

Elementary Surveying 14th Edition

Elementary Surveying 14th Edition Mastering Horizontal Curves A Guide for Surveyors Horizontal curves are essential elements of road and highway design allowing vehicles to navigate smoothly around bends As surveyors understanding the principles and calculations involved in horizontal curves is paramount for accurate layout and construction This article will delve into the fundamental concepts of horizontal curves drawing upon the knowledge presented in Elementary Surveying 14th Edition to provide a comprehensive guide for surveyors

Key Definitions

Horizontal Curve A curve that lies in a horizontal plane and is used to connect two straight tangents

Tangent A straight line that is a continuation of the roadway before or after the curve

Point of Tangency (PT) The point where the curve ends and the second tangent begins

Point of Curvature (PC) The point where the curve begins and the first tangent ends

Point of Intersection (PI) The point where the two tangents intersect

Radius (R) The distance from the center of the curve to any point on the curve

Degree of Curve (D) The central angle subtended by a 100-foot chord for arc definition or a 100-meter chord for chord definition

Length of Curve (L) The distance along the curve from PC to PT

External Distance (E) The distance from the PI to the midpoint of the curve

Long Chord (C) The straight line distance between the PC and PT

Types of Horizontal Curves

Simple Curve A single curve connecting two tangents

Compound Curve Two or more simple curves with the same direction of curvature

Reverse Curve Two simple curves with opposite directions of curvature

Curve Calculations

Determining the Degree of Curve (D)

Arc Definition $D = \frac{5729.58}{R}$

Chord Definition $D = \frac{5729.58}{R} \cdot \frac{C}{L}$

Calculating the Length of Curve (L) $L = \frac{D}{I} \cdot \frac{360}{2}$

Calculating the External Distance (E) $E = R \cdot \frac{1 - \cos(D/2)}{\cos(D/2)}$

Calculating the Long Chord (C) $C = 2 \cdot R \cdot \sin(D/2)$

Calculating the Tangent Distance (T) $T = R \cdot \tan(D/4)$

Curve Layout in the Field

Setting Out the PC and PT Measure the tangent distances T from the PI to the PC and PT Mark the PC and PT using stakes or other survey markers

Setting Out Points Along the Curve Use a total station or transit to measure angles and distances from the PC Calculate the coordinates of points along the curve using the following formulas

$X = X_{PC} + R \cdot \sin(\theta)$

$Y = Y_{PC} + R \cdot (1 - \cos(\theta))$

Where θ is the angle measured from the PC to the desired point

Verifying the Accuracy of the Curve Measure the distances between setout points and compare them to the calculated distances Ensure all points lie on a smooth continuous curve

Practical Applications of Horizontal Curves in Surveying

Road and Highway Design Determining the radius degree of curve and other parameters for safe and efficient road curves

Railroad Engineering Designing and laying out tracks for efficient and safe rail transportation

Land Development Establishing property boundaries and easements that incorporate curves

Utility Design Aligning pipelines power lines and other utilities along curves

Tips for Success Thorough Understanding of Formulas Master the calculations for

determining the degree of curve length of curve external distance long chord and tangent distance Accurate Field Measurements Utilize appropriate survey equipment and techniques for precise angle and distance measurements Careful Data Management Maintain detailed records of measurements calculations and field notes for accurate and traceable results Visualization of the Curve Always visualize the geometry of the curve to ensure proper understanding and application of calculations Conclusion 3 Horizontal curves are a crucial element in many surveying projects By understanding the concepts definitions and calculations involved surveyors can accurately layout and construct curves that ensure the safe and efficient functioning of roads railroads and other infrastructure The guidelines provided in this article along with a thorough grasp of Elementary Surveying 14th Edition will equip you with the necessary knowledge to master the art of horizontal curve design and layout

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