Angular Deflection/Curvilinear Sewers

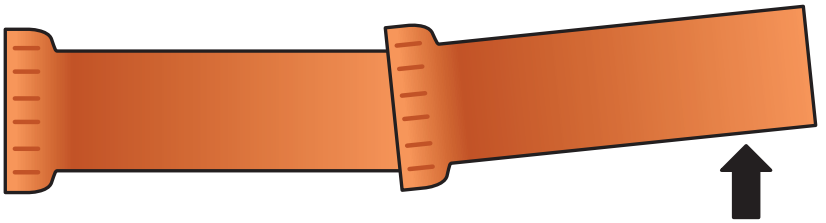

Figure 31: Angular deflection of joints along the pipeline can be intentional to create a curvilinear sewer. Modern VCP joints will maintain the specified leak-free performance.

The factory-applied joints of modern VCP pipe are designed to allow angular deflection while maintaining joint integrity (see the joint cutaway images on page 5 and 6). ASTM C425 (*Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings*) requires clay pipe joints to seal in angular deflection up to specified limits depending upon the pipe diameter (see the testing photos on page 7).

Figure 32: Installation of a curvilinear sewer

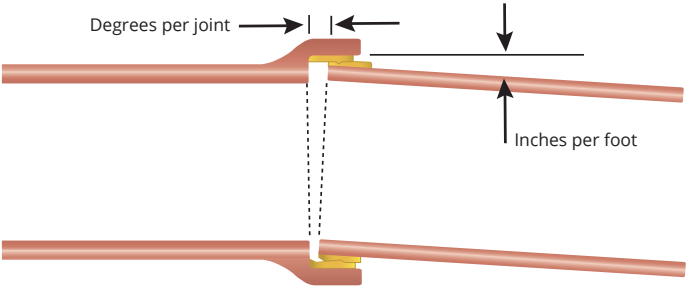

Figure 33: Cross-sectional plan view of an assembled joint in a curvilinear sewer. Note the design measurements and the intentional gap created at the outside radius of the curve.

Curvilinear sewers are designed using this angular deflection. Although there will be an apparent gap on one side due to the angular deflection, the joint is completely tight. See the photo below from inside the pipe to note the appearance of this condition.

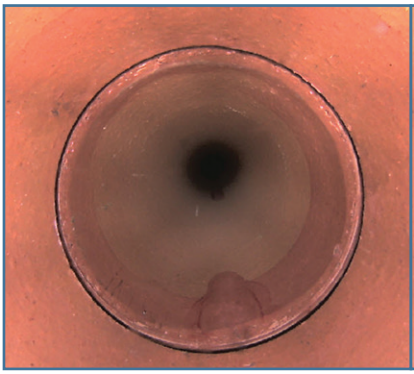

Figure 34: Vertical Angular Deflection
½-inch per foot (Section pulled up)

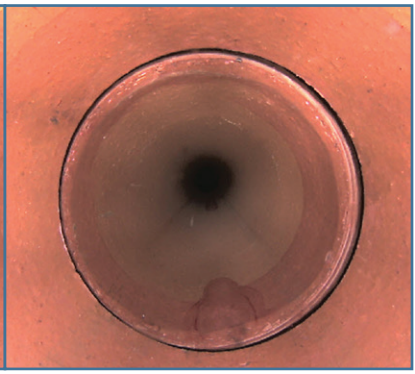

Figure 35: Horizontal Angular Deflection
½-inch per foot (Section pulled to the left)

Angular deflection can be used as an intentional design option to create a curvilinear pipeline. When used within ASTM limits, it does not affect the performance of the pipeline or integrity of the pipe.

RADIUS OF CURVATURE & ANGLE OF DEFLECTION

Pipe Diameter (inches)	Maximum Deflection		Values for r*	Minimum Radius of Curvature (r*)			
	In./LF	Angle Θ		Pipe Length L (feet)			
				4	6	8	10
3 – 12	1/2	(2.4°)	r = 24(L)	96	144	192	----
15 – 24	3/8	(1.8°)	r = 32(L)	128	192	256	320
27 – 36	1/4	(1.2°)	r = 48(L)	192	288	384	480
39 – 42	3/16	(0.9°)	r = 64(L)	256	384	512	640
48	1/8	(0.6°)	r = 96(L)	384	576	768	960

* r = Minimum radius in feet for the equation: r = (360°/θ)(L/2π)

Table 1: Radius of Curvature & Angle of Deflection. For more detail, see the Engineering Manual.