5.1 Introduction

Derailments are caused mostly by defects in either the vehicle or the track. As in the prototype they can occur from a combination of track and vehicle defects or characteristics which in isolation would not necessarily cause a derailment.

Part 1, Section 1 of the Guild Manual contains a full explanation of the critical dimensions of wheelsets and pointwork crossings, including drawings of gauges to check them. Figure 1 illustrates the relationship of these dimensions.

Whilst the gauges prove that the dimensions of wheelsets and crossings are correct, they are not a complete check because they do not reveal axle misalignment, (either temporary on sprung axles or permanent on rigid ones), track twist or crossing misalignment. These three defects are probably the most common causes of persistent derailment.

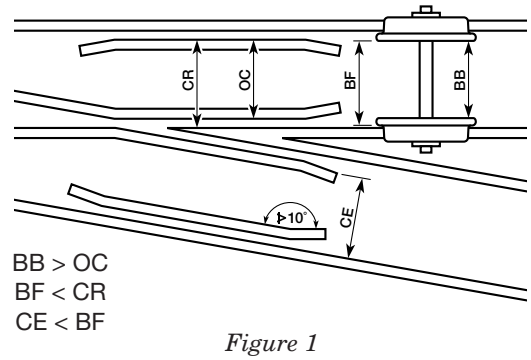


Figure 1
Relationship between wheelset and track.

5.2 Track Defects

5.2.1 Plain track

a) Gauge errors
The gauge should be between 32 and 32.4mm. The gauge of track on plastic sleepers can be significantly narrowed if it is fixed to the bed by nails passing through the centre of selected sleepers and driven home tightly (Figure 2). Also, lengths of this type of track have been found to have a gauge of 31.5mm presumably due to shrinkage of the plastic. If this causes derailment the only cure is replacement although some narrowing of the gauge can be tolerated on straight or large radius curved track.

Track on copper laminate sleepers is unlikely to lose its gauge unless the copper starts to peel away from the laminate. This can happen if excessive heat is applied when soldering.

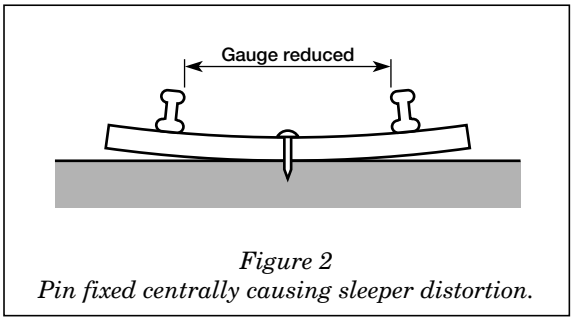


Figure 2
Pin fixed centrally causing sleeper distortion.

b) Misaligned joints
These are most likely to occur on heavy section rail where the fishplates may not hold the rails in true vertical alignment. This defect is unlikely to cause derailment on straight track because the taper on the wheeltreads keeps the flanges clear of the rail face but it is a common cause of derailment on sharp curves due to the flanges mounting the outer rail, (Figure 3). It can be eliminated by filing a slight taper on the railhead at the joint.

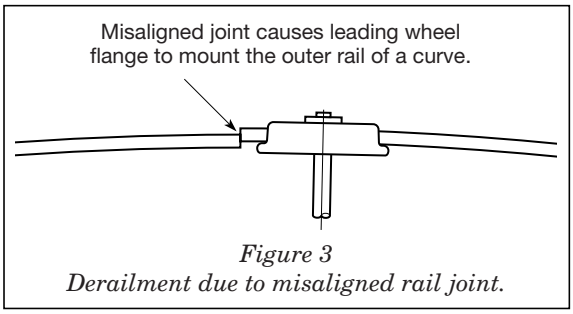


Figure 3
Derailment due to misaligned rail joint.

c) Track twist
This is a common cause of derailment, particularly on outdoor lines laid on baseboards where changes in moisture content of the wood may cause warping.

For a flange depth of 1mm it is recommended that track twist should not exceed 0.75mm over the longest rigid wheelbase of any vehicle on the line. Slight errors in cross level are not important, but if they occur on curves the inner rail should be the lower one. Both twist and cross level can be checked by a track alignment vehicle which incorporates a small spirit level to check cross level, (Figure 4).

Note: Twist when entering or leaving a superelevated curve must be within the above limit.

d) Sudden change of gradient
Such problems are most likely to occur on portable layouts where the rail and baseboard joints must

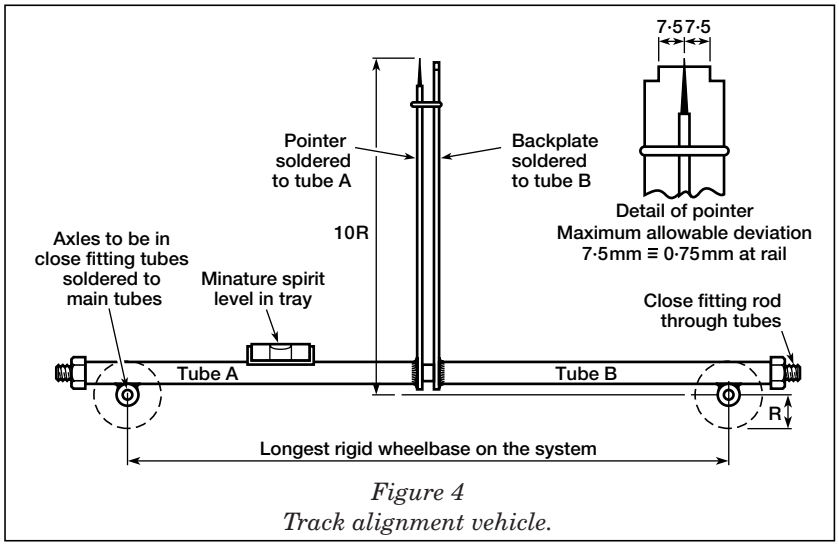


Figure 4
Track alignment vehicle.

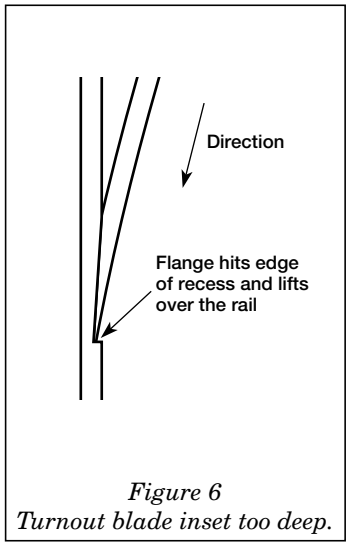


Figure 6
Turnout blade inset too deep.

necessarily coincide and there may be sag in the baseboards. On permanent layouts it is preferable that rail and baseboard joints do not coincide.

Gradient change will cause derailment only if the middle axles of other than four wheel vehicles have insufficient vertical play to allow the outer axles to accommodate the change, (Figure 8).

5.2.2 Pointwork

a) General
Derailments when propelling trains through complex trackwork incorporating sharp curves can occur if the track geometry makes it impossible to provide positive guidance by check rails at all of the crossings. This is because absence of a check rail can allow a flange to take the wrong side of a crossing nose when subject to the side pressure which is inherent when propelling. Provision of check rails is more difficult on complex model pointwork than on the prototype because the curves are usually much sharper.

Recommended values of minimum curvature for Gauge O are given in Section 1. The sharpest turnout curve traversed by British main line locomotives is equivalent to 1.6 metres (5ft 3in) radius. In places where propelling of long trains is a requirement it is therefore recommended that the track layout should consist only of simple turnouts and crossovers of the largest practicable radius. For further information on pointwork refer to Section 2.

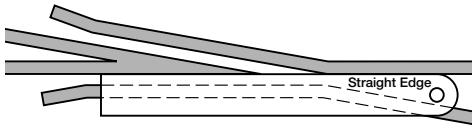


Figure 5 - Checking alignment of crossing nose and wing rails.

b) Incorrect crossing dimensions
Check the flangeways with a gauge and correct if found to be necessary. The rail top surfaces should be level through the crossing and slight rounding of the nose tip will often give smoother running.

c) Misalignment of the wing rails with the crossing nose
The nose and the wing rail must be accurately aligned. This can be checked by using a straight edge not shorter than the check rail, (Figure 5). Check both routes through the crossing.

d) Too little point throw
This can cause a flange to hit the open point blade. Check with a gauge. Recommended minimum point throw is 3mm for Fine Standard, 4mm for Coarse Standard and 2.6mm for ScaleSeven.

e) Check or wing rail face to opposite rail face dimension too wide at entry
This has the same effect as too small a point throw. Check with a gauge. Maximum values of the dimension at the point of entry are 29.4mm for Fine Standard, 28.4mm for Coarse Standard and 30.9mm for ScaleSeven. The entry angle of check and wing rails should not exceed 10˚.

If gauges are not available the above dimensions can be checked by direct measurement. Refer to Figure 1.

f) Inset for turnout blade too deep or too sharp.
This can cause a flange to lift over the stock rail (Figure 6).

g) Insufficient support for the turnout blades
The blades should always be firmly supported with their top surfaces level with the top of the stock rails.

5.3 Vehicle Defects

5.3.1 Wheelsets dimensionally incorrect

It is commonly thought that a check on the back to back dimension of a wheelset is all that is required, but the back to opposite flange face dimension, which is less easy to measure, is equally important, as shown by Figure 1. Both dimensions can be checked by a wheelset gauge. The gauge should be used at two points at right angles to check that the axle is not bent. The wheelset should run visibly true when spun in its bearings.

If wheelsets are proved to be correct when first installed they will not necessarily remain so as wheels, particularly those with plastic centres, can move on the axle. If this has occurred the wheels should be returned to the correct spacing and secured with liquid adhesive.

5.3.2 Axle alignment

Axles must be accurately aligned in both the vertical and horizontal planes. If the vehicle is sprung or compensated, the axles should return freely to the level track position after negotiating uneven track. It is essential that axles are parallel, if they are not the vehicle or bogie will always be trying to run round a curve and minor track defects which would otherwise be negotiated safely will cause derailment. Figure 7 shows how to check for parallelism.

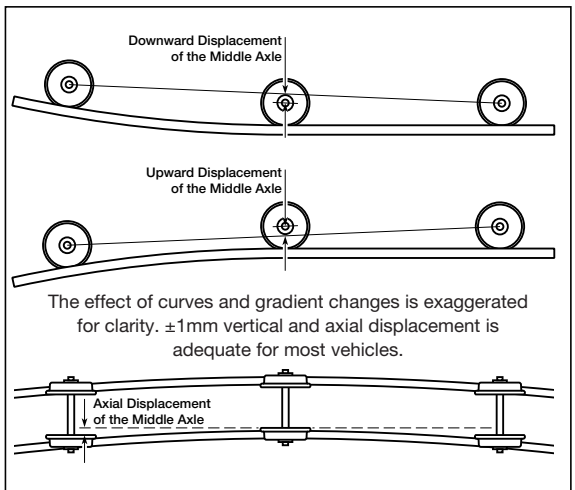
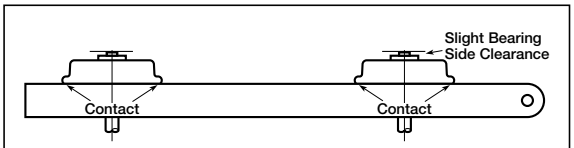


Figure 8
Negotiation of gradient change and curvature by multi-axle vehicles



Wheelset pushed against straight edge should be in contact at flange extremities. All wheeltreads should be in contact with the rail when standing on level track.

Figure 7
Checking wheelset parallelism

The middle axles of rigid wheelbase vehicles (usually locomotives) must have adequate sideplay and vertical freedom to negotiate curves and changes in gradient, (Figure 8).

5.3.3 Bogie freedom

If the location of coach and wagon bogies is too rigid, this is sure to cause derailment. Transverse location of the body should be on one bogie and the other should be free to tilt crosswise. Both bogies must be free to tilt longitudinally and must pivot freely to negotiate the sharpest curve to be traversed, (Figure 9).

5.3.4 Light weight

Many vehicles made from plastics are very light and derail easily, particularly outdoors where light vans can be blown off the rails by moderate gusts of wind.

The rounded buffer heads of some light weight plastic wagons can cause overriding of the buffers when propelling, (Figure 10). Flatten them by filing (taking care not to remove the head completely).

It is recommended that vehicles should not weigh less than 200g and that the weight be evenly distributed between the axles. The load per axle for all vehicles should be not less than 70g.

5.3.5 Excessive axle side play

Side play in the outer axles of a vehicle or bogie should be the minimum needed to ensure free running. Excessive play can contribute to bufferlocking when propelling.

5.3.6 Wheel profile

Part 1 Section 1 of the Guild Manual gives dimensions and tolerances for Fine, Universal and Coarse Standard wheelsets. Some alternative profiles may be more prone to derailment particularly those with small or non-existent flange root radius or tread taper. If the flange root radius is less than the rail edge radius the wheel is much more likely to climb over the rail on sharp curves.

Dirt picked up from the track can significantly affect the tread profile and if a vehicle develops a persistent tendency to derail accompanied by a

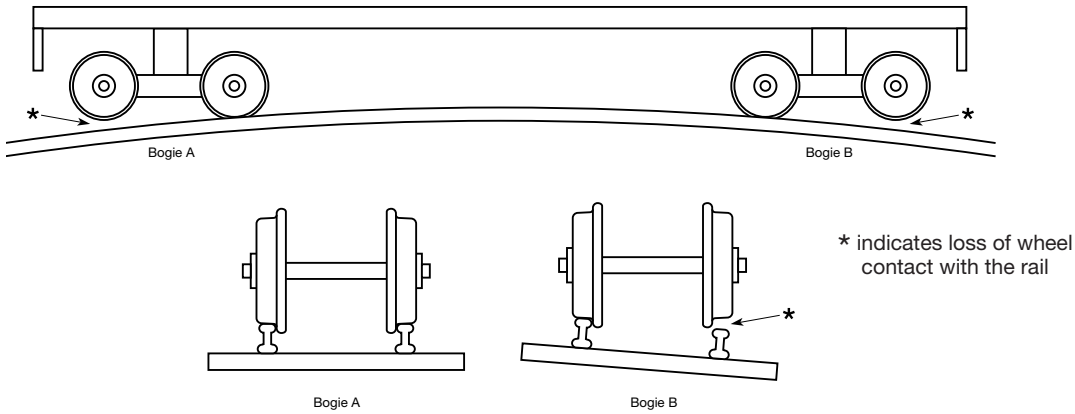


Figure 9
Bogie mounting too rigid to accomodate variations in tract level

wobble when running, cleaning the treads may be an easy cure. An eccentric wheel can have the same effect, in which case the wheelset should be replaced.

5.3.7 Journal Friction
Bearings should be free running and kept lubricated unless intended to run dry.

Note: Certain plastics used for bearings are attacked by normal lubricants, if in doubt use specially formulated oils. See Data Sheet T2/1 for more information on journal friction.

5.3.8 Bufferlocking
The curves on most model railways are sharper than their prototype equivalents and therefore bufferlocking when propelling loose coupled or uncoupled rolling stock can be a problem. Locking can also occur when hauling stock with sprung couplings or buffers due to loss of buffer face contact allowing the springs to pull the buffer faces behind each other, (Figure 11).

If the track layout cannot be modified (e.g. by increasing the radius or eliminating reverse curves which double buffer displacement), either some form of rigid coupling or oversize buffers must be fitted. Section 1.1.1 gives recommended values of minimum radius.

It is important that relative side and vertical movement between vehicles should be free. Corridor connections should touch but the contact pressure should be as low as possible. The rubbing faces must be very smooth, sliding across each other with the minimum of friction. Corridor connections on the ends of coaches next to a loco may foul brake pipes and other fittings on the tender. In such cases a rigid single-link coupling may be needed on the coaches.

5.3.9 Coupling links or chains fouling the track.
All vehicle parts other than the wheel treads should be not less than 4mm clear of the railhead. This is a Guild Standard dimension which is shown on Figure 12 of Part 1 Section 1. It corresponds approximately to the prototype clearance of 150mm.

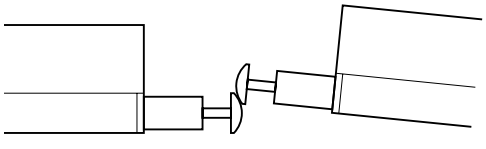


Figure 10
Derailment when propelling light vehicles due to excessive vertical curvature of buffer faces

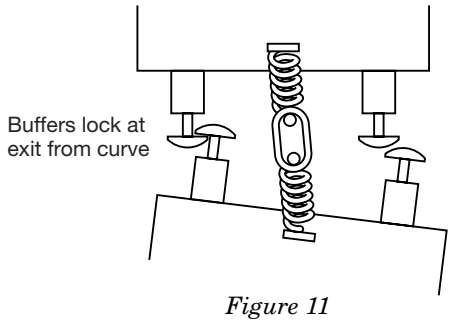


Figure 11
Buffer-locking of hauled stock with sprung couplings.