CE 103: Surveying

Lecture 12: Curve setting

Course Instructor: Saurav Barua (SB)

Assistant Professor, Dept. of Civil Engineering, DIU

Email: saurav.ce@diu.edu.bd

Phone: 01715334075

Outline

- Classification of circular curves
- Designation of a curve
- Setting out simple curve
- Linear method

- Curves are generally used on highways and railways to change the direction of motion.

Classification of Circular Curve

- Simple Curve
- Compound Curve
- Reverse Curve

- Simple Curve: It consists of a single arc of a circle.

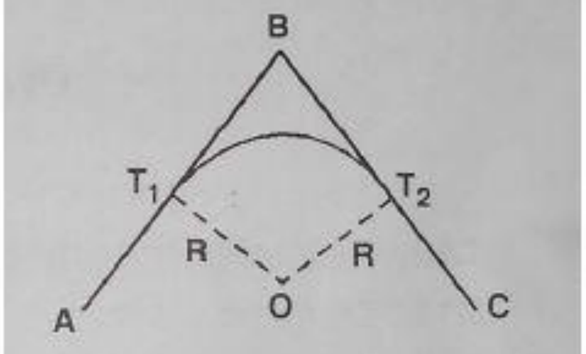
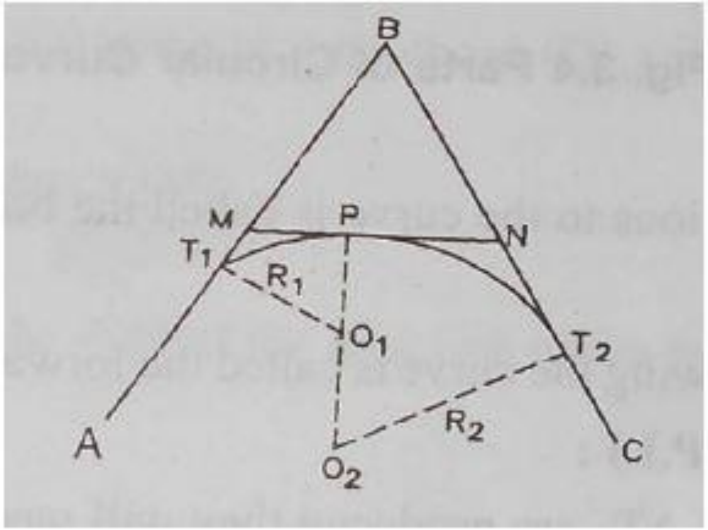
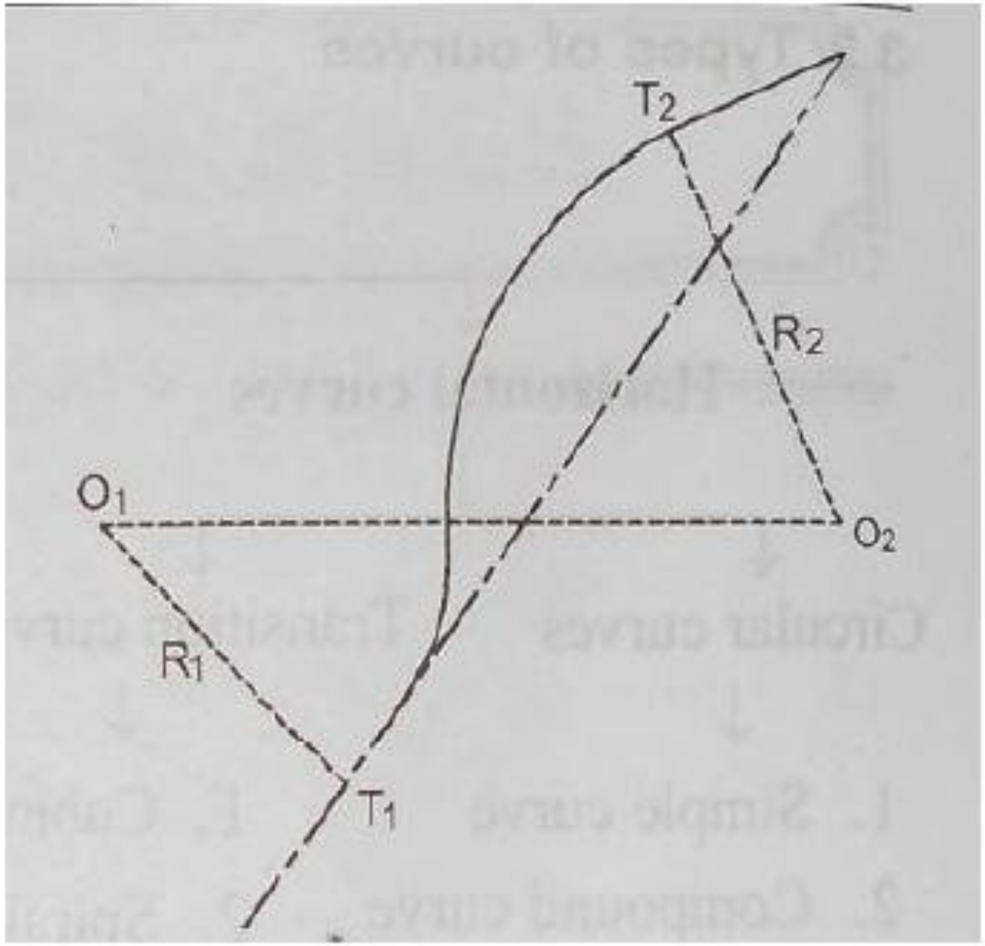


Fig. 3.1 Simple Curve

- Compound Curve: It consists of two or more simple arcs that turn in the same direction and join at common tangent points.



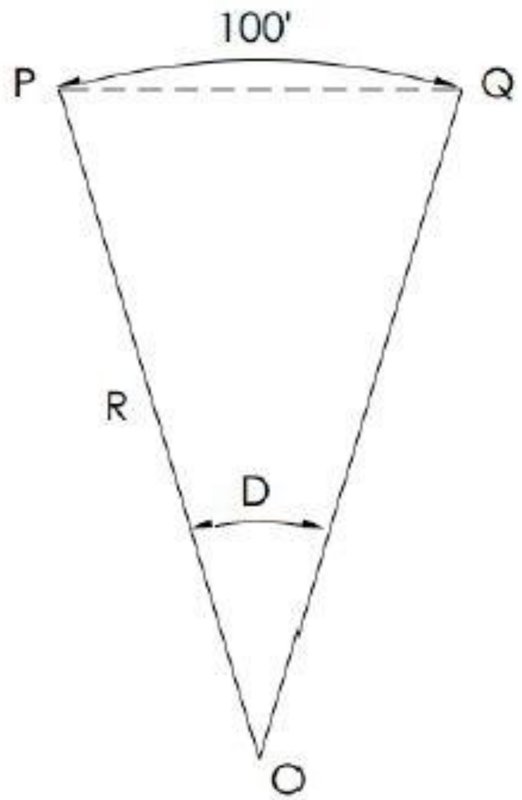
- Reverse Curve : It consists of two circular arcs of same or different radii, having their centres to the different sides of the common tangent.



Designation of a curve

Arc definition

- According to arc definition, degree of curvature is defined as angle in degrees subtended by an arc of 100′ length.



$$100 : 2\pi R = D^\circ : 360^\circ$$

$$\Rightarrow R = \frac{360}{D} \times \frac{100}{2\pi}$$

$$= \frac{5729.578}{D} ft$$

$$= \frac{5730}{D} ft$$

Chord Definition

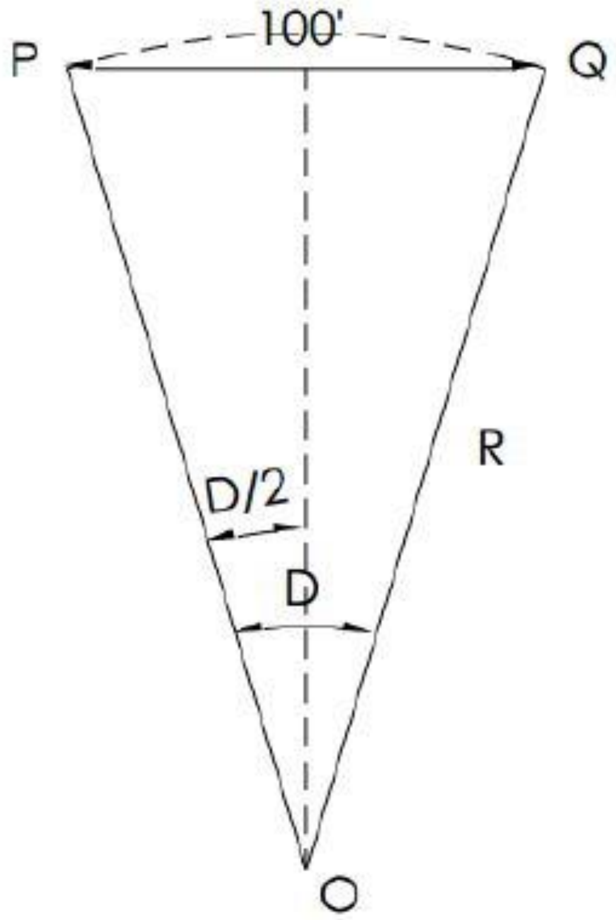
- According to chord definition, degree of curvature is defined as angle in degrees subtended by a chord of 100′.

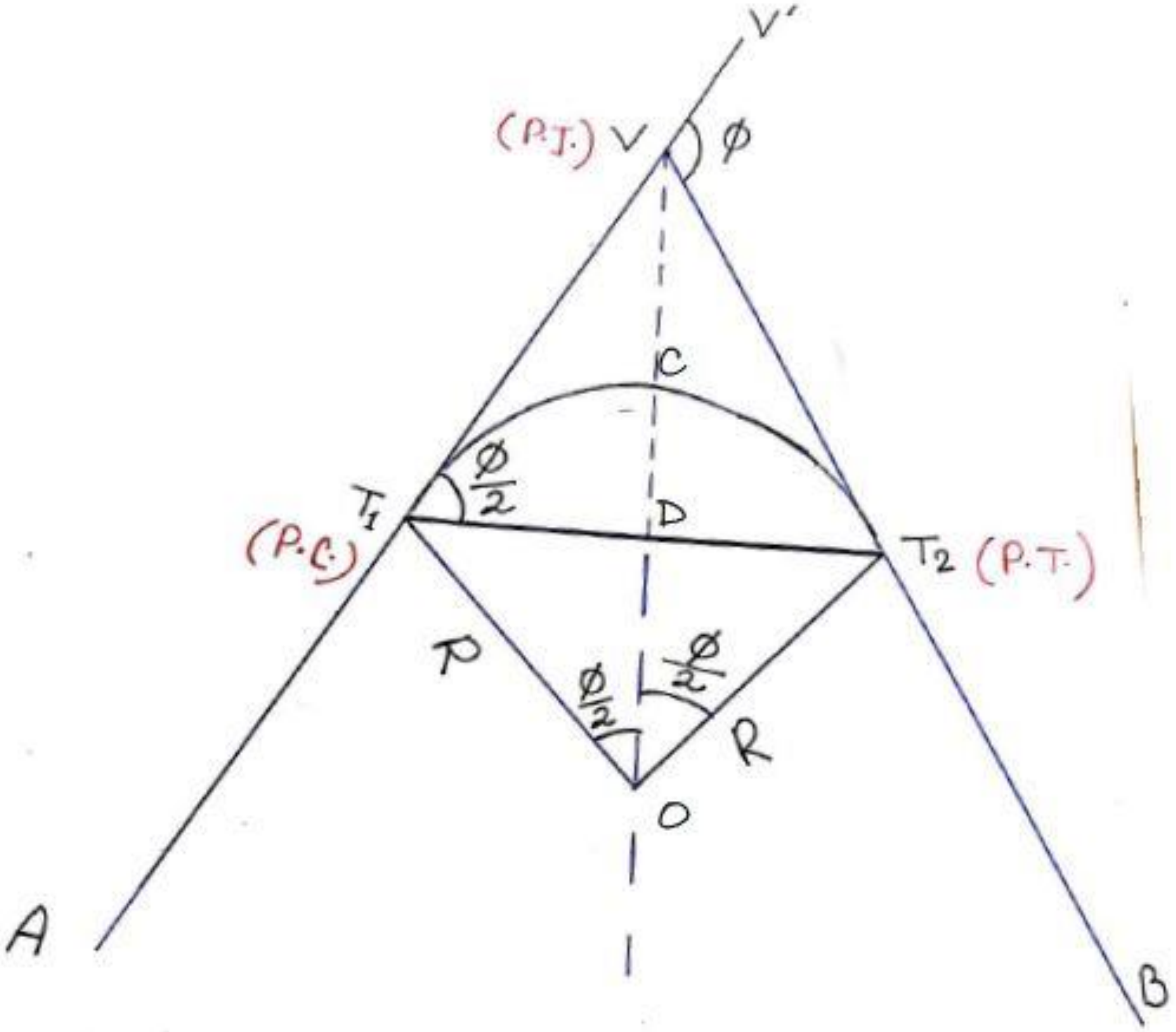
$$\sin\frac{D}{2} = \frac{50}{R}$$
$$\Rightarrow R = \frac{50}{\sin\frac{D}{2}}$$

If D is small, sin (D/2) can be taken as D/2.

So,

$$R = \frac{50}{\frac{D}{2} \times \frac{\pi}{180}} = \frac{5730}{D}$$




V'
(P.I.) V
ϕ
C
ϕ/2
T1
(P.C.)
D
T2 (P.T.)
R
ϕ/2
ϕ/2
R
O
A
B

- Back tangent - AT_1.
- Forward tangent - BT_2.
- Point of intersection (P.I.) – The point at which two tangents (AT_1 and BT_2) meet.
- Point of curve (P.C.) – It is beginning of the curve where the alignment changes from a tangent to a curve.
- Point of tangency (P.T.) – It is end of the curve where the alignment changes from a curve to a tangent.
- Length of curve, $l = T_1CT_2 = R\phi$, *where ø is in radian*

$$= \frac{\pi R}{180^\circ}\phi \quad \text{where ø in degrees.}$$

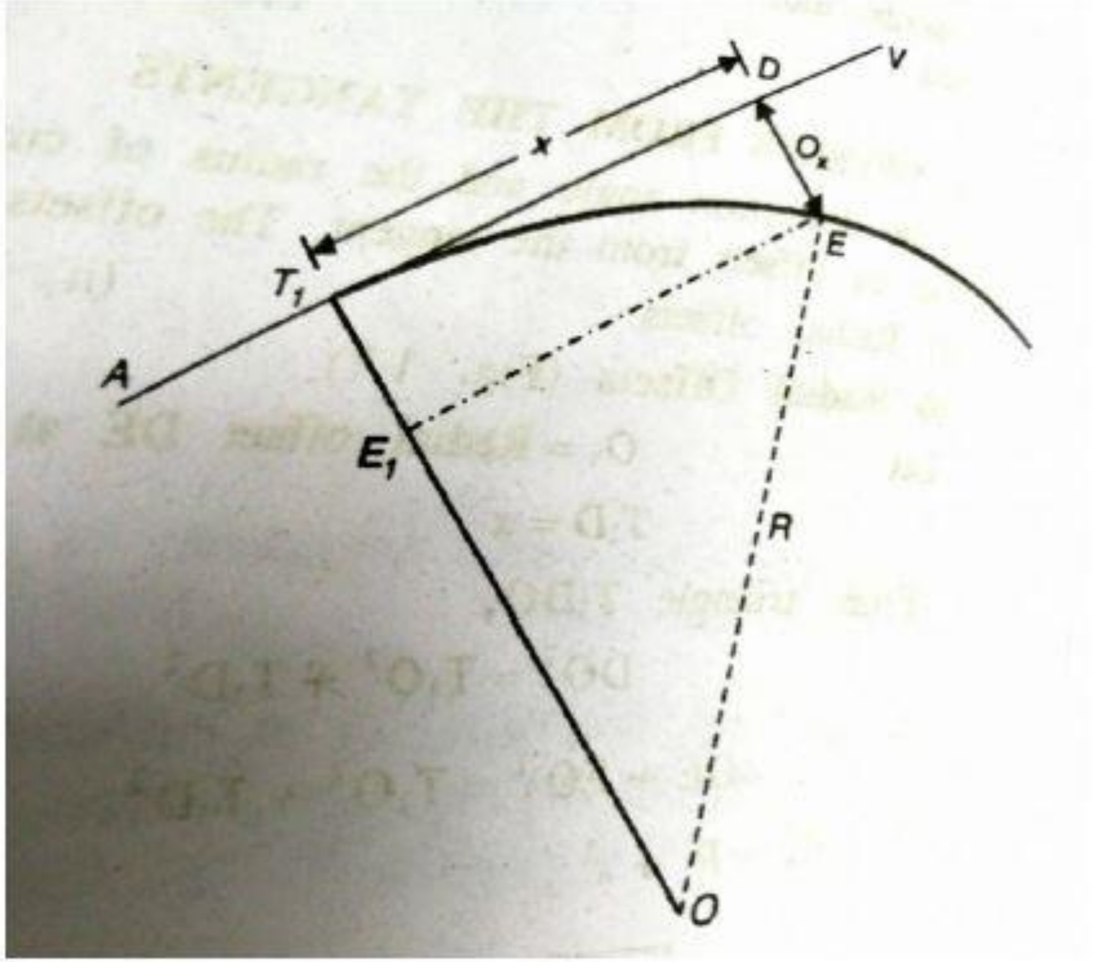
- Tangent length, $T = T_1V = VT_2 = OT_1 \tan(\phi/2) = R \tan(\phi/2)$
- Length of long chord , $L = T_1 T_2 = 2\ OT_1 \sin(\phi/2) = 2R \sin(\phi/2)$
- Mid Ordinate, $M = CD = CO\text{-}DO = R\text{-}R\cos(\phi/2)$
- Apex distance or external distance , $E = CV = VO\text{-}CO = R\sec(\phi/2) - R$

Setting out simple curves

- Linear Method: A chain or a tape is used.
- Angular Method : Theodolite with or without a chain (or tape) is used.

Linear Methods

Perpendicular offsets from tangent :



$$OE^2 = OE_1^2 + EE_1^2$$

$$\Rightarrow R^2 = (OT_1 - O_x)^2 + x^2$$

$$\Rightarrow R^2 = (R - O_x)^2 + x^2$$

$$\Rightarrow (R - O_x)^2 = R^2 - x^2$$

$$\Rightarrow R - O_x = \sqrt{R^2 - x^2}$$

$$\Rightarrow O_x = R - \sqrt{R^2 - x^2}$$

Calculate the offsets at 50 ft interval along tangents to locate a curve having a radius of 1500 ft.

Solution: R = 1500 ft

Using formula ,

$$O_x = R - \sqrt{R^2 - x^2}$$

x (ft)	**O_x(ft)**
50	0.833
100	3.34
150	7.52
200	13.39