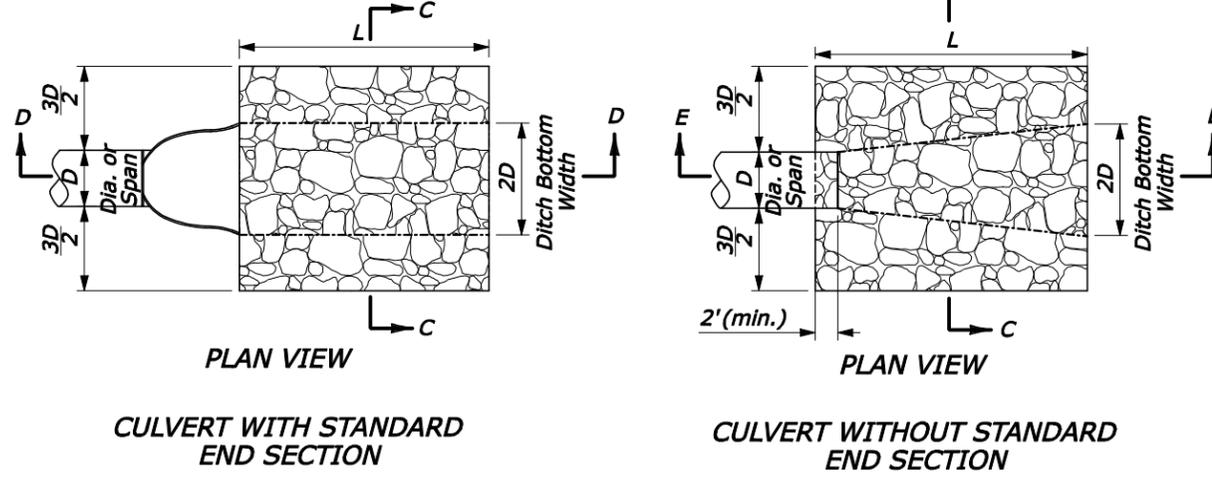


SECTION A-A SECTION B-B

PROTECTIVE APRON AT CULVERT OUTLET WITHOUT DITCH

OUTLET WITHOUT DITCH PROTECTIVE APRON DIMENSIONS AND ESTIMATED QUANTITIES						
	CULVERT SIZE D (inches)	RIPRAP CLASS	LENGTH OF APRON L (feet)	DEPTH OF APRON H (feet)	ESTIMATED RIPRAP QUANTITY (CY)	ESTIMATED GEOTEXTILE QUANTITY (SY)
WITH END SECTION	12	2	4	1.5	1	5
	18	2	6	1.5	2.2	9
	24	2	8	1.5	3.9	14
	30	3	12.5	2	10.9	28
	36	3	16	2	15.6	37
	42	4	21	2.5	34.1	63
WITHOUT END SECTION	12	2	6	1.5	1.7	8
	18	2	8	1.5	3.2	12
	24	2	10	1.5	5.2	17
	30	3	14.5	2	13.3	33
	36	3	17	2	18.5	43
	42	4	23	2.5	38.7	70

- NOTE:**
1. Use for aprons serving culverts with slopes of less than 10%.
 2. Furnish geotextile conforming to Subsection 714.01(a).
 3. Excavation for placement of riprap will not be measured for payment.



PLAN VIEW PLAN VIEW SECTION C-C SECTION D-D SECTION E-E

PROTECTIVE APRON AT CULVERT OUTLET WITH DITCH

OUTLET WITH DITCH PROTECTIVE APRON DIMENSIONS AND ESTIMATED QUANTITIES						
	CULVERT SIZE D (inches)	RIPRAP CLASS	LENGTH OF APRON L (feet)	DEPTH OF APRON H (feet)	ESTIMATED RIPRAP QUANTITY (CY)	ESTIMATED GEOTEXTILE QUANTITY (SY)
WITH END SECTION	12	2	4	1.5	0.9	5
	18	2	6	1.5	2	8
	24	2	8	1.5	3.6	13
	30	3	12.5	2	9.3	24
	36	3	15	2	13.4	32
	42	4	21	2.5	27.3	53
WITHOUT END SECTION	12	2	6	1.5	1.4	6
	18	2	8	1.5	2.7	10
	24	2	10	1.5	4.5	15
	30	3	14.5	2	10.8	27
	36	3	17	2	15.2	36
	42	4	23	2.5	29.9	57

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

U.S. CUSTOMARY DETAIL

**PLACED RIPRAP
AT CULVERT OUTLETS**

DETAIL APPROVED FOR USE 07/2004
REVISOR: 08/2006 03/2009 11/2010 04/2011

DETAIL
C251-50



NOTES TO THE DESIGNER

Last Updated: April 2011

General Information

1. **Maximum slope.** Riprap aprons shown in this drawing can be used for culvert outlets with slopes up to 10%. For steeper applications, use alternate protective aprons, such as revet mattresses.
2. **Riprap classes.** Use these drawings with either the FP-03 riprap classifications or the NCHRP classifications (See the Section 251 SCRs on the LOS).

Applicable SCRs

1. Section 251:
http://www.cflhd.gov/resources/design/constructspecs/scr/documents/scr_03/S251-03E.doc
2. Section 602:
http://www.cflhd.gov/resources/design/constructspecs/scr/documents/scr_03/S602-03E.doc
3. Section 705:
http://www.cflhd.gov/resources/design/constructspecs/scr/documents/scr_03/S705-03E.doc

Typical Pay Items Used

- 25101-2000 Placed riprap, class 2 and/or
- 25101-3000 Placed riprap, class 3 and/or
- 25101-4000 Placed riprap, class 4

- 60201-0700 [12-inch to 48-inch] pipe culvert
- 60210-0700 End section for [12-inch to 48-inch] pipe culvert

- Geotextile quantity is shown for information only

Updates

October 16, 2000

- Updated border to FLH Standard

February 2, 2005

- Updated to MicroStation V8

March 2009

- Added drawings of aprons in ditches
- Added quantity tables
- Moved riprap rundown at culvert inlet to template drawing

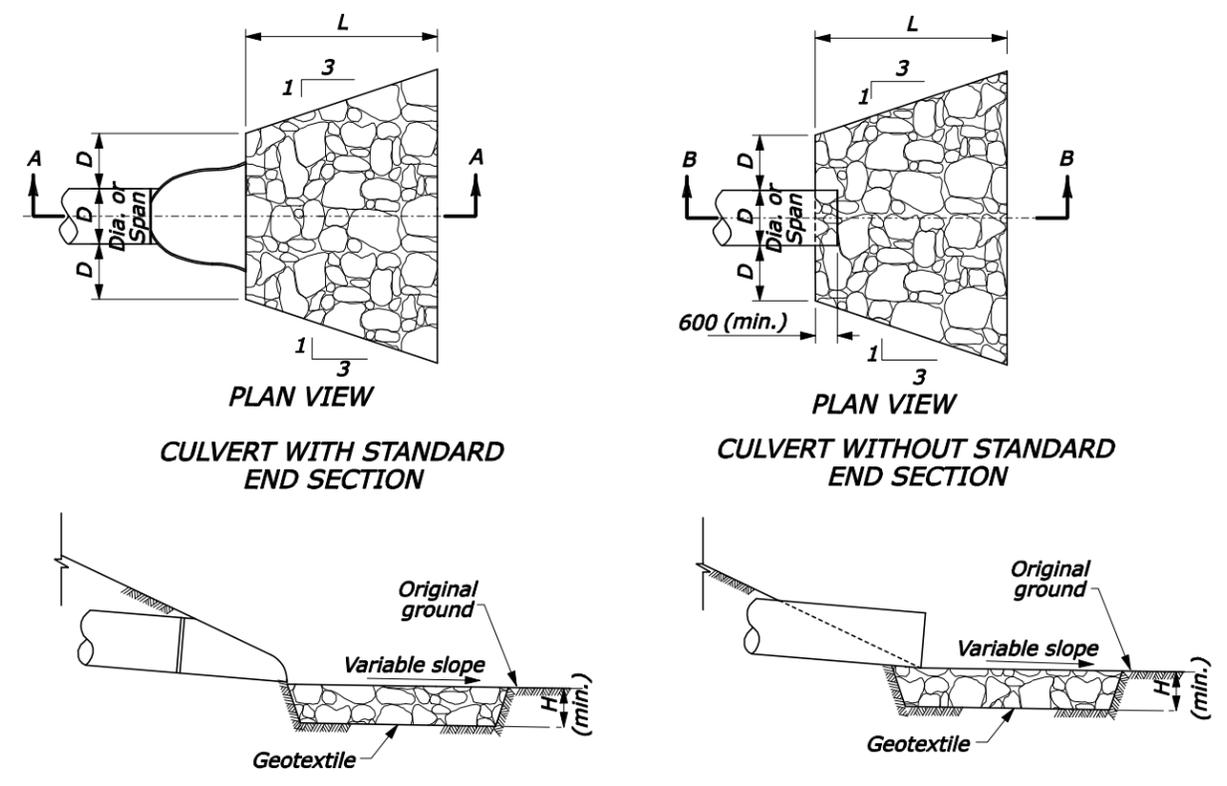
November 2010

- Revised Section C-C and quantity table for outlet with ditch

April 2011

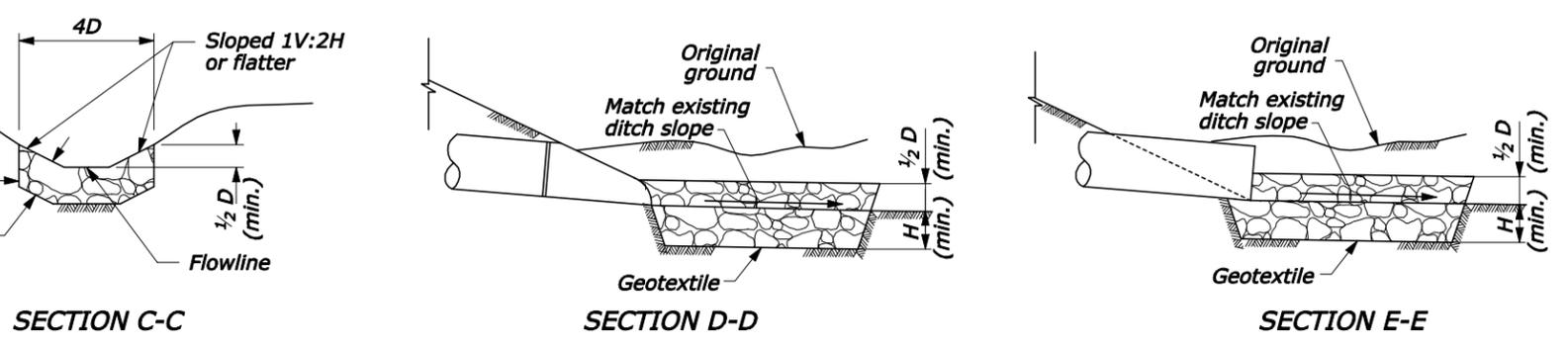
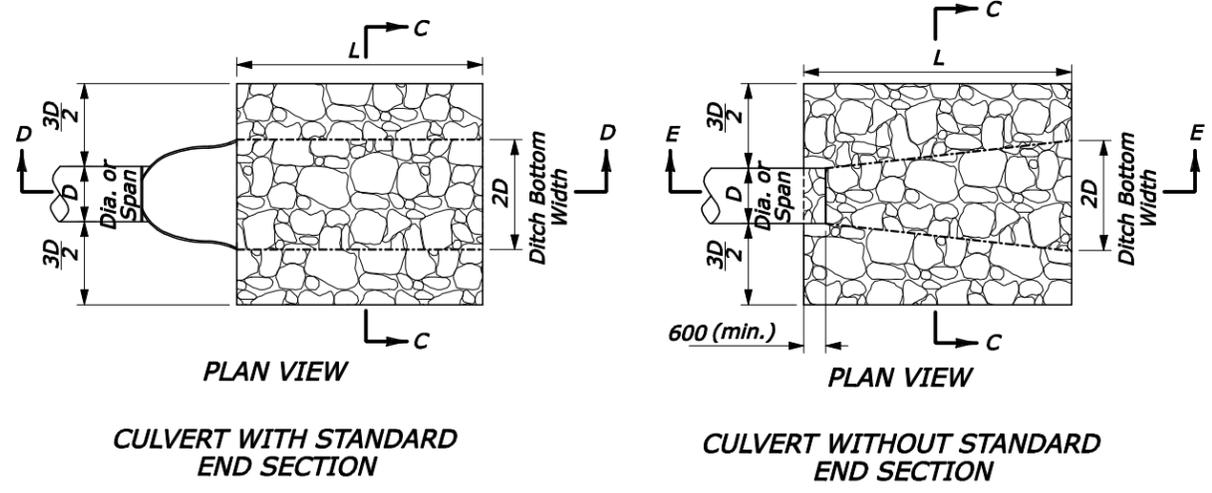


- Eliminated riprap apron under end section



SECTION A-A SECTION B-B

PROTECTIVE APRON AT CULVERT OUTLET WITHOUT DITCH



PROTECTIVE APRON AT CULVERT OUTLET WITH DITCH

**OUTLET WITHOUT DITCH
PROTECTIVE APRON DIMENSIONS AND ESTIMATED QUANTITIES**

	CULVERT SIZE D (mm)	RIPRAP CLASS	LENGTH OF APRON L (m)	DEPTH OF APRON H (m)	ESTIMATED RIPRAP QUANTITY (m3)	ESTIMATED GEOTEXTILE QUANTITY (m2)
WITH END SECTION	300	2	1.2	0.5	0.8	5
	450	2	1.8	0.5	1.8	8
	600	2	2.4	0.5	3.2	12
	750	3	3.8	0.6	7.9	23
	900	3	4.5	0.6	11.4	30
	1200	4	7.2	0.8	34.6	65
WITHOUT END SECTION	300	2	2.2	0.5	1.8	8
	450	2	2.8	0.5	3.2	12
	600	2	3.4	0.5	5	17
	750	3	4.8	0.6	11	29
	900	3	5.5	0.6	15	38
	1200	4	7.3	0.8	32.7	63
1200	4	8.2	0.8	41.6	76	

NOTE:

1. Use for aprons serving culverts with slopes of less than 10%.
2. Furnish geotextile conforming to Subsection 714.01(a).
3. Excavation for placement of riprap will not be measured for payment.

**OUTLET WITH DITCH
PROTECTIVE APRON DIMENSIONS AND ESTIMATED QUANTITIES**

	CULVERT SIZE D (mm)	RIPRAP CLASS	LENGTH OF APRON L (m)	DEPTH OF APRON H (m)	ESTIMATED RIPRAP QUANTITY (m3)	ESTIMATED GEOTEXTILE QUANTITY (m2)
WITH END SECTION	300	2	1.2	0.5	0.8	4
	450	2	1.8	0.5	1.3	7
	600	2	2.4	0.5	2.2	10
	750	3	3.8	0.6	6.8	20
	900	3	4.5	0.6	9.8	26
	1200	4	6.3	0.8	21.2	44
WITHOUT END SECTION	300	2	2.2	0.5	1.4	7
	450	2	2.8	0.5	2.6	10
	600	2	3.4	0.5	4.1	14
	750	3	4.8	0.6	8.6	24
	900	3	5.5	0.6	11.9	31
	1200	4	7.3	0.8	24.6	50
1200	4	8.2	0.8	31.5	61	

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

METRIC DETAIL

**PLACED RIPRAP
AT CULVERT OUTLETS**

DETAIL APPROVED FOR USE 07/2004
REVISD: 08/2006 03/2009 11/2010 04/2011

DETAIL
CM251-50



NOTES TO THE DESIGNER

Last Updated: April 2011

General Information

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2. Section 602:
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3. Section 705:
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Typical Pay Items Used

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Updates

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- November 2010 - Revised Section C-C and updated quantity table for outlet with ditch
- April 2011 - Eliminated riprap apron under end section