

**649.3.05 Construction**

Construct the glare screen using one of the following alternatives:

**A. Alternative One**

Cast the median barrier and while the concrete is still plastic, insert “D” bars into the fresh concrete as indicated on the Plans. Wait until the median barrier concrete has reached a compressive strength of 2000 psi (14 MPa) or an age of seven days. Then place a second course of barrier, of the dimensions shown on the Plans, on top of the first course and finish and cure according to Subsections 621.3.05.C and 621.3.05.D.

**B. Alternative Two**

As an alternative to inserting “D” bars into the plastic concrete, wait until the median barrier concrete has reached a compressive strength of 2,000 psi (14 MPa), then drill holes for the “D” bars and epoxy them in place.

Construct the second course of barrier on top of the first course according to Plan dimensions. Finish and cure according to Subsections 621.3.05.C and 621.3.05.D.

**649.3.06 Quality Acceptance**

General Provisions 101 through 150.

**649.3.07 Contractor Warranty and Maintenance**

General Provisions 101 through 150.

**649.4 Measurement**

Concrete glare screen is measured for payment in linear feet (meters) of accepted work of each specified height. The surface is measured along the top of the glare screen.

**649.4.01 Limits**

General Provisions 101 through 150.

**649.5 Payment**

This work will be paid for at the Contract Unit Price per linear foot (meter) for each specified height. Payment will be full compensation for furnishing materials and performing the Work.

Payment will be made under:

Item No. 649	Concrete glare screen (height)	Per linear foot (meter)
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**649.5.01 Adjustments**

General Provisions 101 through 150.

**Section 650—Impact Attenuator Units (Compression Crash Cushion)****650.1 General Description**

This work consists of furnishing and installing impact attenuator units to conform with Plan locations and details and/or as directed by the Engineer.

**650.1.01 Definitions**

General Provisions 101 through 150.

**650.1.02 Related References****A. Standard Specifications**

General Provisions 101 through 150.

**B. Referenced Documents**

ASTM A 123/A 123M

NCHRP 350

### 650.1.03 Submittals

#### A. Installation Drawings

Submit all required certifications, test reports and drawings of details for completing the installation. Obtain the Engineer's approval of these documents before beginning work on the attenuator installation.

#### B. Manufacturer's Information

Furnish items such as manufacturer's brochures or specifications that completely outline the manufacturer's recommendations for materials and installation methods. All workmanship and materials are subject to the Engineer's approval.

## 650.2 Materials

### A. Attenuator

1. Ensure that the manufactured materials for each type of crash cushion comply with current Specifications and recommendations of the manufacturer.
2. Use attenuators that have been classified as "accepted" by the Department's Office of Materials and Research and approved by the Federal Highway Administration (FHWA) as meeting NCHRP-350 for the test level specified.
3. Ensure that restoration and/or repair can be accomplished without the necessity of removing the unit from the original location.
4. Ensure the approach end of the attenuator is equipped with a reflectorized object marker in accordance with Plan Details. The object marker may be furnished by the manufacturer of the attenuator or by others. Ensure that the front most section of the unit (the "nose") is yellow in color unless specified otherwise.
5. Use an approved back-up system as specified in the Plans.
6. Anchor the attenuator to the pavement according to a system recommended by the manufacturer for the type pavement encountered.
7. Use Class "A" concrete for reinforced concrete pads, concrete back up if used, and concrete transition where required.
8. Use metal components and hardware galvanized according to ASTM A 123/A 123M unless otherwise specified. Ensure all metal components and hardware of permanent attenuators are free of corrosion when shipped.

### 650.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

## 650.3 Construction Requirements

### 650.3.01 Personnel

General Provisions 101 through 150.

### 650.3.02 Equipment

General Provisions 101 through 150.

### 650.3.03 Preparation

General Provisions 101 through 150.

### 650.3.04 Fabrication

#### A. Design Criteria and Type Selection

The Impact Attenuator Unit Type will be shown on the plans. Four characters designate the type attenuator.

- First character
  - Indicate either a permanent or temporary installation.
  - The letter "P" designates a permanent installation.
  - The letter "T" designates a temporary installation as typical for work zones.
  - The two-letter designation of "T/P" indicates the unit is to be used in a temporary situation and then converted to a permanent unit.
- Second character
  - Designates the required NCHRP test level.

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- Third character

Indicates the traffic flow direction(s).

The letter "B" indicates bi-directional traffic typical for median applications or when the unit is installed on the shoulder of a two-lane, two-way traffic facility. Bi-directional means traffic flows in opposite directions at the site of the attenuator installation.

The letter "U" indicates uni-directional traffic flow typical for gore areas. Uni-directional means traffic on both sides traveling the same direction, from the nose to the rear of the unit.

The letter "S" indicates traffic flow in one direction on a single side only, typical for a unit located on the outside shoulder of a roadway with one-way traffic and the other side of the attenuator not being exposed to traffic.

- Fourth character

Indicates the numerical value of the width, in inches (millimeters), of the base of the rigid object that the attenuator will be shielding.

At bridge columns, this character is typically the width of the column plus the barrier base widths on the column sides at the pavement surface.

### B. Examples

A Type T-3-B-30 attenuator indicates:

- a temporary installation
- tested and approved at NCHRP test level 3
- bi-directional traffic flow
- a 2'-6" (760 mm) wide base of the rigid object being shielded.

A Type P-3-U-60 attenuator designates

- a permanent installation
- tested and approved at NCHRP test level 3
- Uni-directional traffic flow
- a 5' (1500 mm) wide base for the rigid object being shielded.

Portable Attenuators are designated as Temporary (Type T) units.

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Field locate the position of the attenuator nose as shown on the plans prior to beginning the installation. Have any variations approved by the Engineer.

If the length of the attenuator unit is less than that indicated in the plan details for the specified conditions, the length of the concrete transition section or the length of the longitudinal barrier shall be increased as needed to provide a proper beginning point for the attenuator nose as shown in the plans.

The length of the system will be the combined length of the attenuator unit, the back-up system and any required transition. The length of the system shall not be excessive to the extent that it intrudes appreciably within the clear offset distance as shown on the plans.

The increased length of transition or barrier is considered as an incidental part of the system and will not be itemized separately.

Temporary portable units shall be installed, moved, reinstalled and maintained as required.

### 650.3.06 Quality Acceptance

- Obtain certification from the manufacturer that the impact attenuator unit installed meets all required approvals and specifications and furnish these to the Engineer.
- Furnish any mill test/galvanizing test reports and heat numbers for all metal components of the unit per current requirements of the Department's Office of Materials and Research.

### 650.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

## 650.4 Measurement

Each Impact Attenuator specified, complete in place and accepted at its location, will be measured by the unit for each type indicated on the plans and detailed in Subsection 650.3.04, "Fabrication". Each unit measured includes all components, hardware, anchors, back-ups, platforms, concrete pads, incidentals, and labor for each installation shown on the plans.

Portable units will be measured for payment only once, regardless of how often they are moved.

### 650.4.01 Limits

General Provisions 101 through 150.

## 650.5 Payment

Impact Attenuator Units will be paid for per each type specified. Payment is full compensation for all materials, labor, and incidentals necessary to complete the Item including installing, moving, reinstalling and maintaining Temporary Units as required.

Payment will also include the back-up system and transitions where required.

Payment will be made under:

Item No. 650	Impact attenuator unit, (compression crash cushion) Type P-	Per each
Item No. 650	Impact attenuator unit, (compression crash cushion) Type T-	Per each

### 650.5.01 Adjustments

General Provisions 101 through 150.

## Section 651—Raised Traffic Bars

### 651.1 General Description

This work includes furnishing and placing raised traffic bars according to the type, locations, and specifications in the Plans.

#### 651.1.01 Definitions

General Provisions 101 through 150.

#### 651.1.02 Related References

##### A. Standard Specifications

Section 500—Concrete Structures

Section 886—Adhesive (Epoxy Resin)

##### B. Referenced Documents

General Provisions 101 through 150.

#### 651.1.03 Submittals

General Provisions 101 through 150.

### 651.2 Materials

Ensure that materials meet the requirements of the following Specifications:

Material	Section
Adhesive (Epoxy Resin)	Section 886
Concrete, Class A, Air Entrained	Section 500

#### 651.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.