2.3 TRACK DRAINAGE

Sources of Moisture in a Railway Track

Various sources of moisture affecting a railway track are the following :

1. Surface water due to train, dew or snow.
2. Moisture sucked up by capillary action resulting in increase of moisture in the subgrade or embankment.
3. Seepage-water from adjacent area.
4. Hydroscopic water or held-water.

SIGNIFICANCE OF TRACK DRAINAGE

The bearing power (or strength) and stability of soil (i.e., resistance to shear of soils) are greatly reduced due to presence of excess moisture. The variation in bearing power and stability depends upon the percentage of moisture, soil type and mode of stress-application.

REQUIREMENTS OF TRACK DRAINAGE SYSTEMS

1. The surface and underground waters should be well away from a track; the banks and cuttings; over or through which they run.
2. The surface water from adjoining land should be prevented from entering the track-formation.
3. The side drains should have sufficient capacity and longitudinal slope to carry away all the possible surface water.
4. Flow of surface water across the track and along the slopes should not cause erosion of the banks and slopes of embankment.
5. Sub-surface water should be efficiently drained off by the sub-surface drainage system.
6. The highest level of ground water table should be well below the level of the subgrade.

7. The track alignment should be made to rest on pervious; naturally drained and suitable soils. Coarse-textured soils are more permeable; retain less capillary moisture and respond more readily to drainage system.
8. In water-logged areas; special precautions should be taken especially if detrimental salts are present or if floods are common in the area.

Special measures should be taken in the following cases :

a. Existence of an underground water pocket due to hollow basin over thick impervious layer.
b. Existence of an underground water pocket over a thin impervious stratum which lies on fissured strata (i.e. good pervious soil).
c. Presence of water bearing strata on side with long-cuttings and banks i.e.; seepage flow.

In case of black-cotton soils; or expansive soils.

In case of track-drainage problems where either

i.wet earth gets into the ballast

ii.ballast sinks into the wet earth.

The drains or pipes should be kept at closer spacing to keep the water table well below the formation to prevent capillary rise of water.

1.Surface Drainage :

Due to rain; dew and snowfalls; the moisture moves into the embankment under the action of gravity. This movement of water is resisted by the permeability of soils. So it is desirable that good soils should be used for bank and formation. The best soil would be a well-graded material of high-internal friction having high-cohesion without any characteristic of detrimental shrinkage i.e.; when it dries without any expansive tendencies; when it gets damp with small capillarity; should possess good elasticity and even with fairly large water content not of too much plasticity. When compacted; such an ideal material must remain stable both when wet and dry i.e.; under all weather

conditions. However; such soils satisfying such characteristics are very rarely available in actual practice.

2. Sub-surface Drainage :

Changes in moisture content of subgrade or formation in embankment or in cutting are caused; mainly due to fluctuations in movement of capillary water; seepage water from adjacent area; ground water table and percolation of rain water. The object of sub-surface drainage is to keep these fluctuations of moisture as minimum as possible.

TRACK DRAINAGE UNDER SPECIAL CASES

Special situations may arise in any one of the following cases:

1. Existence of an underground water-pocket due to hollow basin over thick-impervious layer.
2. Existence of an underground water-pocket over a thin impervious stratum which lies over a fissured strata (i.e.; good pervious soil).
3. Presence of water bearing strata on side-long cuttings and banks i.e.; seepage flow.
4. In case of black-cotton soils or expansive soils.

3.Cross-drainage

Whenever streams or water courses have to cross the track; facility for cross-drainage has to be provided. The water from the side-drains is taken across by these cross drains in order to divert the water away from the track. Generally, the cross-drainage structures consist of drain pipes, culverts or the bridges.

The choice of the type of a bridge will depend upon several factors like span, loads, etc. However; the cross-drainage system can be designed and used depending upon the requirements and economic considerations. R.C.C. and steel bridges are very common these days.

TRACK DRAINAGE PROBLEMS

The bad drainage results in either of the following two problems :

1. wet earth clogs (or gets into) the ballast
2. ballast sinks into the wet earth

TRACK DRAINAGE REMEDIAL MEASURES

1. Use of pervious cess
2. Use of perforated pipes and trench drains
3. Use of inverted filter blanket
4. Cement grouting
5. Combination of pervious cess and inverted filter
6. Use of sand piles
7. Use of counterfort drains
8. Use of Capillary break