

## PRECONSTRUCTION DESIGN MEMORANDUM

**MEMO:** PCDM-02  
**SUBJECT:** Permanent Crash Cushions  
**DATE:** REVISED - September 28, 2018  
**RE:** Standard Drawings 805-785-xx

This memo provides clarification and guidance for the selection of appropriate permanent crash cushions. Please refer to the following information and examples to ensure the appropriate system and pay item are selected. Qualified systems are listed on SCDOT Qualified Products List 49.

When evaluating a site, the designer must identify the effect of the crash cushion system on length of need calculations and consider all other appropriate end treatment alternatives prior to selecting the crash cushion end treatment.

Once a designer has identified a crash cushion system as the appropriate treatment for a site, select the type of crash cushion as specified in this design memo or document the decisions used to select a different type.

For crash cushion geometry, grading, and site requirements, see manufacturer's installation instructions or SCDOT Standard Drawings, if available.

Pay items are available in order to quantify the complete installation of appropriate permanent crash cushions. The designer is required to specify the width, test level, and class of device to be installed. The pay item descriptions are available for the range of available systems. The pay items shall be as follows:

**80573XX**     *[width] Crash Cushion [test level, category class] EA*



## 1.0 Width of System

Permanent crash cushions are available in a variety of widths to accommodate attachment to barrier or other back-up structures. For all locations, provide the following note on the plan sheets under the crash cushion label indicating the width of rigid structure behind the crash cushion:

**“for xx” wide \_\_\_\_”**

where,

**xx** is the width of the rigid structure in inches

**\_\_\_\_** is a brief description of the rigid structure.

Use narrow crash cushions for 24” wide rigid structures. Where practical, connect multiple hazards (such as adjacent barrier walls on either side of a gore) and taper the rigid components to 24” width to facilitate the use of narrow crash cushions. See details 1 through 4 for some design options to facilitate the use of narrow crash cushions. **These details need to be considered early enough that bridge details and earthwork quantities can be adjusted to accommodate the shifted geometry.**

For wide hazards subjected to two way traffic or on the roadside, consider aligning a narrow crash cushion to shield the leading side of the hazard as shown in the Standard Drawings.

Crash cushion connections and transitions will vary for structure widths greater than 24”. Different brands have some stock barrier width designs. Designers are encouraged to construct wide barriers only at 36”, 48”, and site-specific widths larger than 48”. Note that wider base structures generally will result in longer crash cushions. Tapering the base structure width is encouraged wherever practical.

Crash cushions may not be available for structure widths in excess of 10’, so another alternative may be required for these locations.

## 2.0 Test Level

Use test level 3 crash cushions on sites with design speeds in excess of 45 MPH and on lower speed sites where a higher level of shielding is desired.

Use test level 2 crash cushions only on sites with design speeds of 45 MPH or less and where a site evaluation indicates that TL2 designs are appropriate (see Standard Drawing 805-001-01 section 5).

### 3.0 Category Class

#### **Class A Low Maintenance**

Low Maintenance is suggested when the site has any of the following conditions:

- ADT > 70,000
- Adjacent Lane Volume (Lane ADT) > 10,000
- Gore area with multiple lanes both sides of gore
- Sites with more than 2 impacts per year are likely (if known)
- Designer is encouraged to specify the highest level of delineation in advance of these configurations

#### **Class B Self-restoring**

Self-restoring is suggested when the site has any of the following conditions:

- ADT > 20,000
- Adjacent Lane Volume (Lane ADT) > 5,000
- Sites with more than 1 impact per 2 years are likely (if known)
- Designer is encouraged to specify a high level of delineation in advance of these configurations

#### **Class C Partially Reusable**

Partially Reusable is suggested when the site has any of the following conditions:

- ADT < 20,000
- Sites with less than 1 impact per 2 years is expected (if known)
- Designer is encouraged to specify additional delineation in advance of these configurations

### 4.0 Test Standard

Qualified Product List 49 identifies crash cushion products that are Qualified as either MASH, Pre-MASH, or Maintenance Only.

Beginning with the January 2019 Letting, install MASH rated devices on new alignments when there is a Qualified MASH device for the required width that meets or exceeds the site's category class recommendations. As of publication of this document, a narrow Class A device is qualified for TL3 and TL2 conditions. Use this device for all new installations of Narrow crash cushions until additional narrow crash cushions are qualified as MASH rated. Follow the procedures outlined in this document when Class B and Class C narrow MASH devices become available on QPL 49.

As of publication of this document, all wide crash cushions remain qualified under their Pre-MASH qualification. Use Pre-MASH wide crash cushions until MASH compliant wide devices become available. Designers are encouraged to modify barrier details to allow the use of narrow MASH crash cushions wherever practical to minimize new installations of Pre-MASH wide crash cushions.

## 5.0 Pay Items

Once width, test level, and category class are identified, the pay items are as follows:

8057305	<i>Narrow Crash Cushion 2A</i>	EA
8057310	<i>Narrow Crash Cushion 2B *</i>	EA
8057315	<i>Narrow Crash Cushion 2C *</i>	EA
8057325	<i>Wide Crash Cushion 2A</i>	EA
8057330	<i>Wide Crash Cushion 2B *</i>	EA
8057335	<i>Wide Crash Cushion 2C *</i>	EA
8057350	<i>Narrow Crash Cushion 3A</i>	EA
8057355	<i>Narrow Crash Cushion 3B *</i>	EA
8057360	<i>Narrow Crash Cushion 3C *</i>	EA
8057370	<i>Wide Crash Cushion 3A</i>	EA
8057375	<i>Wide Crash Cushion 3B *</i>	EA
8057380	<i>Wide Crash Cushion 3C *</i>	EA

\* **Maintenance Only** – At time of publication, these devices are not qualified as MASH. These items may be used for Maintenance Applications. Before specifying these items on new construction, see QPL49 to determine if Class B or Class C devices have become qualified as MASH devices.

January 2019 Letting

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George R. Bedenbaugh, Jr.  
Preconstruction Support Engineer

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Effective Date

GRB:hjc

ec:

John Boylston, Director of Preconstruction  
Claude Ipock, Director of Construction  
David Cook, Director of Maintenance  
Robert Perry, Director of Traffic Engineering  
Chris Gaskins, RP Engineer – Design Build  
Ladd Gibson, Dir. of Mega Projects

Jennifer Necker, RP Engineer – Lowcountry  
Leah Quattlebaum, RP Engineer - Pee Dee  
Philip Sandel, RP Engineer - Midlands  
Julie Barker, RP Engineer - Upstate  
Dan Hinton, FHWA  
Steve Ikerd, FHWA  
Tad Kitowicz, FHWA

File:PC/GRB

**Example 1:**

Design Speed 45MPH (TL2 is appropriate)  
Standard 2' wide concrete median barrier wall end (24" NARROW is appropriate)  
ADT 25,000 (self-restoring or low maintenance are appropriate)

Use Pay item:

8057350	<i>Narrow Crash Cushion 2A</i>	EA
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(8057310 might be more appropriate once there is a MASH qualified version)

Additionally, when noting the pay item in the plans, include the appropriate note:  
“**for 24” wide median barrier wall**”

**Example 2:**

Design Speed 55MPH (TL3 is appropriate)  
Standard 2' wide concrete roadside barrier wall end (24" NARROW is appropriate)  
ADT 45,000 (self-restoring or low maintenance are appropriate)  
Exit lane volume 12,000 (low maintenance is most appropriate)

Use Pay item:

8057350	<i>Narrow Crash Cushion 3A</i>	EA
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Additionally, when noting the pay item in the plans, include the appropriate note:  
“**for 24” wide roadside barrier wall**”

**Example 3:**

Design Speed 55MPH (TL3 is appropriate)  
Standard 2' wide bridge parapet (24" NARROW is appropriate)  
ADT 12,000 (partially reusable, self-restoring or low maintenance are appropriate)

Use Pay item:

8057360	<i>Narrow Crash Cushion 3C</i>	EA
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(8057350 & 8057355 might also be appropriate, but more expensive initially)

Additionally, when noting the pay item in the plans, include the appropriate note:  
“**for 24” wide bridge parapet**”

**Example 4:**

Design Speed 65MPH (TL3 is appropriate)

Roadside barriers on both sides of gore taper to a 5'-9" wide end (69" WIDE is appropriate)

ADT 65,000 (self-restoring or low maintenance are appropriate)

2 lanes on both sides of the gore (low maintenance is appropriate)

Use Pay item:

8057370	<u>Wide Crash Cushion 3A</u>	EA
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(8057375 is not recommended because of the work requirements in a high volume multi-lane gore)

Additionally, when noting the pay item in the plans, include the appropriate note:  
“for 69” wide roadside barrier wall”

**Example 5:**

Design Speed 65MPH (TL3 is appropriate)

Roadside barriers on both sides of gore taper to a 6' wide end (72" WIDE is not a stock width, so designer should consider modifying hazard width. If this is not feasible, a 72" WIDE crash cushion will be required)

ADT 65,000 (self-restoring or low maintenance are appropriate)

2 lanes on both sides of the gore (low maintenance is appropriate)

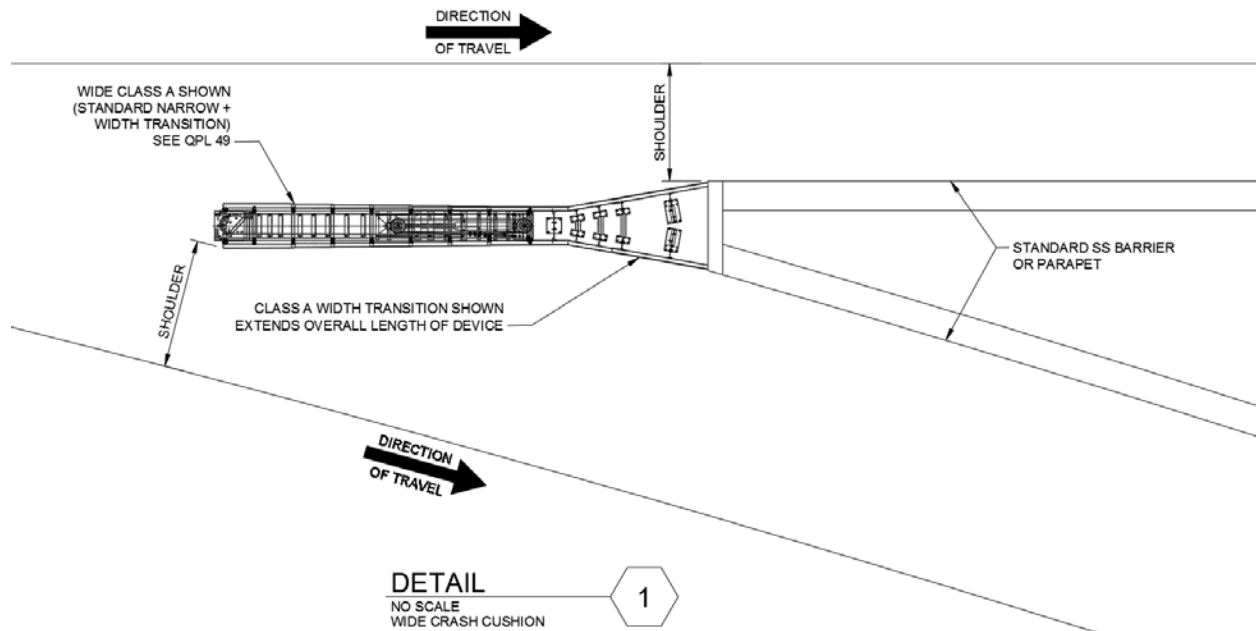
Use Pay item:

8057370	<u>Wide Crash Cushion 3A</u>	EA
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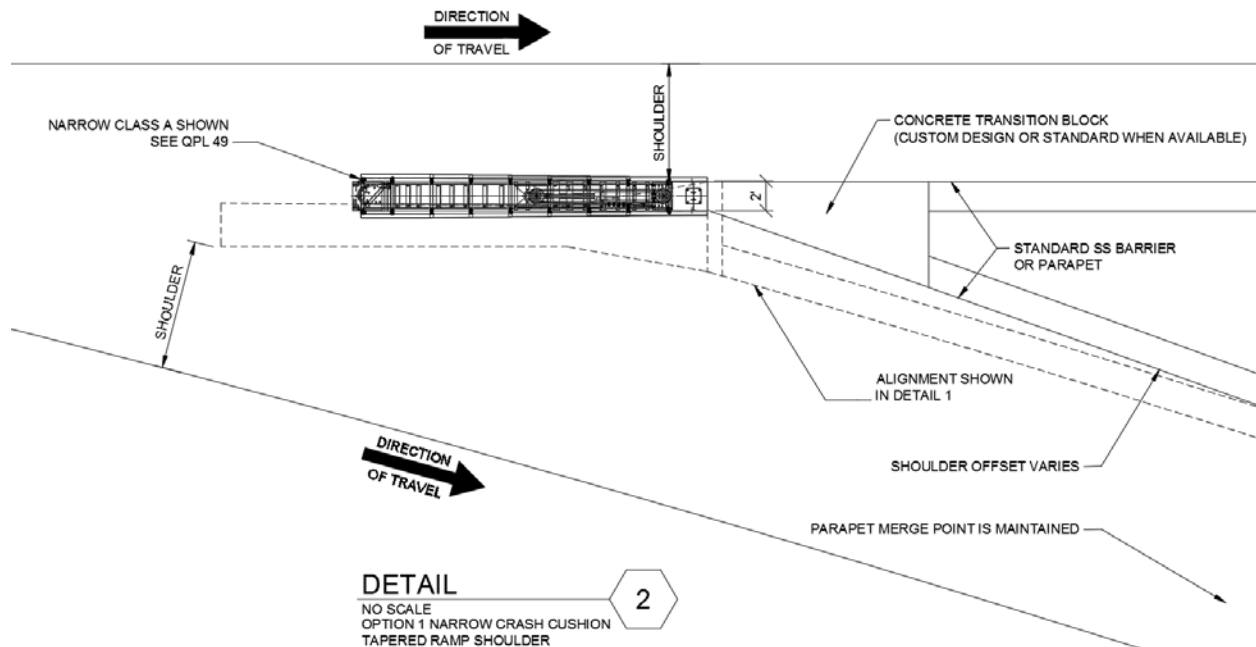
(8057375 is not recommended because of the work requirements in a high volume multi-lane gore)

Additionally, when noting the pay item in the plans, include the appropriate note:  
“for 72” wide roadside barrier wall”

### Details

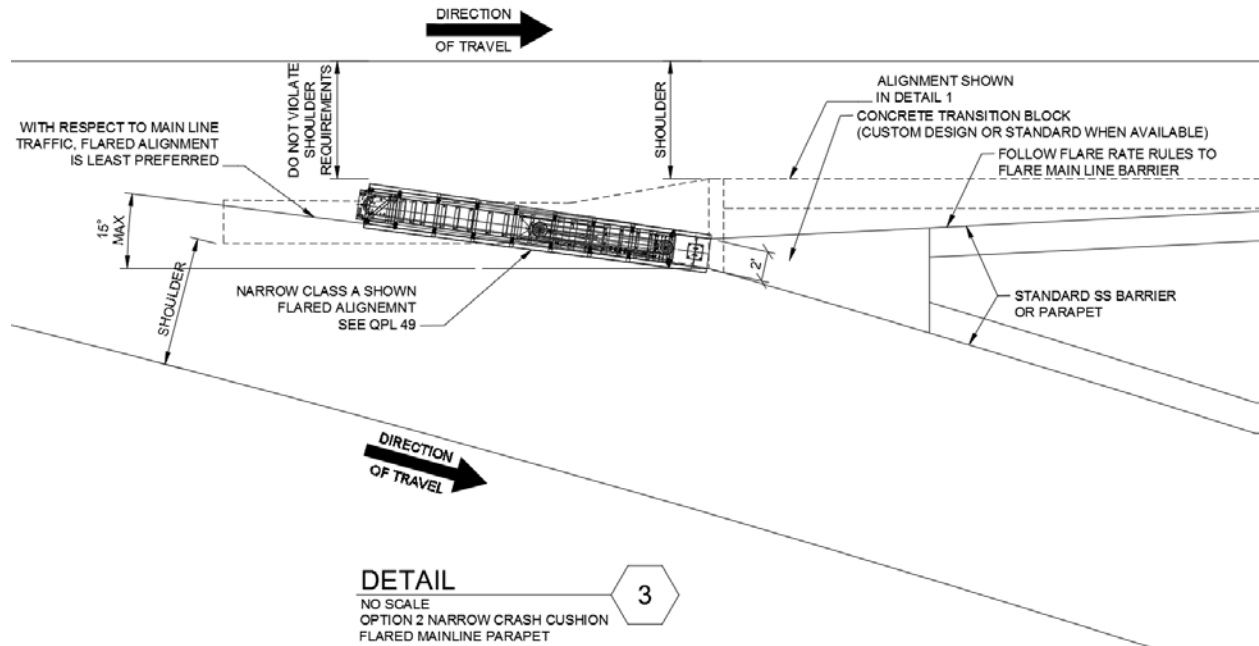


Detail 1 shows a common condition where a wide crash cushion might be used.

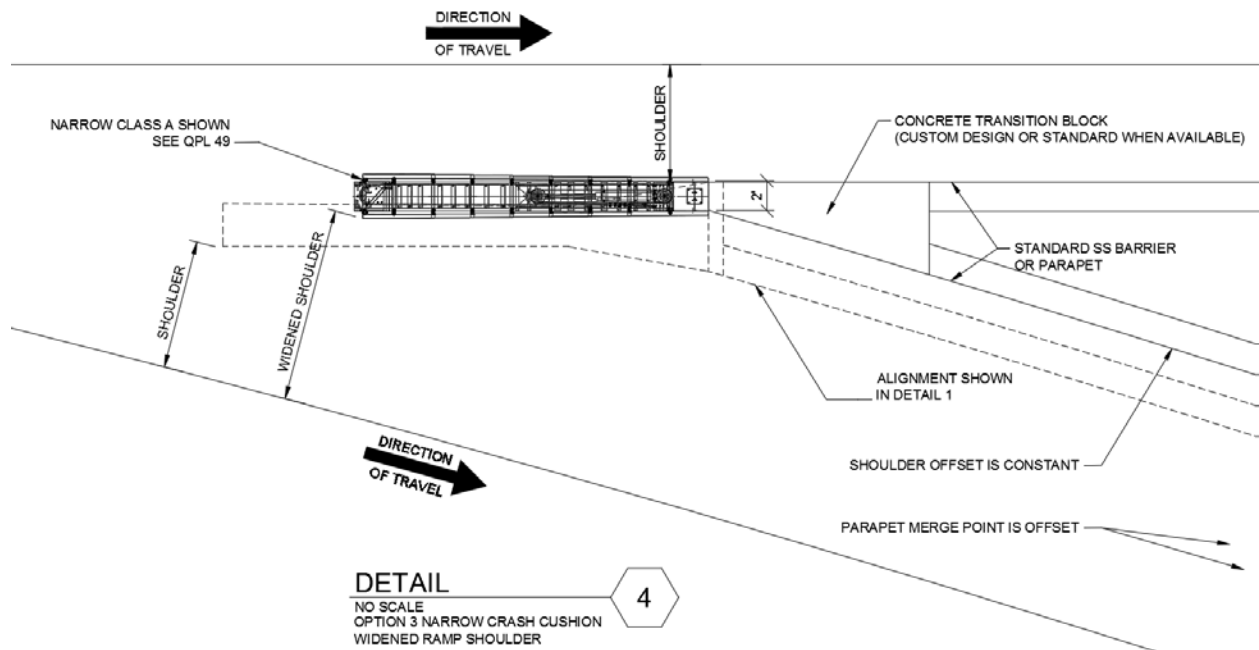


Detail 2 shows the wide crash cushion configuration of detail 1 with an alternate barrier design superimposed to facilitate a narrow crash cushion. In this case, the ramp shoulder is tapered gradually so that the ramp barrier meets the back of the tangent barrier and the trailing end of the ramp is unaltered.





Detail 3 shows the wide crash cushion configuration of detail 1 with an alternate barrier design superimposed to facilitate a narrow crash cushion. In this case, the mainline shoulder is flared so that it meets the back of the ramp barrier. In this case, the narrow crash cushion can be installed with a maximum flare of 15 degrees to keep it from encroaching on the ramp shoulder.



Detail 4 shows the wide crash cushion configuration of detail 1 with an alternate barrier design superimposed to facilitate a narrow crash cushion. In this case, the ramp shoulder is widened at a constant distance so that the ramp barrier meets the back of the tangent barrier. Offsetting the ramp barrier (details 2 and 4) and flaring the mainline barrier (detail 3) may be used together as needed.