South Carolina
Department of Transportation

PRECONSTRUCTION DESIGN MEMORANDUM

MEMO: PCDM-15

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

SUBJECT: Slope Flume Standards

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 –

The **Roadway Portion** will include items needed to connect the roadway drainage to the inlet.

The **Inlet Portion** will include handwork construction needed between the roadway portion and the slope portion.

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. 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 would conflict with the guardrail posts, so is not recommended.)

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.

Include at least 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. (Include at least 17.5’ for TL2 conditions 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

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that guardrail may not be required in some locations, but the flume inlet is sized to accommodate a future guardrail installation.

Increase pavement quantities. Designer should include sufficient pavement quantities to fill the gap between the curb and gutter and the typical roadway section. The 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. Use engineering judgement to determine if the additional pavement quantities are based on roadway pavement or shoulder pavement based on the site conditions.

2.0 Inlet Portion

Details of the Inlet portions are located in the drawing subsection detailing the item that the inlet must penetrate since these items must be coordinated in order to minimize construction conflicts. The following subsections list inlets 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. Quantities shown in yellow replace the slope portion for 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) but may be used in locations without guardrail as well.

Include **one (1) Flume Inlet At Guardrail (Handwork)** quantity for each flume location selected. Note that this inlet is required if the flume is under guardrail but may be used in locations were guardrail is not present.

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 Engineer for the outlet pipe size and type (smooth or corrugated), needed at the Catch Basin 16 inlet and what nearby drainage structure to connect the outlet end of the pipe.

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

Use a standard **7191605 Catch Basin Type 16.**

Calculate length of pipe needed to reach designated outlet drainage structure. Include appropriate **Pipe Quantity** and labels in plans.

Calculate **Extra Depth of Box** if catch basin depth exceeds 6'. Extra depth of box = Gutter Elevation + 1.0 FT – Flow Line Elevation of Outlet Pipe in box – 6' (include in CB16) {do not include this quantity if calculation is less than 0.5 ft.}

For the Catch Basin Closed System style flume inlet, no additional **Slope Portion (section 3)** quantities are required.

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 a settlement analysis (Geotechnical Engineer) 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. Do not use brick masonry construction for drop boxes, add the note "Precast Only" to the plan label for these structures.

Drop Box Height = Curb Elevation at CB16 – Flow line of outlet pipe inside box + 2' Approx Drop box height should be approximately equal to embankment height at the location of the CB16.

Contact the Hydraulic Engineer for outlet pipe size, type (smooth or corrugated), invert elevation inside drop box, pipe outlet location (typically in outfall ditch), pipe outlet detail (beveled end, or other,) and rip-rap/geotextile at the outlet end if more than 10 tons is required.

Use a standard **7191605 Catch Basin Type 16.**

Calculate **Extra Depth of Box** = Drop Box Height – 6' (portion included in CB16 item) [This amount should not exceed 19' without further structural evaluation]

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 Engineer.

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

For the Catch Basin Drop Box style flume inlet, no additional **Slope Portion (section 3)** quantities are required.

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.

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

3.0 Slope Portion:

Standard Drawing 719-920-xx show 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 at least 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 at least 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 not to construct flume with other quantities. If the connected rip-rap is larger than Class B, use the larger size rip-rap at the bottom end of the flume.

Pay Items

	ROADWAY PORTION:	
7203210	**CONCRETE CURB AND GUTTER(2'-0") VERTICAL FACE**	**LF**
	PAVEMENT QUANTITIES (VARY)	

	INLET PORTION:	
8053257	**FLUME INLET AT GUARDRAIL (HANDWORK)**	**EA**
	SLOPE PORTION:	
7199200	**4' SLOPE FLUME (6" CURB STYLE WITH CUTOFFS)**	**LF**
8041020	**RIP-RAP (CLASS B)**	**TON**
8048210	**GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP(CLASS 2)TYPE C**	**SY**

Pay items for Catch Basin Style inlets not included in this summary.

The above procedures are recommended to calculate quantities to complete Slope Flume details where required. The designer is encouraged to use this procedure on all projects.

Example 1:

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 = (18'^2 + 36'^2)^(.5) = 40.25' or can be dimensioned along the slope of a scaled cross section drawing.

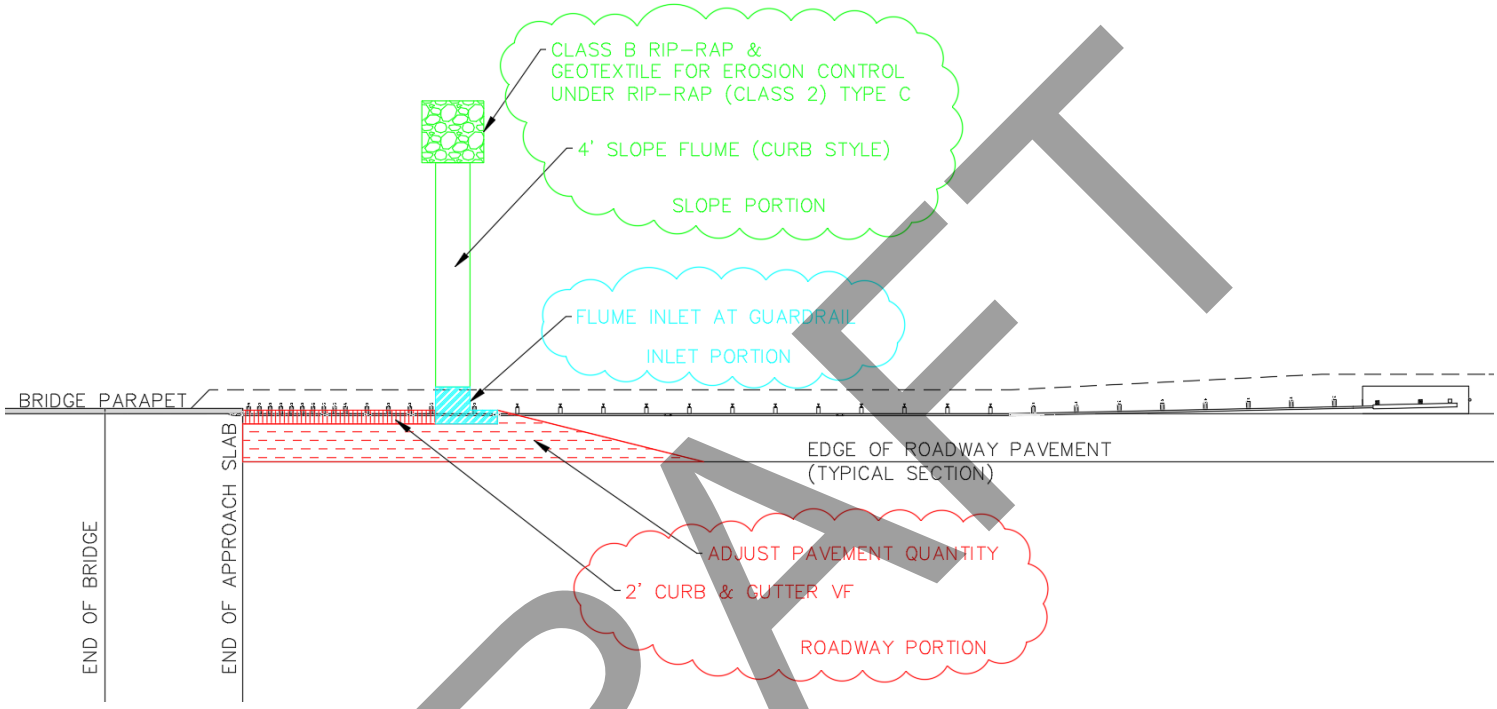

Figure 1

- 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**
- Use 1 EA **Flume Inlet at Guardrail (Handwork)** (for this flume location)
- 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.

Implementation Schedule:

For all projects letting in January 2019 as well as projects that have not been submitted to Right of Way by the publication date of this document, follow these procedures for slope flumes and inlets with or without guardrail. The designer is encouraged to use this procedure on all other projects prior to January 2019 if quantities have not been finalized. Note that additional style flume inlets may be used as they become available or when included in the project plans or special provisions.

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George R. Bedenbaugh, Jr. Effective Date
Preconstruction Support Engineer

GRB:hjc
ec:

John Boylson, 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
Tad Kitowicz, FHWA
Betsy McCall, DM – Lowcountry
Leah Quattlebaum RP Engineer - Pee Dee
Phillip Sandel RP Engineer - Midlands
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