-FD-4</td>
</tr>
<tr>
<td></td>
<td>SAE$^{14}$ .......... 12FYEW2</td>
</tr>
<tr>
<td>Vehicle Stopping Distance</td>
<td>........ 8.23 m downstream</td>
</tr>
<tr>
<td></td>
<td>........ 0.78 m to the left</td>
</tr>
<tr>
<td>Test Article Damage</td>
<td>Moderate</td>
</tr>
<tr>
<td>Maximum Deflection</td>
<td>Permanent Set ........ 7,659 mm</td>
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<tr>
<td></td>
<td>Dynamic ............ 7,676 mm</td>
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<tr>
<td>Working Width</td>
<td>........ 8.5-m long by 2.14-m wide</td>
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</table>

Figure 24. Summary of Test Results and Sequential Photographs, Test FLEAT-8
- Test Number ................. SMG-1 (3-31)
- Date .......................... 9/23/03
- Test Article
  Type .......................... SKT-MGS End Terminal
  Key Elements ................. SKT impact head
  Orientation .................. Centerline of truck with center of post no. 1
- Soil Type ..................... Grading B - AASHTO M 147-65 (1990)
- Vehicle Model .............. 1997 GMC C2500 pickup truck
  Curb .......................... 1,988 kg
  Test Inertial .................. 2,028 kg
  Gross Static .................. 2,028 kg
- Vehicle Speed
  Impact ....................... 100.5 km/hr
  Exit .......................... 0.0 km/hr
- Vehicle Angle
  Impact (trajectory) .......... 0.28 deg
  Exit (trajectory) .......... NA
- Vehicle Stability ............... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  Longitudinal .......................... 8.67 g’s < 20 g’s
  Lateral .......................... 4.11/-5.66 g’s < 20 g’s
- Occupant Impact Velocity
  Longitudinal .................. 5.64 m/s < 12 m/s
  Lateral .......................... 0.28 m/s < 12 m/s
- Vehicle Damage .................. Minimal
- TAD^8 .................. 12-FC-3
- SAE^9 .................. 12FCEN2
- Vehicle Stopping Distance .... 17.53 m downstream
- Test Article Damage ............. Extensive
- Maximum Deflection
  Permanent Set ................. 17.53 m
  Dynamic .................. NA
- Working Width .................. 26.87-m long by 4.23-m wide

Figure 24. Summary of Test Results and Sequential Photographs, Test SMG-1
- Test Number ................. FLEAT-6 (3-34)
- Date .......................... 7/23/03
- Test Article
  Type .................. FLEAT-MGS End Terminal
  Key Elements .......... FLEAT impact head
  Breakaway steel posts
  Midwest Guardrail System
- Orientation .............. Impact at post no. 2
- Soil Type ................. Grading B - AASHTO M 147-65 (1990)
- Vehicle Model .............. 1997 Geo Metro
  Curb ........................ 755 kg (1,664 lbs)
  Test Inertial .......... 822 kg (1,813 lbs)
  Gross Static .......... 898 kg (1,979 lbs)
- Vehicle Speed
  Impact .................. 102.6 km/h
  Exit ..................... 73.5 km/h
- Vehicle Angle
  Impact (trajectory) ...... 15.8 deg
  Exit (trajectory) ........ NA
- Vehicle Stability .............. Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  Longitudinal .............. 7.34 g’s < 20 g’s
  Lateral ................... 12.77 g’s < 20 g’s
- Occupant Impact Velocity
  Longitudinal .............. 5.94 m/s < 12 m/s
  Lateral ................... 4.98 m/s < 12 m/s
- Vehicle Damage ............... Moderate
  TAD11 ........................ 11-LFQ-5
  SAE12 ..................... 11FZEW2
  YES11 ..................... 11LYES1
- Vehicle Stopping Distance ........ 40.2 m downstream
                                     11.4 m to the right
- Test Article Damage .......... Moderate
- Maximum Deflection
  Permanent Set .............. 603 mm
  Dynamic ................... 837 mm
- Working Width .............. 1,372 mm

Figure 25. Summary of Test Results and Sequential Photographs, Test FLEAT-6
Figure 24. Summary of Test Results and Sequential Photographs, Test FLEAT-5