

Chris Cooper

To: Dallas Hammit; Steve Boschen; Barry Crockett; Todd A. Emery; Jesse Gutierrez; Brent Cain; James Windsor; Scott Beck; David Eberhart; Maysa Hanna; Julie Kliewer; Paul O'Brien; Jerry James; Raul Amavisca; Audra Merrick; Ed Wilson; Matt Moul; Alvin Stump; Roderick F. Lane; Bill Harmon; Paul Patane; Randy Everett; Gregory Byres; Marwan Aouad; 'Deitering, Thomas (FHWA)'; Gregory Wristen; Steve O'Brien; Iqbal Hossain; Lisa Pounds

Cc: Michael DenBleyker; Reed Henry; Doug Smith; Hassan Eghbali; Hiren Shah

Subject: Crash Cushion Requirements

SENT ON BEHALF OF MICHAEL DENBLEYKER, STATE ROADWAY ENGINEER

TO ALL ADOT AND CONSULTANT DESIGN PERSONNEL

RE: CRASH CUSHION REQUIREMENTS

All permanent crash cushions installed under projects advertised after December 31, 2018 must be compliant with testing described in the 2016 Manual for Assessing Safety Hardware (MASH 16). Redirective crash cushions meeting MASH 16 will be listed in the ADOT Approved Products List under Category V-1, and non-redirective systems (sand barrels) will be listed under Category V-3.

Designers should follow the updated Crash Cushion Selection Procedure attached. Revised "MASH Barrier Design Aids" guidance and MASH compliant sand barrel array detail Det-10.29 are also attached. This detail should be inserted in plan sets calling for permanent sand barrel installations. These attachments can be found under "Roadway Design Memos", "MASH Barrier Design Aids", and "Crash Cushion Information" located on-line at <https://www.azdot.gov/business/engineering-and-construction/roadway-engineering/roadway-design/standards-and-guidelines/barrier-design-information>.

Please distribute this information to all design personnel, project managers, consultants, and other users within your groups and districts. Comments and questions can be directed to Chris Cooper, Roadway Support Manager.



MEMORANDUM

TO: All ADOT Design Personnel and Consultants

FROM: Michael DenBleyker, Assistant State Engineer, Roadway Engineering Group *MD*

CC: Dallas Hammit, State Engineer

DATE: December 19, 2018

RE: Crash Cushion Selection Procedure

The attached procedure for the selection of crash cushions outlines the process to be followed for selecting crash cushions on ADOT projects. This supersedes the procedure described in the July 9, 2009 memo, and should be utilized on all ADOT projects currently under development requiring crash cushions.

Project Managers should ensure this updated procedure is followed.

Please distribute this memorandum to all design and development personnel, including consultants, within your District, Group, or Section.

Thank you for your attention to this updated procedure. For further assistance, please contact Chris Cooper, Roadway Support Manager at 602-712-8365.

Attachment

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|---------------------------------|----------------------------|
| C: Roadway Engineering Group | Project Management Group |
| Construction & Materials Group | Contracts & Specifications |
| Districts | Bridge Group |
| Traffic Engineering Group | State Engineer's Office |
| PRO and LPA Section | Regional Traffic Engineers |
| Engineering Consultants Section | TSMO |
| Federal Highway Administration | |

**CRASH CUSHION SELECTION PROCEDURE
ROADWAY ENGINEERING GROUP
December 19, 2018**

(Supersedes July 9, 2009 Design Memorandum)

The following procedure is to be followed for design and selection of crash cushion devices for permanent use on federal-aid and state funded projects. This procedure does not apply to guard rail end terminals or to temporary crash cushion devices during construction.

Crash Cushion devices can be found on the Approved Products List (APL). Subcategories V-1 and V-3 list the crash cushions that have been approved through the Product Evaluation Program. The APL can be viewed at the following ADOT website:

<https://www.azdot.gov/docs/default-source/approved-products/apl.pdf?sfvrsn=44>

Selection of possible crash cushions requires that they be MASH 2016 compliant devices. The normal usage for high speed applications requires a TL-3 design. Designs for lower speeds (45mph and less) are normally available from the manufacturer and can be considered for low speed applications.

The designer is to select devices from the APL for use that will meet the design requirements of the specific application. The manufacturers' websites, and their representatives can be resourced for design manuals, consultation on installation details and other specific requirements. Site preparation details and special provisions as needed should be included in the plans with the specific applications selected.

All applicable devices should be considered from the lists and it is also evident that one device will not always substitute for another. It is desirable that more than one device be considered for a specific location in order to promote competition in bidding. It is also recognized that with consideration of cost, construction and maintenance requirements, one device may be preferable for a specific location.

ADOT has adopted criteria for usage of crash cushion devices for APL Category V-1 that require the concurrence of the District Maintenance Engineer to maintain a crash cushion device that is constructed on a project. This is to ensure that the District is comfortable and willing to maintain a device and that an undue burden for maintenance of proprietary crash cushions is not imposed on a District. This procedure recognizes that ease of maintenance of a device is an important factor in addition to performance of the device. It is in the public interest not to impose devices on the Districts which are not within their resources to maintain.

Documentation and requests for approvals must be made early in the design process to avoid delay of bid.

The following procedure outlines the steps for documenting and finalizing the crash cushions to be shown on the plans:

Procedure:

1. Determine the need for a crash cushion. Barriers with guardrail end terminals may be a more suitable alternative where room allows, and traffic is not exposed to the terminal's back side.
2. Determine which general type of crash cushion is most suitable. Redirective cushions, listed in APL Category V-1 are more suitable for gores, and for hazards near the shoulder. Non-redirective sand barrels, listed in Category V-3 are more suitable for individual obstructions further off the shoulder.
3. Review all crash cushions in APL Category V-1 to determine which crash cushions will fully satisfy the requirements of the design for each site being evaluated. All current category V-3 products are suitable for use in ADOT's sand barrel array detail.
4. Review Manufacturer's website for design requirements and contact them as needed.
5. Review site locations for compatibility with each system's requirements, including grade, system length, pad dimensions, and approach geometrics.
6. Determine if the posted or the 85th percentile speed is greater than 45 mph, and if at least three documented crash cushion hits occurred within a 36 month period. For locations meeting these conditions, only crash cushions shown to be quickly and inexpensively repaired following a substantial hit should be selected. Similar crash cushions should also be selected for new locations where high crash rates are anticipated, such as system interchange ramp gores, and service interchange off ramp gores in metropolitan areas.
7. Discuss the alternatives with the District Maintenance Engineer to obtain concurrence on maintenance of all devices selected. Provide alternates where practicable.
8. Provide plan details and special provisions as needed to clearly indicate appropriate pad and approach dimensions, and manufacturer drawing numbers for each V-1 crash cushion option. Include or integrate the ADOT sand barrel array detail for V-3 applications. The Engineer preparing the roadway design plans will prepare documentation of the selections for future reference in the design file.
9. In the event it is determined that only one V-1 alternative is recommended, the design engineer will prepare a Certification for Proprietary Product Use letter request for approval to the State Roadway Engineer providing justification for use in the public interest. Copies of sole source approvals will be sent to Contracts and Specifications and will be placed in the project file.

Please contact the Roadway Engineering Support Manager for any information or assistance required in respect to this procedure.