Transition (Spiral) Curve Length and Shift

Length of a transition (clothoid) curve from the design speed, circular radius and allowed rate of change of radial acceleration, with the shift and spiral angle.

Method: Shortt's transition length; superelevation run-off; clothoid shift

Input parameters

Unit system: SI

Parameter	Value	Unit
Design speed	80.000	km/h
Radius of the circular curve	300.00	m
Rate of change of radial acceleration (0.3–0.6)	0.45000	
Superelevation	6.0000	%
Width rotated (carriageway)	7.0000	m
Rate of superelevation change 1 in N	150.00	

Calculated results

Parameter	Value	Unit
Transition length by comfort V³/(CR)	81.288	m
Transition length by superelevation run-off eNW	63.000	m
Transition length adopted (larger)	81.288	m
Shift L²/(24R)	0.91775	m
Spiral angle L/(2R)	7.7625	°
Radial acceleration on the circular curve	1.6461	m/s²

Notes for this case

- Shortt's comfort criterion L = V³/(CR) (V in m/s, C in m/s³) and the length needed to run off the superelevation at 1 in N about the centre line. Design codes add their own minimum lengths.

Formula and method

$$L_s = \frac{V^3}{CR}, \quad L_e = eNW, \quad S = \frac{L^2}{24R}, \quad \theta_s = \frac{L}{2R}$$

Variables

V	Design speed	m/s
R	Radius of the circular curve	m
C	Rate of change of radial acceleration (0.3–0.6)	-
e	Superelevation	-
W	Width rotated (carriageway)	m
N	Rate of superelevation change 1 in N	-
L_s	Transition length by comfort V³/(CR)	m
L_e	Transition length by superelevation run-off eNW	m
L	Transition length adopted (larger)	m
S	Shift L²/(24R)	m
θ_s	Spiral angle L/(2R)	rad
V^2/R	Radial acceleration on the circular curve	m/s²

Method and standards

Transition curve design.

Assumptions and limits

- Clothoid spiral, small deflection approximations for the shift.

References

Shortt's transition length; superelevation run-off; clothoid shift

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/roads/transition-curve-length

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.