QuadGuardÒ System

GENERAL SPECIFICATIONS

I. GENERAL

All QuadGuard Systems shall be designed and manufactured by Energy Absorption Systems, Incorporated, of Chicago, Illinois.

II. DESCRIPTION OF SYSTEM

A. General

The QuadGuard System shall consist of energy absorbing cartridges surrounded by a framework of steel Quad-beam™ guardrail which can telescope rearward during head-on impacts. The QuadGuard System shall have a center monorail which will resist lateral movement during side angle impacts and a backup which will resist movement during head-on impacts. The nose shall consist of a formed plastic nose wrap and an energy absorbing cartridge. Transitions are available and may be required depending on site conditions.

B. Component Description

1. A bay describes a section of the QuadGuard System consisting of an energy absorbing cartridge, a diaphragm, two fender panels and fasteners.

   a. There are two types of cartridges, referred to as Type I and Type II. The front portion of the system shall be fitted with Type I cartridges. The rear of the system shall be fitted with Type II cartridges. The outside of each cartridge shall be fabricated from a weather resistant plastic. The actual quantity of each shall be determined by the system design speed. Refer to the product design manual for more information.

   b. The diaphragms shall be made from 10 gauge, steel Quad-beam sections. Two support legs shall be welded to the Quad-beam. Ski-shaped plates shall be welded to the bottom of the support legs. The diaphragms shall be designed to lock onto and be guided by a ground-mounted, center monorail support structure.

   c. The fender panels shall be fabricated from 10 gauge steel Quad-beam sections. The rear of each fender panel (the panel end furthest from the nose of the assembled system) shall be tapered to help maximize performance during wrong-way, redirective impacts. Each fender panel shall be drilled and slotted in accordance with the manufacturer's

specifications so that when assembled in the field, the front end (the end closest to the nose of the assembled system) shall be bolted to a diaphragm or hinge plate (depending on width of system) by means of 5/8" bolts. The rear of each Quad-beam™ fender panel shall overlap the next rearward fender panel and be connected to the diaphragm or hinge plate of the next bay by means of a bolt and "mushroom" washer. The bolt fits through the long horizontal slot in the forward fender panel. This permits the movement, front to back, of one set of fender panels relative to the panels in the underlying, next rearward bay. For QuadGuard® Systems with a backup width greater than 915mm (36"), the mushroom bolt assembly is held in place by a compression spring, which allows limited separation of the fender panels during an impact.

2. The monorail support structure shall be made of steel and be anchored per manufacturers instructions, to a specified concrete pad. The monorail shall prevent lateral movement, vertical movement and overturning of the diaphragms during design impacts.

3. The nose section shall contain a nose cover and an energy absorbing cartridge and is not counted as a bay. The nose cover shall be made from a plastic material formulated to resist weathering. The nose shall attach to the front diaphragm. Standard colors shall be gray or yellow.

4. The backup shall be made of steel and be attached to concrete or an integral tension strut framework, and shall be available in nominal widths of 610mm (24"), 762mm (30"), 915mm (36"), 1753mm (69"), and 2286mm (90").

5. Several transition panels are available as required by site conditions including: Quad-beam to Safety Barrier, Quad-beam to Thrie-beam, Quad-beam to W-beam, and Quad-beam End Shoe. Contact Energy Absorption Systems, Inc. for specific applications.

C. Material Specifications

1. Metal work shall be fabricated from either M1020 Merchant Quality or ASTM A-36 steel. After fabrication, metal work shall be galvanized in accordance with ASTM A-123. All welding shall be done by or under the direction of a certified welder.
2. The system shall be assembled with galvanized fasteners. All bolts, nuts, and washers shall be Commercial Quality "American National Standard" unless otherwise specified.

III. PERFORMANCE CRITERIA

A. For head-on impacts into the nose, a QuadGuard® System shall be specified which is capable of meeting the occupant risk criteria as recommended in NCHRP 350. For vehicles weighing between 820 and 2000 kg [1,810 and 4,410 lbs], the theoretical impact velocity of a hypothetical front seat passenger against the vehicle's interior (calculated from vehicle acceleration and 600mm [24"] forward displacement) shall be less than 12m/s [39.4 ft/sec], and the vehicle's highest 10 millisecond average acceleration subsequent to the instant of the hypothetical passenger impact shall be less than 20 G's.

B. The QuadGuard System shall be capable of redirecting 2000 kg [4,410 lbs] vehicles which impact the sides of the system at speeds up to 100 km/h [62 mph] at angles of 20° for both right-way and wrong-way impacts (angles measured from system's longitudinal centerline). The QuadGuard System shall be capable of redirecting 820 kg [1,810 lbs] vehicles which impact the sides of the system at speeds up to 100 km/h [62 mph] at angles of 15°. (See Test Criteria below.)

C. The QuadGuard System shall be designed and constructed so there is no solid debris from the system which can create a hazard on the roadway after either head-on or side angle design impacts.

IV. TEST CRITERIA

The QuadGuard System shall have been fully tested per the recommended criteria set forth in National Cooperative Highway Research Program (NCHRP) Report 350, 1993, Test Level 3 for redirective, non-gating terminals and crash cushions.

V. 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 QuadGuard System attenuators shall be accomplished in accordance with the recommendations of Energy Absorption Systems, Incorporated.