CHAPTER 6

Railway, Airport, Dock, Harbour and Tunnel Engineering

Points and Crossing

Q.1 To design a cross-over between parallel tracks, the required components are
(a) two switch, points, two acute angles crossing and two check rails
(b) two switch points, two acute angles crossing and four check rails
(c) two switch point, two acute angle crossing and six check rails
(d) None of the above

Q.2 If D is the distance between centres of two parallel tracks of gauge G, then total length of cross-over with an intermediate straight portion and N crossing is given by
(a) $DN + G\left(N + \sqrt{1+N^2}\right)$
(b) $DN + G\left(2N + \sqrt{1+N^2}\right)$
(c) $DN + G\left(3N + \sqrt{1+N^2}\right)$
(d) $DN - G\left(4N + \sqrt{1+N^2}\right)$

Q.3 The spread between the point and splice rails at a distance of 4.25 m is 50 cm. The size of crossing is
(a) 1 in 6 (b) 1 in 8.5
(c) 1 in 12 (d) 1 in 16

Q.4 According to railway code no diamond crossing should be flatter than
(a) 1 in 6 (b) 1 in 8.5
(c) 1 in 12 (d) 1 in 16

Q.5 To prevent damage of nose of crossing, the wing rails are ramped so that nose of crossing remains at a lower level by
(a) 3 mm (b) 4 mm
(c) 5 mm (d) 6 mm

Q.6 If the standard length of BG crossing is 597 cm, the number of crossing is
(a) 1 in 8.5 (b) 1 in 12
(c) 1 in 16 (d) None of these

Q.7 If L_1 and L_2 are actual and theoretical lengths of a tongue rail respectively, d is heel divergence and t is thickness of tongue rail at toe, the switch angle α is
(a) $\sin^{-1}\dfrac{d-t}{L_1}$ (b) $\tan^{-1}\dfrac{d-t}{L_1}$
(c) $\sin^{-1}\dfrac{d-t}{L_2}$ (d) $\tan^{-1}\dfrac{d-t}{L_2}$

Q.8 If D is distance between centres of two parallel tracks of gauge G with entire curved leads and equal angles of crossing, total length of crossover, is
(a) $\sqrt{D(4R-2G-D)}$
(b) $\sqrt{(3R-2G-D)}$
(c) $\sqrt{D(3R+2G-D)}$
(d) $\sqrt{D(1R+2G-D)}$

Q.9 If a is average number of peaks more than 10 mm of unevenness per kilometer, b is average number of peaks more than 6 mm for gauge variation per kilometre and c is average number of peaks more than 2 mm twist per metre, then composite current track recording index (I_c), as recommended by the Indian Railways, is
(a) $I_c = 10 - a - b - c/4$
(b) $I_c = 20 - a - b - c/4$
(c) $I_c = 30 - a - b - c/4$
(d) $I_c = 40 - a - b - c/4$

Q.10 The distance between the theoretical noses of crossing along the same rail, in case of diamond crossing, is
(a) $\dfrac{G}{\sin\frac{1}{2}F}$ (b) $\dfrac{G}{\sin F}$
(c) $\dfrac{G}{\tan F}$ (d) $\dfrac{G}{\cos F}$

Q.11 If D is the distance between parallel tracks, G is the gauge and α is angle of crossing, the distance between theoretical noses of two crossing measured parallel to tracks, is
(a) $(D - G - G\sec\alpha)\cot\alpha$
(b) $(D - G + G\sec\alpha)\cot\alpha$
(c) $(D - G - G\sec\alpha)\tan\alpha$
(d) $(D + G + G\sec\alpha)\cot\alpha$

Q.12 The equilibrium superelevation to be provided on a curve of radius R metres and speed of vehicle V kmph is given by
(a) $\dfrac{GV^2}{127R}$ (b) $\dfrac{GV^2}{160R}$
(c) $\dfrac{GV^2}{147R}$ (d) $\dfrac{GV^2}{217R}$
where G is gauge.

Q.13 The correct relation between curve lead (CL), switch lead (SL) and lead of crossing (L) is given by
(a) $CL = L - SL$ (b) $L = CL - SL$
(c) $SL = L + CL$ (d) $L = (CL + SL)/2$

Q.14 In a scissors cross-over, the crossings provided are
1. 2 obtuse angle crossings
2. 4 obtuse angle crossings
3. 4 acute angle crossings
4. 6 acute angle crossings
The correct answer is
(a) 1 and 3 (b) 1 and 4
(c) 2 and 1 (d) 2 and 4

Q.15 A treadle bar is used for
(a) interlocking points and signal
(b) setting points and crossings
(c) setting marshalling yard signals
(d) track maintenance

Q.16 If 'A' is the angle formed by two gauge faces, the crossing number will be
(a) $\tan A$ (b) $\cot A$
(c) $\sec A$ (d) A rad

Q.17 Match List-I (Alignment) with List-II (Topography) and select the correct answer using the codes given below the lists:

List-I
A Valley alignment
B Cross country
C Zig-zag alignment
D Switch back

List-II
1. Sags and summits in succession
2. On steep regular slope alignment
3. One slope of valley
4. A slope with deep valley alignment

Codes:

	A	B	C	D
(a)	3	1	4	2
(b)	1	2	3	4
(c)	3	2	1	4
(d)	1	2	3	4

Q.18 Match List-I with List-II and select the correct answer by using the given below the lists:

List-I
A. Diamond crossing
B. Square crossing
C. Cross-overs
D. Double slip

List-II
1. Two acute angles, two obtuse angles crossings, four special curved lead rails, four pairs of switches and four check rails
2. Two acute angle crossings, two obtuse angle crossings, two-wing rails opposite obtuse angle crossing and four check rails
3. Two pairs of tongue rails, two acute angle crossings, a reverse curve and four check rails
4. Four right angle diamond crossings and a square shaped check rail.

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	3	4	2	1
(d)	1	4	3	2

Q.19 The type of a track layout arrangement which can be conveniently used in marshalling yard is
(a) Gauntlet track type
(b) Ladder track type
(c) Diamond crossing type
(d) Scissor crossing type

Q.20 The gradient for a B.G. track when the grade resistance together with curve resistance due to curve of 3° shall be equal to resistance due to ruling gradient of 1 in 200?
(a) 1 in 235 (b) 1 in 265
(c) 1 in 280 (d) 1 in 295

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Answers Points and Crossing

1. (b) 2. (c) 3. (b) 4. (b) 5. (a) 6. (b) 7. (a) 8. (a) 9. (d) 10. (b)
11. (a) 12. (a) 13. (b) 14. (b) 15. (b) 16. (b) 17. (a) 18. (a) 19. (b) 20. (b)

Explanations Points and Crossing

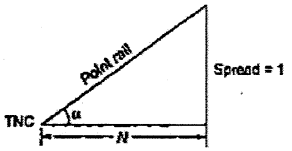
13. (b)
The correct relation given as;

$$CL = SL + L$$

$$\Rightarrow \quad L = CL - SL$$

where CL = curves lead,
SL = switch lead
and L = lead or crossing lead

16. (b)
Right angle or Cole's method;



From figure,

$$\tan\alpha = \frac{1}{N}$$

$$\Rightarrow \quad N = \cot\alpha$$

17. (a)
Valley Alignment: The alignment of a railway line in valley is simple and does not pose any problem. If two control points lie in the same valley, a st. line is provided between the two points.
Cross Country Alignment: The alignment of a railway line in this terrain crosses the water sheds of two or more streams of varied sizes. There are sags and summits for cross country alignment, the controlling or obligatory points may be lowest saddles or tunnels.
Zig-Zag Alignment: In this method, the railway line follows a convenient side slope which is nearly right angles to the general direction of the alignment. The line then turns about 180° in a horse shoe pattern to gain height.
Switch Back Alignment: In case of steep side slopes, considerable gain of elevation is accomplished by switch back method. In this method, reverse of direction is done by a switch where the train has to stop.

20. (b)
Let w be the weight of the train and 1 in x be the required gradient.
Hence, resistance due to required gradient

$$= \frac{1}{x} \times w$$

Resistance due to ruling gradient

$$= \frac{1}{200} \times w$$

Resistance due to curve of 3° curve on BG track

$$= 0.0004 \times 3 \times w$$

Therefore, under given condition

$$\frac{1}{x} \times w + 0.0004 \times 3 \times w = \frac{1}{200} \times w$$

$$\therefore \quad \frac{1}{x} + 0.0004 \times 3 = \frac{1}{200}$$

$$x = 263 \text{ say } 265$$

∴ Ruling gradient is 1 in 265.

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