

APPENDIX

F. APPLICATION GUIDELINES FOR PIPE END TREATMENTS

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Table F-1: Application Guidelines for Pipe End Treatments - Part A

(see page F-3 for notes)

Standard Plan Index	Description		Application			Inlet End		
	Type	Pipe Size	Cross Drain	Side Drain	Median	Application	Hydraulic Performance	K _e
430-010	U Type Concrete With Grate	Single 15" thru 30"	Limited	Limited	Yes	Yes	Fair	0.7
430-011	U Type Concrete	Single 15" thru 30"	Limited	No	Yes	Limited	Good	0.5 to 0.7
430-012	Concrete Energy Dissipater	Single 30" thru 72"	Limited	No	No	No	NA	NA
430-020	Flared End Section Concrete	Single 12" thru 72"	Yes	No	Yes	Yes	Good	0.5
430-021	Cross Drain Mitered End Section	Single & Multiple 15" thru 72"	Yes	No	Yes	Yes	Fair	0.7
430-022	Side Drain Mitered End Section	Single & Multiple 15" thru 60"	No	Yes	No	Yes	Fair	0.7 w/o, 1.0 w/ grate
430-030	Straight Concrete	Single & Multiple 15" thru 54"	(a) Yes	No	Limited	Yes	Excellent	0.2
430-031	Straight Concrete	Single & Double 60"	Yes	No	Limited	Yes	Excellent	0.2
430-032	Straight Concrete	Single & Double 66"	Yes	No	Limited	Yes	Excellent	0.2
430-033	Straight Concrete	Single & Double 72"	Yes	No	Limited	Yes	Excellent	0.2
430-034	Straight Concrete	Single 84"	Yes	No	Limited	Yes	Excellent	0.2
430-040	Winged Concrete	Single 12" thru 48"	Yes	No	Yes	Yes	Very Good	0.3

Table F-2: Application Guidelines for Pipe End Treatments - Part B

(see page F-3 for notes)

Standard Plans Index	Description		Outlet End		Safety		Economic Rating
	Type	Pipe Size	Applicable	Erosion Tolerance	Permitted Location	Traffic-Safe Grate Available	
430-010	U Type Concrete With Grate	Single 15" thru 30"	Yes	Very Good	Inside CZ	Required	Good
430-011	U Type Concrete	Single 15" thru 30"	Yes	Good	Grate Required Inside CZ	Yes	Fair
430-012	Concrete Energy Dissipater	Single 30" thru 72"	Yes	Excellent	Outside CZ	No	NA
430-020	Flared End Section Concrete	Single 12" thru 72"	Yes	(c) Very Good	(c) Outside CZ	No	Very Good
430-021	Cross Drain Mitered End Section	Single & Multiple 15" thru 72"	Yes	Good	(d) Outside CZ	No	Very Good
430-022	Side Drain Mitered End Section	Single & Multiple 15" thru 60"	Yes	Good	(e) Inside CZ	Yes	Good
430-030	Straight Concrete	Single & Multiple 15" thru 54"	Limited	Good	Outside CZ	No	Fair
430-031	Straight Concrete	Single & Double 60"	Limited	Good	Outside CZ	No	Fair
430-032	Straight Concrete	Single & Double 66"	Limited	Good	Outside CZ	No	Fair
430-033	Straight Concrete	Single & Double 72"	Limited	Good	Outside CZ	No	Fair
430-034	Straight Concrete	Single 84"	Limited	Good	Outside CZ	No	Fair
430-040	Winged Concrete	Single 12" thru 48"	Yes	Good	Outside CZ	No	Good

LEGEND:

- (a) For back of sidewalk location, see Standard Plans, Index 425-060.
- (b) For temporary construction or use on a minor facility.
- (c) Construction of optional toewall and concrete jacket may be necessary. Flared end section sizes 12 inch and 15 inch may be located as close as 8 feet beyond the outside edge of the shoulder.
- (d) Mitered end section sizes 15 inch, 18 inch, and 24 inch may be located as close as 8 feet beyond the outside edge of the shoulder.
- (e) Mitered end section size 30 inch and larger does not require a grate if pipe is located outside CZ and is offset from approach ditch alignment.

NOTES:

- 1. All end treatments must be selected to satisfy hydraulic suitability with proper consideration given to safety and economics.
- 2. CZ denotes clear zone; it was formerly CRA, denoting clear recovery area.
- 3. Grates should not be placed on outlet ends unless positive debris protection is provided at inlet end.
- 4. Additional notes concerning application restrictions may be shown on individual indexes.
- 5. Economic ratings are based on statewide average costs.
- 6. End treatments with a K_e of 0.5 or greater should be used only in areas of low design velocities and negligible debris.
- 7. Pipe sizes are circular, Class III B wall, concrete pipe. Elliptical pipe and corrugated pipe are to be checked for fit. Metal pipe sizes should be reviewed using 2 $\frac{3}{8}$ -inch x $\frac{1}{2}$ -inch corrugation up to 30 inches and 3-inch x 1-inch corrugation for larger sizes.