Product Specification

Universal TAU-II®
Redirective, Non-Gating, Crash Cushion

I. General

The Universal TAU-II® system is a Redirective, Non-Gating Crash Cushion in accordance with the definitions in the National Cooperative Highway Research Program Report 350 (NCHRP 350). The system configurations that have been evaluated for various impact velocities and hazard widths are shown in the Universal TAU-II System Configuration Chart (Figure 1).

II. Performance

The Universal TAU-II® system is designed to absorb the impact energy of an errant vehicle in accordance with NCHRP 350 guidelines for Redirective, Non-Gating Crash Cushions. The system is designed for locations where both head-on and angled impacts are likely to occur and where it is desirable to have the majority of post impact trajectories on the impact side of the system. The design provides for a high degree of flexibility in applying the system to a wide range of hazard widths (up to 2.6 meters (8.5 feet)) in 150mm (6 inch) increments and a large variety of non-proprietary transitions to other highway barriers. The systems also provide a very low life-cycle cost by demonstrating an average repair cost of less than 20% for the whole NCHRP 350, Test Level 3 test matrix. When installed in accordance with the manufacturer’s instructions, any of the configurations shown in the Configuration Chart (Figure 1) under the 100 km/hr (62.1 mph) column is capable of safely redirecting or stopping a 2000 kg (4400 lb) pick-up truck and an 820 kg (1800 lb) car impacting the system at 100 km/hr (62.1 mph).

A. When properly installed according to the manufacturer’s recommendations, the systems shall be able to meet the recommended structural adequacy, occupant risk, and vehicle trajectory criteria set forth in the in NCHRP 350 for Test Level 3 (100 km/hr) Redirective, Non-Gating Crash Cushions with an average material cost for refurbishment of less than 20% of the installed cost. The NCHRP 350, Test Level 3 Test Matrix includes the following conditions:

1. A 2000 kg vehicle at -20 degrees (reverse direction) impact to the midpoint of the system (Test 3-39).
2. A 2000 kg vehicle at 20 degrees impacting at the Critical Impact Point of the system. The critical impact point was determined to be the front of the backstop along the centerline of the system (Test 3-38).

3. A 2000 kg vehicle at 20 degrees impacting the side, near the front of the system (Test 3-37).

4. An 820 kg vehicle at 20 degrees impacting the side, near the front of the system (Test 3-36).

5. A 2000 kg vehicle at 15 degrees impacting the front of the system (Test 3-33).

6. An 820 kg vehicle at 15 degrees impacting the front of the system (Test 3-32).

7. A 2000 kg vehicle at 0 degrees and centered on the front of the system (Test 3-31).

8. An 820 kg vehicle at 0 degrees and an offset of ¼ the width of the vehicle from the centerline of the system (Test 3-30).

B. The impact velocity of a hypothetical front seat passenger against the vehicle interior as calculated from the longitudinal vehicle acceleration and 600 mm [23 5/8 in] forward displacement, and the lateral vehicle acceleration and 300 mm [12 in] lateral vehicle displacement, shall be less than 12 m/s (39.3 ft/s). The highest 10 ms average vehicle acceleration in the longitudinal and lateral directions subsequent to the instant of hypothetical occupant impact shall be less than 20 g’s in the NCHRP 350 testing matrix of the Universal TAU-II system.

Detached debris shall not show potential for penetrating the vehicle occupant compartment or present a hazard to other traffic, pedestrians, or workers in a work zone. The vehicle shall remain upright during and after the collision, although moderate roll, pitch, and yaw may occur. Vehicle deformations shall not cause intrusion into the occupant compartment in excess of 150 mm (6 inches).

III. Description of System

A. The Universal TAU-II crash cushion is made up of independent collapsible bays that are guided and supported by high strength galvanized steel cables. The system’s energy capacity is provided by an array of Energy Absorbing Cartridges. The Universal TAU-II systems are available in various length and width configurations and with capacities as shown in the Universal TAU-II System Configuration Chart (Figure 1). All of these configurations can be assembled from the basic parts as shown in the Universal TAU-II Parts List (Figure 2). The systems shall be made up of the following components and shall be fabricated from materials conforming to the following specifications:
1. The foundation system for the Universal TAU-II consists of two cables, a Back Support and Front Cable Anchors as shown in Figure 2 or Figure 3. The Front Cable Anchor weighs approximately 35 kg (75 lb). The types of Cable Anchors and Back Supports can be selected from those shown in Figures 2 and 3 based on the requirements of the specific site.

   a. All steel structural components of these assemblies shall be fabricated from mild steel in conformance with ASTM A-36 specifications. These components are hot dipped galvanized per ASTM A-123.

   b. Fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

   c. The steel cables shall be at least 25 mm (1 in) diameter and galvanized in accordance with ASTM A-603.

2. Front and Middle Supports and the various sizes of Bulkheads (XL, XXL and XXXL) (Figure 2) separate each independent collapsible bay. Cable Guides bolt to the Middle Supports and Bulkheads, capturing the cables and connecting the bays to the foundation system.

   a. All Front and Middle Supports, Bulkheads and cable guides shall be fabricated from mild steel in conformance with ASTM A-36 specifications. These components are hot dipped galvanized per ASTM A-123.

   b. All fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

3. Each Bay is enclosed on the sides with Sliding Panels. Sliding Bolts fasten the panels to the Front and Middle Supports and Bulkheads. End Panels are attached to the Back Support and the last bay’s Sliding Panels through Pipe Panel Mounts and provide transition mounting points. The Pipe Panel Mounts are bolted to the back support.

   a. Steel panels are to be fabricated from steel that conforms to the requirements of AASHTO M180 Class B.

   b. Sliding Bolts are to be cast from ASTM 1045 HT steel and galvanized per ASTM A-123.
c. Steel Pipe Panel Mounts shall be fabricated from mild steel in conformance to ASTM A513, Type 5 specifications.

d. Fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

4. Flexible Front Support Legs and a Nose Piece mount to the Front Support. The Front Support Legs and Nose Piece are bolted in place. The Nose Piece provides a location to attach suitable delineation in conformance with local specifications (to be supplied by others).

a. The front support legs shall be fabricated from either synthetic or natural rubber or polyurethane.

b. The Nose Piece shall be fabricated from polyurethane.

c. All fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

5. Two types of Energy Absorbing Cartridges (Figures 4 and 5) provide the primary energy absorbing capacity for the system. The cartridges appear as cylindrical plastic containers measuring approximately 775 mm (30 ½ in) in length and approximately 635 mm (25 in) in diameter. Each cartridge weighs approximately 16 kg (35 lb).

a. All plastic parts shall be molded from specially formulated High Density Cross-linked Polyethylene.

B. The Universal TAU-II systems are available in various capacities, each requiring a specific configuration of Energy Absorbing Cartridges (Types A and B). The capacities and configurations are shown in the Universal TAU-II System Configuration Chart (Figure 1).

C. The Universal TAU-II system shall require attachment to a foundation. Anchoring of the system will require attachment in accordance with the manufacturer’s drawings and instructions. Anchor capacity will require 12000 kg (25000 lb) pull out and 8500 kg (19000 lb) shear strength.

D. The TAU-II system shall be assembled, installed, and refurbished in accordance with the manufacturer’s instructions.

IV. Application of Safety Appurtenances

Highway safety appurtenances should be applied to hazardous sites in accordance with the guidelines and recommendations in the American Association of State Highway
Transportation Officials (AASHTO), “Roadside Design Guide”, and other Federal Highway Administration and State Department of Transportation requirements. Placement of the TAU-II system must comply with these specifications and guidelines as well as those of the manufacturer.