



MEMORANDUM

STATE OF ALASKA

Department of Transportation and Public Facilities
Central Region-Division of Design and Engineering Services
Traffic, Safety, & Utilities Section

To: Design Chiefs and Project Managers

Thru: Ken Morton, P.E.
Regional Preconstruction Engineer

Date: March 7, 2014

Thru: Randy Vanderwood P.E., Chief
Maintenance & Operations

From: Scott E. Thomas, P.E.
Central Region Traffic Engineer

Subject: Central Region Design Practice
Permanent Crash Cushion Selection

There is not a statewide specification for permanent crash cushions. Central Region special provisions for permanent crash cushions are based upon the 2011 AASHTO Roadside Design Guide, 4th edition, Section 8.3 and 8.4. These specifications (attached) meet three primary goals:

- High speed performance at Test Level 3 for most of our roads
- Perform when snow/ice layers build up at the base/shoulder
- Provide some protection for repeat impacts until repair
- Minimize M&O parts orders and rebuild/replacement costs

Select permanent crash cushions during design as follows:

Cat	Typical Design Conditions	Crash Cushion Category	Qualified products*	Estimated Costs
1	Wide locations, lots of work space No historical impacts or very infrequent Future impacts not expected Freeway medians 30' +	Sacrificial	See AASHTO Table 8-3, Table 8-5. (can also use Parallel Guardrail Terminals per DOT/PF spec when unidirectional.)	<\$5000 each time replaced.
2	Intermediate widths of 15-30 feet wide. No historical impacts or very infrequent. Lower speed areas <45 MPH not typical of most state roads.	Reusable	QUEST, TAU II	\$15,000 - \$25,000 each. Parts \$5,000 up to \$15,000.
3	Narrow locations, little workspace for M&O crews Frequent impact locations Freeway gores, urban medians, railroad crossings	Low Maintenance AND Self Restoring	REACT-350, TAU-II-R (not yet in AASHTO)	\$25,000-75,000 each. Parts <\$5,000.

*FHWA certifies end terminals at

http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/term_cush.cfm
however, their categories up through low maintenance and self restoring are incomplete. AASHTO has the more recent complete rating of product use.

Most sites in Central Region are expected to require Category 3 Low Maintenance AND Self Restoring crash cushions. While some products meet one condition OR the, we require they meet both. We do not accept devices that travel on rails with an interlocking shoe in the first six inches of the freeze/thaw layer. Even with annual cleaning by M&O, sand and ice buildup in this layer has resulted in device failures. Central Region now excludes the TRACC, Quadguard family, and SCI products listed in AASHTO due to interlocking designs in the freeze thaw layer.

Design as much space as possible to allow for various manufacturer's crash cushions. Follow AASHTO RDG Table 8-11 for "crash cushion reserve area". Attached is a design example.



2008 and 2013 Crash cushion failures on Minnesota Drive. Interlock at ground level.

Attachments: Special Provision 606-CR60610-010114.doc
Design Example

Distribution: James Amundsen, P.E., Chief Highway Design
Sean Baski, P.E., Project Manager
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SECTION 606

GUARDRAIL

Special Provisions

606-1.01 DESCRIPTION. Add the following:

CR60610. Use this special when installing or removing crash cushions.

Construct all new permanent crash cushions to shield the hazard width and travel direction shown in the plans.

Add the following Subsection 606-1.02 Submittals:

606-1.02 SUBMITTALS. Submit the following for crash cushions:

1. A letter from the Manufacturer or their approved representative with the name of their representative, certification of their installation contractor, and their recommendations for the crash cushions shown on the plans, including product information, foundations, and rigid backup or transition connection type.
2. A copy of the manufacture's installation requirements and recommendations. Provide detailed assembly instructions and shop drawings for the crash cushion, foundation, and rigid backup anchorage, or transition connection before beginning installation.
3. FHWA Acceptance Letters(s) for the crash cushion submitted to support either AASHTO Manual for Assessing Safety Hardware (MASH) Test Level 3 or NCHRP 350 Test Level 3. Acceptance must include the shielding typical hazard widths and travel directions shown in the plans.
4. AASHTO acceptance or written updates for the crash cushion classification as noted in the 2011 AASHTO Roadside Design Guide, Section 8.4.
5. Manufacturer Certified Installers: Submit the installer certification to the Engineer at the Preconstruction Conference.

606-2.01 MATERIALS. Add the following:

Crash Cushion.

Generally acceptable crash cushion classifications are listed in the 2011 AASHTO Roadside Design Guide, 4th Edition. The Engineer will determine the final classification of each materials submittal. Each crash cushion in the plans is specified as one of the following:

1. Sacrificial: These are demonstrated to be designed for a single impact. These may also be "narrow" crash cushions or "median barrier" crash cushions as defined by the FHWA Office of Safety.
2. Reusable Crash Cushion. These are demonstrated to have some major components that survive most impacts intact and can be salvaged when the unit is being repaired. Some components need to be replaced after a crash.
3. Low-maintenance and Self-restoring Crash Cushion. These are demonstrated to suffer very little, if any damage, upon impact and are easily pulled back into their full operating condition. They may partially rebound after an impact and may only need an inspection to ensure that no parts have been damaged or misaligned. Supply crash cushions that are redirective and non-gating.

Crash Cushion – Flexible Marker Post: Provide Carsonite CIB-380, TAPCO Curve-Flex, TrafficWorks Guardian TW-375, or approved equal.

CONSTRUCTION REQUIREMENTS

606-3.07 REMOVAL AND DISPOSAL OF EXISTING GUARDRAIL. Add the following:

CR60610. Fill in the M & O Yard specific to the project.

Crash Cushion.

Notify the Engineer a minimum of 5 days before removing crash cushions. The Engineer will notify the ADOT & PF, M & O, and have an M & O representative designate portions of the crash cushion for salvage. Deliver salvaged crash cushion and associated hardware to the M & O yard located at _____. Remaining items removed become the Contractor's property.

Add the following Subsection 606-3.13 Crash Cushion:

606-3.13 CRASH CUSHION. Install crash cushions according to the manufacturer's recommendations.

Manufacturer's Representative. Provide the services of a manufacturer's representative to review both the initial planned installation and the final installation onsite. Pre-installation inspection and observation of the installation onsite by the manufacturer's representative is required. Cooperate with the Manufacturer's Representative and the Engineer to ensure the materials are placed according to these specifications and the manufacturer's recommended procedures.

Manufacturer Certified Installers. Install crash cushions using installers certified by the materials manufacturer. Install Crash cushions as follows:

1. Parallel to the approach traveled way or as shown on the plans.
2. Follow Section 203 for the excavation and embankment requirements of the concrete base component of the crash cushion.
3. Follow Section 501 for a concrete pad, sized according to the manufacturer's recommendations, constructed on a minimum of 12 inches of Selected Material, Type B.
4. Cut or fill to the top of the concrete pad with Selected Material, Type B at 12:1 or shallower on installations in grass median.
5. Install top elevation of concrete pad flush to pavement edge when adjacent to or within asphalt pavement.
6. Bolt crash cushion to median barrier with manufacturer approved barrier to crash cushion connector when attached to median barrier.
7. Install a flexible marker post on the nose of each crash cushion, Use a yellow post 3-inch to 4-inch wide by 78-inch long. Attach the marker post to the inside of the crash cushion nose piece with two 3/8-inch stainless steel bolts, nylon lock nuts, and 1 1/2-inch fender washers (two per each bolt), spaced 10-inch apart. The marker post is in addition to, not a substitute for, the reflective tape delineation installed on the crash cushion nose.

Any excess excavated material shall become the property of the Contractor.

Provide permanent crash cushions with performance features designed to minimize the impacts of snow and ice buildup due to frequent freeze and thaw cycles. Crash cushions using supports which interlock and travel within fixed tracks at or below the first six inches from ground level are not accepted for permanent winter use. Crash cushion covers must be provided when available from the manufacturer.

606-4.01 METHOD OF MEASUREMENT. Add the following:

4. Crash Cushion. Per each, installed and accepted.

606-5.01 BASIS OF PAYMENT. Add the following:

4. Crash Cushion. The contract price includes all work and materials required to install each crash cushion, foundations, and connections along with the manufacturer's field support, recommendations, and shop drawings. Removal and salvage of existing crash cushions is subsidiary to Pay Item 606(~~4518~~) Pay Item(s).

Add the following Pay Item(s):

<u>Pay Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
606(18_)	_____ Crash Cushion	Each

CR60610-010114

Pay Item Number. Fill in the blank with "A," as in (18A). If more than one type of crash cushion make the next item (18B) etc.

Pay Item. Fill in the blank with the type name as in "Type Name" Crash Cushion

Pay Item Type Names: Sacrificial
 Reusable
 Low Maintenance and Self-Restoring

ORIGINAL

