

REPAIR OF SLURRIED TRACK



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1. Scope

This booklet has been produced for the guidance of track staff at all levels. It is intended to give general information on causes, identification and the manual repair of slurried track.

2. Definition of Slurried Track

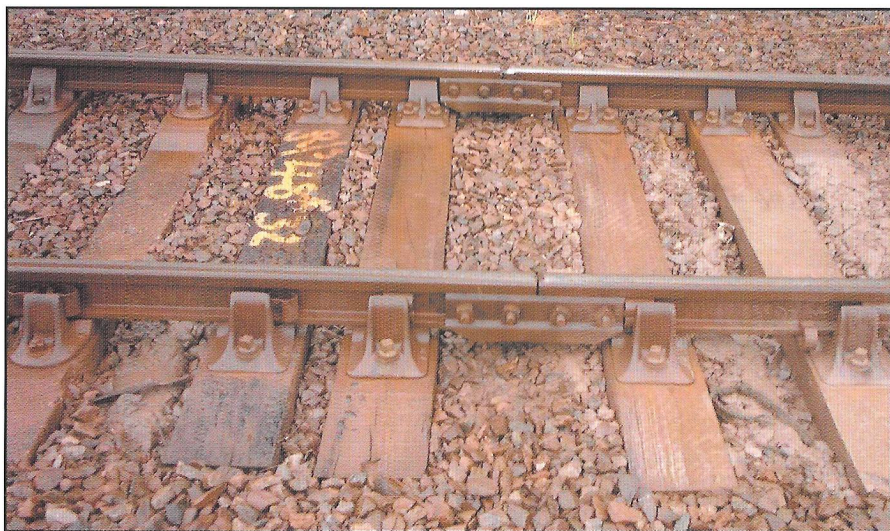
Slurried Track is the common term used to describe localised clogging of the ballast. There are three main causes which lead to this condition:

- 1 Ballast attrition (or wear), which is caused by abrasion of the ballast and leads to contamination by producing fines which can mix with water to produce a slurry.
- 2 Subgrade failure, which allows clay, etc. to pump up from below and clog the ballast; and
- 3 Spillages of oil, sand, aggregate dust, etc. which can also clog the ballast.

3. Introduction

The purpose of this Blue Book is to inform the Permanent Way Maintenance staff on the identification, causes and consequences of slurried track, and then describe a means of suitable manual repair. Slurried track (wet beds) are often caused by other track faults e.g. dipped joints or poor welds, these faults should be rectified before they develop into slurried track.

Prevention is always better than cure!



Ballast

4. Ballast

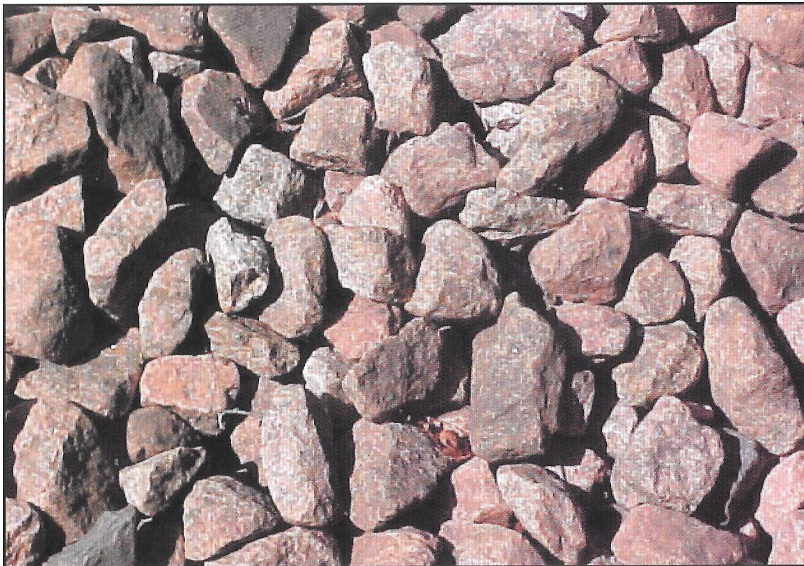
Ballast is the crushed graded rock which supports the track. The requirements for its procurement and physical properties are documented in Railtrack Company Standard RT/CE/S/006. Although the ballast performs an important function in supporting the track, there is no definite specification fully defining the properties required to optimise track performance.

Economic and geographical considerations have therefore played a major part in the selection of ballast materials to date, this places a greater emphasis on the maintenance activity to ensure the integrity of the track is not impaired.

4.1 Function

The principal functions of the ballast are:

- To spread the dynamic load evenly from the sleepers onto the formation.
- To retain track geometry whilst withstanding lateral loading and thermal forces.
- To provide a resilient foundation for the track thus reducing fatigue-loading effects.
- To provide a free draining medium for water.
- To allow restoration of track geometry by mechanical or manual methods.



Ballast

4.2 Deterioration

Deterioration of ballast during service occurs as a result of :

- Damage caused by crushing under traffic.
- Damage caused as a result of tamping or “Kango” packing.
- Weathering.
- Contamination from various sources, i.e. wind born materials and spillage from trains.

4.2.1 Ballast and Sleeper Wear

The product of the damage described above is a fine dust, which when mixed with water can clog the ballast. This reduces both the resilient nature and drainage properties of the ballast preventing it from performing its function fully.

4.2.2 Ballast Pollution

As a result of a track defect, the sleepers are subject to excessive vertical movement (voiding), and a 'pumping action' can occur when the sleeper is subjected to vertical loading. This can result in the suction of sub-base materials into the ballast. This will affect the drainage properties and behaviour of the ballast.



An example of a slurried track. The ballast has clearly deteriorated to the extent that it is no longer capable of performing its function.

Ballast

4.3 Causes and Rectification

As described previously a cause of 'slurried track' is the pumping action of the sleeper, due to the presence of voids. This causes abrasion between the ballast and the sleeper, creating fines which pollute the ballast.

The initiation of voiding is generally associated with the presence of one or more of the track faults listed below:

TRACK FAULTS
Dipped joints
Welds in poor condition, giving rise to dips and peaks
Loose or missing fastenings
Severely worn or missing rail pads and/or insulators
Rail surface irregularities
Ballast or drainage deficiencies
Poor quality tamping

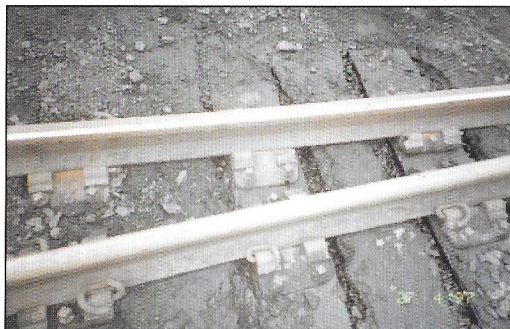
The presence of one or more of the above defects will allow the vertical movement or the pumping action, of the sleeper to take place as the track is subjected to the loading - unloading cycle under traffic. Slurried track is the inevitable outcome.



Poor Top caused by a variety of faults such as the dipped joint, rail end batter, incorrect sleeper spacing, loose fastenings and missing fishbolts. Note that the voiding sleepers are creating a wet spot.

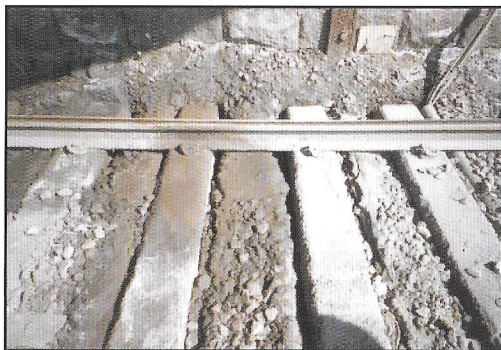
Ballast

4.3 Causes and Rectification (continued)



Poor Top and Alignment caused by broken housings on base plates, broken and missing Pandrol clips and loose chair screws.

Note again that the voiding timbers are the cause of a wet spot.



Again, Poor Top caused by voiding sleepers and poor drainage in the area.

Whilst it is clearly desirable to prevent the development of slurried track by the timely rectification of track defects, it is recognised that this is not always achievable and that a suitable means of repair is required. The remainder of this book will concentrate on describing how slurried track may be rectified.

Manual Repair

5.0 Manual Repair of Slurried Track

The intention of this Blue Book is to describe the process of manual rectification of slurried track. Nevertheless, mechanical methods are available. Two examples of which are shown below.



Track Gopher (mini ballast cleaner)



Wet Bed Machine

Manual Repair

5.1 Tools

Below is a suggested list of tools and equipment that may be required for the method described in 5.2.

- Ballast forks and shovels
- Approved tool for removing and inserting fastenings e.g. Panpuller
- Cross Level
- 'Kango' hammer with clay spade and plate compactor and accessories
- Compressor or generator
- Sighting Boards
- Cable Detector
- Track Jacks
- Heel Bars

It should be noted that the list is indicative only. Health and Safety considerations and/or local policy may dictate the method of work.

5.2 Repair Method

Except where an emergency repair is carried out, the reason for the formation of a wet spot should be determined and remedied in advance of, or at the same time as, the wet spot treatment is undertaken. If this is not possible, the repair should only be considered as a temporary repair and the cause of the wet spot remedied as soon as it is practical.

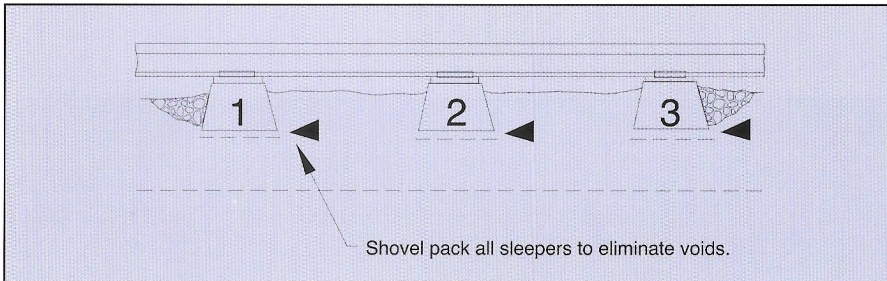
To minimise the risk of track instabilities during the work, repairs to the slurried track, or wet spots should:

- Not be carried out on more than 2 consecutive cribs
- Not be undertaken when the rail temperature is above 32°C
- Not be undertaken when the rail temperature is likely to rise above 32°C during the work.
- Not be undertaken when the rail temperature is likely to rise above 38°C within the next three days.
- Not be undertaken when the rail temperature is below 0°C

The preferred method of work is as described over.

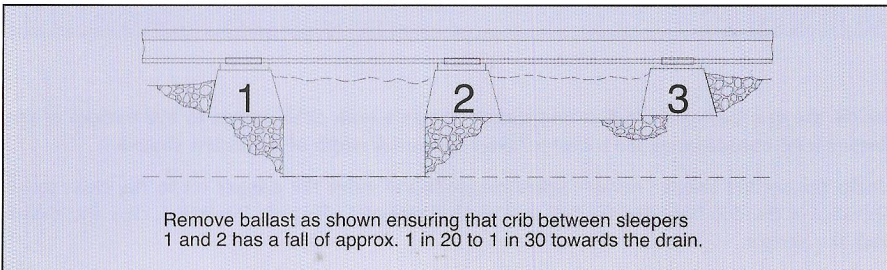
Manual Repair

Stage 1



Shovel pack all sleepers in the section of track to be treated to eliminate voids

Stage 2



Excavate all ballast from between the first and second sleepers and open out the crib between the second and third sleepers to just below the bottom of sleeper level, for the length of the sleeper.

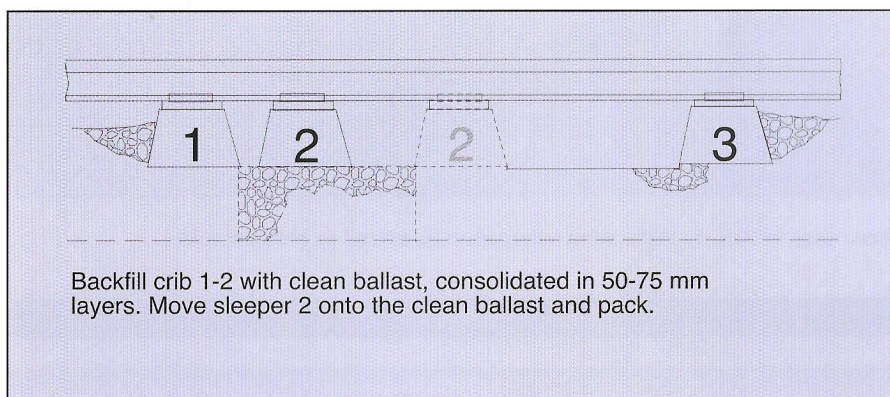
Any contaminated ballast taken out should be removed from site to avoid contaminating the clean ballast used in the repair and the surrounding ballast.

The base of the excavation between the first and second sleepers must fall towards the drain, or adjacent cess, as described in the sketch above to ensure adequate drainage of the ballast is provided.

It is worth mentioning here that when the opening out is being undertaken it is good practice to remove the ballast by shovel but to return the ballast to the track by means of a ballast fork. In this way fine material will be removed from the track and only the reasonable size stones returned.

Manual Repair

Stage 3

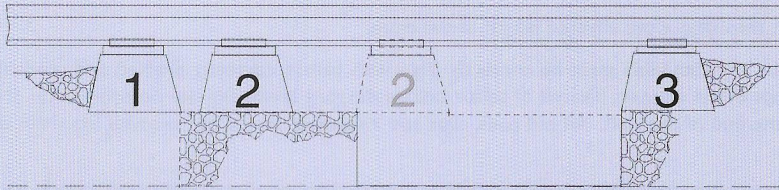


Backfill the crib between the first and second sleepers with clean stones to the bottom of the sleeper level, consolidating the ballast in layers to the full width of the ballast shoulder.

Unclick the second sleeper, remove insulators, pads and move the sleeper on to the clean stone provided in the crib between the first and second sleepers. Fit pads, insulators, clips and shovel pack the sleeper.

Manual Repair

Stage 4



Remove remaining ballast from crib 2-3 including original support to sleeper 2. Repeat stage 3 for this crib and return sleeper 2 to its original position.

Excavate the remaining ballast in the crib between the second and third sleepers and the ballast, which originally supported the second sleeper. Again this excavation should provide a drainage fall, as described previously, towards the drain or other suitable ground.

Backfill these cribs with clean stones as described in Stage 3, to the level of sleeper bottom and return the second sleeper to its correct position. Fit new pads, insulators, clips and pack the sleeper.

Repeat the relevant stages above for the remaining sleepers which require treatment.

Manual Repair

Stage 5

Excavate the ballast at the sleeper ends in the interval between the tracks (6ft or 10ft space) in lengths not exceeding 1.5 metres to the same depth reached when the cribs were excavated. Backfill with clean ballast and consolidate before moving to the next 1.5 metres section.

Excavate the ballast shoulder and replace with clean stones as described above, ensuring the consolidated shoulders are the correct profile.

Repeat throughout the affected length of the track.

All cribs and shoulders must be correctly filled with ballast, correctly profiled and consolidated. The tops of the sleepers cleared of ballast before the gang leaves the site on completion of work, or at the end of the shift. All old pads, clips and insulators should be removed from the site for scrap.

Note:

- Ballast and other materials must always be kept clear of rail heads, slide chairs or baseplates, flangeways and signalling equipment.
- At locations where ATP and TPWS equipment has been installed special instructions will apply.
- When ballast is tipped in the fourfoot, it must always be kept below top of rail level.
- Care must be taken to keep conductor rails and the collector shoe envelope clear of ballast on all lines over which DC rolling stock pass.
- Follow up work may be required after settlement has taken place, e.g. tamping, mechanical packing or measures shovel packing (MSP). Follow up work should be allowed for in the work plan at an appropriate timescale.
- SFT Register in hot weather season

6. References:

A useful technical reference source is the "Repair of Wet Beds" (Railtrack) video
Ballast Drainage and Formation Best Practice Guide RT/PWG/003
British Railways Track - Volume 4 Plain Line Maintenance
Permanent Way Institution British Railway Track 6th Edition 1993
Continuously Welded Rail (CWR) Track RT/CE/S/011

