TRACK FEATURES & CONSTRUCTION

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This Manual Sheet has been produced by Nick Ridgway of Essex.

Nick has practical experience of design and construction of bullhead junctions on heritage railways using recovered materials in 12in : 1ft scale.

Each photograph is provided with a commentray on the features of the prototype of special note for the modeller in order more accurate and realistic models can be constructed.

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Figs. 1 and 2 show an ex-LNER left-handed bullhead 1 in 6½ common crossing assembly. This junction has seen a lot of traffic of late along the right-hand road, and much less along the left, reproducible in models by selecting nickel silver rail for the principal route and phosphor bronze rail for the other one. Note a) the 6½ throat block, the through-bolt and the cover plates at the neck of the crossing, a feature often omitted from model junctions. b) the style of the LNER A-chair under the crossing nose, which is fabricated from two half-pieces bolted through two spacer-blocks, the point and the splice rails. c) the massive steel base-plate for this chair, the whole lot being held down with no less than 5 long A-chair screws. On some, older, patterns of crossing the A-chair may be formed from a single casting instead; the tendency was for these to break early under traffic, resulting in the introduction of the steel plate multi-component A-chair instead. Cast iron is brittle whereas steel is tougher, and fabricated A-chairs tended to last a lot longer.

Crossing timbers are usually a scale 12in x 6in in section whereas the humble timber sleeper is a mere scale 10in x 5in. The reason for broader timbers is to provide more support for the more massive chairs to be found at switches and crossings, and also to allow for the fact that many of them are installed at an angle to the timber to support rails that are not at right-angles to the timber. Thrust impact forces are much larger at junctions and crossings than in plain line and the greater cross-section of the crossing timber helps distribute these forces better.

FIG. 1

FIG. 2

Note from fig. 2 that the splice rail stops short of the blunt nose,

> Calculation: by 6½ times (in the case of a 6½ crossing) the width of the rail 2¾in, less the width of the blunt nose ¾in, = scale 13in total,

being bolted to the point rail by four bolts, one of which passes through two spacer blocks, both wing rails and two cover plates as well. The heavy bolting arrangements are necessary to provide the required stiffness here; heavy impact forces occur where the wheelset passes the rail surface discontinuities at the blunt nose.

Were the image to be of a GWR crossing, where the point rail is applied to the diverging line and the splice rail applied to the main route, it would be termed a right-hand crossing.

Fig. 3 shows a short pre-grouping-type bullhead check rail at only a scale 11ft in length, held in place by only 5 chairs and keys. Just visible in this image is the flat Z-shaped switch anchor that has been commandeered to stop the check rail driving to the right under traffic should the keys loosen; it is bolted through both the check rail and the running rail with fishbolts in this case, and through pieces of fishplate cut off to one hole in length; a non-standard, though effective, solution to local difficulties. Ballasting here is perhaps excessive, and the sleepers are unnecessarily partially covered.

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FIG. 3

FIG. 4

Fig. 4 details the closure rails of an ex-LNER B&6½ bullhead junction on timbers. It reveals the use of broad-base S1J chairs in use at the timbers either side of the fishplate joints in an attempt to lessen the impact load on these timbers, with ordinary S1 running line chairs in use elsewhere where a check rail is not provided. Not available in model form as a specific moulding as of 2008, the S1J fits the same chair-screw holes as the S1, incidentally, the two being fully and readily interchangeable on the prototype.

It is on a falling gradient towards the right. Note the local keying practice: "towards the joint, the station or the river" tends to reduce the tendency for rails to creep under traffic. It is not possible to drive a key in the direction of away from the joint, as the fishplate gets in the way and prevents it happening. Handed chair plastic mouldings are available in 4mm scale. The type of metal key in fig. 4 is sometimes known as a "Mills spring" and the one on the left is driven in too far; perhaps it is well-worn and a strong drive is the only way for it to hold the rail effectively. For a check rail, the preference is to use compressed, treated oak wooden keys, as these are stiffer and lessen the tendency of the check rail gaps to open-up under traffic. In 4mm scale, the difference between the two key types would probably only be visible using a magnifying glass.

The check rail chairs are either pattern CC or pattern PW, providing a check rail gap of a scale 1¾in in this case; the CC pattern holds the check rail vertical and the running rail inclined at 1 in 20 towards the track centre line while the PW inclines the check rail at 1 in 20 as well - practically insignificant at full size and practically undetectable in 4mm scale.

Were the curve any tighter than the scale 374ft radius presented here, then CC2 chairs would be in use to provide a scale 2in check rail gap with appropriate gauge-widening. CC2¼ chairs are also available for applications involving very tight radii where a scale 2¼ in check rail gap is needed simply to get vehicles to pass round the curve. The chances of finding these on a passenger line would be rather low.

Where fishplate joints occur on checked curves it is standard practice to put the bolts in from the outside and put the nuts on them from the inside; were it otherwise then the check rail would need to be removed to attend to the fishplate during maintenance as well, which operation would then be rather awkward and more time-consuming. Further, it is commonplace for smaller, older, patterns of fishplate to be used on check rails than those on the adjacent running rails, so as to provide less risk of obstructing the flangeway.

Figs. 5 and 6 show an ex-LNER bullhead A&6½ junction on timbers, in use on a mechanically-signalled passenger running line and pictured from the toe end. The distance from the toe-end fishplate joint to the tip of the straight switch rail is a standard scale 5ft 5in. The A switch rails have a straight planing angle of 1 in 24 for a scale 5ft 6in, clearly visible in the photograph, followed by a turnout radius between the end of planning and the heel fishplate of the curved switch rail of a scale 482ft. Beyond the fishplate joint at the end of the switch rails and all the way to the blunt nose the curve tightens to a scale 398ft radius. The junction is therefore a "compound curve", somewhat sharper than the "natural" bullhead junction configuration of A&7, which would be a scale 482ft throughout. The distance from the tip of the straight switch rail to the blunt nose, the "lead" is a scale 52ft 9¼ in for an LNER A&6½.

Things to note include the mechanism in the "4ft", which is an ex-LNER facing point lock and its drive rods and cranks connected to the nearby signal box; often these

FIG. 5

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mechanisms and their drive rods are partially covered by hinged planking supported on metal brackets with two flat-Z-shaped "dink plates" on the approaches so to as to reduce the risk of impact damage from the odd dangling coupling that might pass over it, while the hinges provide access for maintenance. That planking is not fitted here. A pin is provided for driving signal detector slide mechanisms as part of the facing point lock mechanism to prove that the facing point bolt is fully home, which facility is not in use here.

The right-hand stock rail has a "joggle" in it so as to provide a slight housing for the right-hand switch rail. This provision tends to reduce the risk of damage to the switch rail as wheelsets strike it in the facing direction, though it does increase the side-impact-thrust to rolling stock passing over it in the trailing direction - hardly an issue with the low speeds involved here.

Fig. 6 There are three tie-bars on this A-switch. The second and third are reproducible in 4mm scale from the proprietary component packs, while the first tie bar and the facing point lock casting would need special sourcing as of 2008. The first slide chair timber takes a heavy side impact thrust as each wheelset rides onto the toe of the switch and is deflected suddenly to one side. It is a requirement on the prototype passenger lines to introduce a steel sole-plate beneath the slide chairs on timbered junctions so as to maintain gauge at the switch tips. The plate ensures that lateral forces are shared between all eight chair screws instead of just the outer four. It is reproducible in 4mm scale with 5-thou plastic sheet stuck to the upper surface of the timber to represent the plate, with 10-thou pieces secured with solvent to the outer edges to represent the ribs. The ribs maintain the slide chairs in the correct place and maintain gauge.

Track circuits are not provided on this particular junction; were they to be present then insulated tie-bars and an insulated slide chair plate would need to be provided. Note the appearance of the S1J chairs again in fig. 5 with their broader base area in deference to the longevity required of the long timbers in use here: the long timbers are needed so as to obviate the use of interlaced sleepers on the adjacent curved running line, and provide the maximum opportunity to route point rodding runs from the adjacent signalbox; their early replacement would be a significant expense for a heritage railway to bear.

Though a passenger running line, the speed restriction around the curve is a scale 5mph, which reduction can introduce restrictions on line capacity in some circumstances, and a longer junction is often selected at design stage to avoid this restriction. Space considerations dictate the use of a "shortie" in this particular case and the line capacity implications of its selection are simply accepted. Bogie stock will clearly pass round this sort of radius on the prototype without buffer-locking, though there is a proviso: as a design principle, it would be inappropriate, and unacceptable on the grounds of buffer-locking risk and excessive corridor connection misalignment, to lay out a crossover on standard double-track centres using 1 in 6½ crossings where passenger trains pass through the connection. As an absolute minimum a pair of 1 in 8 crossings, and preferably 1 in 10 or flatter, would be found there by design, unless compromise non-scale couplings were in use on the model to obviate the risk. For a crossover, at double-track centres, in use only for locomotive release purposes, one could probably get away with 1 in 8 crossings on a model; anything sharper would certainly be "chancing it".

The A-pattern switch rails are a scale 20ft long, supported on 5 slide chairs each side that bolt through the stock rails, and four special chairs each side in the series 1PLA to 4PLA on the left, and 1PRA to 4PRA on the right. While plastic slide chair mouldings are readily available in 4mm scale, the above special chairs would probably need to be dodged together from cut-down mouldings of other chairs as of 2008. The fourth and fifth slide chairs feature a spacer block bolted to the stock rail between the stock rail and the switch rail so as to support the outer face of the switch rail correctly when the switch is closed; the correct spacer blocks here are 1AL, 2AL on the left switch, and 1AR and 2AR on the right one and they are practically invisible here - they would be even less visible on a model and are often omitted.

The timbers for the first and second pairs of slide chairs of any junction are usually longer than the rest, a feature omitted from many point templates in 4mm scale, and due allowance for the provision of either scale drive cranks or hand-levers needs to be made when laying out a top-notch model of a junction. As fig. 5 shows, the necessary extension has been made here by joining additional timbers on to the right of the scale 8ft 6in slide chair timbers using an array of old fishplates and chair screws.

The left-hand check rail is longer than the normal scale 13ft 6in for this pattern of junction.

Fig. 7 shows an insulated sole plate in use at the tips of another junction. Insulated sole plates and tie-bars are required where track circuits are in use, though one might deduce from the image that, as the tie bars are not insulated, track circuits are not in use here.

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FIG. 8

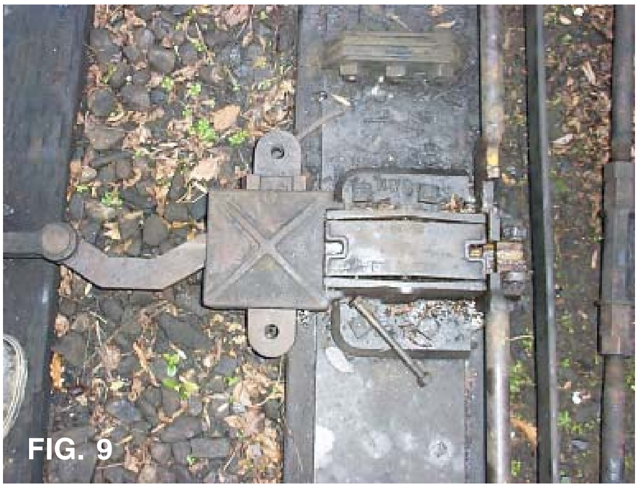

FIG. 9

The hole in the slide component of the facing point lock to the right is to enable the position of the facing point lock bolt to be detected so as to prove signalling mechanisms in more complex installations; it is clearly not in use here.Fig. 8 shows the arrangement of tie-bars and point drive from the heel direction, showing the signal box rodding connected to the tie bar close to the left, curved switch rail. It also shows the ports in the first tie-bar that admit the facing point lock bolt both ways, more of which can be seen in fig. 9. The principle is that the bolt passes through the slot in the tie-bar when the junction switches are fully closed and not otherwise. For interest, the thickness of an old-pattern 50p coin provides a readily-available "no-go" gauge when setting these things up; with the switch closed against a 50p coin and trapping it against the stock rail the facing point lock bolt should not engage - this practice provides a junction that is set up tighter than HM Railways Inspectorate insists on and is a good target to aim for.

Fig. 10 shows the commencement of a check rail on a curve of a scale 374ft radius - part of a B&6½ junction. The chair closest to the camera is pattern PWX and the next one is pattern PW. There is a PWX throat block bolted through both the running rail and the check rail to ensure a smooth entry and exit to this check rail gap; the bolt provides for extra rigidity in this area. Compressed oak keys are in use on the check rail to increase rigidity. Provided the back-to-back measurement on the wheelset is correct, the back of the inner wheelset flange should strike the check rail somewhere near this block when travelling away from the camera, which will deflect the flange to the left and help guide it round the curve. In this way, the side-thrust on the wheelset is shared between the running rail on the outside of the curve and the side of the check rail.

Greater rigidity is also needed from the chairs, so those supporting the check rail have four chair-screws in the LNER pattern PW and PWX instead of the regular three for an ordinary S1 chair.

Fig. 11 The maximum permissible drive for mechanically-worked points without an intervening Ground Frame is usually a maximum of 350 yards, and rodding of this length can expand significantly between the coldest winter and the hottest summer days. Fig. 11 shows what are known as "compensators" in the rodding runs. A set of rodding compensators are introduced so as to provide an equal amount of rodding in "pull" to that in "push", thereby cancelling out the effects of expansion and thereby ensuring that the junction and its associated facing point lock (that is what the second rod is for in this case) drive correctly whatever the temperature.

A wild array of steel plates and fishplates are in use here to secure the longitudinal timbers supporting the compensators to the lateral timbers supporting the running rails, which is not unusual though local practices vary.

Fig. 12 shows the special chairs 1PRA, 2PRA, 3PRA and 4PRA in use on the right-hand switch an ex-LNER right-hand A & 7 junction. The switch rail clearly slides on the surface of the 1PRA and 2PRA chairs, whereas the 3PRA and 4PRA hold the heel of the switch rail rigid; the rail is keyed into jaws in the chair. A flat-Z-shaped switch anchor strap is bolted through both the switch and the stock rail so as to stop the switch rail driving forward under traffic and causing the facing point mechanism at the tips of the switches to bind-up.

A spare bullhead rail lies in the "4ft". It is sitting on top of a spare piece of point rodding so as to provide clearance for the point rodding connected to a signal box to move freely underneath it.

The closure rails beyond the heel of the switch are supported on "bridge chairs" of pattern L1 beyond the fishplate joint, which are available in 4mm scale at 2008 as plastic mouldings. The next timber uses the pattern M2 chair, with a tiny base area, on the straight rail, whereas a pattern L1PWX is in use on the curve, being a special broad chair intended for locations such as this. There is just enough space between them to extend the check-rail through the gap and a home-brew spacer block is bolted through both the check rail and the curved closure rail to

FIG. 10

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FIG. 11

FIG. 12

improve rigidity where the back of the wheelset strikes; on a junction with a scale 482ft radius, the check rail has a lot of work to do!

The next timber beyond them is fitted with an M1 chair on the straight, with a larger base than the M2, and an L1PW on the curve. As of 2008, the modeller intending to reproduce these chairs in 4mm scale will probably need to dodge them together by modifying plastic mouldings of other chair types.

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FIG. 13

Fig. 13 shows a de-railer mechanism, a modern development used in locations where a regular trap point is either not provided or where there is insufficient space for it. The connection to a local ground frame hinges the mechanism out of the way of the wheelset flange when a movement past it is authorised. Should an unauthorised movement take place away from the camera, the de-railer simply carries the weelset flange up and out of the 4ft, and drops it into the 6ft, ensuring that the errant vehicle is swiftly brought to rest.

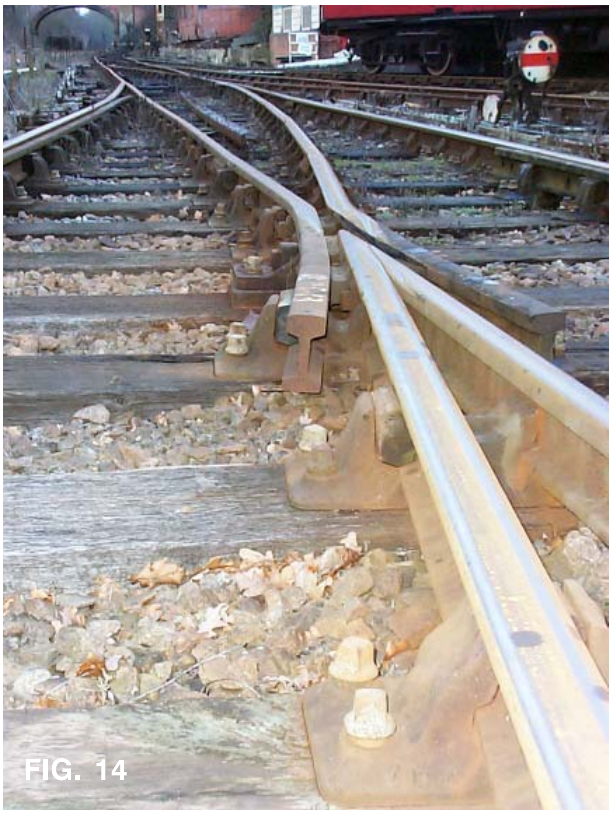

FIG. 14

Fig. 14 shows clearly that the wing rail, which is a continuation of the running rail, is inclined towards the track centre-line at 1 in 20 by the chairs in which everything is carried.

"There is no such thing as flat track".

Special thanks to the museum for allowing us to use the photographs in this Manual sheet which were taken on the railway by Nick Ridgway.

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