
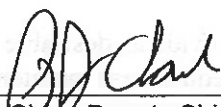


<b>SUPERSEDED BY</b> <u>EB 06-057</u> <b>EFFECTIVE</b> <u>5/3/07</u>		<i>New York State Department of Transportation</i> <b>ENGINEERING INSTRUCTION</b>	<b>EI</b> <b>03-033</b>
<b>Title: Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms (REACT 350)</b>			
<b>Distribution:</b> <input checked="" type="checkbox"/> Manufacturers (18) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Main Office (30) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Contractors (39) <input checked="" type="checkbox"/> Regions/Agencies (32) <input type="checkbox"/> _____ ( )		<b>Approved:</b>  <hr/> P. J. Clark, Deputy Chief Engineer, Design Division	
		<u>09/17/03</u> Date	

**ADMINISTRATIVE INFORMATION:**

- **Effective date.** This EI is effective with projects submitted for the letting of May 6, 2004.
- **Superseded issuances.** Nothing is hereby superseded.
- **Disposition of issued materials.** The revised specifications will be included in the next edition of the *Standard Specifications*.

**PURPOSE:**

- To issue pay items and standard specification changes necessary to specify the subject impact attenuator.
- To provide guidance on its use.

**TECHNICAL INFORMATION:**

- **Interim Guidance.**
  - These impact attenuators may be used to protect objects up to 3.0 m wide.
  - They are rated as Test Level 3 (100 km/h) devices. As such, they may be used on all classes of highways.
  - There are no Test Level 2(70 km/h) or Test Level 1(50 km/h) devices of this type currently available.
  - In the use of these devices, all curbing from the backup structure to a point 15 m in front of the unit either must be removed or effectively reduced in height to 100 mm or less.
  - On the nonapproach traffic side of bidirectional highways, the backup structure must not protrude beyond the object being protected by the subject device. The specifications require transitions on the nonapproach side to avoid snagging of the backup structure.
  - The specifications require the contractor to select, furnish, and install either steel or reinforced concrete backup structures. If, for some reason, one or the other would be inappropriate at a given site, the contract documents should limit the choice.
  - Cross slopes of 1 on 12 or flatter may be tolerated. Differential cross slope (twist)from front to back may not exceed two percent (2 %).
- **Policy issues.** The contract items for these units are proprietary. Therefore, it will be necessary to justify the use of Items 654.201527, 654.202429, 654.203029, 654.211527, 654.212429, and 654.213029. These are the specifications marked with asterisks below. The following information may be useful in making these justifications.
  - When objects wider than 610 mm need impact attenuators, only three types are available. These are: beam types employing cartridges or metal tearing strips, Sand Barrel Arrays, and the subject HDPE impact attenuators. Of the three types, only sand barrel arrays are nonproprietary.
  - When objects 610 mm or less in width need impact attenuators, four types are available. These are the three above plus a second beam type employing cartridges. Of the four, only sand barrel arrays are nonproprietary.
  - To avoid 'coffin corner' impacts, sand barrel arrays must be 1.5 m wider than the protected object in gores and other situations where approaching traffic may pass on both sides of the unit. For bidirectional situations and

where approaching traffic will pass on only one side of the unit, 750 mm of added width will be required.

- Damaged sand barrels must be replaced.
- Beam style and HDPE cylinder type impact attenuators provide good redirection in side impacts; therefore, would be good choices if side hits are the more likely hits. Impacts on the sides of sand barrel arrays may result in higher occupant impact velocities<sup>1</sup>.
- Beam styles require only moderate replacement of parts on impact, but more than would be required for the subject impact attenuators.
- The subject units may not provide as desirable a post-collision trajectory on a head-on impact as do the beam types, but the subject units require less maintenance and have more “uptime” than other types.
- The subject units and beam style units require foundations and backup structures. Sand barrel arrays need neither.

● **Other Information.**

- Steel backup structures are also available.
- The vendor should be contacted if drainage units, buried culverts, or expansion joints are present at the site.

● **Actions**

- DQAB will insert the attached shelf note into proposals calling for these contract items.
- EICs should provide drawings and extra copies of product, installation, and maintenance manuals to the Regional Maintenance Groups.

● **Changes.** This Engineering Instruction adds new widths to one of the standard impact attenuators in the *2002 Standard Specifications*.

**IMPLEMENTATION:**

● **New Specifications** The following new items may be included in proposals submitted for the letting of May 6, 2004 or later:

* <sup>2</sup> Item 654.201527	Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 1.5 m Wide, 27 Cylinders	Each
*Item 654.202429	Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 2.4 m Wide, 29 Cylinders	Each
*Item 654.203029	Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 3.0 m Wide, 29 Cylinders	Each
*Item 654.211527	Impact Attenuator, HDPE Cylinders, Diaphragms, on Existing Foundation, 1.5 m Wide, 27 Cylinders	Each
*Item 654.212429	Impact Attenuator, HDPE Cylinders, Diaphragms, Existing Foundation, 2.4 m Wide, 29 Cylinders	Each

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<sup>1</sup> Velocity of unrestrained occupant striking dashboard of vehicle on impacts.

<sup>2</sup> Items preceded by an asterick (\*) are proprietary. Refer to Policy Issues.

*Item 654.213029	Impact Attenuator, HDPE Cylinders, Diaphragms, Existing Foundation, 3.0 m Wide, 29 Cylinders	Each
Item 654.2215	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Remove and Dispose	Each
Item 654.2224	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Remove and Dispose	Each
Item 654.2230	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Remove and Dispose	Each
Item 654.2315	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Remove and Store	Each
Item 654.2324	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Remove and Store	Each
Item 654.2330	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Remove and Store	Each
Item 654.241527	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Relocate to and Construct New Foundation Slab	Each
Item 654.242429	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Relocate to and Construct New Foundation Slab	Each
Item 654.243029	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Relocate to and Construct New Foundation Slab	Each
Item 654.2515	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Relocate to Existing Foundation	Each
Item 654.2524	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Relocate to Existing Foundation	Each
Item 654.2530	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Relocate to Existing Foundation	Each
Item 654.2615	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Refurbish Diaphragm	Each
Item 654.2624	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Refurbish Diaphragm	Each
Item 654.2630	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Refurbish Diaphragm	Each

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Item 654.2715	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Refurbish Monorail	Meter
Item 654.2724	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Refurbish Monorail	Meter
Item 654.2730	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Refurbish Monorail	Meter

- **Disapproved Specifications.** None.

### TRANSMITTED MATERIALS:

- Shelf note incorporating the above pay items into the Standard Specifications. See bullet under "Other Information," given above.
- No drawings or design or installation information is transmitted herein, but product information is available electronically on the Energy Absorption Systems, Inc. website at [www.energyabsorption.com/products/permanent/React350w.htm](http://www.energyabsorption.com/products/permanent/React350w.htm). This page may also be accessed through the IntraDot weblink at <http://intradot/design/dqab/specs/endterms.html> for REACT 350 then selecting React 350 60/96/120 in. from the list of permanent products. Page 5 of 9 of the federal approval letter includes dimensioned plan view and elevation view of the REACT 350 (120") System.

**BACKGROUND:** A number of impact attenuators were included in the 2002 edition of the *Standard Specifications*. They included a type referred to as "reusable HDPE cylinders and cable type." These are available from the vendor identified below, and are known as the REACT 350. They use cables anchored front and rear and passing along both sides of the cylinders to resist lateral force and to guide the compression of the cylinders. REACT 350s have been available only as a single line of 915 mm diameter HDPE cylinders four, six, or nine cylinders long and are designed to protect narrow objects up to 610 mm wide. The backup structure is steel structural tubing welded to a steel base plate, which is bolted to the foundation using anchor studs set in drilled holes filled with polyester adhesive.

A wider REACT 350 is now available. This wider unit uses 27 or 29 HDPE cylinders of 610 mm width bolted to steel diaphragms which are designed to slide along and transfer lateral forces to a steel monorail. The monorail is bolted to a 200 mm thick concrete reinforced foundation slab using anchor studs set in drilled holes filled with polyester adhesive. The wider unit requires either a reinforced concrete or a steel backup structure, and is intended to protect objects up to 3.0 meters wide.

**VENDOR:** All sizes of the REACT 350 are manufactured by Energy Absorption, Inc., One East Wacker Drive, Chicago, Illinois, 60601-2076. They are sold in NYS by Transpo Safety, New Rochelle, NY, tel. (914) 636-1000.

**CONTACT:** Marc Connolly, Design Quality Assurance Bureau, Room 5-410, (518) 457-5440.

**Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms**

Make the following changes to the Standard Specifications of January 2, 2002:

Volume II, Page 6-169, between lines 35 and 36. (§654-2) *add* "Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms 712-22"

Volume II, Page 6-171, Lines 30 to 38. (§654-3.06) *replace with the following*

**“654-3.06 Impact Attenuator, HDPE Cylinder Types.**

**A. General.** In addition to the requirements indicated in §654-3.01 General, §654-3.02 Impact Attenuators Requiring Foundation, and 654-3.03 Anchorages, the Contractor shall furnish and install Impact Attenuator, HDPE Cylinders and Cable Type or Impact Attenuator, HDPE Cylinders with Monorail and Diaphragm Type on existing or new foundations, as indicated, of the indicated number of cylinders of the required thicknesses and dimensions in accordance with these specifications, the manufacturer’s directions, and the working drawings.

**B. Impact Attenuator, HDPE Cylinders and Cable Type.** In addition to the above in A. General, the following shall also apply. The base of concrete barriers and other similar solid objects shall be cut back at a 45° angle, and transition pieces shall be provided on both sides between the backup structure and the concrete barrier or other similar object.

**C. Impact Attenuator, HDPE Cylinders with Monorail and Diaphragm.** In addition to the above in A. General, the following shall also apply. Unless indicated otherwise, the Contractor shall select, furnish, and install either a metal backup structure or concrete backup structure. In bidirectional situations, a transition piece shall be installed to shield the back of the backup structure from impact by traffic. “

Page 6-174 (§654-5, list of pay items.) *Add the following”*

654.201527	Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 1.5 m Wide, 27 Cylinders	Each
654.202429	Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 2.4 m Wide, 29 Cylinders	Each
654.203029	Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 3.0 m Wide, 29 Cylinders	Each
654.211527	Impact Attenuator, HDPE Cylinders, Diaphragms, on Existing Foundation, 1.5 m Wide, 27 Cylinders	Each
654.212429	Impact Attenuator, HDPE Cylinders, Diaphragms, Existing Foundation, 2.4 m Wide, 29 Cylinders	Each
654.213029	Impact Attenuator, HDPE Cylinders, Diaphragms, Existing Foundation, 3.0 m Wide, 29 Cylinders	Each
654.2215	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Remove and Dispose	Each
654.2224	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Remove and Dispose	Each
654.2230	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Remove and Dispose	Each
654.2315	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Remove and Store	Each
654.2324	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Remove and Store	Each

**Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms**

654.2330	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Remove and Store	Each
654.241527	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Relocate to and Construct New Foundation Slab	Each
654.242429	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Relocate to and Construct New Foundation Slab	Each
654.243029	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Relocate to and Construct New Foundation Slab	Each
654.2515	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders, Relocate to Existing Foundation	Each
654.2524	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Relocate to Existing Foundation	Each
654.2530	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Relocate to Existing Foundation	Each
654.2615	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Refurbish Diaphragm	Each
654.2624	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Refurbish Diaphragm	Each
654.2630	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Refurbish Diaphragm	Each
654.2715	Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders, Refurbish Monorail	Meter
654.2724	Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Refurbish Monorail	Meter
654.2730	Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Refurbish Monorail	Meter"

Volume III, Page 7-143, Line 40. (Following §712-20), *add the following:*

**“712-22 Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms**

**SCOPE.** Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms are manufactured, NCHRP 350 Test Level 3 crash-tested products intended for the protection of objects having width of 3000 mm or less. These impact attenuators have 27 HDPE cylinders arranged in 14 rows or 29 arranged in 15 rows. They are suitable in situations where frequent frontal impacts are expected.

**MATERIALS REQUIREMENTS.** The components shall meet the following requirements:

**Cylinders.** Cylinders shall be black, high-molecular-weight polyethylene conforming to ASTM D3350 cell class 345434C. Dimensions and wall thicknesses of all cylinders shall be as given on the manufacturer’s drawings.

**Steel Parts.** Metal parts shall be fabricated from M1020 Merchant Quality or ASTM A36 steel. Chain shall be high-strength-steel-linked chain of the indicated sizes, galvanized, and fitted each end with screw-pin anchor shackles. Fasteners, anchor bolts and anchor pins, and other parts not specified herein shall be as given on the manufacturer’s drawings or in the fabricator’s instructions.

All metal parts shall be galvanized after fabrication in accordance with §719-01 Galvanized Coatings and Repair Methods, Type I. Welding shall be in accordance with the *Steel Construction Manual*.

## **Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms**

**Reflectorized Sheeting.** Class B (High-Intensity) sheeting conforming to §730-05, premounted on a weatherproof substrate, shall be affixed to the front cylinder of the impact attenuator. Aluminum sheeting, if used, shall be 6061T6, 0.81 mm thick. The pattern and color of the reflectorization shall be as indicated on the plans.

If no pattern is provided, the pattern shall be approximately square, 450 mm on a side. Whenever approaching traffic is allowed to pass on both sides of the unit, the pattern shall be upward-pointing chevrons formed with alternating 100 mm reflectorized stripes and black-opaque-nonreflectorized stripes. When traffic will be permitted on only one side, the pattern shall be diagonal 100 mm stripes, downward sloping to the side traffic is to be permitted, formed as indicated above. If no color is given, the color shall be yellow.

**BASIS OF ACCEPTANCE.** Impact Attenuator, HDPE Cylinder with Monorail and Diaphragms will be accepted at the project site on the basis of the manufacturer's name appearing on the Approved List, conformance of the delivered article with the manufacturer's drawings, and the manufacturer's certification that the product delivered is in conformance with these specifications."