LONGITUDINAL TIMBERS

CIVIL ENGINEERING

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Introduction

This publication identifies the features of track supported on longitudinal timbers that may be encountered on the UK rail network, their associated problems and to provide guidance on their maintenance and inspection.

Scope

In general terms, there are three main types of bridge timber construction, namely:-

- Timbers in metal troughs (fig 1)
- Longitudinal timbers on rail bearers (fig 2)
- Cross-beams on timber/rail bearers (fig 3)

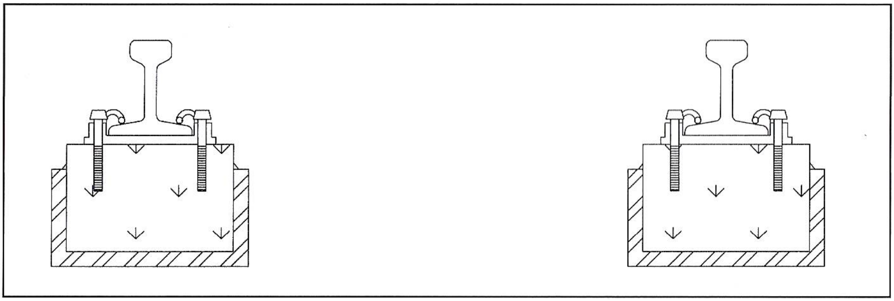

Figure 1

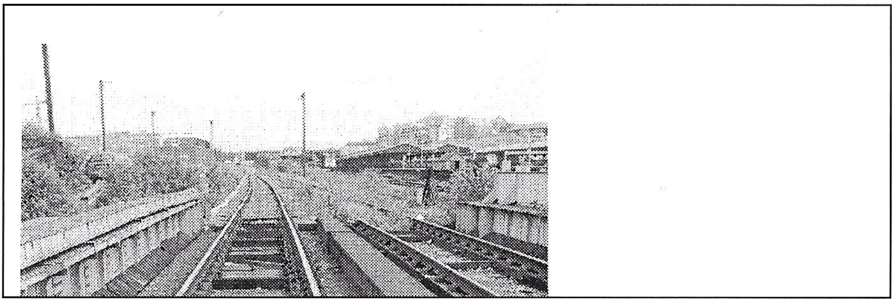

Figure 2

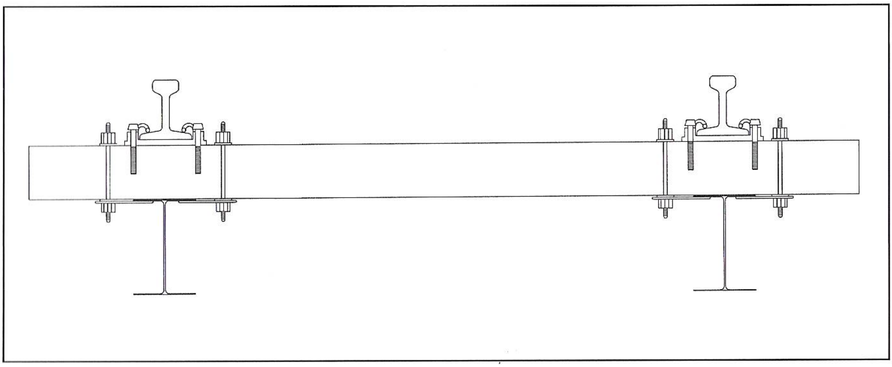

Figure 3

Baseplates

Several types of baseplates are available for fixing the rail to the longitudinal timber including the following that are the most commonly used: -

Pan L6	Standard baseplate in use on longitudinal timbers
Pan M6	As Pan L6 but decreased width for narrow beams
Pan WB	Even narrower baseplate with screw holes at 25° to the vertical where the edge distance may be a problem
Pan WB (M)	As Pan WB but allows packing pieces to be inserted for adjustment of vertical level
Pan LGN	Incorporates integral support for guard rails
Pan LN	Used in conjunction with Pan LGN when guard rails are provided. Normally provided as 2No. LN baseplates followed by 1No. Pan LGN etc.

Baseplate Positioning

Baseplate centres should be placed along or as near to the timber centreline as is possible but in any case not less than 75mm from the edge of the longitudinal timber to the centre of the coach screw hole. (See Fig 4)

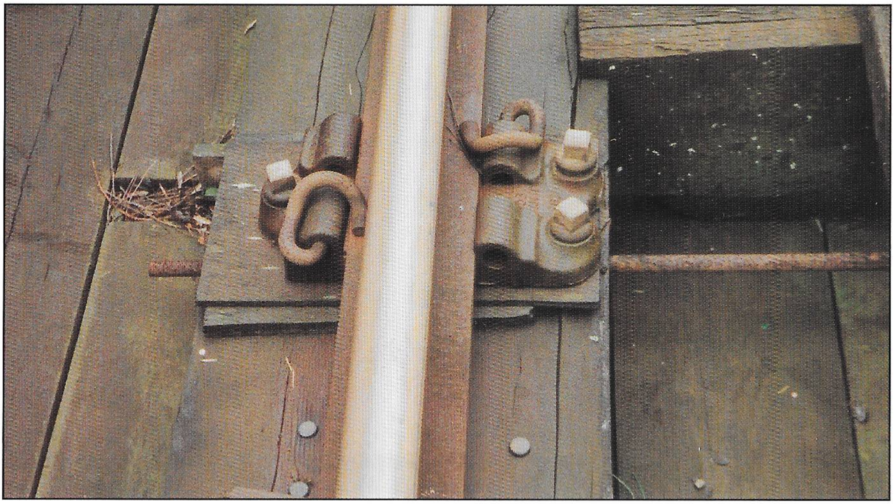

Figure 4 Splitting of the timber has occurred due to the screw hole centres being too close to the timber edge and the cut out for the transom. A more suitable baseplate should have been used to prevent this happening e.g. Pan M6 or Pan MB. The timber has been treated with borate rods. Also note that the lower packing should cover the Baseplate foot print area.

Baseplate Spacing

Baseplates should be spaced as laid down in the track construction requirements RT/CE/S/102 for CWR and Jointed track respectively.

Welds and Joints

Wherever practicable welds and joints should be kept clear of longitudinal timbers. If this cannot be achieved the positioning of alumino-thermic welds and joints must conform to Line Standard RT/CE/S/102. (See fig 5)

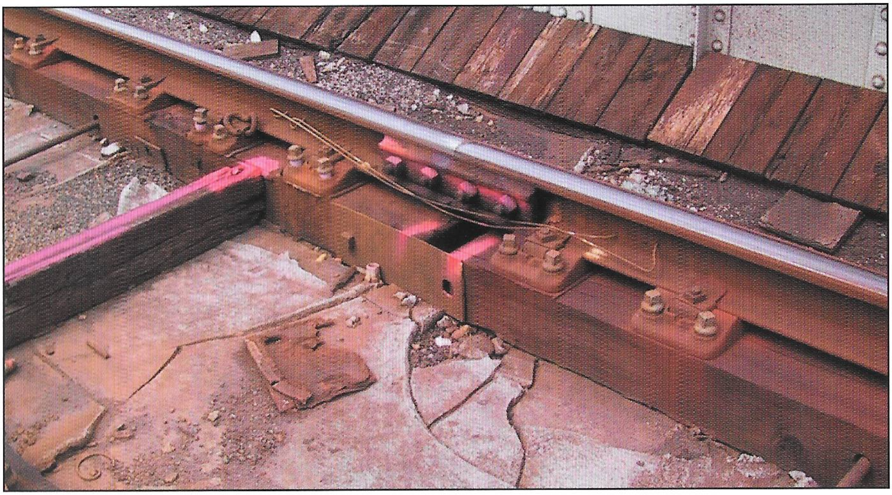

Figure 5 The positioning of a rail joint as shown at longitudinal timber ends is not permitted and steps should be taken to reposition it as soon as possible.

Inspections

Routine visual inspections of the longitudinal timbers should identify defects that, if uncorrected, would affect the safety or reliable operation of the railway before the next inspection and must be carried out at a frequency as per the track inspection requirements RT/CE/S/103.

Special Inspections

A special inspection in addition to the routine visual track inspection requirements should be carried out by a competent person as per the line standard RT/CE/S/103 who shall record the details of the inspection together with any temporary and/or permanent remedial action carried out.

Particular attention should be paid to new defects and to developments of existing defects. From these inspections a programme for the repair and renewal of the timbers should be produced for inclusion in the annual programme.

Specific Features of Track on Longitudinal Timbers

Gauge loss is the main cause of derailment on longitudinal timber bridges. This can be caused by the failure of the coach screws to hold the baseplates in position and may show itself in a number of ways, which include: -

Enlargement of the coach screw holes, baseplate and packing movement giving rise to indentations in the timber surface, crushed and damaged ferrules and side bursting if the baseplates were placed too near the timber edge. This last point is most commonly found on curves and indicates that the lateral forces are too great for the timber to withstand.

Figure 6 Although there is no laid down minimum length for a longitudinal timber they should be as long as the track design allows. Short timber lengths are bad practice which should be avoided.

Gauge loss can also arise as a consequence of movement of the longitudinal timbers themselves. This can happen if the wooden transoms are badly decayed and the tie rods become loose or start pulling through the timber. Corroded and damaged cleats, straps and holding down bolts will fail to hold the longitudinal timbers in place. Rotten transoms, wedges etc. and corroded cleats should be replaced at the earliest opportunity. Tie rods and other fastenings should be routinely tightened as part of their general maintenance. Gauge loss over a longitudinal timber bridge can also occur due to rail rotation, especially on curved track where the track is highly canted. This type of problem is usually indicated by unusual wear marks on the rail head i.e. shiny on the gauge face of the rail but rusty on the running surface and by indentations in the timber.

These problems can be overcome by relocating the baseplates on the longitudinal timber, using longer coach screws and if the timbers are due for renewal using a hardwood timber to increase the strength of the coach screw/timber interface.
A satisfactory top is usually achieved with the use of packing plates under each baseplate as required but a twist and loss of top may occur at the run-on and run-off ends of the bridge. This is mostly due to the difference in stiffness between the ballasted track and the longitudinal timbers and results in differential settlement and movement between the two-track support types. This can best be prevented by the construction of a stiffness transition structure at each end when the timbers are being renewed otherwise this problem can only be reasonably controlled by manual packing methods. eg Measured shovel packing or Hand held stoneblowing.

Figure 7 A typical longitudinal timber bridge. Once again the packings used do not cover the baseplate foot print area, note also how close the screw hole centres are to the edge of the timbers.

There are a number of other points that should be considered during routine inspections such as the condition of the structures supporting and maintaining the conductor rail in position (3rd rail areas only),

- Are there any metal to metal contacts? e.g. baseplate to holding down bolts that may cause a track circuit failure
- Is there any deterioration of the sealant where the timbers are in troughs?

Many of these features (rail rotation, gauge spread, baseplate movement) are best observed under traffic to determine the extent and severity of the problem. Voiding under the longitudinal timber can only be observed, in general, under traffic although marks can be found on the sides of the longitudinal timbers caused by the pumping action under the passage of traffic where the timbers are set in troughs.

Guidlines for Track Staff when Inspecting Track on Longitudinal Timber Bridges

- Gauge. This should be checked regularly. It should be checked at various locations along the length of the bridge, particulary at susceptible locations. eg joints.
- Chair Gall. Excessive indentation around the baseplates. Special note should be made if the galling occurs at the outer edges of the baseplate or chair.
- Standard Tie Rods. Are they pulling through the timbers?
- Temporary Tie bars. Are they tight and holding gauge?
- Transoms. Are they loose, decaying or splitting?
- Contact marks. A shiny wheel contact mark along the gauge face of the rail whilst the rail head remains rusty can indicate rotation of the rails/timbers and thus gauge spread when under load. This can conflict with static gauge.
- Chair Screws. Are they loose, bent or broken?
- Rotten Timber. Condition of timber joints, especially around transoms. Timber preservation systems only penetrate the outer layers and as with sleepers the timber can be rotten on the inside whilst looking good on the outside.
- Check for rot on sides of timbers especially in ballasted track.
- Side Bursting. Watch for timber splitting or side penetration due to baseplates being located too near to edge of longitudinal timber.
- Track circuits. Are track circuits in jeopardy from metal contact with fishplates, tie bars, chair screws, cross girders, bridge decks etc.?
- Packings. Are there too many packing pieces under the chair? Are they split or missing? Thin hardwood packings should be replaced with metal shims.
- Welds - No welds (thermic or flashbutt) should be closer than 4.5m from the end of a bridge and not closer than 2m from the end of an individual timber.
- On cross-sleepered track, no weld should be closer than 4.5m to the end of the longitudinal timbers.

- Voiding underneath timbers. Look for signs of pumping on edges of longitudinal timbers especially where located in troughs. Voiding caused by abrasion can occur beneath both cross and longitudinal timbers where laid direct onto the rail bearers.

- Conductor Rail Supports. Are these loose or tearing away from the timber side? Are the blocks split / rotten?

- Cross Level / Cant. How is this achieved? Are longitudinal timbers cant planed or is the cant achieved by raising one timber above the other in a vertical plane? This latter type of canting will cause asymmetric loading on the rails and can lead to rail rotation in situations of high cant.

- Top and Twist. Is there a loss of top or is a twist developing particularly on the run off / run on ends of the longitudinal timbers?

- Curved Alignment. Particular emphasis must be placed on bridges with curved track with special attention being made to the Cross Level / Cant.

- Holding Down Assemblies. Are the holding down assemblies (on cross-timber bridges) loose or broken?

- Cleats. Are any metal cleats missing? Are the wooden wedges in good condition and in place?

Loading Under Traffic. It is important to observe all types of non-ballasted track construction on bridges whilst under load as gauge spread, rail rotation, chair movement, timber voiding etc. can be best seen in action.

Great care should be taken if inspecting under traffic and is essential that satisfactory measures are taken to ensure the safety of the observer.

General Maintenance

The Infrastructure Maintenance Contractor is responsible for: -

- The maintenance of top, line, cross level and gauge on all types of longitudinal and cross-timbered bridges.
- The integrity of all types of bridge timbers (longitudinal and cross types) whether acting as a track carrier or spanning between rail bearers, deckplates or troughs.
- Maintaining the tightness of the tie rods, holding down bolts, wedges and any other fixings, recording any outstanding maintenance work and making arrangements for remedial action which, if delegated to third parties, should be signed off through a completion certificate.
- All wind blown rubbish, leaves etc. should be removed on a regular basis from the bridge superstructure. The accumulation of such rubbish prevents the timber from drying out and is a fire hazard during the summer months.
- Drainage holes/channels should be kept unblocked at all times. This allows free drainage of the bridge superstrucure and prevents the longitudinal timbers being in a continuously damp environment.
- Ballast should be kept clear of the timbers by a ballast wall in order to prevent rot and enable inspection of timber ends.
- Shakes and splits should be sealed with bitumen and/or preservatives.
- Loose packings under the baseplates should be replaced as soon as they show signs of movement.
- Severely corroded items such as cleats, holding down straps and bolts etc. should be replaced.
- It is also good practice for liberal coats of creosote to be applied to soft wood longitudinal timbers every five years.

In-Situ Timber Treatment

A significant cause of failure is fungal decay, especially wet rot.

- All cuts made on site should be properly and liberally coated in preservative before laying the timber in place.

If baseplate relocation is required the old coach screw holes, especially for softwood longitudinal timbers, should be treated with preservative and plugged with poured in bitumen. In the case of hardwood longitudinal timbers the application of preservative is not required and holes may be filled with hardwood plugs and/or poured in bitumen.

Treatment with Boron Rods

These rods diffuse boric acid as a preservative into the timber over a relatively long time period. A code of practice for their installation is available from AEA Technology (formerly BR Research Derby). A single treatment may increase the life of the longitudinal timber by 6 years, repeated treatment may extend this to 20 years.

References

RT/CE/S/102	Track Construction Requirements
RT/CE/S/103	Track Inspection Requirements

OTHER RELEVANT PUBLICATIONS

CEC/C/0005	Track Maintenance Handbook
CEC/C/0006	Code of Practice Longitudinal Timber Design and Maintenance
RT/CE/S/029	Hardwood Sleepers, Bearers and Longitudinal Timbers
RT/CE/S/031	Softwood Sleepers, Bearers and Longitudinal Timbers