

Chapter 8 - Culverts

**Appendix 8D-2 Entrance Loss Coefficients (K_e),
Outlet Control, Full or Partly Full**

Type of Structure and Design of Entrance	Coefficient
<i>Pipe, Concrete</i>	
Mitered to conform to fill slope	0.7
*End-Section conforming to fill slope	0.5
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Square-edge	0.5
Rounded (radius = $D/12$)	0.2
Socket end of pipe (groove-end)	0.2
Projecting from fill, socket end (groove-end)	0.2
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
<i>Pipe, or Pipe-Arch, Corrugated Metal</i>	
Projecting from fill (no headwall)	0.9
Mitered to conform to fill slope, paved or unpaved slope	0.7
Headwall or headwall and wingwalls square-edge	0.5
*End-Section conforming and to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
<i>Box, Reinforced Concrete</i>	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of $D/12$ or $B/12$ or beveled edges on 3 sides	0.2
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Wingwalls at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls at 30° to 75° to barrel	
Crown edge rounded to radius of $D/12$ or beveled top edge	0.2
Square Edge at crown	0.4
Side-or slope-tapered inlet	0.2

*Note : "End Sections conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet.

Source HDS-5