UNIT-2 Track Geometrics

QUESTION 1 Define points and crossings. (Sum-22, Marks-2) .

ANS: Points and crossing are the special arrangement provided on rail way track to facilitate trains to be diverted from one track to another.

QUESTION 2 List out the tools required for the track maintenance.

(Win-23 , Marks-2) . (Win-22, Marks-2) (Sum-22, Marks-2) .

Ans: i. Cant board. ii. Wire claw. iii. Powarah. iv. Hammer.

v. Rail bender. vi. Jacks. vii. Rail Gauge. viii. Sleeper tongs.

ix. Auger. x. Shovels. xi. Rail tong. xii. Claw bar.

xiii. Sledge hammer. xiv. Chisel. xv. Beater cum pickaxe. xvi. Spanner.

QUESTION3. Define equilibrium cant. (Sum-22, Marks-2)

ANS: For a constant speed of a running train the amount of required cant to achieve the balance is called equilibrium cant.

QUESTION 4. Discuss wayside stations, junction station and terminal station.
(Sum-23, Marks-2) (Sum-22, Marks-6)

ANS: **1. Wayside stations:** The railway stations having an arrangement only for crossing up and a down train and o overtaking a slow moving train by the fast moving train is called a non-junction or way side station. Way side stations are further divided into following types:

a. Halts or Halt Stations. b. Flat Stations. c. Crossing Station.

a. **Halt Stations:** This is simply a stopping place having no building and staff. This way side station usually consists of a platform with a name board of the station on either side.

b. **Flag Stations:** These way side station are similar to halt stations But in their case building and staff are provided. These stations may also have telegraph facility some flag stations may have siding on which few wagons can be detached for loading and unloading purposes. These stations are so called because the movement of trains at such station is controlled usually by showing flag signals. Such way side stations are normally without signal system.

c. **Crossing Stations:** At these way side stations facilities are provided for crossing of an up and down train therefore these stations are provided with one loop line so that while one train is standing on loop line. The other train which is not to be stopped at the station can cross it. The loop line may or may not have dead end sidings. This type of way side stations can be provided on a single line, double line, or a triple line railway tracks.

2. Junction station: At Junctions stations some special arrangements are made to fulfill the following requirements. a. To facilitate the interchange of traffic between main and branched lines. For this purpose, cross over, foot over bridges etc. are provided. b. To clean and repair the railway vehicles as locomotives, passenger coaches, wagons etc. which are terminated at such stations, for this purposes, loco sheds, diselsheds, washing lines etc. are provided. c. To change the direction of engines for this purpose turn table, or triangle is provided. The junction station may occur between a single branch line and a single or double main line or between double line, branch and main tracks. At junction stations occurring between a single branch line and a single line main track a loop line is provided on the branch line so that the train can be taken back along the same route. A crossover between main line and branch line is provided to make connection between them. At junction stations occurring between a single branch line and a double line main track, a scissor cross over is provided to make connection between main line and branched line and island platform with a turn table is located to permit addition extra lines. A foot over bridge between main platform and island platform can be provided to facilitate to interchange the passengers.

3. Terminal station: The station at which a railway line terminates or ends is known as terminal station or junction station. At terminal station addition arrangement such as a turn table or a triangle, number of sidings, examination pits etc. are provided. Hydraulics buffers are provided at the ends to stop the trains without excessive damage in case driver does not apply the brakes properly. In the circulating area, ticket office, restaurant etc. are provided. This area is directly connected to road. The simple layout of this type of Railway station without additional facilities such as marshalling yards etc.

QUESTION 5. Draw a neat sketch of standard cross-section of double B.G. Track in cutting. (Sum-22, Marks-6)

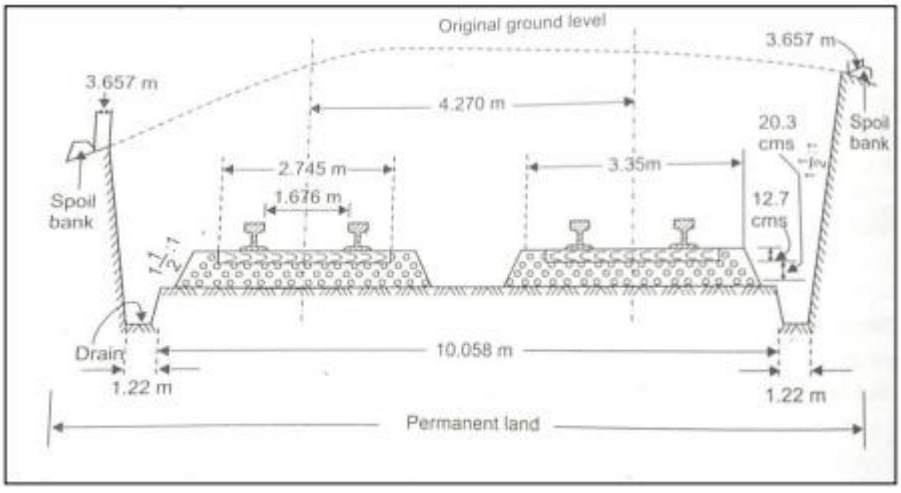


Fig. Standard Cross-section of a Double B.G. Track in Cutting.

QUESTION 6. State steps involved in the construction of Railway Track.

(Sum-22, Marks-6)

ANS: Steps involved in the construction of railway track:

1. Introduction: Brief history of project starting from proposals end ending with finalization of detailed drawings and estimates.

2. A brief description of alternative routes - primarily chosen and finally rejected.

3. Main requirements for project.

4. Alignment: details of alignment with respect to proposed gauge, gradients etc.

5. Specifications.

6. Design standards.

7. Execution of work laying at ballast/sleepers and laying of track.

8. Safety measures and trial and allow for the traffic.

QUESTION 6. State the requirements of rail alignment OR

Factors affecting alignment of railway.

(Sum--23, Marks-2) (Win-19, Marks-2)

ANS: i) The alignment should be short and straight.

ii) The alignment should be economical.

iii) It should take care of obligatory points.

iv) Marshy and low-lying areas should be avoided.

v) Raw materials for construction should be easily available near the site.

vi) It should facilitate easy slope and curve.

QUESTION 7. State the classification of station yards

(Win-19, Marks-2)

ANS: Station yards are classified as follows:

i) Passenger Bogie Yard ii) Goods Yard

iii) Locomotive Yard iv) Marshalling Yard

QUESTION 8. Explain Cant deficiency with its values. (Sum-23, Marks-6)

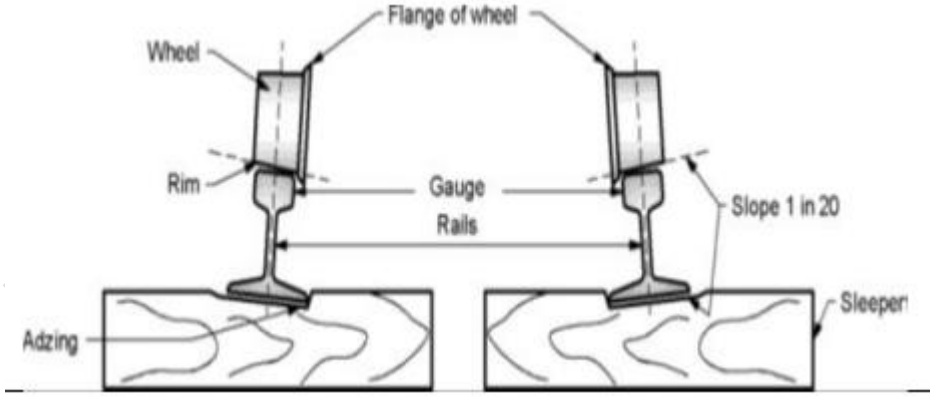
(Win-19, Marks-6)

ANS: **Cant Deficiency:** The difference between equilibrium cant necessary for maximum permissible speed on curved track and the actual cant provided is known as cant deficiency. It should be as low as possible as higher cant deficiency result in extra pressure, more side wear and creep of outer track and results in discomfort to passenger.

For different gauges, cant deficiency prescribed by Indian Railway for speed upto 100 km/hrs is 7.6 cm, 5.1 cm, 3.8 for B. G. M. G and N. G respectively and for speed more than 100 km/hr, it will be 10 cm for B. G. only.

QUESTION 9. Explain coning of wheels with neat sketch (Win-23, Marks-6) (Win-19, Marks-6)

ANS: If the flanges of the wheel are flat then due to shocks there will be movement between wheel and the rails and due to which, vehicle will not be maintained in central portion and there will be unequal distribution of load. Therefore, the flanges are made in the shape of cone with a slope of l in 20. This is termed as coning of wheel. It will also help in decreasing the wear and tear of the flanges and the rail. To prevent rubbing inside face of rail and flanges, the distance between inside edge of flanges kept less than the gauge and thus the pressure is always maintained at the inner edge of rail due to coning of wheel.



QUESTION 10. Describe the functions of any six tools required for rail track maintenance . (Sum-24, Marks-6) (Win-19, Marks-6)

Ans: 1) Cant board: It is used to check cant on curve.

2) Wire claw: It is used to clean the ballast.

3) Powarah: It is used to spread ballast.

4) Hammer: It is used to drive spikes.

5) Rail bender: It is used to bend rail to keep them in desired position.

6) Jacks: It is used to lift the track.

7) Rail Gauge: It is used to check the rail gauge width.

8) Sleeper tongs: It is used to lift the sleepers.

9) Auger: It is used to drill holes.

10) Shovels: It is used to handle ballast.

11) Rail tong: It is used to lift rail.

12) Claw bar: It is used to take out spikes from sleeper.

13) Sledge hammer: It is used to cut rails by chisel.

14) Chisel: It is used to cut the rails.

15) Beater cum pickaxe: It is used to pack ballast under the sleepers.

16) Spanner: It is used to fix bolts .

17) Spirit level along with straight edge: It is used to maintain cross levels of rails.

QUESTION 11 Define cant deficiency and negative cant (Sum-24, Marks-2) (Win-23, Marks-2)

Ans: **Cant deficiency:** The difference between the equilibrium cant, necessary for maximum permissible speed on a curved railway track and the actual cant provided is known as cant deficiency. OR

Cant deficiency: is the amount by which the actual superelevation falls short of the equilibrium superelevation.

Negative cant: The elevation of outer rail below the inner rail of a turnout or branch track at the place where it meets the main track on a curve is called as negative cant or negative super elevation.

QUESTION 12 Give two purposes of station yard. (Sum-24, Marks-2)

Ans: I. Passenger bogie yards provide facilities for the safe movement of the passengers and vehicles for the passenger.

II. Goods yard provide facilities for receiving, Loading, Unloading and delivery of goods and movement of goods vehicle.

III. Marshalling yards provide facilities of receiving train and other loads, sorting out and forming new trains and their dispatch onwards.

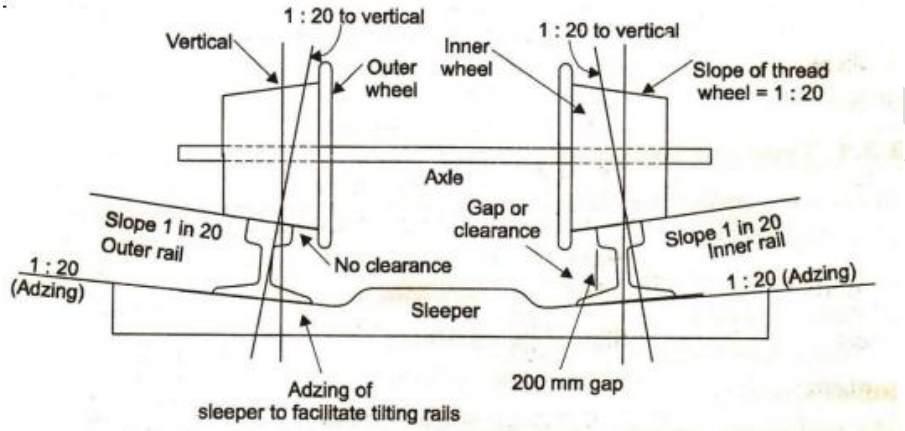
IV. Locomotive yards provide facilities for coaling, watering, repairing, oiling, cleaning etc for servicing and maintenance of locomotive.

QUESTION 13 Explain the necessity of tilting of rail with neat sketch

(Sum-24, Marks-6) (Sum-19, Marks-6)

Ans: In case the rail of track are placed in vertical position ,the top surface will not come in full contact with the treads of wheels of a train due to coning of wheels and the pressure of wheels will always be exerted near the inner edges of the rails. Therefore, the rails will wear out quickly .To make full contact of top surface and thereby reducing the wear of rails in this way, these are placed at an inward slope of 1 in 20.which is known as tilting of rails.

The tilting of rail is achieved by providing a cut in the wooden sleeper called as "Adzing". Canted bearing plates can also be used in wooden sleepers to provide tilting of rails. Steel, CI and PSC sleepers have in built slope on the bearing surface to provide tilting of rails.



Tilting of Rail

QUESTION 14 Explain the duties of following personnel's in rail track maintenance: (i) Permanent Way Inspector (ii) Gang Mate (iii) Key Man

(Sum-19, Marks-6)

Ans **Duties of permanent way inspector** – (Win-22, Marks-2)

1. The duties of permanent way inspector are as follows;

2. The PWI is personally responsible for maintaining the track in good condition for the passage of trains. For this purpose, he travels over the track by push trolley and watches the defects of the track and arranges the repair of the defective track by his gang.

3. He is responsible to carry out the renewals of rails and sleepers.

4. He should maintain the record of wear of rails in his section. He should check out the programme for lubrication of rail joints in such a way that the entire rail joint are lubricated on a year during winter season.

5. He is responsible to maintain the correct gauge, super elevation on curves and removal of creep etc.

6. He should supervise the work of his gang regularly.

7. He should see the welfare of his gang man.

8. Level crossing under his charge must be maintained in perfect condition. During this visit to level crossing, he should check the working of gateman also. If necessary he should issue instructions to the gateman.

9. At the time of accident, he is responsible to store the traffic in the shortest possible time. He should also find out the causes of accident.

10. He should prepare the estimates of the maintenance work and should report the progress to his seniors.

Duties of gang mate :

1. Gang mate means the person in charge of gang of work men employed on permanent way.

2. He is responsible for the maintenance of track.

3. It is his duty to arrange for tools and other requirement for his gang.

4. He has to allot duties to each of his gang man and to check their work.

5. He has to maintain record of work, reports of key man.

Duties of Keyman:

1.The position of a Keyman in his gang is next to the Gangmate and hence, in his absence the Keyman is to perform his duties

2. He is responsible for the upkeep of all fastening and rail joints in the track of his section.

3. He is to walk on the whole section to inspect fastening and joints every day.

4. He is to tight all the fittings like fish bolts, spikes, sleepers, keys etc. found loose during his inspection.

5. He should grease fish plates and oil fish bolts.

6. He should open and refit all joints at least once in a year

QUESTION 15 State the importance of cross drainage works.

Ans: 1. The cross drainage work helps to maintain the continuity of a road or a railway track while going across the river, streams, nala depressions and valleys.

2. It also maintains the gradient in undulating area in case of railway.

3. It provides the continuous access to the surrounding villages and towns even at the time of flood and heavy rain.

4. It helps to drain the water by providing the structure called as scuppers in hilly areas.

5. It maintains the continuous communications.

QUESTION 16 State the requirement of railway station.

Ans: **(1) Public requirement:** A booking office for issuing tickets and for booking of goods.

1. Passenger and goods platform.
2. Waiting rooms and retiring rooms
3. Name board of station.
4. Arrangement for drinking water.
5. W/C and bath room arrangement.
6. Suitable light arrangement.
7. An enquiry office.
8. Microphones to announce arrival and departure of train.

(2) Traffic and police requirement:

1- Staffroom. 2- Retiring room and rest houses. 3- Residential quarters for railway staff.

(3) Trains requirement: The following arrangement should be there for the control of trains movement :

1. Arrangement for controlling the movement of trains by signal.
2. Sufficient number of siding for receiving, sorting, storing and despatching trains.
3. Sufficient number of platform for handing passenger and goods.

(4) Requirement of locomotive: The Railway station should provide following facilities for locomotives:

1. For changing the direction of engine; a turn table must be there.
2. Arrangement for cleaning, examining, inspecting and maintaining the locomotives such as ash pits, inspection pits, etc. should be provided.
3. Coal lifting cranes, water columns for supply of fuel and water should be provided.

(5) Requirement for development of railways: The railway station should provide the following facilities for development of railway:

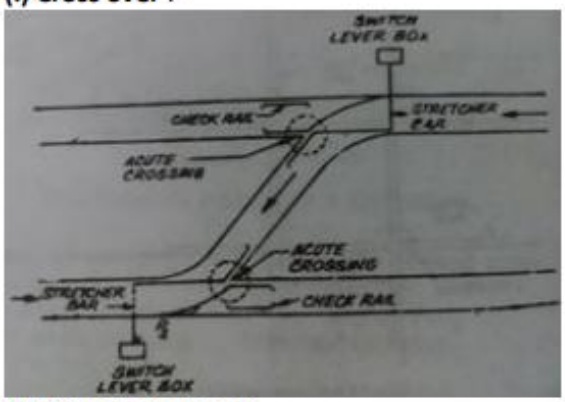
1. Easy and comfortable approach roads. 2. Big waiting halls.

3. Guide map of city separate arrival and departure of trains. 4. Sufficient number of coolies.

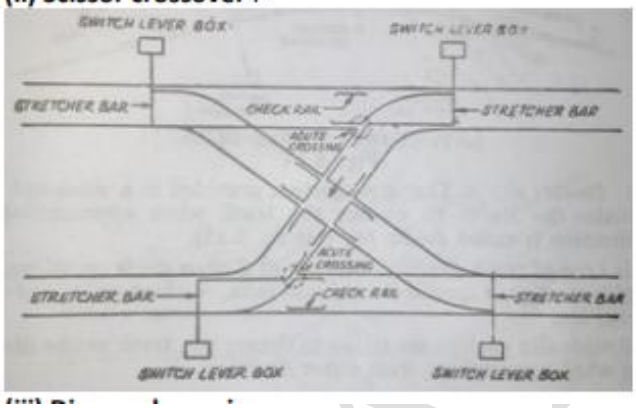
QUESTION 17 Draw a neat line sketch of the following: (Win-23, Marks-4)

(i) Cross over (ii) Scissor crossover (iii)Diamond crossing (iv) Triangle

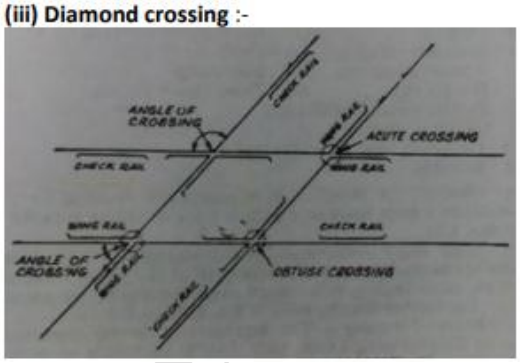
(i) Cross over :-

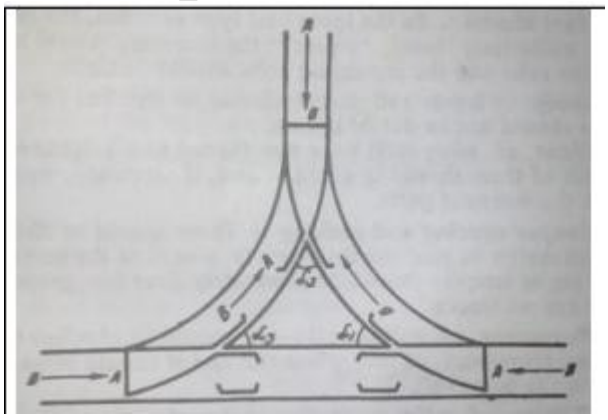


(ii) Scissor crossover :-



(iii) Diamond crossing :-





QUESTION 18 Explain the necessity of gradients.Discuss all types of gradients giving their permissible values in India. (Sum-23, Marks-6)

Ans: The rate of rise or fall provided to the formation of a railway track along its alignment is called as gradient. The various types of gradients are

1. Ruling or maximum gradient 2. Momentum gradient

3. Station yard gradient 4. Pusher gradient

1.Ruling gradient : It is the maximum gradient allowed on the track over which a train is hauled by one locomotive. It is generally 1 in 150 to 1 in 200 for plane and 1 in 100 to 1 in 150 for hilly regions.

2. Momentum gradient :Sometimes rising gradient is followed by falling gradient. In that case when train travelling due to falling gradient, it acquires momentum and due to which it becomes easy to travel in rising gradient. This type of gradient is known as momentum gradient.

3.Station yard gradient : The gradient provided in station yard for easy drainage is known as station yard gradient. It has been recommended for easy drainage of rain water and it is in between 1 in 400 to 1 in 100 for maximum and minimum respectively.

4. Pusher gradient : These are steeper than ruling gradient. In this type of gradient, an extra engine is attached to push the train and hence called as pusher gradient. These are helpful in the regions where heavy cutting is to be avoided and to reduce the route length.