



South Carolina  
Department of Transportation

## PRECONSTRUCTION DESIGN MEMORANDUM

**MEMO:** PCDM-16

**SUBJECT:** Slope Flume Standards

**DATE:** September 28, 2018

**RE:** Standard Drawings 719-9xx-xx, 805-325-75, and 805-325-76

This memo provides clarification and guidance for the selection of appropriate flume drainage and pay items at typical bridge ends or other locations where flumes will be used.

Flumes will be divided into 3 segments as identified on Standard Drawing 805-325-75:

The **Roadway Portion** will include items needed to connect the roadway drainage to the inlet including the curb and gutter.

The **Inlet Portion** will include handwork construction needed between the roadway portion and the slope portion as well as the material and installation of non-mow strip along the shoulder in the area of the flume.

The **Slope Portion** will include the flume along the embankment slope and the rip-rap to dissipate the energy of the water at the bottom of the flume as well as the non-mow strip provided on the shoulder from the parapet end through the pavement taper. This portion will not be included for catch basin style inlet details.

Note that this document covers typical ditch/shoulder section. Curbed sections with sidewalk and guardrail can use any of the standard drainage structures that fit between the posts and do not extend beyond the back of the sidewalk (CB16B is not recommended because it will conflict with the guardrail posts).

An example has been provided at the end of this memorandum to assist designers with implementation of this guidance.



## **PRECONSTRUCTION DESIGN MEMO 16**

Page 2 of 7

### **1.0 Roadway Portion**

Typically flumes are used adjacent to bridge ends. The geometry of the roadway section generally tapers (widens) as it approaches bridge section.

For Test Level 3, include a minimum 33' of **7203210 Concrete Curb & Gutter 2'-0"** **Vertical Face** with FOC aligned with the face of the bridge parapet or other structure using the MASH Thrie-Beam Bridge Connector TL3 shown on drawing 805-325-70 Detail 71 (for Test Level 2, include a minimum 17.5' as shown on Detail 72). The Designer may increase the length of this curb in 6.25" increments if needed to locate the flume further away from the end of the bridge/structure. In locations where the guardrail is not connected to a bridge parapet or rigid barrier, the curb length should be determined by the hydraulic engineer or may be continuous through the roadway section. Note that guardrail may not be required in some locations, but the flume inlet is sized to accommodate a future guardrail installation.

The designer should increase pavement quantities to fill the area between the curb and gutter and the typical roadway section (see Standard Drawing 805-325-75). This area should extend from the back of curb at a 4:1 taper in advance of the flume location and fill the entire area between the curb and gutter and the typical roadway section. The additional pavement will typically be established utilizing the shoulder pavement design; however, the designer may choose to utilize the roadway pavement design based upon contextual site conditions.

### **2.0 Inlet Portion**

Details of the inlet portions are located in the Standard Drawing subsections that specify the item that the inlet must penetrate since these items must be coordinated in order to minimize construction conflicts. The following subsections specify inlets that are currently available or planned for the near future. For each item, provide appropriate **Roadway Portion** and **Slope Portion** quantities unless indicated otherwise. Catch Basin style inlets should be tied to either closed drainage system or a stub outlet pipe. Use methods shown in sections 2.2 or 2.3 for the **Inlet Portion** and **Slope Portion** of catch basin style inlets.

#### **2.1 Inlet Portion (at Guardrail or Standalone)**

Standard Drawing 805-325-75 shows the **8053257 Flume Inlet at Guardrail (Handwork)** needed to connect the roadway portion to the flume portion. This detail is required when placing the flume between 2 standard guardrail posts (6'-3" post spacing.)

Include **one (1) Flume Inlet at Guardrail (Handwork)** quantity for each flume location selected.

Include a minimum 25 square yards of **8055250 NON-MOW STRIP UNDER GUARDRAIL** to cover the shoulder from the end of the bridge parapet through the pavement taper beyond the end of the curb. (20 square yards for MTBBC2 configuration.) Increase these quantities as appropriate if additional curb length or flumes are provided in the design or when

## **PRECONSTRUCTION DESIGN MEMO 16**

Page 3 of 7

non-mow strip will be provided throughout the guardrail length. This non-mow strip is intended to reduce maintenance issues around the guardrail in this area as well as help with possible surface erosion in the event that some water does bypass the flume at the end of the curb taper.

### **2.2 Inlet Portion (Catch Basin Type 16 at Guardrail, “Closed System”)**

Standard Drawing 805-325-30 and 805-325-50 show the pay items for using a Catch Basin Type 16 [719-016-xx] for the inlet at guardrail. When this option is selected, provide the appropriate **Roadway Portion** quantities to connect the surface drainage to this inlet.

Follow instructions from the Hydraulic designer for the pipe size needed to connect the Catch Basin 16 to an adjacent drainage structure.

**NOTICE TO HYDRAULIC DESIGNER** - Set cover over pipe a minimum 4' when pipe is located under standard guardrail posts.

Use a standard **7191605 Catch Basin Type 16**. Other standard catch basins for 6" vertical face curb are not recommended between standard guardrail post spacing. Multiple CB16's can be considered; however, each additional CB16 would be spaced at 6'-3" to be centered on the guardrail posts. In addition, the stub pipe between the boxes would need sufficient fill height cover so that guardrail posts can be driven and replaced without damaging the pipe segments.

Include appropriate Pipe and Box quantities to tie this inlet to an adjacent drainage structure.

For the Catch Basin Closed System style flume inlet, no additional **Slope Portion** quantities are required from section 3.0.

### **2.3 Inlet Portion (Catch Basin Type 16 At Guardrail, “Drop Box”)**

Standard Drawing 805-325-30 and 805-325-50 show the pay items for using a Catch Basin Type 16 [719-016-xx] for the inlet at guardrail. When this option is selected, provide the appropriate **Roadway Portion** quantities to connect the surface drainage to this inlet.

Do not use this detail for embankment heights in excess of 25' without coordinating with the Geotechnical designer to obtain a settlement analysis at the Drop Box. When using a Drop Box to bring the water to an elevation near the toe of the slope, include an outlet stub pipe and outlet rip-rap protection (804-305-xx or 805-310-xx.) Do not use brick masonry construction for Drop Boxes and add the note “Precast Only” to the plan label for these structures.

Drop Box Height = Top of Curb Elevation at CB16 – Flow line of outlet pipe (bottom invert) inside box + 2'. Drop box height should be approximately equal to embankment height at the location of the CB16. [This overall height of the box should not exceed 25' without further structural & geotechnical evaluation.]

## **PRECONSTRUCTION DESIGN MEMO 16**

Page 4 of 7

Contact the Hydraulic designer for outlet pipe size and type, invert elevation inside Drop Box, pipe outlet location (typically in outfall ditch), pipe outlet detail (beveled end, etc.) and rip-rap/geotextile at the outlet end if more than 10 tons is required.

In the event that more than one CB16 inlet is required, connect as described in section 2.2 and construct only the shortest overall box as the Drop Box outlet. Size the outlet stub pipe appropriately based on the number of catch basins connected.

Calculate **Stub Pipe [size, type] Length** by measuring from the center of the catch basin to the designated outlet location.

Include **Beveling of Pipe End** where specified by the Hydraulic designer.

Use Standard Drawings 805-305-XX at outlet end of stub pipe unless specified otherwise by the Hydraulic designer to determine **Rip-Rap** and **Geotextile under Rip-Rap** at outlet end.

As with the flume option, include a minimum 25 square yards of **8055250 NON-MOW STRIP UNDER GUARDRAIL** to cover the shoulder from the end of the bridge parapet through the pavement taper beyond the end of the curb. (20 square yards for MTBBC2 configuration.) Increase these quantities as appropriate if additional curb length or CB16s are provided in the design or when non-mow strip will be provided throughout the guardrail length. This non-mow strip is intended to reduce maintenance issues around the guardrail in this area as well as help with possible surface erosion in the event that some water does bypass the CB16 at the end of the curb taper.

For the Catch Basin Drop Box style flume inlet, no additional **Slope Portion** quantities are required from section 3.0.

### **2.4 Inlet Portion (At Rigid Barrier Moment Slab)**

This inlet is under development – check standard drawings (805-8xx series) for availability. Estimated 2019 publication.

### **2.5 Inlet Portion (At Sidewalk Bypass)**

This inlet is under development – check standard drawings (720 series) for availability. Estimated late 2019 publication.

### **2.6 Custom Inlets**

Custom inlets may be developed and provided in the project plans. Include all details and quantities to complete construction when providing custom inlets.

## **PRECONSTRUCTION DESIGN MEMO 16**

Page 5 of 7

### **3.0 Slope Portion**

Standard Drawing 719-920-xx shows the **7199200 4' Slope Flume (6" Curb Style with Cutoffs)**. Measure this item along the slope from the shoulder break to the toe of the embankment in linear feet.

Use only straight runs for the flume. Bends or turns in the flume are discouraged because they will increase the chance that debris will get trapped in the flume or that water could come out of the flume and cause erosion. Once the water is collected at the toe of the slope, the direction can be changed using the outfall alignment.

Include a minimum 25 square yards of **8048210 GEOTEXTILE FABRIC FOR EROSION CONTROL UNDER RIP-RAP (CLASS 2) TYPE C** to place under the rip-rap at each flume end.

Include a minimum 10 tons of **8041020 RIP-RAP (CLASS B)** at the base of each flume. This weight of rip-rap will cover approximately 8'x10' area 2' deep. Use Class B rip-rap, or if the outlet is connected to larger size rip-rap, add this quantity to the larger size.

Where rip-rap is tied to other rip-rap (such a ditch lining), provide enough total quantity to construct base of flume with other specified rip-rap. If the connected rip-rap is larger than Class B, use the larger size rip-rap at the bottom end of the flume as well.

# **PRECONSTRUCTION DESIGN MEMO 16**

Page 6 of 7

## **4.0 Summary of Pay Items**

	<b>ROADWAY PORTION:</b>	
<b>7203210</b>	<b>CONCRETE CURB AND GUTTER(2'-0") VERTICAL FACE</b>	<b>LF</b>
	<b>PAVEMENT QUANTITIES (VARIES)</b>	
	<b>INLET PORTION:</b>	
<b>8053257</b>	<b>FLUME INLET AT GUARDRAIL (HANDWORK)</b>	<b>EA</b>
<b>8055250</b>	<b>NON-MOW STRIP UNDER GUARDRAIL</b>	<b>SY</b>
	<b>SLOPE PORTION:</b>	
<b>7199200</b>	<b>4' SLOPE FLUME (6" CURB STYLE WITH CUTOFFS)</b>	<b>LF</b>
<b>8041020</b>	<b>RIP-RAP (CLASS B)</b>	<b>TON</b>
<b>8048210</b>	<b>GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP(CLASS 2)TYPE C</b>	<b>SY</b>

January 2019 Letting

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George R. Bedenbaugh, Jr.  
Preconstruction Support Engineer

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

## PRECONSTRUCTION DESIGN MEMO 16

Page 7 of 7

### Example:

A flume is specified near the end of the bridge shown in figure 1.

The embankment is 2:1 slope and is 18' tall at the flume location. Flume length along this slope =  $\sqrt{(18ft)^2 + (36ft)^2} = 40.25'$  or can be dimensioned along the slope of a scaled cross section drawing.

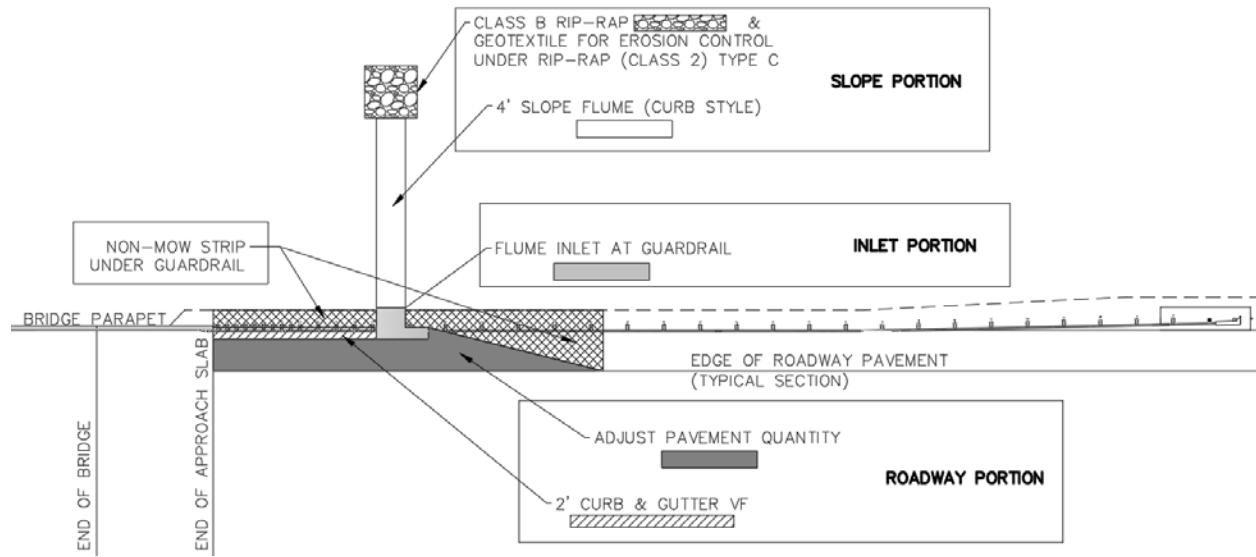


Figure 1

### Roadway Portion:

- Use 33 LF of **Concrete Curb & Gutter (2'-0) Vertical Face** (closest location to bridge)
- Calculate additional **shoulder or pavement quantities** to fill the area in the transition to the bridge. Provide measurement units consistent with quantities already in use on the project.

### Inlet Portion:

- Use 1 EA **Flume Inlet at Guardrail (Handwork)** (for this flume location)
- Use 25 SY of **Non-Mow Strip Under Guardrail** (adjust if applying through entire guardrail length or when using multiple flume inlets)

### Slope Portion:

- Use 41 LF of **4' Slope Flume**
- Use 10 TON of **Rip-Rap Class B**
- Use 25 SY of **Geotextile for Erosion Control (Class 2) Type C**