CE 380

Highway and Traffic Engineering

Lec. 5

Super Elevation, Transition curve and Widdning

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Example Problem

A tangent with a bearing of N 56° 48’ 20” E meets another tangent with a bearing of N 40° 10’ 20” E at PI STA 6 + 26.57. A horizontal curve with radius = 1000 feet will be used to connect the two tangents. Compute the degree of curvature, tangent distance, length of curve, chord distance, middle ordinate, external distance, PC and PT Stations.

Solution:

I = 56° 48’ 20” - 40° 10’ 20” = 16° 38’ 00”

D = 5729.578/R = 5729.578/1000 = 5° 43’ 46”

L = 100 (I/D) = 100 (16.63333/5.72944444) = 290.31’

T = R tan (I/2) = 1000 tan (16.63333/2) = 146.18’

LC = 2R sin (I/2) = 2(1000) sin (16.63333/2) = 289.29’

E = R [1/cos (I/2) -1] = 1000 [1/cos 16.63333/2) – 1] = 10.63’

M = R [1 – cos (I/2)] = 1000 [1 – cos (16.63333/2)] = 10.52’

Example Problem (continued)

Solution:

PC STA = PI STA – T = 626.57 – 146.18 = PC STA 4 + 80.39

PT STA = PC STA + L = 480.39 + 290.31 = PT STA 7 + 70.70

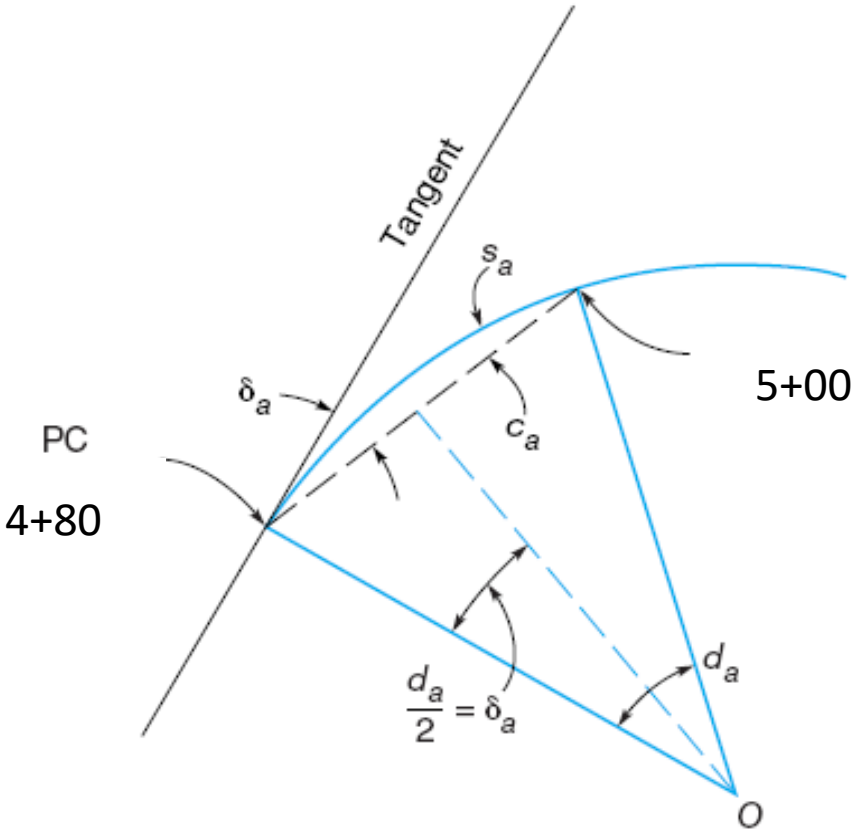
Setting Out the Curve

Horizontal Curve Construction

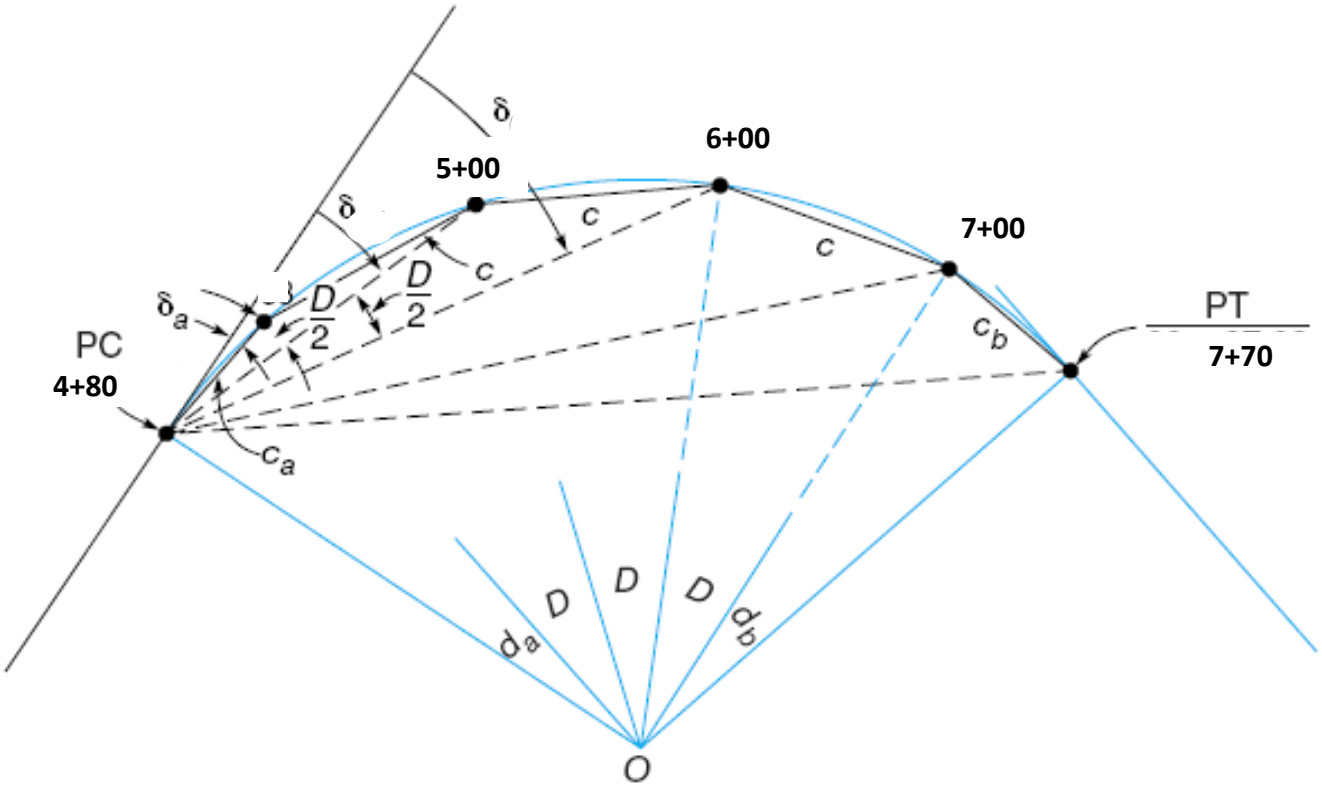
- With using theodolite and length measurements

Road Station	*Angle increase*	Theodolite Angle	Chord Length

Subchords and Subdeflections



Curve Layout by Deflection Angles



Complementary Parts

- Transition Curve
- Superelevation Runoff
- Widening

Objectives for providing transition curve

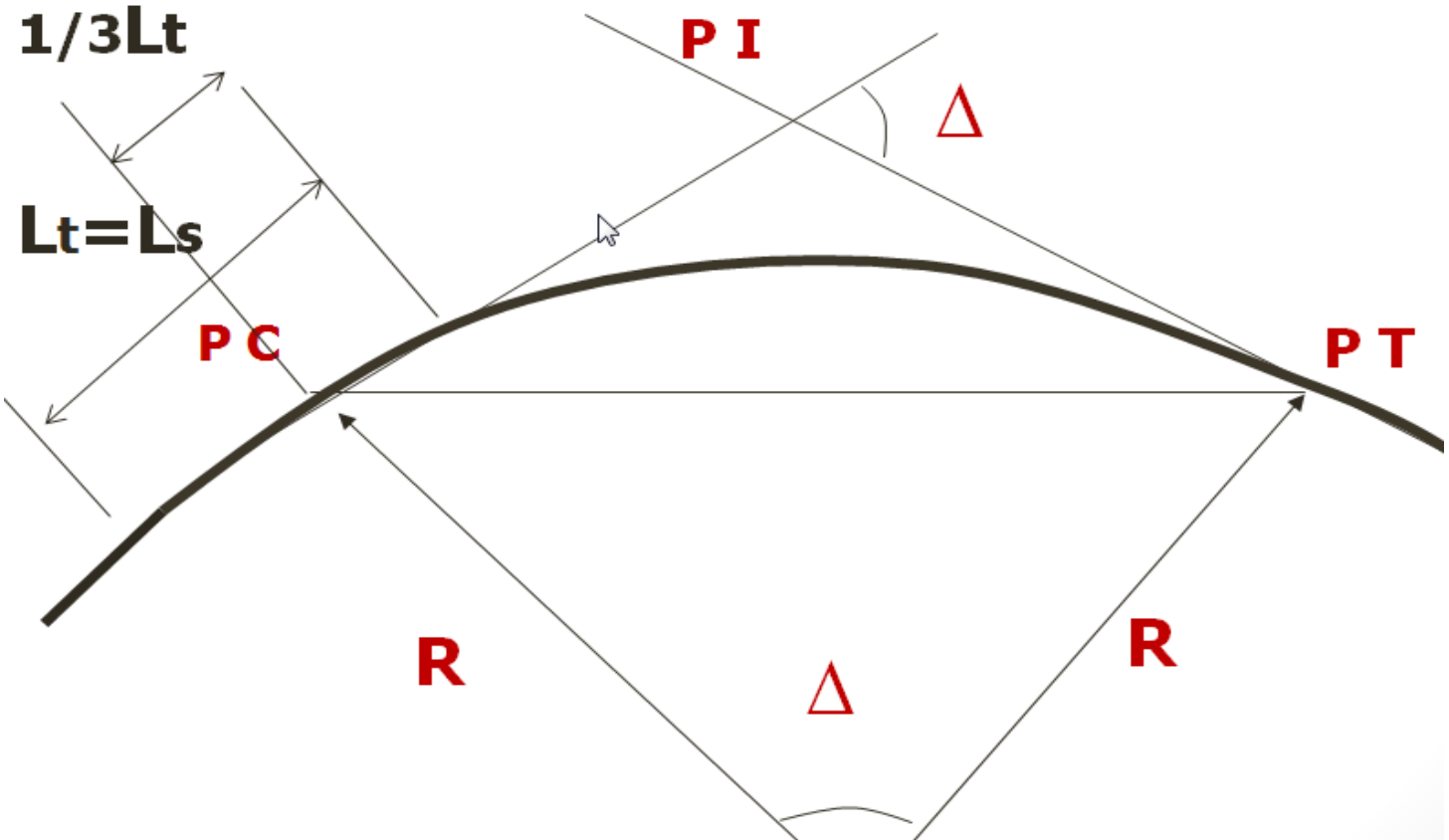
- To introduce gradually the centrifugal force.
- To enable the driver turn the steering gradually for his own comfort and security
- To provide gradual introduction of super elevation
- To provide gradual introduction of extra widening.

Value of Transition curve (Lt or L_s)

$L_s = V^3 / 28\ R$

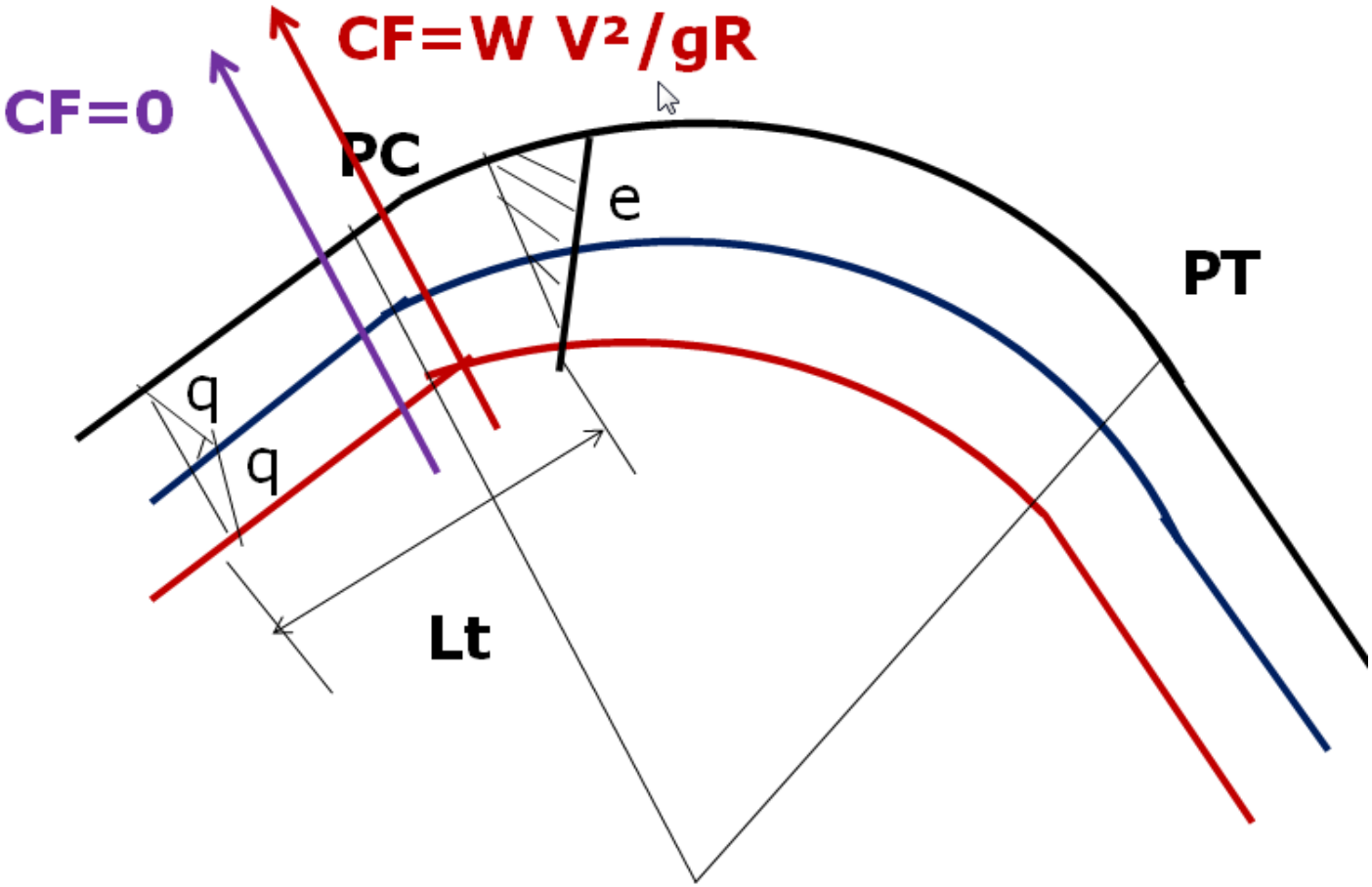
Where :

L_s = length of spiral curve (m), V = vehicle speed (kph), R = Radius of the circular curve



Superelevation Runoff (Lt)

It is the term denoting the length of highway needed to accomplish the change in cross slope from a normal crown section to a fully superelevated section, or vice it versa It called Transition length (Lt).


CF=W V²/gR
CF=0
PC
e
PT
q
q
Lt

Method of attaining superelevation

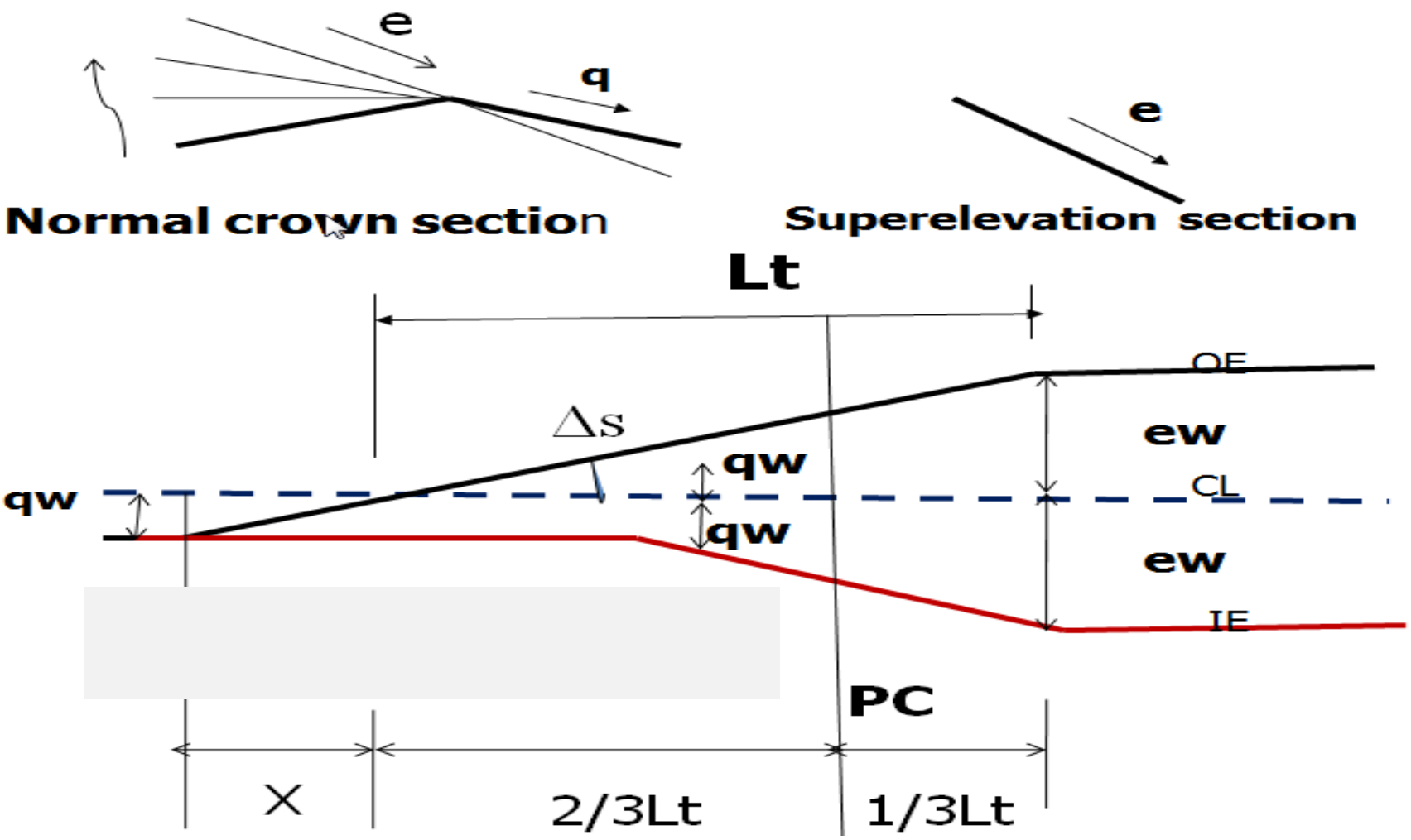
1-Revolving about the centerline profile(C.L).

2-Revolving about the inside-edge profile (I.E).

3-Revolving about the outside-edge profile (O.E).

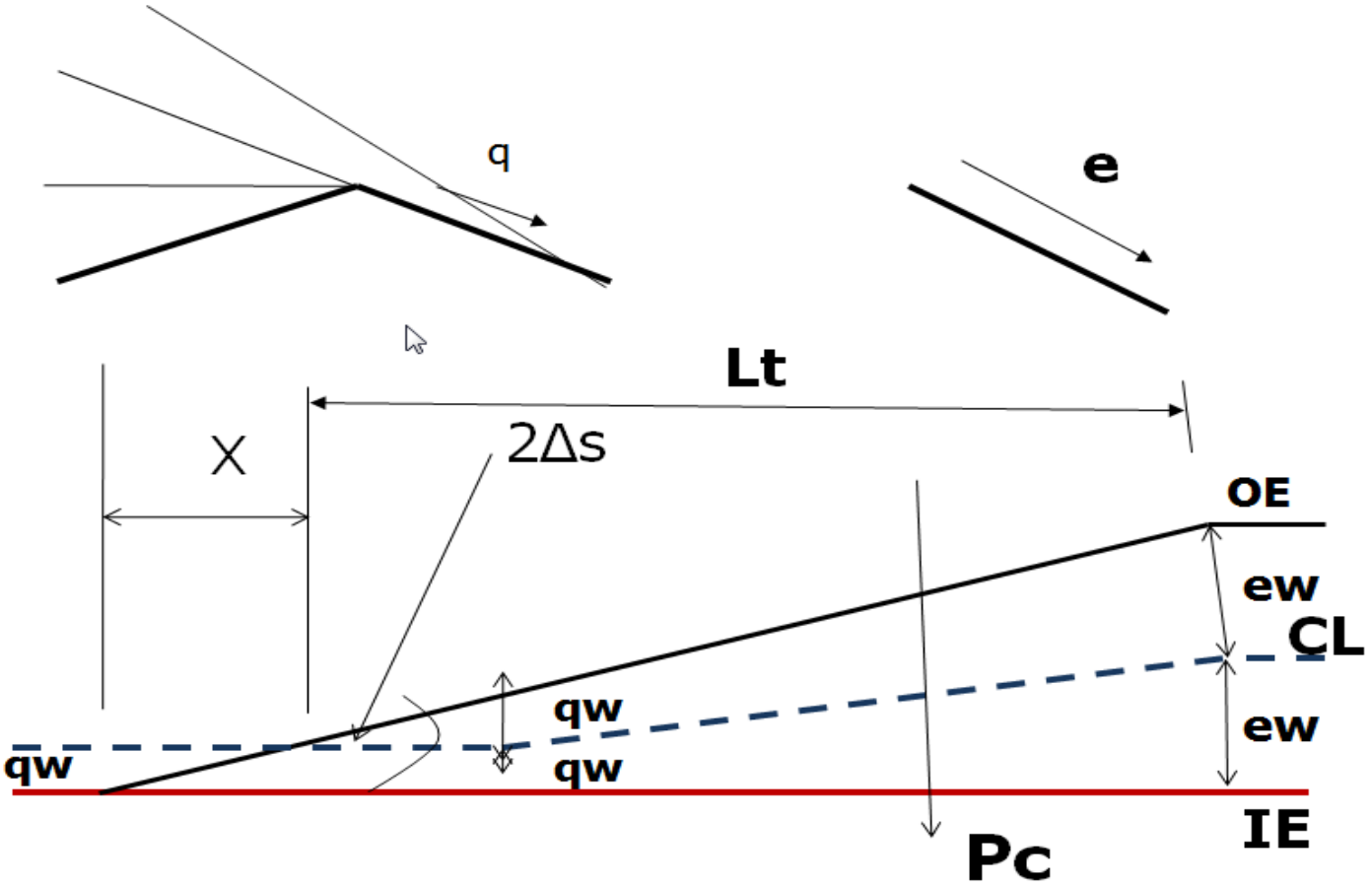
Method of attaining superelevation

1-Revolving about Centerline



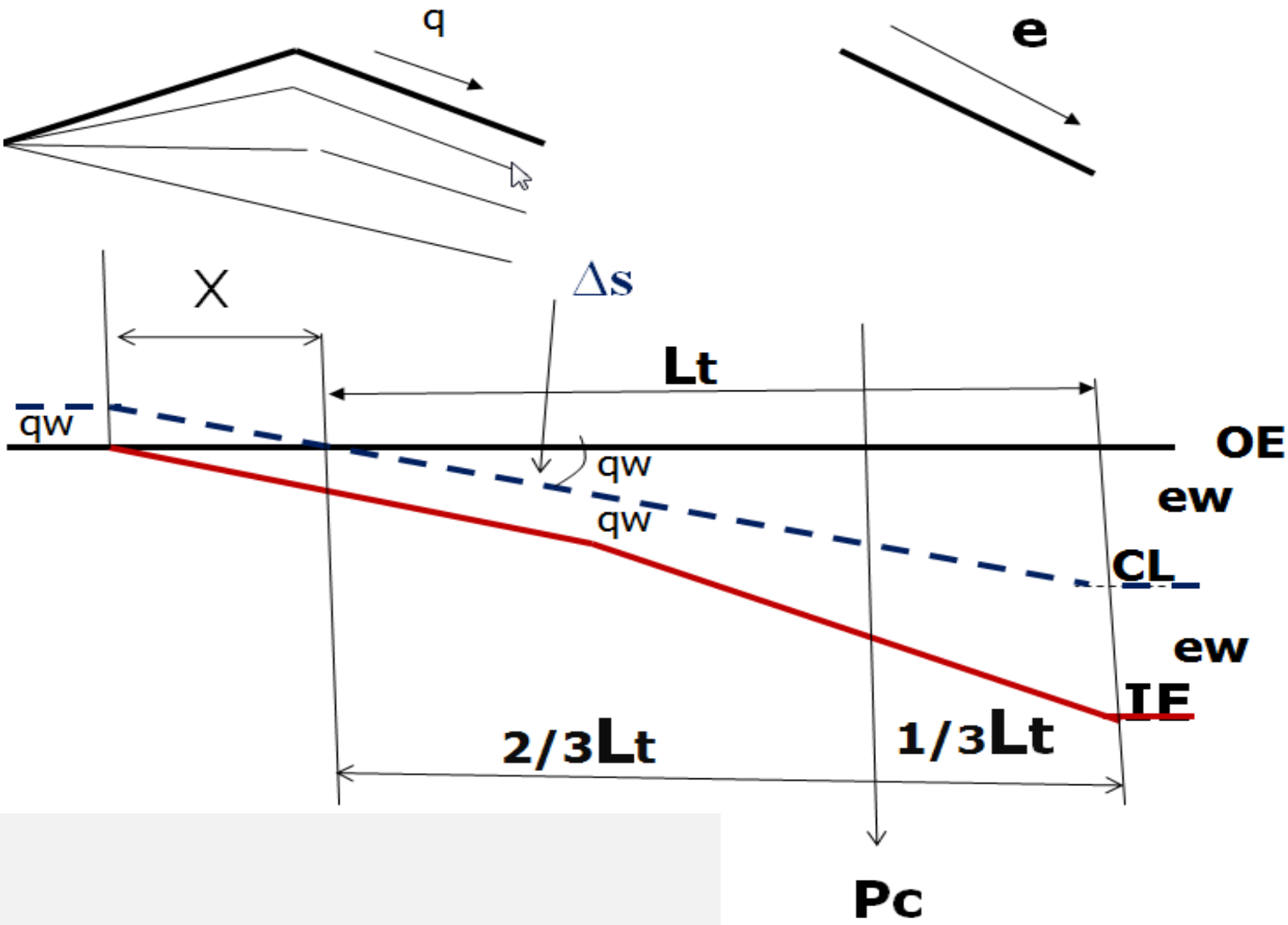
Method of attaining superelevation

2-Revolving about Inner Edge



Method of attaining superelevation

3-Revolving about Outer Edge



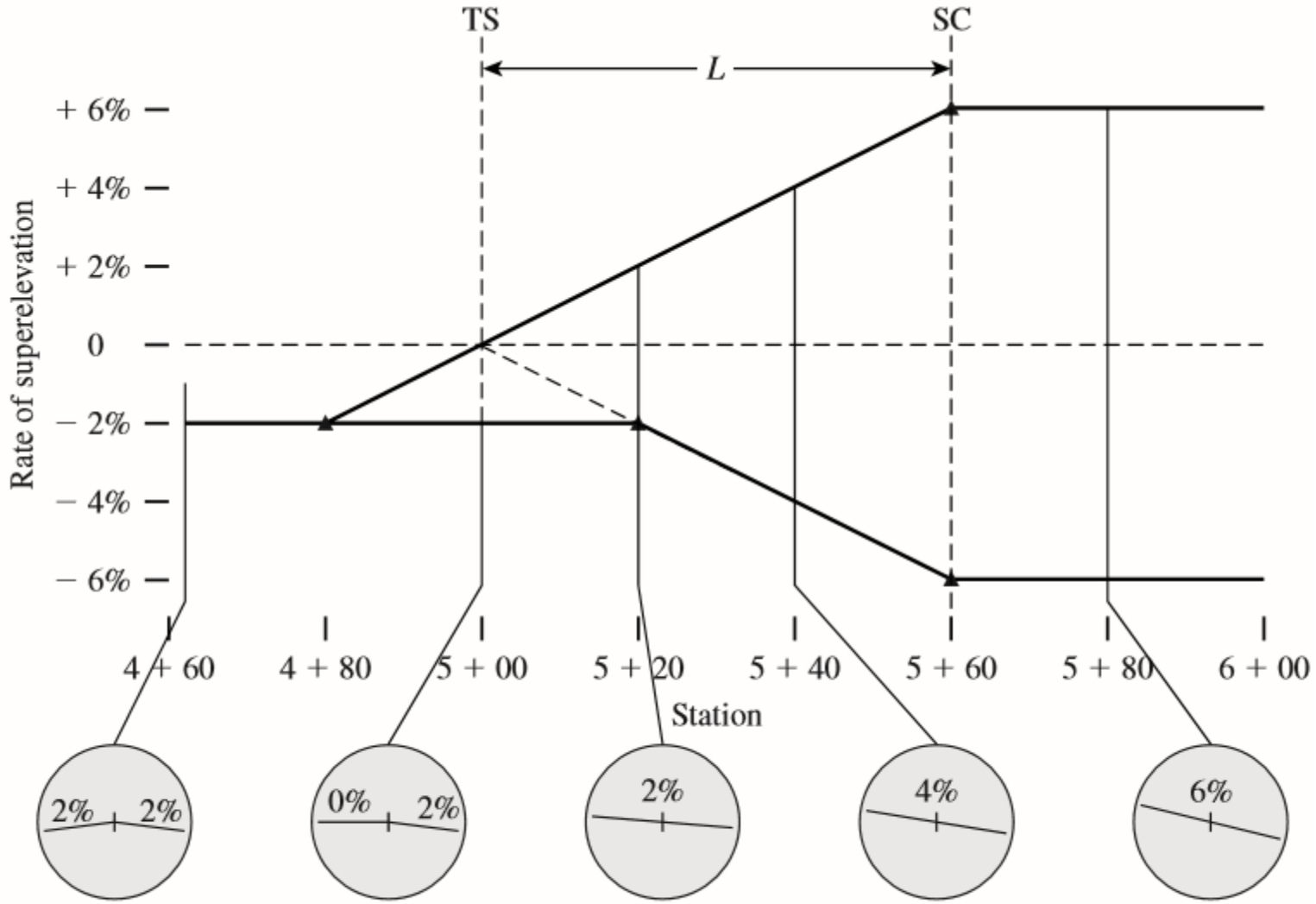


FIGURE 4.20

Superelevation diagram, showing roadway cross sections.

Pavement Widening on Horizontal Curves

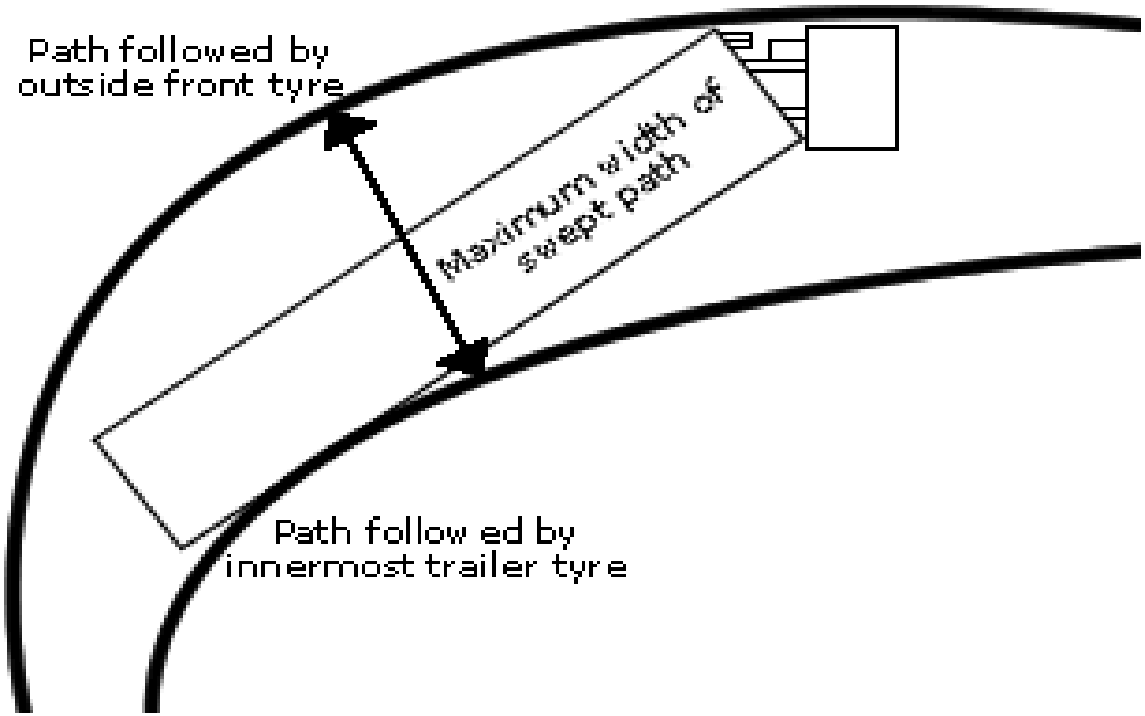
On horizontal corves, especially when they are not of very large radii, it is common to widen the pavement slightly more than the normal width,

•Widening is needed for the following reasons :

1. The driver experience difficulties in steering around the curve.
2. The vehicle occupies a greater width as the rear wheel don't track the front wheel. known as 'Off tracking'
3. For greater visibility at curve, the driver have tendency not to follow the central path of the lane, but to use the outer side at the beginning of the curve.
4. While two vehicle cross or overtake at horizontal curve there is psychological tendency to maintain a greater clearance between the vehicle for safety.

Off tracking

•An automobile has a rigid wheel base and only the front wheels can be turned, when this vehicle takes a turn to negotiate a horizontal curve, the rear wheel do not follow the same path as that of the front wheels. This phenomenon is called off tracking.
•The required extra widening of the pavement at the horizontal curves depends on the length of the wheel base of the vehicle 'l', radius of the curve 'R' and the psychological factors.

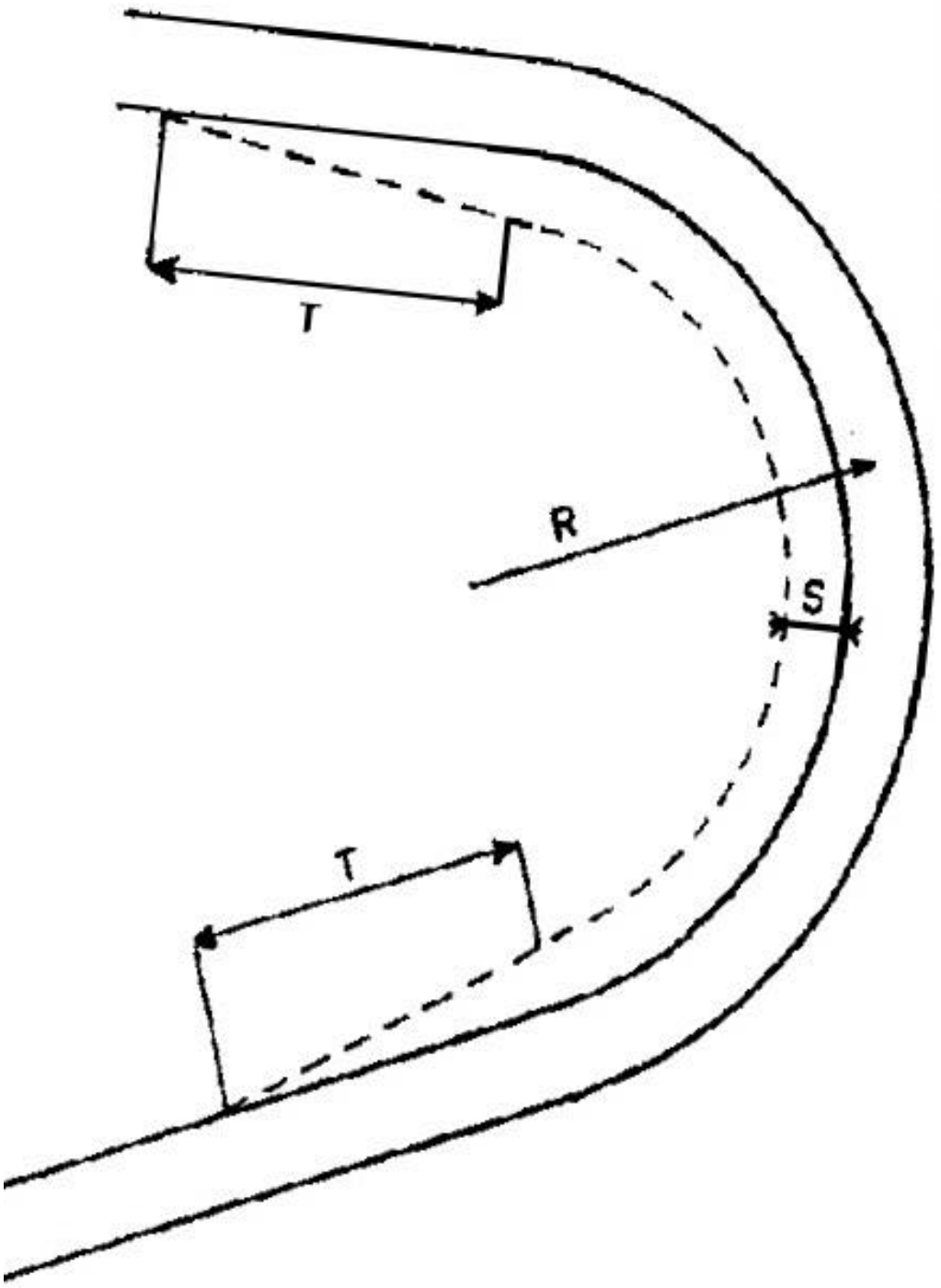


Pavement Widening on Horizontal Curves

$$W_e = \frac{nl^2}{2R} + \frac{V}{9.5\sqrt{R}}$$

where:

W_e = widening on curve, m
n =no. of traffic lanes
l = wheel base; 6 m for SUT
R = radius on centerline, m
V = design speed; kph


T
R
S
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