

VULCAN BARRIER™ TL-3 GENERAL SPECIFICATIONS

I. GENERAL

- A. The VULCAN BARRIER TL-3 (VULCAN TL-3) shall be a highly portable and crashworthy longitudinal barrier especially suited for use as a temporary barrier in highway construction zones when assembled as specified by the manufacturer.
- B. The VULCAN TL-3 shall provide a portable traffic control and positive protection system.
- C. All elements, components, and subassemblies of the VULCAN TL-3, as well as optional accessories, shall be designed, manufactured, and/or supplied by Energy Absorption Systems, Inc., of Chicago, Illinois.

II. DESCRIPTION OF THE SYSTEM

- A. An installation of the VULCAN TL-3 shall be constructed from a series of individual “**section**”.
- B. Each “**section**” shall be composed of the following:
 - 1. One barrier section.
 - a) Each barrier section shall be constructed of two 10 gauge side panels. The side panels will be inwardly sloping to interact with an impacting vehicle in a manner that resists penetration, vaulting, and under riding. The panels shall be secured with 5/8” rail bolts.
 - b) The approximate physical dimensions and capacities of the sections shall be: **4M SECTION:** length (pin to pin) 4115 mm [162 in.]; width: 546 mm [21.5 in.]; height: 813 mm [32 in.]; weight: 395 kg [870 lb.]. **8M SECTION:** length (pin to pin) 7944 mm [315 in.]; width: 546 mm [21.5 in.]; height: 813 mm [32 in.]; weight: 790 kg [1741 lb.]. **12M SECTION:** length (pin to pin) 11754 mm

[463 in.]; width: 546 mm [21.5 in.]; height: 813 mm [32 in.]; weight: 1185 kg [2612 lb.].

- c) The ends of each barrier section shall be constructed with 3/8" steel plate with vertically aligned knuckles which interlock with those of adjacent sections and which accept a 51 mm [2 in.] dia. steel connecting pin. The connecting pin shall be constructed to securely connect adjoining sections. The ends shall be designed to facilitate vertical stacking of barrier sections
- d) Each barrier section shall be constructed with a center bulkhead with lifting point to allow for mechanical lifting.

C. Material Specifications

1. All structural steel elements shall be fabricated from the specified steel. After fabrication, all metal work shall be galvanized in accordance with design specifications. All welding shall be done by or under the direction of a certified welder.
2. All bolts, nuts, and washers shall be galvanized. All bolts, nuts, and washers shall be Commercial Quality "American National Standard," unless otherwise specified.

III. PERFORMANCE CRITERIA

The VULCAN TL-3 shall be fully tested to, and shall meet the recommended structural adequacy, occupant risk, and vehicle trajectory criteria set forth in the National Cooperative Highway Research Program Report 350 (NCHRP-350) when properly installed according to the manufacturer's recommendations.

1. **The minimum length of an installation of unanchored VULCAN™ TL-3 shall be sixty – four (64) sections.**
 2. **The Beginning Length of Need (BLON) for any unanchored installation of VULCAN™ TL-3 shall begin at the 24th section from the end of the installation.**
 3. Within the length of need (LON), as defined in NCHRP-350, the VULCAN TL-3 shall meet the criteria for Test Level 3 (TL-3) impact conditions for 820 kg and 2000 kg [1808 and 4409 lb.] vehicles at speeds of 100 km/h [62 mph].
 4. When assembled as specified by the manufacturer, the components of the VULCAN TL-3 shall provide an integral end treatment for the installation. This end treatment shall meet the criteria for an NCHRP-350, TL-3, Non-Redirective or Redirective Crash Cushion for impact conditions involving vehicles of 820 kg and 2000 kg [1808 and 4409 lb.] at a speed of 100 km/h [62 mph].
 5. **The Beginning Length of Need (BLON) for any VULCAN end with a QuadGuard CZ end treatment shall begin at the first diaphragm of the QuadGuard. Refer to VULCAN manual.**
 6. **The Beginning Length of Need (BLON) for any VULCAN end with a TRITON end treatment shall begin fifteen (15) sections beyond the TRITON end treatment. Refer to VULCAN manual.**
- B. For TL-3 LON impacts, the VULCAN TL-3 shall be capable of preventing vehicle penetration, vaulting, and underriding, and shall bring the impacting vehicle to a controlled stop in the vicinity of the impact area, or for shallow angle impacts shall redirect the vehicle, while undergoing controlled lateral deflection.
- C. For TL-3 LON impacts, detached debris shall not show potential for penetrating the vehicle occupant compartment or presenting a hazard to other traffic, pedestrians, or workers in a work zone.

- D. For TL-3 LON impacts, a vehicle impacting the VULCAN TL-3 shall remain upright during and after the collision though moderate roll, pitch, and yaw may occur.
- E. Following TL-3 LON impacts, the intrusion of the vehicle's trajectory into adjacent traffic lanes shall be minimized.
- F. For a TL-3 LON impact by a 2000 kg light truck, the theoretical longitudinal impact velocity of an unrestrained front seat passenger upon impact with the interior of the vehicle shall be no more than 12 m/s [39.3 ft/s]. That theoretical longitudinal occupant impact velocity shall be calculated from the measured acceleration history of the vehicle during impact, and shall be determined at the instant the passenger has moved forward 600 mm [23 5/8 in.] relative to the vehicle.
- G. For a TL-3 LON impact by an 820 kg automobile, the theoretical longitudinal impact velocity of an unrestrained front seat passenger upon impact with the interior of the vehicle shall be no more than 12 m/s [39.3 ft/s]. That theoretical longitudinal occupant impact velocity shall be calculated from the measured acceleration history of the vehicle during the impact, and shall be determined at the instant the passenger has moved forward 600 mm [23 5/8 in.] relative to the vehicle.
- H. For a TL-3 LON impact by an 820 kg automobile, the theoretical lateral impact velocity of an unrestrained front seat passenger upon impact with the interior of the vehicle shall be no more than 12 m/s [39.3 ft/s]. That theoretical lateral occupant impact velocity shall be calculated from the measured acceleration history of the vehicle during the impact, and shall be determined at the instant the passenger has moved laterally 300 mm [1 ft.] relative to the vehicle.
- I. For TL-3 LON impacts into the VULCAN TL-3, the highest 10 millisecond average vehicle accelerations in the longitudinal and lateral directions (with respect to the vehicle), subsequent to the instant of occupant impact with the vehicle interior as defined by NCHRP-350, shall be less than 20G.

IV. DESIGN AND SELECTION CRITERIA

- A. Design, selection, and placement of the VULCAN TL-3 should conform with applicable guidelines in:
1. U.S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices", Washington, D.C. U.S. Government Printing Office, 2003 and all subsequent revisions.
 2. American Association of State Highway and Transportation Officials, "Roadside Design Guide", Washington, D.C. AASHTO, 2002 and all subsequent revisions.
- B. Installation of the VULCAN TL-3 with or without end treatment shall be accomplished in accordance with the recommendations of Energy Absorption Systems, Inc., in the VULCAN™ TL-3 product / installation manual.
- C. **Applicable End Treatment** shall conform to site specific applications. When specified the end treatment shall meet the criteria for an NCHRP-350, TL-3, Non-Redirective or Redirective Crash Cushion for impact conditions involving vehicles of 820 kg and 2000 kg [1808 and 4409 lb.] at a speed of 100 km/h [62 mph]. Applicable crash cushions that have been tested and are suitable end treatments for VULCAN TL-3 are as follows:
1. **QuadGuard CZ – Redirective/Head On Crash Cushion:** 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. For unidirectional applications the Vulcan can be pinned directly to loops on the Quadguard CZ backup. For bidirectional applications where the Quadguard CZ may get hit from a reverse impact the Quadguard to Vulcan transition shall be used and anchored per instructions from the manufacturer.

2. **Triton VET – Non-Redirective Gating Crash Cushion:** The TRITON Vulcan End Treatment System shall have been tested and evaluated per the criteria set forth in the National Cooperative Highway Research Program Report 350 (NCHRP-350). An FHWA acceptance letter shall be available authorizing its use on the National Highway System. TRITON Vulcan End Treatment System is a narrow, non-redirective, gating crash cushion. Its impact performance is similar to a sand-filled inertial barrel array. It is recommended that the TVETS only be used with unanchored VULCAN and placed at sites where the probabilities of side impacts are low. However if used in a VULCAN TL-3 unanchored application the first nose TRITON segment should be free of water, flipped upside down, and supported with a short steel pedestal. The following five TRITON segments shall be filled with water and supported with the hardware in the TRITON Barrier TL-3 Kit. The six segments shall be connected directly to the VULCAN.

D. Anchoring Criteria

1. **Anchoring Straps – VULCAN TL-3 Minimum Deflection:** Vulcan Anchor straps can be provided for applications or work zones requiring minimum deflection. The Anchor straps are to be placed every 4M (each bulkhead). Anchor Straps must be capable of anchoring to asphalt and concrete with a deflection of the VULCAN base no greater than 101 mm [4 in]. Anchor Straps must be made of 10 mm x 75 mm [3/8 in x 3 in] steel.