

627 IMPACT ATTENUATORS

627.01 DESCRIPTION

This work consists of furnishing, assembling and installing permanent impact attenuators at designated locations in the District. Also included is replacement or refurbishment of damaged existing attenuator systems. The attenuator systems shall be furnished in the type and size specified and in the locations as shown in the contract documents. They shall be installed according to the manufacturer's recommendations and comply with the requirements of the National Cooperative Highway Research Program (NCHRP) Report 350, TL-3. All materials supplied with the attenuator systems shall be the same as tested and certified in the NCHRP report and by the Federal Highway Administration.

Shop drawings shall be submitted according to [105.02 \(B\)](#) prior to installation of the attenuator system.

627.02 SAND-FILLED MODULE IMPACT ATTENUATOR

(A) **GENERAL** – Work consists of furnishing and installing permanent attenuators of the frangible sand-filled inertial crash cushion module type to construct arrays at proposed locations shown on the contract plans, or restore damaged arrays at designated existing locations.

(B) **MATERIALS** – Each module shall consist of an outer container, inner core, lid and sand. The modules shall be federal yellow or as shown on the plans. They shall be durable, waterproof, resistant to deterioration from ultra-violet rays, deformation from dynamic loadings due to vibration in the placement area and long-term stresses induced by thermal expansion and contraction and fill settlement.

(1) Outer containers, inner cores and lids shall be an approved type.

(2) Sand shall conform to [804.02](#) dried to contain not more than one (1) percent moisture by weight. Sand shall also contain 3-5% sodium chloride as dry rock salt by weight.

(C) **INSTALLATION PROCEDURES** – Sand modules shall be installed in accordance with the following procedures and the manufacturer's recommendations:

(1) **New Locations** – The modules shall be placed on a concrete or asphalt pad or roadway pavement in the configuration as shown on the contract plans. Care shall be taken to ensure that the modules are placed in the specified sizes containing the proper weight of sand. Prior to placement, circles shall be painted on the pad in the proper location with the specified weight of sand indicated in pounds.

(2) **Existing Locations** – In attenuator repair contracts, sand modules shall be replaced in existing installations as they are damaged by vehicle impact. Within 48 hours of notification by the Chief Engineer, the Contractor shall commence operations for restoration of the site. The Contractor will be provided with a sketch of the site showing the number and orientation of the modules and weight of sand in each module. Prior to beginning work, the contractor shall photograph the damaged array to verify the condition.

The Contractor shall remove all damaged modules, dirt, debris and sand in the immediate area and dispose of these properly. Sand may be salvaged and reused if it

meets the requirements of [\(B\) \(2\)](#) above. Undamaged elements may be reused for temporary locations. Reusable lids shall be used to replace missing lids on existing modules. New modules shall be installed per manufacturer's recommended procedures. To insure that installations are restored as soon as possible, the contractor shall maintain an adequate supply of materials on hand. Unused modules and lids remaining at the end of the contract will be purchased from the contractor under the terms describe in Payment.

- (D) MEASURE AND PAYMENT** – The unit of measure will be per each. The total will be the number of new modules installed in new permanent locations and/or used to replace damaged modules in existing installations.

Payment for this item will be made at the contract unit price per each, which payment will include furnishing and installing new modules, removal and disposal of damaged modules, dirt, debris, and sand and all labor, tools, equipment and incidentals required to complete the specified work.

In replacement contracts, unused modules remaining after the conclusion of the project will be purchased from the contractor under the terms in Payment. Unused and undamaged modules paid for under this item will become the property of the District and be delivered to a designated storage yard. Installation of reusable lids is considered to be incidental work and allowances should be made when preparing bid price for sand modules.

627.03 QUAD BEAM IMPACT ATTENUATOR

- (A) GENERAL.** Work under this item consists of furnishing, assembling and installing Quad Beam Impact Attenuator systems of the size and of the type specified in the contract documents, complete in place at the locations shown on the contract drawings. The Quad Beam Attenuator systems shall be installed according to the manufacturer's recommendations and in compliance with the requirements of the National Cooperative Highway Research Program (NCHRP) Report 350, TL-3.

The Quad Beam Impact Attenuator shall be installed on a PCC pad of the size indicated on the manufacturer's drawings and shown on [Standard Drawing 627.06](#).

- (B) MATERIALS.** Each Quad Beam Impact Attenuator, shall contain all external and internal parts necessary to give satisfactory service at the indicated site.

Components shall meet the following requirements:

- (1) Cartridges** – The Energy Absorbing cartridge boxes shall be of the number and arrangement indicated by the manufacturer for the intended application. Cartridge boxes shall be manufactured from a weather resistant plastic material. Cartridges boxes are of two types. One type shall contain paper honeycomb material, and the other type of cartridge box shall contain steel honeycomb material which shall be coated to minimize the effects of corrosion.

Each bay of the attenuator shall contain cartridge support brackets.

- (2) Diaphragms** – Diaphragms shall be made from 10 gage ASTM A 36 M steel quadruple corrugated beam. The length of each diaphragm shall be as required for each application. Two support legs shall be welded to channel which, in turn, shall be welded to the quadruple corrugated 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, an anchored and mounted support structure.

After fabrication, the diaphragms shall be hot dip galvanized in accordance with AASHTO M 111.

- (3) Fender Panels – Fender panels shall be fabricated from 10 gage steel quadruple corrugated beam guide rail sections. Each fender panel shall be drilled and slotted so that when assembled in the field, the front end shall be bolted to a diaphragm by means of the three horizontally placed 16 mm bolts, one of which shall be a “mushroom bolt.” The back end of each quadruple corrugated beam fender panel shall overlap and be connected to the fender panel of the next bay by means of mushroom bolts which shall fit through the long horizontal slot in the forward fender panel and the short vertical slot in the overlapped fender panel. (The bolt shall have a nut and square washer on the inside.) This permits movement, front to back, of one set of fender panels relative to the panels in the following bay.
 - (4) Nose Wrap – The nose wrap shall be made of cross-linked, high density polyethylene molded to match the quad beam. It shall offer substantial yielding yet possess strong ability to recover to its original molded shape.
 - (5) Backup – If a concrete back-up structure is not to be provided, a tension strut back-up assembly shall be provided. The details of this assembly shall be as indicated in the manufacturer’s or working drawings.
 - (6) Hazard Marker – A hazard marker shall be wrapped around and securely attached to the nose of the attenuator facing oncoming traffic. The material shall be 0.025 gauge aluminum sheet and the legend shall be made from Type III High Intensity Reflective Sheeting.
 - (7) Metal – All metal shall be AASHTO M 183 unless otherwise specified and galvanized per AASHTO M 111.
Fasteners – American Standard Regular Bolts, unless indicated otherwise in the contract documents.
Anchor bolts shall be ASTM A193 grade B7 grouted into the concrete pad with non-shrink grout.
- (C) **CONSTRUCTION REQUIREMENTS.** Installation of the attenuator shall be accomplished by the Contractor with experienced workers in accordance with the recommendations of the manufacturer.
- (D) **SHOP DRAWINGS.** Before fabricating the unit, shop drawings shall be submitted for approval by the Chief Engineer.
- (E) **MEASURE AND PAYMENT.** The unit of measure for Quad Beam Impact Attenuator will be per each unit installed, complete in place. Payment for Quad Beam Impact Attenuator will be made at the contract unit price per each, which payment will include fabricating, furnishing, assembling, PCC pad, concrete back-up structure, and installing the units and all labor, tools, materials, equipment and incidentals needed to complete the specified work.