

## **QuadTrend<sup>®</sup>-350**

### **GENERAL SPECIFICATIONS**

#### **I. GENERAL**

All QuadTrend-350 end treatments shall be manufactured by Energy Absorption Systems, Incorporated, of Chicago Illinois.

#### **II. DESCRIPTION OF SYSTEM**

##### **A. General**

The QuadTrend-350 System shall consist of interlocking telescoping Quad-Beam fender panels, wide flange posts, slip bases, sand containers, back straps, and a redirecting cable. When hit head-on, the system shall be capable of simultaneously collapsing and moving laterally to redirect an impacting vehicle away from the end of the hard point. The system is a redirective, gating, tangent roadside terminal designed to be attached to the end of concrete barrier or concrete wall.

##### **B. Component Descriptions**

1. The fender panels shall be fabricated from 10 gauge steel Quad-Beam sections. Each fender panel shall be drilled and slotted in accordance with the manufacturer's specifications. When assembled in the field, all fender panels shall be bolted to a break-away post by means of three bolts. The back end of each fender panel shall overlap and be connected to the fender panel of the next bay by means of a bolt and "mushroom" washer which fits through the long horizontal slots in the forward fender panel and underlying panel into a pivot strap mounted to break-away post. This connection method shall permit movement, front to back, of one set of fender panels relative to the panels in the underlying section.
2. The front post of the QuadTrend-350 System shall have a 7/8" diameter, 6 x 19 galvanized steel wire rope passing through it. The wire rope material shall be made from improved plow steel with a minimum load limit of 315 kN (71,000 lbs).

3. The 1<sup>st</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> posts shall be fitted with sand containers which hold either 45 or 68 kg (100 or 150 lbs) of sand. Two small, 45 kg (100 lbs) each, sand containers shall be fastened to each of the 1<sup>st</sup> and 3<sup>rd</sup> posts. Two large, 68 kg (150 lbs) each, sand containers shall be fastened to the 4<sup>th</sup> post. The sand containers shall be molded from black plastic having U.V. stabilizers and anti-oxidants. Each sand container shall have an integral hinged plastic lid which snaps firmly in place after the containers have been filled with sand.
4. The front of the QuadTrend™-350 System shall be fitted with a nose belt and steel transition. The nose shall interface to the front Quad-Beam™ fender panel.

C. Material Specifications

1. All metal work shall be fabricated from either M1020 Merchant quality or ASTM A-36 steel. After fabrication, all metal work shall be hot dipped galvanized in accordance with ASTM A-123. All welding shall be done by or under the direction of a certified welder.
2. All bolts, nuts and washers used to assemble the QuadTrend-350 System shall be zinc-coated, commercial quality "American National Standard" unless otherwise specified.

### **III. PERFORMANCE CRITERIA**

- A. The QuadTrend-350 System shall perform as a redirective gating terminal as specified in the National Cooperative Highway Research Program Report 350 Test Level 3 (NCHRP 350 TL-3).
- B. Evaluation Criteria
  1. The QuadTrend-350 System shall meet the occupant risk criteria as recommended in NCHRP 350 for vehicles weighing between 820 to 2000 kg [1810 to 4,410 lbs]. For the applicable tests, the impact velocity of a hypothetical front seat passenger who travels 600mm [24"] against the vehicle interior (calculated from vehicle acceleration) shall be less than 12 m/s [39.4 ft/sec]. The highest 10 millisecond vehicle average acceleration subsequent to the passenger impact with the interior surface shall be less than 20 g's in the longitudinal direction.

2. The QuadTrend™-350 System shall meet the structural adequacy criteria as recommended in NCHRP 350 for vehicles weighing between 820 to 2000 kg [1810 to 4,410 lb.]. The QuadTrend-350 System shall be capable of redirecting vehicles which impact the side of the system at speeds of up to 100 km/h [62.5 mph] at an angle of 20° for 2000 kg [4410 lb.] vehicles and 15° for 820 kg [1810 lb.] vehicles.
3. The QuadTrend-350 System shall meet the following vehicle trajectory criteria, as recommended in NCHRP 350, for applicable tests for vehicles weighing between 820 to 2000 kg [1810 to 4,410 lb.]: After collision, the vehicle trajectory and final stopping position shall intrude a minimum distance into adjacent or opposing traffic lanes.

#### **IV. DESIGN AND SELECTION CRITERIA**

- A. Design, selection and placement of crash cushions shall conform to The American Association of State Highway and Transportation Officials (AASHTO) Publication, "Roadside Design Guide" 1996
- B. Installation of the QuadTrend-350 System shall be accomplished in accordance with the recommendations of Energy Absorption Systems, Incorporated.