SECTION 1

EARTHWORKS, FORMATION AND DRAINAGE

This page is intentionally left blank

1.1 INTRODUCTION

In a railway track, the surface on which the ballast is laid has considerable influence on the condition of the track. The purpose, preparation, and maintenance of this surface, called the formation, is discussed in this chapter. The definitions in Section 1.2 apply to the earthworks, formation and drainage of a railway. Figure 1.1 illustrates some of the definitions.

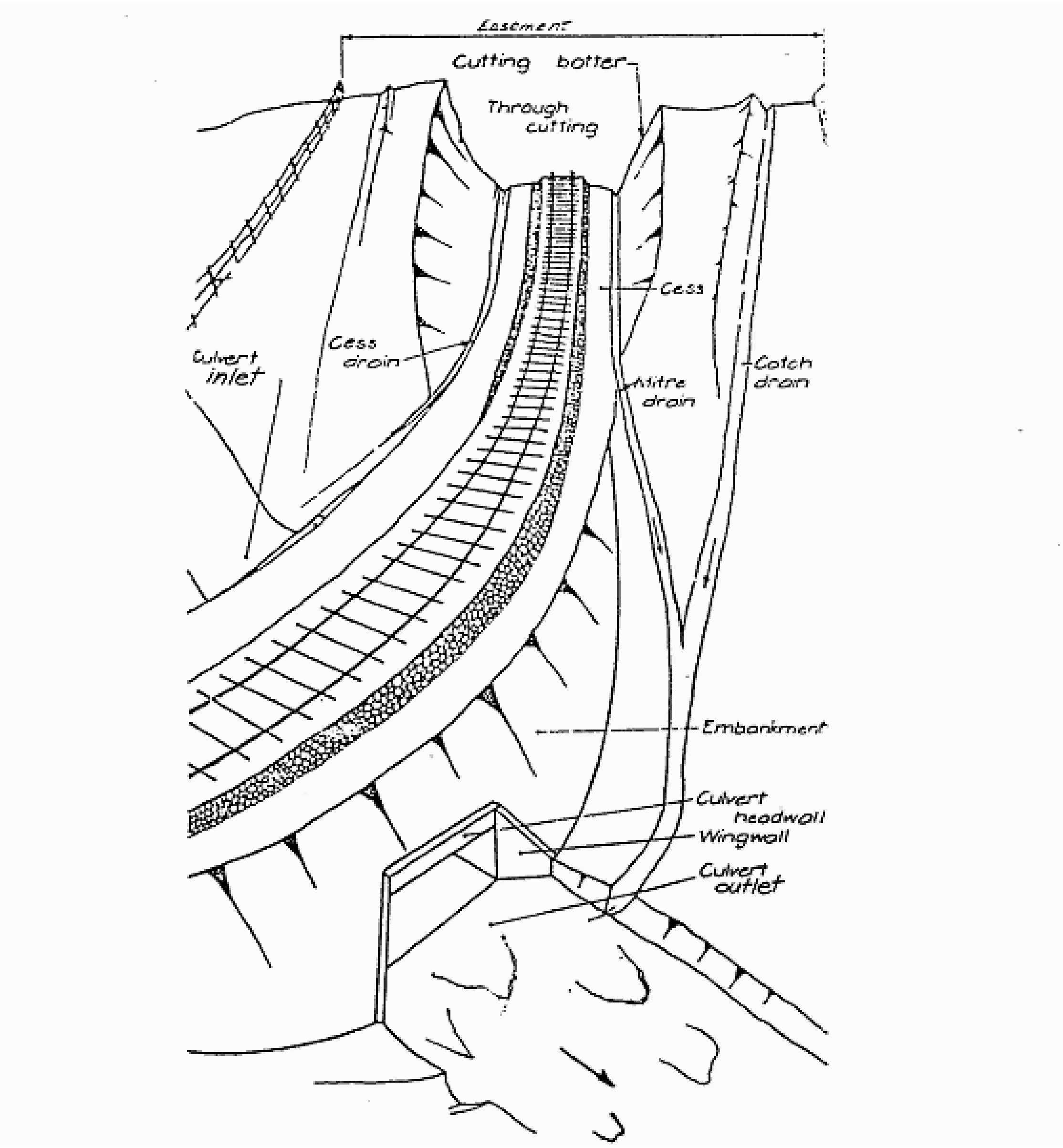

Figure 1.1 Parts of a Railway

1.2 DEFINITIONS

EASEMENT - The strip of property on which earthworks, structures and track are constructed.

CUTTING - An excavation along the centreline of a railway for the purpose of forming the formation to the correct grade and section, commonly referred to as a 'cut'. Depth of cutting is the vertical distance between natural ground surface and formation level at track centreline. Excavation less than 300 mm deep is not normally referred to as cutting.

EMBANKMENT - The filling obtained from cuttings or by 'borrowing' material from elsewhere, placed along the centreline of a railway for the purpose of forming the formation to the correct grade and section, commonly referred to as a 'fill'. Height of an embankment is the vertical distance between natural ground surface and formation level at track centreline. An embankment less than 300 mm high is not normally referred to as embankment or fill.

SURFACE FORMING - Where side slopes are not severe and cut and fill are less than 300 mm in depth, the formation is said to be constructed by surface forming.

FORMATION - The prepared surface on which the ballast is laid. It is also known as the Roadbed or Subgrade.

FORMATION LEVEL - On straight track this is the level of the prepared surface on its centreline. In the case of curved track, where superelevation is provided, formation level is the level of the prepared surface under the low rail of the curve.

FORMATION WIDTH - The distance between the edges of the prepared surface. This is typically 4000 mm as shown in Figures 1.2.1 to 1.2.7.

FORMATION SHOULDER - The edge of the formation.

CESS - That part of the formation lying between the toe of the ballast and the formation shoulder.

BALLAST SHOULDER - The top edge of the ballast section.

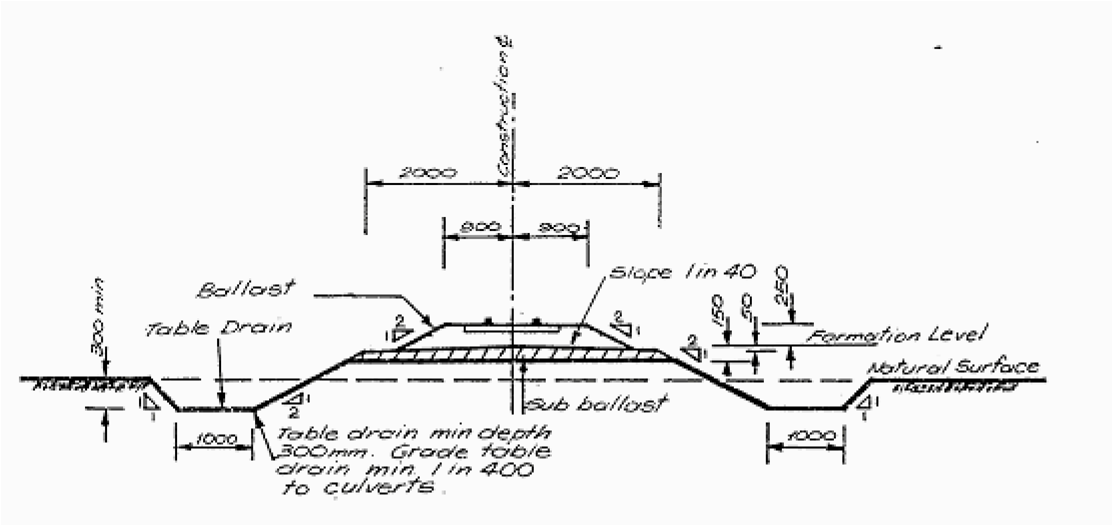

Figure 1.2.1 Typical Surface Formation (1 500 mm Timber Sleepers)

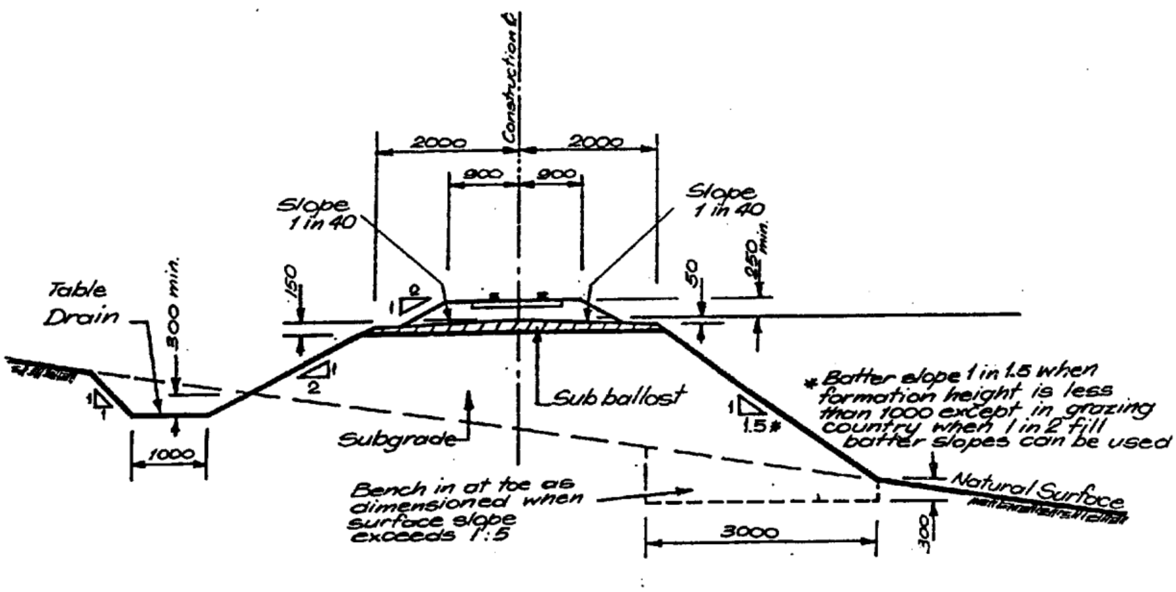

Figure 1.2.2 Typical Embankments (1 500 mm Timber Sleepers)

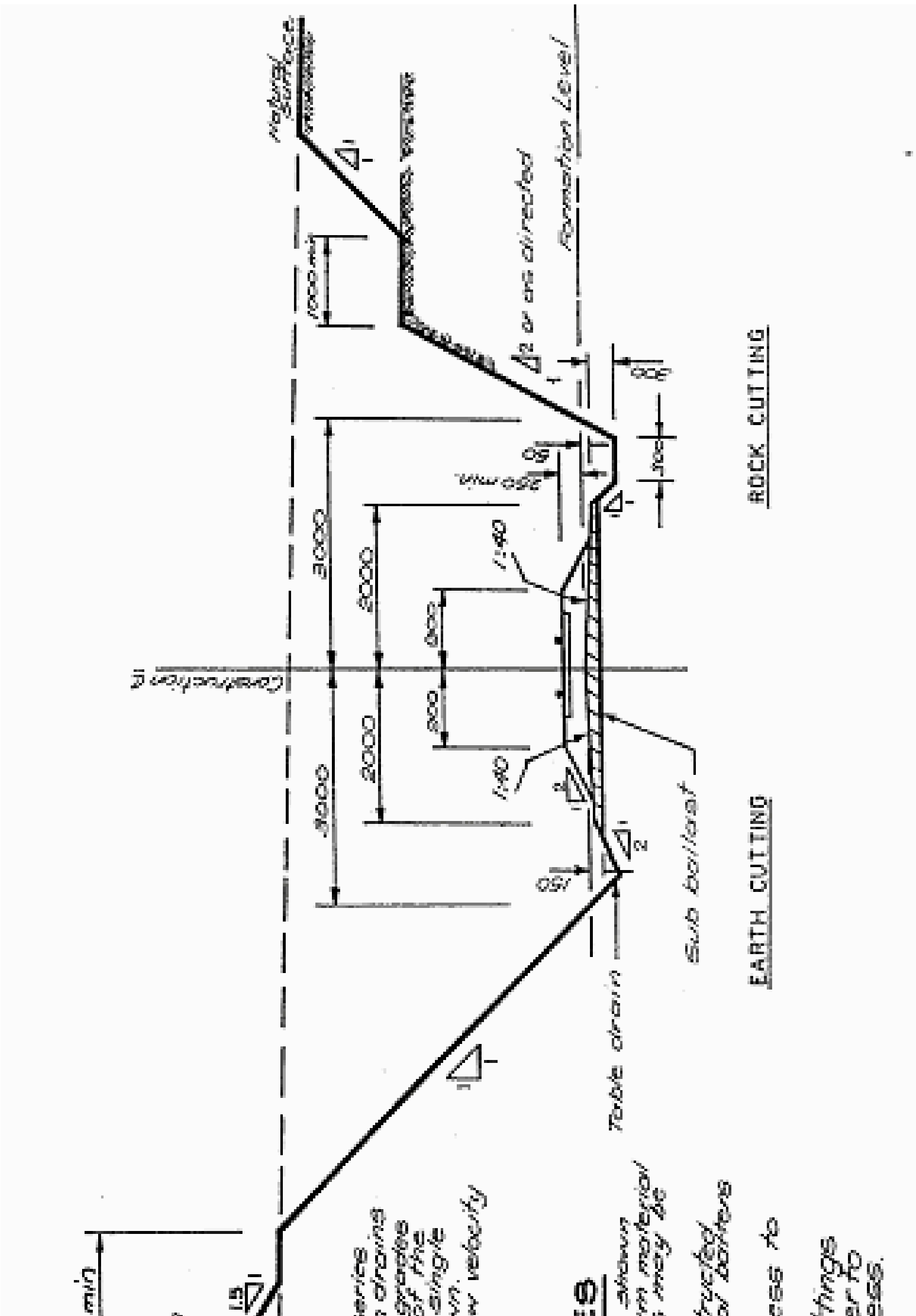

Figure 1.2.3 Typical cutting details (1 500 mm Timber Sleepers)

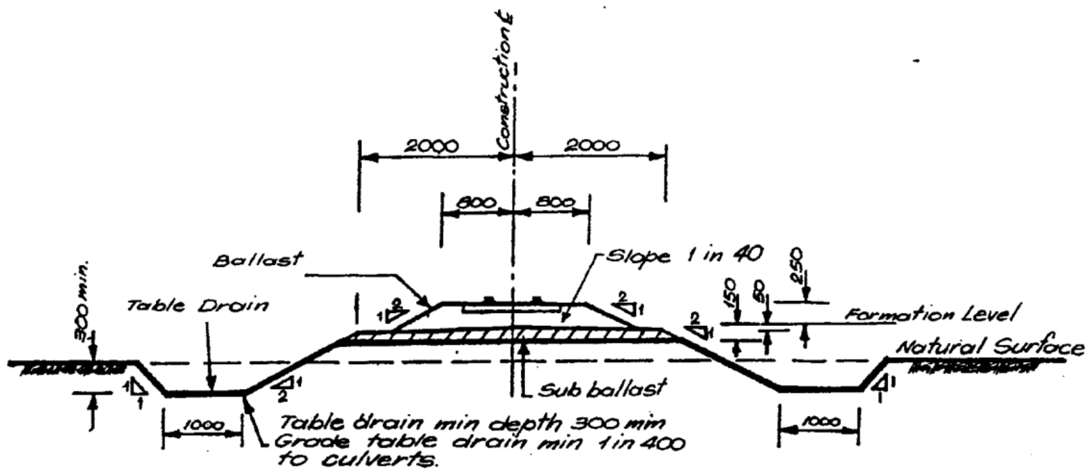

Figure 1.2.4 Typical Surface Formation (1 200 mm Concrete Sleepers)

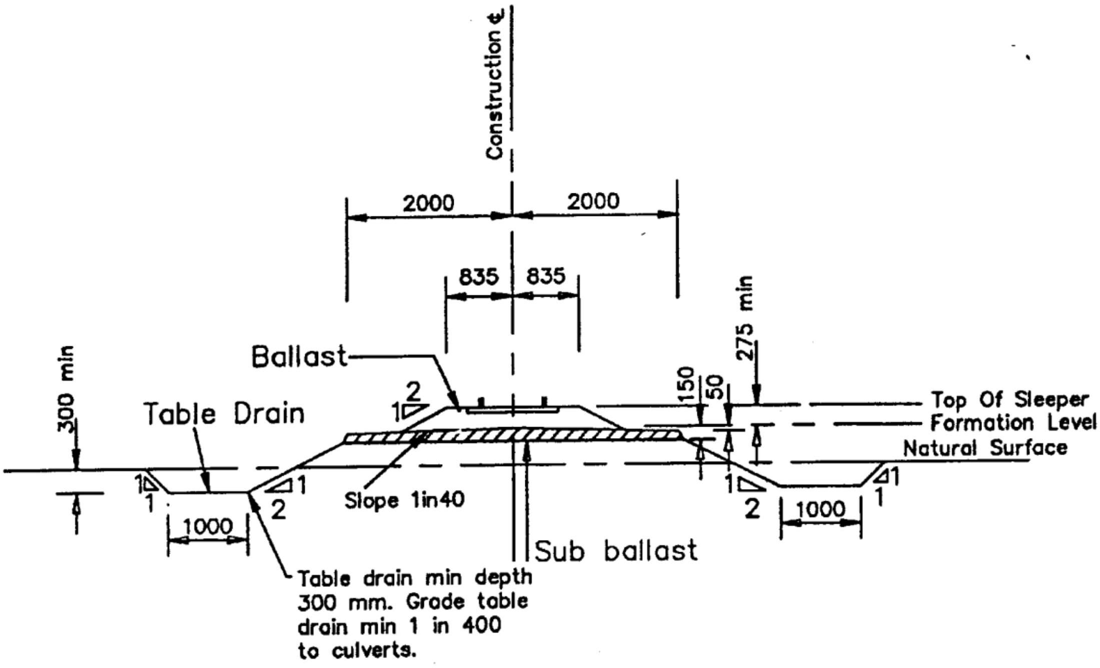

Figure 1.2.5 Typical Surface Formation (1 370 mm Concrete Sleepers)

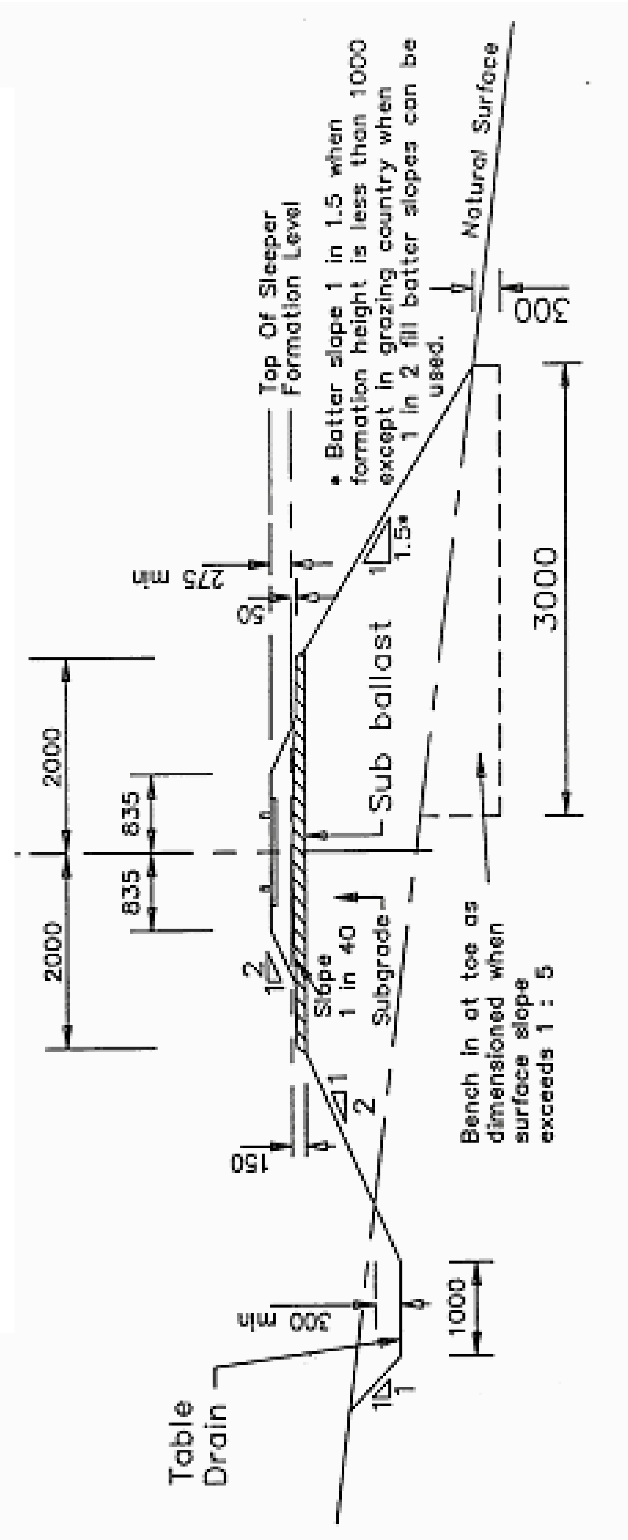

Figure 1.2.6 Typical embankments (1 370 mm concrete sleepers)

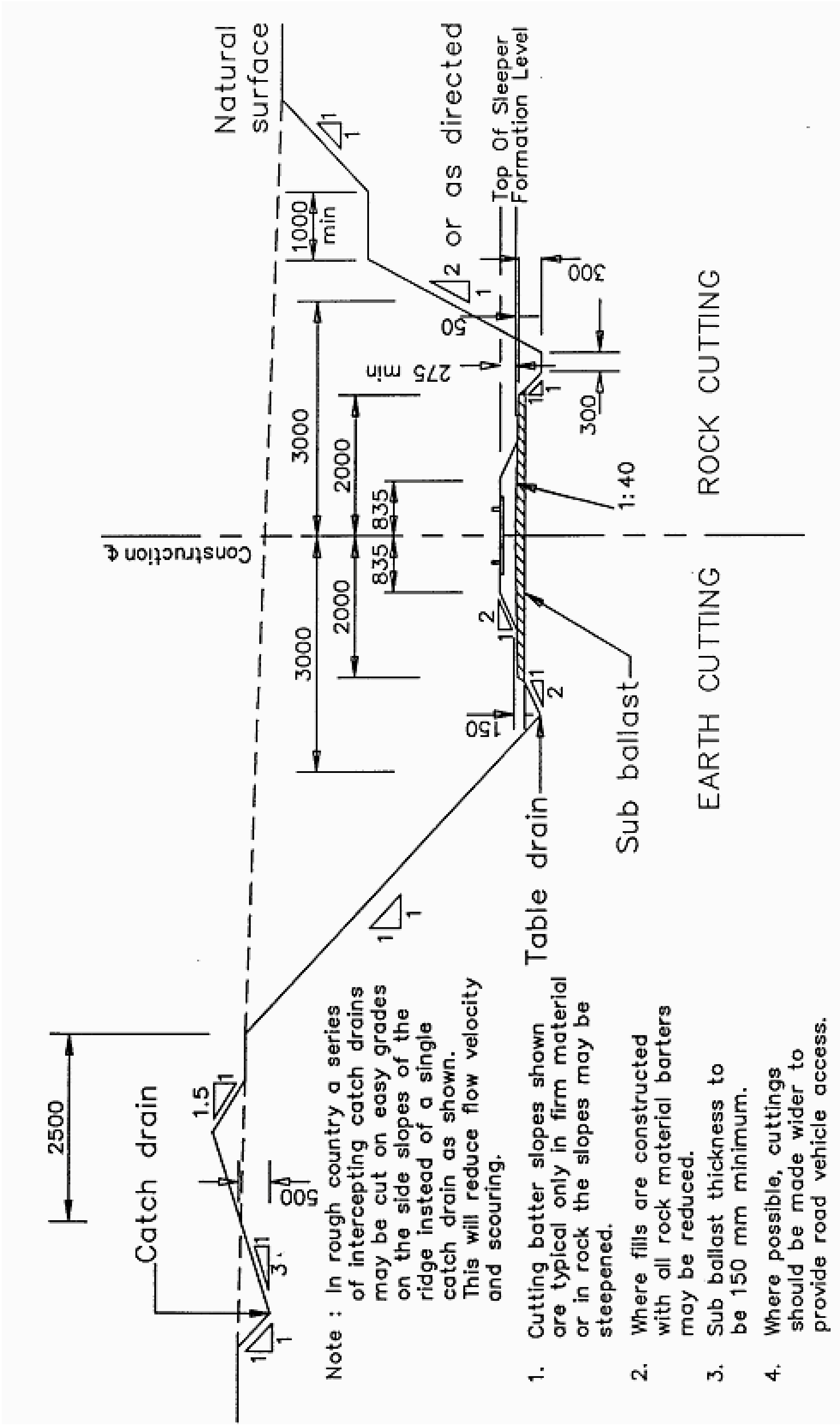

Figure 1.2.7 Typical cutting details (1 370 mm concrete sleepers)

BATTER - The inclined face of a cutting or embankment. It is sometimes referred to as a side slope.

GRADE LINE - The planned longitudinal section of a railway, from which formation levels are determined and cut and fill calculated by reference to the natural ground profile.

GRADIENT - The slope of the railway. This is also referred to as the grade. It is expressed as a relationship of height to distance, e.g. 1 in 66 means the level rises by one metre for each sixty-six metres of horizontal distance.

CESS DRAINS - The open drains at the toe of the batter of a cutting which collect water flowing down the batter and the formation.

CATCH DRAINS - Open drains cut parallel to the general line of the railway which intercept water flowing across the track towards the batters of cuttings or embankments. Catch drains may also be used with surface forming.

CROSS DRAINS - Any form of drain which is used to conduct water from one side of a railway to the other.

OPEN TOP DRAINS - Particular types of cross drains which do not have a covered top, e.g. steel and concrete drains, Amos drains.

CULVERTS - Covered cross drains below the formation for the passage of water or for other purposes. Culverts are usually specified by their shape and construction, e.g. concrete box culverts or corrugated metal pipe culverts.

DRAIN INLETS AND OUTLETS - Excavation in stream channels or gullies to improve flow through cross drains.

INVERT - The surface over which water flows in a drain or culvert.

DIVERSION DRAINS - Open drains cut to divert flow from small gullies to suitable cross drains. These are generally larger and deeper than catch drains.

BERMS - Benches by which batters are stepped to reduce their size and improve stability in deep cuttings and in cuttings through bad ground.

MITRE DRAINS - Small open ditches at the ends of cuttings which direct flow from the cess drains to catch drains or to cross drains.

BORROW PIT - A place outside the limits of the earthworks from which material is excavated for use as filling.

SIDE CUTTING - A borrow pit located within the easement and not exceeding 600 mm in depth.

EARTHWORKS AND FORMATION - Figures 1.2.1, 1.2.2, and 1.2.3 show typical details for cane railway formations where 1500 mm long timber sleepers are used. Figure 1.2.1 is typical for surface formations on level ground, Figure 1.2.2 gives typical details for an embankment. The left hand side of Figure 1.2.3 shows details for a cutting through natural earth and the right hand side shows a typical rock cutting. A typical formation for 1200 m long concrete sleepers is shown in Figure 1.2.4. Figures 1.2.5, 1.2.6 and 1.2.7 show respectively typical surface formations on level ground, for an embankment and a cutting where 1 370 mm long concrete sleepers are used.

1.3 DIMENSIONS OF EARTHWORKS

The basic dimensions shown in Figures 1.2.1 to 1.2.7 have been found satisfactory but should be checked against site geological conditions. Note that cuttings in soil have a formation width of 6 m. In rock, the formation width could be reduced to 5.6 m provided the rock in the cutting face is sound.

The slopes of the batters of embankments are normally 2 to 1, while cuttings in soil generally have batters sloped at 1 to 1. In unstable ground battens are usually flattened, while in rock cuttings batters may be constructed as steep as 1 to 2. In very firm rock, vertical batters may be used in some cases.

1.4 THE FORMATION

The formation is required to serve four functions:

(a) To distribute the weight of the ballast, track, and the rolling loads over sufficient area of the natural ground so that the track retains its running surface and alignment.

(b) To provide a smooth and regular surface at the proper profile and grading on which the ballast and track can be laid.

(c) To facilitate good drainage.

(d) To provide access to the track for maintenance and other purposes.

1.4.1 Formation for restricted easements

Formation details shown in Figures 1.2.1 to 1.2.7 are suitable where easement width of at least 10 metres is permitted. In many cane railway locations, such as through farms, easement widths of only 5 metres are possible. Figures 1.4.1.1 and 1.4.1.2 show formation cross-sections typical for these situations. Farm headlands should be located outside the easement width.

Drainage for this type of formation is often difficult but cross drains described in Section 1.10 are effective in conducting water from one side of the formation to the other. Where overtopping occurs flood protection work (Section 1.11) should be carried out.

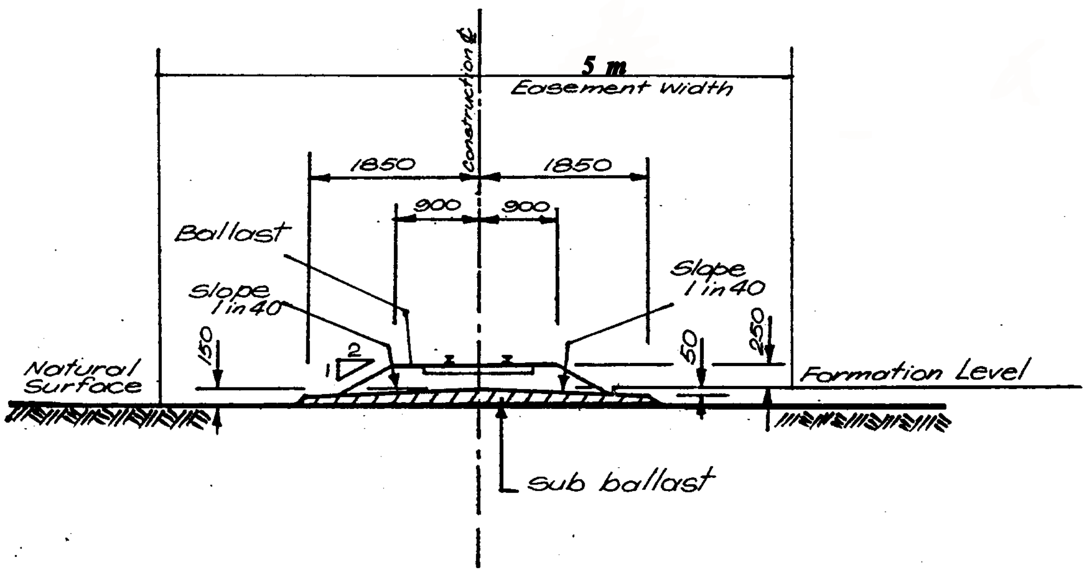

Figure 1.4.1.1 Formation for restricted easements (1 500 mm Sleepers)

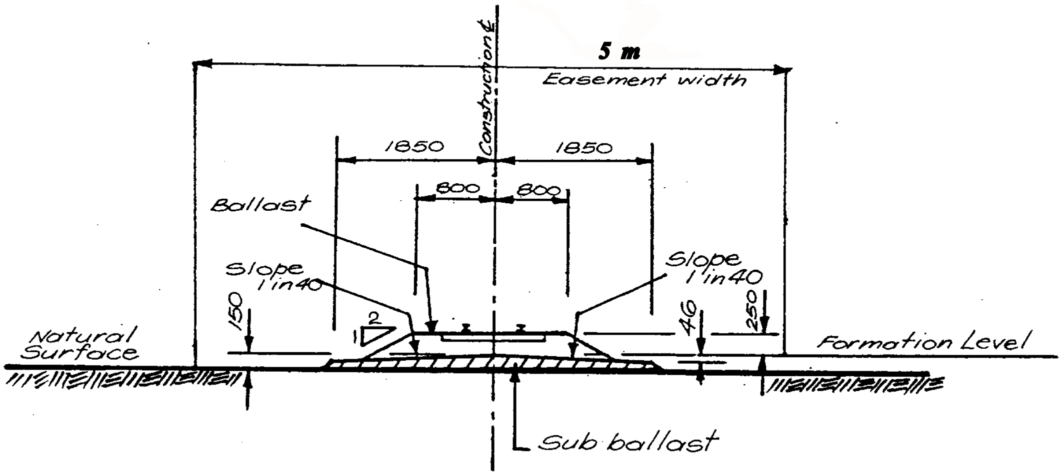

Figure 1.4.1.2 Formation for restricted easements (1 200 mm sleepers)

1.4.2 General

Good formation is essential of good track. It should be made from the best materials available, properly shaped to the full dimensions, and protected from the effects of water. Formation which does not comply with these requirements will provide serious problems in maintenance.

Wheel loads from trains are distributed by the rails over the adjacent sleepers which in turn further distribute the loads over the ballast and through to the formation.

The portion of ballast which may be regarded as effective in carrying the load of the sleeper is that forming an imaginary pyramid under the load, the sides of which slope at approximately 1 to 2, as shown in Figure 1.4.2. From the figure it is apparent that the deeper the ballast is, the less the pressure on the formation becomes. If the ballast is shallow, the tendency is for the ground to be depressed under each sleeper. If the soil is of a plastic nature, such as wet clays, it will be forced outwards and will rise in the spaces between the sleepers. In extreme cases the clay intrusion will work its way into the ballast in the form of a slurry as the sleepers 'pump' up and down under traffic.

Although the design of a track is a complex matter, it is sufficient to state that the pressure on the formation depends mainly on the depth of ballast and the size and spacing of the sleepers. Apart from the matter of cost, there is a practical limit to the number of sleepers which can be used, as sufficient space must be left between sleepers for tamping. The use of a heavier rail does not necessarily reduce the pressure on the formation to any great extent. Typical ballast properties are given in Section 2.6.

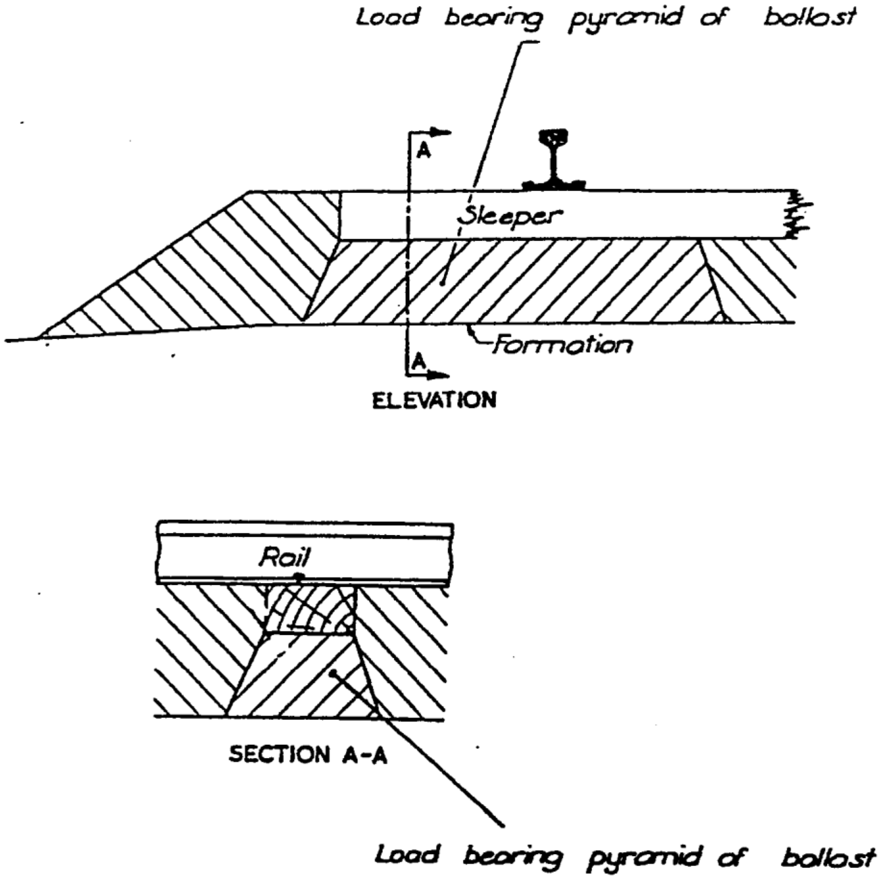

Figure 1.4.2 Load on Formation

1.5 FORMATION MATERIALS

Apart from rock cuttings, the formation is constructed from soil. Soil is defined by the engineer as 'any naturally occurring loose or soft deposit forming part of the earth's crust and resulting from weathering or breakdown of rock formations or from the decay of vegetation'.

Soil is composed of particles of varying size, from gravel on the one hand to fine clay on the other. It is one of the most variable construction materials in common use.

The main factors which determine the value of soil as a formation material are:

(a) Soil type,
(b) Moisture content,
(c) Degree of compaction.

It is obvious that good hard gravelly soils, well drained, and thoroughly compacted to form a stable formation are needed. In practice, it is sometimes difficult to meet all these requirements, and the best use must be made of available materials.

Where the natural soil contains too much clay or silt to form a suitable formation, a layer of fine gravel may be used to form the formation. For reasons of economy, the formations of some of the earlier tracks were not provided with a better class of material and they have been difficult to maintain over black soil, clay and wet areas. In the maintenance of tracks under these conditions, the aim should be to strengthen the formation by using a stronger material under the ballast. In practice, this is usually best achieved by raising the track on new ballast and using the original ballast as bottom ballast or sub-grade material.

When any cess building work is carried out, care should be taken to use good materials. Use of clay, black soil or silty materials should be avoided if possible, as free drainage will not occur and this will contribute largely to formation of water or mud pockets, and cause many problems in maintenance of the track. Where possible the formation should be compacted by mechanical means such as rolling and watering.

For further discussion concerning formation design and materials refer to Section 2.6.

1.6 DRAINAGE OF FORMATION

Most soils have a lower safe bearing pressure or strength when saturated with water than when dry, as moisture in the soil tends to alter the properties of the soil material and make it plastic or more readily deformed under load. It is therefore important that the formation should be well drained and shaped to shed rain water quickly and to reduce the penetration of water which could soften the formation material. New formation is provided with a cross fall of 1 in 40, as shown in Figure 1.2.1, and the cesses should be maintained with a similar fall away from the centre to shed the water quickly. The means of draining the formation are dealt with in Section 1.12.

1.7 DRAINAGE - GENERAL

Thorough drainage is the most important single factor in the maintenance of a railway track. Almost without exception, track faults either stem from or are made worse by poor drainage. Poorly drained formation results in the development of 'soft' spots and fouled ballast, which in turn affects the track surface and alignment. Pumping sleepers and other faults such as rail wear, joint batter, loosening and wear of fastenings, sleeper cutting and bad gauge all develop rapidly and the quality of the track deteriorates rapidly. If adequate facilities are not provided for the disposal of heavy rainfall, such faults as flooded track, scouring of ballast and formation, washouts and slips may occur. In general, water in the roadbed arises almost wholly from rainfall or irrigation accompanied by bad drainage features. Some tracks, due to the high cost of constructing them above flood level, have been designed so that the track can be overtopped by floodwaters during heavy wet weather. In these locations, the formation is normally protected against scour by use of stone pitching, riprap or other flood protection works.

Drainage is most important and must be given particular attention in the construction and maintenance of railways.

Drains may be classified into a number of types.

1.8 CESS DRAINS AND MITRE DRAINS

Cess or table drains (Figures 1.1 and 1.2.7) are the most important of all drains. Water falling on the track, cesses and cutting batters is collected by the cess drains and led away from the formation by means of mitre drains and cross drains. Cess drains must be of adequate size to cope with normal rainfall, and they must always be well maintained. On many tracks constructed with narrow formation, cess drains are generally inadequate, and every opportunity should be taken during maintenance operations to increase the size of the cess drains on these lines.

Cutting batters weather and erode in time and silt washes from cuts and adjacent fields and collects in the cess drains. If the cess drains are not cleaned out, they become choked and ineffective, and as a result of this poor drainage the track condition deteriorates rapidly. Silt, vegetation, or any other obstructions should be regularly cleared from the cess drains to ensure they operate efficiently all the time. Debris from the cess drains should not be thrown back on the batters or on the top of the cutting, as it will be washed back into the cutting again. When cess drains are cleaned out, the material should be taken out of the cutting and distributed on the side slopes of embankments. Wherever possible, mechanical plant should be used for cleaning cess drains.

In some cases, it may be necessary to deepen cess drains to obtain an adequate fall and to prevent water lying in the drains and keeping the formation wet. In shallow cuttings where grades are slight, the cess drains can be deepened to the stage where the formation is virtually on a low embankment, thus allowing water to drain out of the formation and hence stabilise the formation material.

Water should not be allowed to run along the cess drains for long distances, but should be turned away from the formation by mitre drains or cross drains wherever possible. Mitre drains should be cut at an acute angle or curved away from the track. In cases of long cuttings on steep grades, scouring of cess drains frequently occurs. This can be reduced by constructing small stops from old sleepers or rocks at regular intervals to break up the speed of flow and thus dissipate the energy of the flow and reduce the scouring action.

Maintenance attention given to cess drains is a good investment. A good return can be obtained for a small outlay in maintenance effort. If cess drains are neglected, the track will quickly suffer. In many cane railway locations cess drains are often far too small. Where this situation exists they should be widened and deepened at the first opportunity, especially during relays.

1.9 CATCH DRAINS

These are open earth drains constructed generally parallel with the railway for the purpose of intercepting water flowing towards the railway earthworks. They should be located and graded to collect water from mitre and other surface drains. They also collect water along their length and lead it to cross drains, bridge water-courses or other locations well away from the track. In earlier days, catch drains were generally constructed by hand excavation to a trapezoidal shape, but apart from rocky ground where a different shape may have to be adopted, they are now constructed by earthmoving plant to a shallow vee shape with the spoil cast on the track side of the ditch (Figure 1.2.3).

As shown in Figure 1.2.3 a typical catch drain is cut a minimum of 2.5 metres from the batter line of a cutting. In ground which scours easily it is desirable to increase this distance, otherwise water in the catch drain could burst into the cutting batter and flood the cutting.

The size of catch drain required depends on the type of country, cross fall of the ground, and size and shape of watershed above the railway. Catch drains must be kept clear of debris and growth which could prevent them functioning efficiently. They frequently scour and this must be prevented from developing by construction of stops similar to those described for in cess drains (Section 1.8) to break up the speed of flow, plugging with stone or using other forms of protection such as stone pitching.

In many cases, diversion drains are cut on the line of catch drains and are virtually large catch drains. However their function is to avoid the necessity for construction of cross drains. Special attention usually has to be paid to these batter drains to prevent scour and damage to the track.

1.10 CROSS DRAINS

Cross drains conduct water from one side of a railway to the other and consist of a number of types. However, they may be considered under the two main categories of open top drains and culverts.

1.10.1 Open Top Drains

Open top drains, as their name implies, are open at the top. They range in size from very small to large openings and consist of open concrete chutes, concrete and timber drains (previously called Amos drains), steel and concrete drains, and a variety of flood openings or structures with timber longitudinals and transom tops. When the span of a flood opening is two metres or more, it is classified as a bridge. In general, open top drains are used where the level of the invert has to be kept close to rail level. By comparison with an open top concrete chute which provides a waterway through the ballast, a concrete box drain or pipe culvert has to be much further below rail level to provide the equivalent waterway. Apart from open concrete chutes, all open top drains have the disadvantage of fixing the rail level over them and providing a hard spot in the track. They all provide difficulties in the operation of track maintenance equipment such as tampers, ballast regulators and under-track sleds. Open top drains and chutes are difficult to keep clean, often being full of ballast or cane and thus ineffective. For these reasons their use should be restricted as much as possible.

1.10.2 Culverts

Culverts may be described as covered openings below the formation for the passage of water or for other purposes. Culverts have been constructed with a variety of shapes, but now they are generally circular or rectangular in section. Rectangular culverts are mostly used where the waterway is shallow, and if necessary, the top of the roof can be placed at formation level. Circular culverts are mostly formed under the deeper embankments. Culverts are constructed from concrete pipes, corrugated metal pipes, precast concrete boxes and cast-in-place concrete boxes. Culverts do not create any difficulties in operation of track maintenance equipment. However, the length of a culvert is fixed by the level of the formation, and it may not be possible to raise the height of the track level without lengthening the culvert or raising the level of the headwall.

All drains must be kept clean and free of grass and rubbish. Special attention should be paid to drain outlets to prevent scouring. When this does occur the normal repair method is to dump rough stones in the scoured channel. In dispersive soils a more sophisticated approach such as stone pitching or the use of concrete grouting is required. Stone rip rap (Figure 1.11) can also be used effectively for erosion prevention around culvert and pipe openings. Gabions (rocks in wire mesh cages) are sometimes used for the same purpose.

1.11 FLOOD PROTECTION

Because sugar cane is often grown on river flats and flood plains, many cane railways are located in flood prone areas. In these areas, the grade line should be kept low over floodway sections so that flood waters will pass over the track when the capacity of the bridges, culverts and cross drains has been exceeded. Most of these sections are protected from scour damage by some protection on the cess, shoulders and batters, and the maintenance of this protection is a most important task.

Stone protection is best placed on the downstream side of the track and the stone should extend up to the level of the top of the rails. If this is not done, water tumbles over the rail and scours the downstream ballast shoulders, and this works back across the track until a washout of the ballast occurs. Once a minor ballast washout commences, the water rushes through and a major washout of the ballast and formation can develop rapidly.

Early practice was to carefully place stone by hand to line and level, and although this stone pitching work, as it is called, looks very neat, it is expensive and not as effective as rough cast stone work for the dissipation of floodwater energy. Rough cast stone is called rip rap, and is constructed by dumping stone from vehicles and working it into a reasonably uniform shape by hand or by machines such as a bulldozer, end loader or Toft loader. Whereas stone pitching offers little resistance to the flow of water over the surface, the purpose of the rip rap is to slow the velocity of the water and help dissipate the energy of the moving water. In addition to this, if scouring does occur, the heavy stones will settle into the scour as it develops and continue to provide protection.

Stone for rip rap work should be generally cubical in shape with a maximum size of 600 mm. It should be reasonably well graded down to approximately 150 mm size, and should be of good quality and free of dirt. Figure 1.11 gives an outline of how stone should be placed to protect a fill. Notice that the stone covers the cess and joins up with the ballast shoulder. This is most important to prevent scouring of the ballast. It is also very important to provide a good toe and an apron for the rip rap so that scouring does not occur in this region. In general, the larger rock should be placed at the toe with sufficient smaller rock placed in the voids to provide a tight, dense protection.

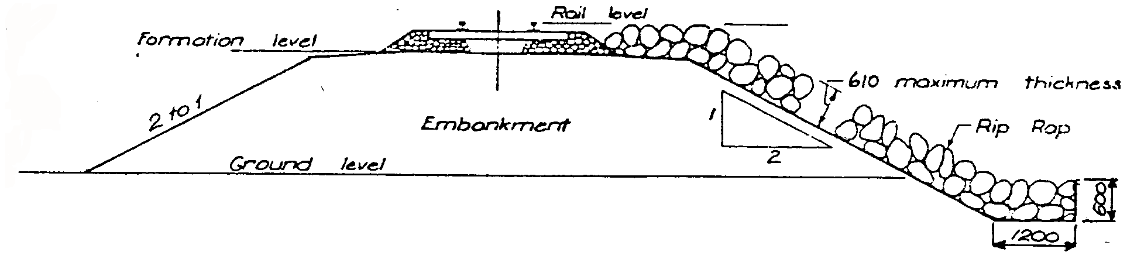

Figure 1.11 Method of placing rip rap stone protection

The presence of stone pitching or rip rap causes problems in renewal of sleepers and maintenance of top and line, and care must be taken to raise the level of the stone protection if it is necessary to lift the track. In some bad flood areas, the track is located on a rock fill and pitching or rip rap extends on both sides of the track. Again in places where high flow velocities are likely, it may be desirable to place cement grout or plaster between the stones in stone pitching work to guard against washouts.

1.12 STABILISATION OF FORMATION

The stability of the formation and earthworks for a railway is closely related to the problem of drainage. It has been previously stated that the formation should be well drained to reduce penetration of water, which can alter the load bearing properties of plastic soils such as clay. In addition, sufficient better class material should be used on top to spread the load and reduce it to a value which the clay can safely support. If clay formations are not well drained, deformation will occur and top and line of the track will be seriously affected.

Where soft spots occur in the formation, mud pockets develop which require constant maintenance unless treated. The ballast is forced down into the formation, leaving the cesses high, and water collects in the depression thus formed. Figure 1.12 shows how this occurs. To cure this trouble, it is essential to drain the water away or to replace the pug material which forms in the mud pocket from the repetitive pumping effects of rail traffic.

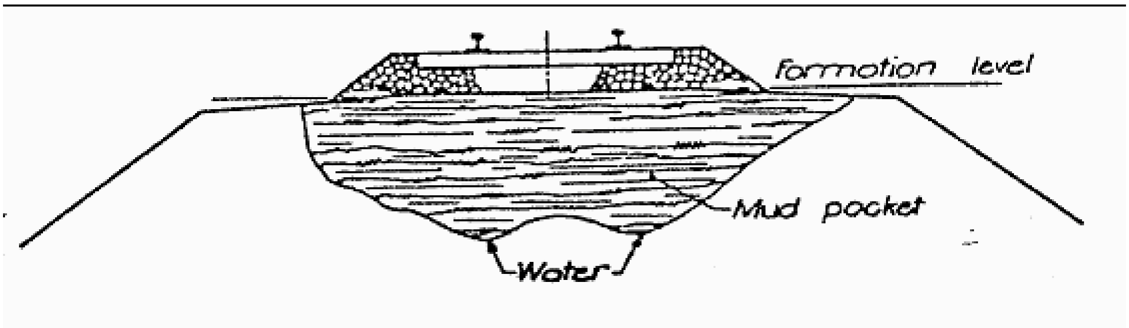

Figure 1.12 Formation of mud pocket

The four main methods of treating soft spots and stabilizing the formation are as follows:

1.12.1 Deep Ditching

This consists of excavating deep ditches on each side of the formation so that the railway is virtually placed on a small embankment. This allows the clay immediately below the formation to drain thus improving its load bearing effectiveness.

1.12.2 Sub-drainage or French Drainage

Sub-drains are drains constructed below ground level to tap the free water in the soil and lead it away. As with the deep ditching technique, the aim is to lower the level of the free water-table and enable the clay to carry the load. These sub-drains or French drains give reasonably good service. Until a few years ago, French drains consisted of a trench filled with heavy rock spalls and drained at the bottom by a 225 mm diameter earthenware pipe laid with open joints. Figure 1.12.2.1 shows the action of a sub-drain in draining the formation. Some failures of the older French drains have occurred through the soil gradually penetrating the voids in the backfill material and plugging them up. Geotextiles or engineering fabrics are now used in french drain construction to prevent soil contamination. This application will be discussed in a future section.

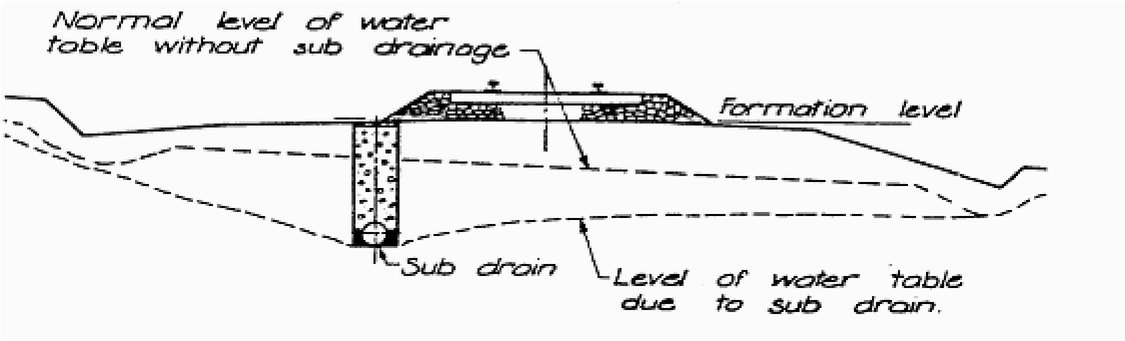

Figure 1.12.2.1 Action of Sub-Drain

The present standard of French drain has been developed from the better knowledge now possessed of the behaviour of soils. It consists of a trench filled with a 'filter' material, consisting of a finer well graded material. A graded gravel of similar quality to concrete aggregate is most suitable. A sub-drain pipe for collecting the ground water and conducting it away is also provided. The top surface of the drainage trench is sealed with screenings mixed with clay to prevent the entry of surface water or silt. The older French drain was provided with vent pipes and gratings, and while these enabled the drain to be inspected, they obstruct the use of track machines if not carefully sited. It is not desirable to use sub-drains to handle surface water as well as sub-surface water. If this is done a head of water builds up and water flows from the pipes into the soil, the very condition it is designed to correct. Sub-drains are most effective provided a good outlet is available. They can be constructed adjacent to a track in service, and as a further improvement, cross drains of similar construction can be built under the formation to more effectively drain mud pockets. Figure 1.12.2.2 shows a section of a French drain. Drains of this type should not be made too deep otherwise the formation/ballast structure could be weakened.

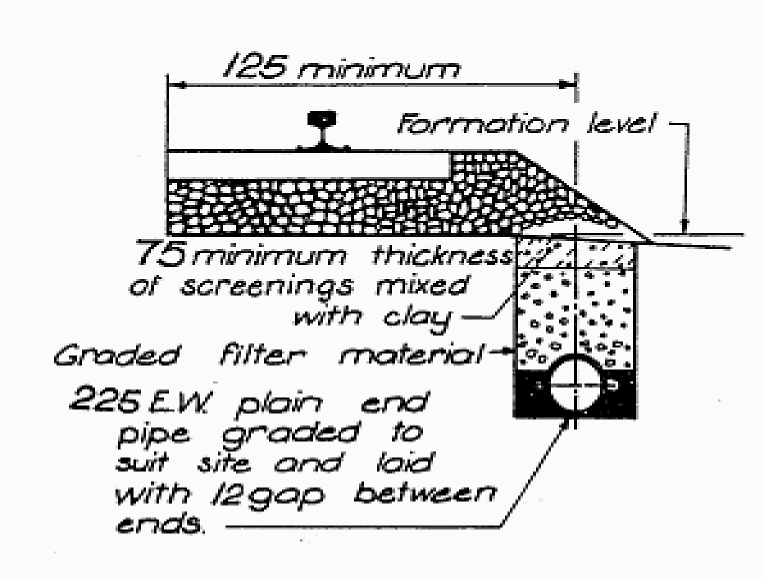

Figure 1.12.2.2
Section of french drain

1.12.3 Replacement of Material

In this method, the clay material is removed to a certain depth and replaced with a stronger material such as sand or gravel. The depth of the stronger material required depends on the characteristics of both new and native materials and the moisture content of the native material. The replacement method is generally effective, except for the worst type of mud pockets. In practice, the formation can be stabilised and strengthened by raising the track on new ballast and using the original ballast as bottom ballast or sub-grade material. However the replacement of material alone will not necessarily correct the problem. It is also necessary to provide a suitable drain from the affected area to remove any accumulated water. Failure to do this could mean the water held by the replaced coarse material (sand, gravel, etc.) could eventually saturate the adjacent formation areas.

1.13 MAINTENANCE OF EARTHWORKS AND EASEMENT

The need for thorough maintenance of the drainage system has already been stressed. Cane railway earthworks and easements require periodical attention. The extent to which this is necessary depends on the terrain, climatic conditions, and the age of the railway.

It is important to minimise the erosion of earthworks and corrective action should be taken as soon as erosion occurs. Erosion of batters of both cuttings and embankments can be minimised by promoting a good growth of vegetation as quickly as possible, but certain types of grass such as couch and kikuyu, and noxious weeds, can spread to the ballast and cause trouble later.

Minor scours in the cess and on the slopes of embankments should be plugged as soon as they occur and not allowed to develop. Material cleaned out of cuttings can be used for this purpose. If not required for filling scours, surplus material can be used for uniformly widening the cesses on embankments.

To minimise the possibility of material slipping from the batters of cuttings and fouling the tracks, regular inspections should be made of all cuttings, particularly those on range sections where trouble has previously occurred. Action should be taken to remove any rocks, loose material, or material likely to become dislodged and menace the track. The removal of rocks and loose material must be carried out carefully to avoid disturbing the surface more than is necessary thus reducing the risk of further erosion.

The frequency of such inspections will depend on local conditions, but should not be less than once every six months. However, inspections should be made after heavy storms, particularly when wet weather extends over a number of days.

The treatment of scours in the surface drains has already been discussed. The maintenance of catch drains or top drains on the high side of cuttings is most important as the blockage of a catch drain, or worse still the scouring of a catch drain into a cutting batter, can cause heavy silting and washouts in the cutting. All drainage systems should be inspected annually and excessive growth of vegetation, debris, or other material which could impede their proper functioning should be cleared prior to the summer wet season. Attention should also be given to scours. The behaviour of drainage systems during wet weather should be noted so that future improvements may be effected.

Most of the hard work associated with maintenance of earthworks can now be performed by earthmoving equipment. Bulldozers and graders can be used for cleaning out and reshaping surface drains, widening cuttings, building up embankments and widening cesses. A tractor-drawn scraper is useful if material has to be won, and transported short distances, while for long hauls material can be loaded by end loader into motor trucks. Excavators can be used for cleaning down cutting batters. Whenever machinery is used, opportunity should be taken where possible to improve drainage of the formation, widen cesses where necessary and to trim up irregularities and provide access along the easement for off-track machines.