ITINIES CALLE 7 MINISTER NAIRON GAUGIE TIRACIEN ORIE

A Practical Guide By John Clutterbuck

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FINESCALE 7mm NG TRACKWORK

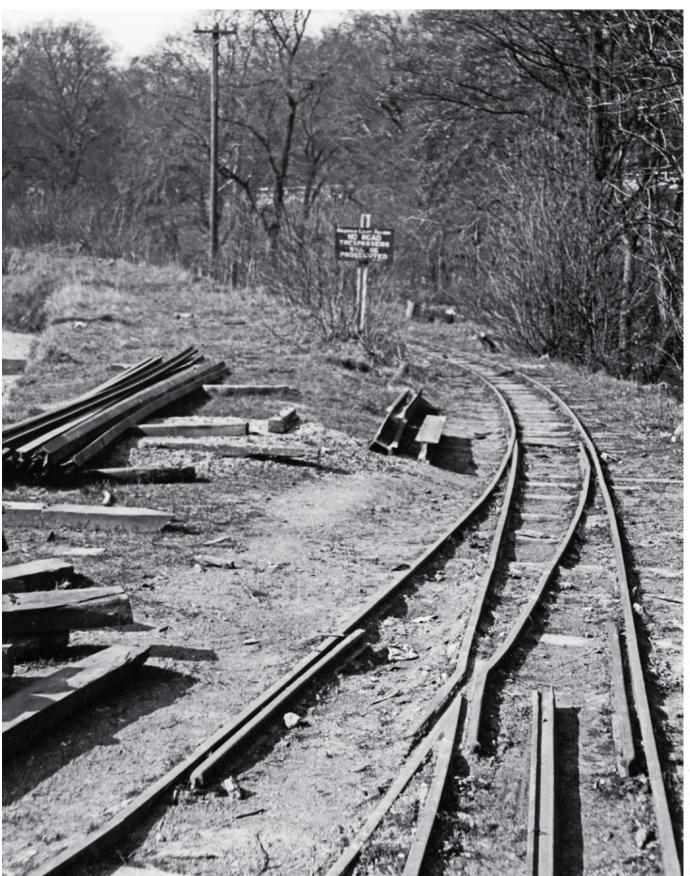
Part One —Introduction & Prototype by John Clutterbuck

HAVE ALWAYS BEEN FASCINATED BY small light railways and industrial railways. However, those of standard gauge were usually always connected to the mainline network somewhere, so one gets the impression that they are a part of a vast network (which they were) - however withered the local arm. One can always find a picture of these with some mainline rolling stock or even a visiting engine. On the other hand narrow gauge railways, by their nature, were isolated little enterprises and, therefore, had to stand alone. The largest and most noticeable aspect of narrow gauge railways was the track itself. Most did not have large formations, substantial engineering works or significant buildings so, when these railways closed and the track was removed, it didn't take long for them to fade back into the landscape. Few, if any, narrow gauge railways were financially sound, especially in their later lives. This usually dictated a 'make do and mend' approach to maintenance which was reflected in the track. I feel this impression of struggling to survive is clear in many of the published pictures of narrow gauge railways. Some are clearly in their final death throes with neglected stock and grass grown track, with the odd rotten sleeper etc. Such sights are long gone, but I do have fond boyhood memories of walking with my father on a damp and dreary day, from Castle Caereinion into Welshpool along the unrestored and decrepit track of the W&L. We thought, from the dense vegetation in places, that nothing could ever have ventured along there. However, something had fought its way through, as we came across a minor road crossing which had recently been re-surfaced and there were some fresh flange marks across the tarmac! Obviously there was enough give in the tar to enable wheels to find the flangeway and stay on the correct course. Reaching Welshpool we even managed to walk along the intact but rather rotten looking town section over the canal! Another time we caught a train up to Tan-y-bwlch and then walked (with permission) along the not then open section up to the mouth of the Moelwyn tunnel. Again, quite a bit of vegetation with some quite substantial saplings here and there. The main impression was one of timelessness. Oh happy pre HSE days! I feel all this adds to their unique character and charm which I'm not sure survives the post preservation era.

Most preserved railways use much more substantial track than they did originally so it is difficult to find places when one can see what the real thing used to look like. One notable exception is the excellent Amberley Museum in Sussex, England, which has some good examples of narrow gauge and industrial track (and lots of non-railway interest for the rest of the family). For our friends down under there is also the Illawarra Light Railway Museum

Society, Tongarra Road, Albion Park Rail, NSW, Australia, which has examples of similar track construction to that being discussed here

This is probably one of the major factors why I wish to recapture this in model form, albeit with a fictitious but plausible railway. Not necessarily a railway in the final death throes but in an era where economies were the order of the day. Before the final onslaught



:ollection Robert Gratton – Ashover Light Railwc



Classic early 1950s Vale of Rheidol. An up train, hauled by No.8 (later, in 1956, named Llywelyn) takes on water at Aberffrwd. The spiked flatbottom rail, with steel baseplates on timber sleepers, is clearly visible in the foreground. Joints are staggered – note that the heads of the fishplate bolts face inwards.

of motor transport and the total change or loss of traditional industries that has occurred since the mid 1960s. (To be honest, I've yet to settle on an exact date). On to modelling track.

Over the past two decades or more there has been a steady increase in the application of the 'fine scale approach' to various branches of railway modelling. P4 is now well established in 4mm/ft and ScaleSeven is trying to do the same in 7mm/ft. The fine scale advocates will argue (and are usually able) to demonstrate that not only does scale trackwork look more convincing but there is a real improvement in running. My own efforts in this area concur with these arguments. Of course, the finescale approach really should cover all aspects of a model railway including stock, track and scenery. However, the latter pair are 'on stage' all the time whereas, on most real narrow gauge railways, trains only periodically disturbed the peace and quiet that prevailed most of the time. This is even more reason why additional effort should be put into the track and scenery.

In my opinion this move towards fine scale is somewhat neglected in 7mm narrow gauge, with the notable exception of those who

model using the excellent OI4 KBscale products. However, these are representations of the 'semi-portable' track used by twofoot gauge industrial railways; my interest is in the larger British industrial or common carrier narrow gauge railways such as the L&B, VoR, Ashover, WHR, W&L, L&M etc. The term 'British' in this context should also include the many railways built overseas by British engineers, or under British influence, which reflect the same style. British narrow gauge railways generally used flat bottom rail of between 30-45lbs weight and wooden sleepers. (Note, I am deliberately excluding the Festiniog, Penhryn and Talyllyn as these had very individual methods of track construction.) Many of these railways had to suffer a paucity of funding throughout their lives after the initial hopes and aspirations of construction. This is often reflected in the condition of the track in their later lives. My techniques are based on my experiences with constructing 14mm track. However, I feel my observations and techniques apply equally to any gauge, especially if you wish to use finer standards to produce better running and more convincing track than commercial 'ready made'.

NARROW GAUGE TRACKWORK

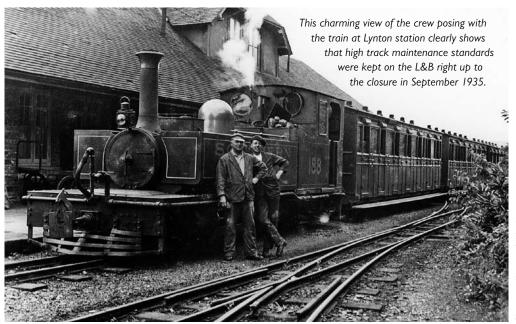
With the exception of the Festiniog and Talyllyn railways the trackwork on all other public British narrow gauge railways was laid in conventional flat bottom rail, either held directly to the timber sleepers with dog spikes or laid on flat sole plates resting on the sleepers. The rail sections used were, invariably, in the range between 30 and 50lbs per yard.

Some heavier rail sections were sometimes used on industrial lines, the various Midlands ironstone tramways, of 3ft or metre gauge using rail of either 55, 56 or 60 lbs while the 18 inch gauge Woolwich Arsenal system actually used 75lb rail on these parts of its system that were dual gauged with standard

gauge tracks. The heaviest rail ever employed was the 85lb flat bottom section installed on the 3ft 6ins gauge system of the short lived Thistleton ironstone mines in south Lincolnshire in the late 1950s.

On today's preserved railways there is an ongoing trend to use much heavier rail, very often serviceable 75lb/yard flat bottom rail recovered from redundant standard gauge industrial sidings, both on the grounds of attractive first cost and lower ongoing maintenance costs. Again, there has been a tendency on some newly laid railways to employ Pandrol clips and concrete or steel sleepers.

Despite that, the lighter rail sections have often given an exceptionally long life. For instance, some of the Welshpool & Llanfair's original



oto: collection A Neale

45lb/yard rail is still in service today, the 28lb/yard rail from the former 3 foot gauge Ravenglass & Eskdale put in decades of service for its 15 inch gauge successor while, when Cohen lifted the original Welsh Highland Railway in 1942, they remarked to potential customers that its 41¼lb (Indian Std Rly section) rail was in virtually new condition.

Inevitably, track standards varied widely between the different railways. Being owned by the Southern Railway, the Lynton & Barnstaple line was particularly good while, at the other extreme, was the Ashover Light Rly – laid with secondhand ex WDLR 25 and 30lb material.

Andrew Neale



Although there is a clear contrast of maintenance standards between the siding and main line on the 2ft 6in. gauge track in Welshpool yard on 26 March, 1956, both are clearly 'Fit for the purpose'.

to: late I A Pede

There were several factors that made me decide, about six years ago, on a complete change of my track construction techniques. Firstly, I had decided long ago to model in 14mm gauge as I felt this was the only way two foot track looked right to me, especially when viewed alongside standard gauge. This also influenced a move to S7 (on the same layout) but that's another story. Secondly, my layout is built in a loft and, therefore, suffers from extremes of temperature and, to a lesser degree, humidity. Like the prototype I had problems with expansion and contraction that tended to result in dead track sections once the soldered joints had given up. Finally, I felt the need to reproduce the real character and features of prototype track. Soldered copper clad (I still have some - but well hidden with ballast) just didn't give me the look I wanted. The more I studied photos of prototype track and, especially, point work, the more I felt this had to be reproduced correctly to get the real character.

A LOOK AT THE PROTOTYPE

Firstly, I would like to review some of the aspects of prototype British narrow gauge track which I feel add to the unique character of NG railways. Most of my comments come from repeated studies of photos published in the many fine books on the British practice NG scene which I have been fortunate to have been given over the years by my lovely wife. Most of these railways used similar materials and construction. However, each railway does seem to have its own unique style. In fact, I would argue that it should be possible to identify each of the major British NG railways from a couple of photos from each showing track and turnouts alone. Studies of photos also show considerable variation within each railway and, especially, over time.

RAILS

Apart from the Festiniog and Penrhyn, which used bull head rail, most narrow gauge railways used flat bottom rail (also known as Vignoles rail) of various weights but, generally, between 30-40lbs per yard. However, over time, replacements would be from new batches of rail which were quite often of a more substantial weight (e.g. 50lb) and, potentially, different profiles than that originally used. Original rails would survive in sidings and other lightly used places. Less worn rails may also be reused in such places. This would give rise to different rail sections being found on the same railway. The accompanying tables of rail sizes and profiles show available model flat bottom rail sections, measured in 7mm scale and compared to the typical prototype profiles. Note that the smaller sizes of prototype rail are not simply scaled down versions of the larger sizes. This, especially, applies to the head width which tends to be proportionally wider in the smaller sizes. Also note how the foot width is usually the same as the rail height. As can be seen, choosing the correct rail is going to be a compromise. Of the Peco rail, IL-3 and IL-4 are the right height for 35lb and 40lb rails respectively but the head is far too narrow and not very prototypical. Although the head width is still a bit narrow, IL-115 has for a long time been the common choice as it has a reasonable prototype section. However, since these articles were first published Karlgarin models have developed new code 82 and 100 rails to accurately represent 40lb and 60lb in 7mm scale. Note that IL-5, as used in the commercial O16.5 track, is approximately the same height as 60lb rail, which is too high for our typical NG railway of old, unless one was modelling such railways in recent times. Rail came in standard lengths and would, generally, be bought in batches. Common lengths were 24ft, 30ft and 33ft. Most railways laid track with joints opposite each other which would involve shortening some rails on the inside of curves. The VoR was notable in that it did not cut its rails in this way so it could swap rails from one side to the other to offset wear. This meant that rail joints were often staggered in the curved sections of the line. As an interesting aside I discovered recently that mainline track in NSW Australia is (or was) deliberately laid with joints staggered in the centre of the opposing rail.

JOINTS

have had difficulty Plain Fishplate Joint establishing the exact sizes of fishplates used so some of this is conjecture. Usually 4 bolt fishplates were used for joints which, for the typical 40-50lb flat bottom rail used, are likely to be either 16in or 18in long assuming holes at 4in. or 4½in. centres. As the web height is proportionally larger on flat bottom rail than standard gauge bullhead (which usually used 18in. fishplates) the fishplate sizes are comparable. Coupled with the shorter rail lengths, this makes fishplates a very prominent feature of narrow gauge track. I have seen several Angled Fishplate Joint photographs which show missing fishplate especially on sidings. Where just one is missing I assume it has fallen out in service whereas, if only 2 bolts are used at the joint with the outer 2 missing, lassume this was a deliberate economy measure. I have also seen 2 bolt fishplates used in sidings etc; which, I assume, were cut down from 4



bolt ones. As the rails were often pre drilled for 4 bolt fishplates there would be obvious holes in the rail next to the 2 bolt fishplate. One aspect that can sometimes be seen is that curves were not always perfectly uniform. Sometimes there are quite visible dog-legs which generally occurred at the joints. Perhaps, with shorter rail lengths than standard gauge and sharper curves, this occurred more easily on the narrow gauge. Reproducing this must be done with care if you want to avoid derailments.

There does not seem to be a huge variation in the profile of sleepers used in British NG railways when first built. The most common size is a 9in. x 4in. profile in lengths between 4ft and 4ft 6in. This is both wider and shallower than the 7in. x 5in. profile which, I understand, was common for NG railways in the USA. The same profile sleepers seem to have been used in point work, unlike British standard gauge railways which used larger (12in. wide) timbers at key places in points. For later replacements many British NG railways used halved ex mainline sleepers which would be 10in. x 5in. profile in either 8ft 6in. or 9ft lengths according to the source. Some railways built at the turn of the 18th/19th centuries seemed to have occasionally used half round or waney edge sleepers. However, this practice soon stopped. The L&B was fully re-laid in 1923 with new sleepers but the original rail reused. This also included using specially made concrete sleepers! However, for many railways, piecemeal replacements were the order of the day. This could give rise to various sizes being used in the same section of track. Furthermore these sleepers would be new, as opposed to

British Narrow Gauge Railway Rail and Sleeper Dimensions

This table shows the main rail weights and sleeper dimensions for some of the principle British narrow gauge railways that used flat bottom track at various stages of their existence.

Sources			Ξ	Ξ	Ξ	Ξ	[2] & [4]	[2]	[4]	[3]	[6]		[4]	[4]	[4]		
Notes			mixed half round and square sleepers in 1883		Tie bars 3 per length on sharp curves	*wood sleepers on bridges	Uncut rails and staggered joints used on mountain section. * Most rail was 40-45 lb/yd [2], ** alternate sleepers [4]	Staggered joints. Check rails have 13/4" clearance	* ex std gauge from Aberayon Branch	Metal plates used under crossing vees. * As observed in photos	10 sleepers per 30' rail length. Spacing closer at joints. Some sleepers half round/waney edge.	11 sleepers per 30' rail length. New sleepers throughout – some concrete!	Original sleepers	Replacement sleepers	* quoted as being cut down main lines sleepers, but these would be 4' 6" long. Tie rods used on curves bolted on the outside.	* If cut would give two sleepers of 4' 6" \times 10" \times 5"	* If cut would give two sleepers of 4' 3" \times 10" \times 5"
	<u>8</u>	Joints	2'					2'		2,	2'*						
	Spacing	Plain track	2' 5 1/4"				3.	2' 6"		2' 9"	2' - 2' 6"*	2' 6"+	2'3"		3' - 4'		
Sleepers	No, fixings per	fastening	Fang bolts + dog spikes on alternate sleepers	Four dog spikes per fastening	Barbed spikes	clips	2 spikes with 4" x 2" clips at joints **	Sole plates		Single spikes no soleplates *	2 Spikes + fang bolts at joints and possibly elsewhere	Bolts, clips & soleplates	Spikes		Clip & bolt at joints & curves – elsewhere spikes. Later years clip & bolt outside, spikes inside		
SIS	(LxWxD)		4' 6" × 9" × 41/2"		4'×?×?	Steel*	4' 6" × 9" × 4½"		*	4' × 6" × 3½"	4' 6" × 9' ½" × 4½"	4' 6" × 9' ½" × 4½"	6' × 9" × 4 ½"	4' 6" × 9" × 6"	5" × 10" × 5" *	9' × 10" × 5" *	8' 6" × 10" × 5" *
s	Length	(£)	24	30	33	54(18m)				24	30	30			25 or 28	09	09
Rails	Weight	(lb/yd)	35 - 40	4/14	40	60 (18kg)	32-60*	48	*	30	40	40 (reused)	45		50	95 (BH)	95 (BH)
Era			<1883	1884+	1922	+9661	1902	1923	1952	1923	8681	1923+	1903		1888+	<1923	1923
Gauge			1.11%		1.11%"		1.11%"			l' 11½"	1. 11%"		2' 6"		2' 4½"	4' 81/2"	
Railway			N N N G R		QT/V/	<u> </u>	> O R			ALR	L&B		10/4/	^^ \	GVT	-	std. Gauge

References and Sources

- (1] Narrow Gauge Railways in South Caernarvonshire, J.I.C. Boyd (Oakwood Press 1972)
 - [3] The Ashover Light Railway, R Gratton & S.R. Band (Wild Swan1989) [2] The Vale of Rheidol Light Railway, C.C. Green (Wild Swan 1986)
- [4] Narrow Gauge Railways in Mid-Wales, J.I.C. Boyd (Oakwood Press 1986)
- [5] The Lynton and Barnstable Railway, Brown Prideaux and Radcliffe (Atlantic 1996) [6] Michael Brown

British Narrow Gauge Flat Bottom Rail Dimensions

This table shows prototype flat bottom rail and comparable model rail dimensions for the weights of rail typically used on narrow gauge railways. See notes below.

				Prototy	type Dir	pe Dimensions (1)(3)	(1)(3)							Scale	Scale Size in 7mm (I)(4)	7mm (I)	(4)		
Weight (Ib/yd) or Model Rail	<u></u>	Rail height		H	Head width		Fo	Foot width		Min web thickness	reb	Rail height (2)	ght (2)	Head width	width	Foot	Foot width	Web thickness	ickness
	(imp)	(in)	(mm)	(dwi)	(in)	(mm)	(imp)	(in)	(mm)	(imp)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
ME Code 55	2 3/8	2.39	60.83	8/1 1	1.13	28.76	2 3/8	2.39	60.83			1.40	0.055	99.0	0.026	1.40	0.055	0.23	0.00
20lb	212	2.50	63.50	1 3/8	1.38	34.93	212	2.50	63.50	[19,64]	0:30	1.46	0.057	0.80	0.032	1.46	0.057		
Peco IL-I	2 11/16	2.69	68.36	1 5/16	1.30	33.09	2 1/8	2.13	53.99			1.57	0.062	0.76	0.030	1.24	0.049		
30lb	3 [2 31/32]	3.00	76.20	711	1.50	38.10	23/4	2.75	69.85	[23,64]	0.36	1.75	0.069	0.88	0.034	1.60	0.063		
ME 70	3 1/16	3.05	77.42	1 5/16	1.31	33.18	2 15/16	2.96	75.21			1.78	0.00	0.76	0.030	1.73	0.068	0.28	0.0
35lb	3 1/8 [3 3/8]	3.13	79.38	1 3/4	1.75	44.45	3 1/4	3.25	82.55	[21/64]	0.33	1.82	0.072	1.02	0.040	1.90	0.075		
C&L 4mm "BSI10A" FB	3 1/4	3.24	82.30	1 3/8	1.37	34.83	2 27/32	2.85	72.28			1.89	0.074	9.0	0.031	1.66	0.065		
Peco IL-3	3 1/4	3.27	82.95	8/8	1.35	34.29	2 15/16	2.96	75.21	91/11	0.70	161	0.075	0.79	0.031	1.73	0.068	0.41	0.016
Peco IL-4	3 1/2	3.44	87.37	8/1 1	1.09	27.65	2 3/8	2.35	59.72	8//	0.87	2.01	0.079	0.64	0.025	1.37	0.054	0.51	0.07
40lb	3 1.2 [3 15.32]	3.50	88.90	3.4 51.64]	1.75	44.45	3 1.2 [3 11.64]	3.50	88.90	[31/64]	0.48	2.04	0.080	1.02	0.040	2.04	0.080		
Peco IL-115	3 1/2	3.57	90.57	7/1 1	1.53	38.75	3 1/16	3.03	77.07	2/8	0.62	2.08	0.082	0.89	0.035	1.77	0.070	0.36	0.014
Karlgarin 82/7	3 9/16	3.57	89.06	1 15/16	1.92	48.77	3 1/2	3.48	88.39			2.08	0.082	1.11	0.044	2.03	0.080	0.35	0.014
ME Code 83	3 5/8	3.61	08'16	8/8	1.37	34.84	2 15/16	2.96	75.21			2.11	0.083	0.80	0.0315	1.73	0.068	0.33	0.013
45lb	3 3 /4	3.75	95.25	131/32	1.97	50.01	3 3/4	3.75	95.25			2.19	980.0	1.15	0.045	2.19	0.086		
50lb	3 15/16	3.94	100.01	2 1/16	2.06	52.39	3 15/16	3.94	100.001	[13/32]	0.41	2.30	0.000	1.20	0.047	2.30	0.090		
55lb	4 1/8	4.13	104.78	2 5/32	2.16	54.77	4 1/8	4.13	104.78			2.41	0.095	1.26	0.050	2.41	0.095		
Peco IL-5 (O16.5)	4 5/16	4.29	108.86	91/81 1	1.78		3 15/16	3.91	99.28	8/1 1	1.10	2.5	0.098	1.04	0.041	2.28	0.090	0.64	0.025
9109	45/16 [4 1/2]	4.31	109.54	7 1 4	2.25	57.15	4 5/16	4.31	109.54	[51/2]	0.44	2.52	660.0	1.31	0.052	2.52	0.099		
Karlgarin 100/7	4 3/8	4.35	110.60	2 1/4	2.26	57.51	4 3/8	4.35	110.60			2.54	0.100	1.32	0.052	2.54	0.100	0.48	0.019
ME Code 100	4 3/8	4.35	110.60	1 3/4	1.74	44.24	3 9/16	3.57	69.06			2.54	0.100	1.02	0.040	2.08	0.082	0.38	0.015
65lb	4 7/16	4.44	112.71	2 5/16	2.31	58.74	4 7/16	4.44	112.71			2.59	0.102	1.35	0.053	2.59	0.102		

(I) The dimensions in bold are the primary measurement - the dimensions in italics have been derived from these.

(4) The dimensions and profiles of the Peco, ME and Karlgarin rail are where the quoted dimensions are different from the older standards. published on S Scale Model Railway Society website with dimensions in [square brackets] from the latest specifications courtesy of Corus from details kindly supplied by Pritchard Patent Products Ltd (Beer, Devon, UK), Micro Engineering Company (Fenton, MO, USA) and (2) The rail height in inches \times 1000 = the code of the rail. (3) Most prototype dimensions are from the BSI I 1905 figures as

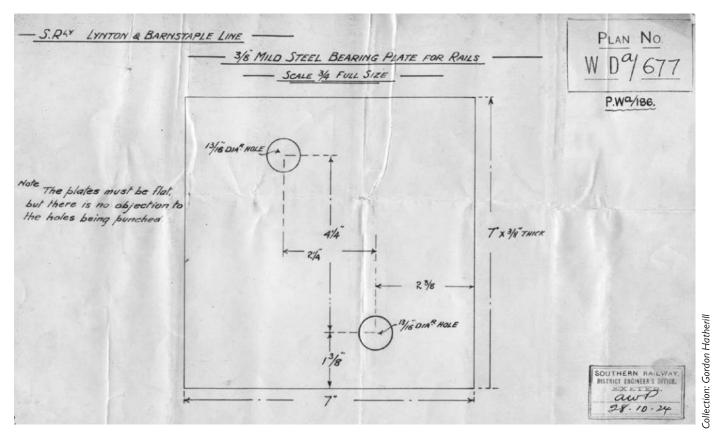
Karlgarin Models respectively.

Comparison of Typical Narrow Gauge/Light Industrial Flat Bottom Rail in 7mm:ft Scale KM 82/7 IL-115

MExx - Micro Engineering Rail with xx=code (= xxlb - B.S. (OLD) Prototype Rail to 7mm scale IL-x - Peco Rail with x = product no KMxx/7 - Karlgarin Models with xx=code inch/1000)

provided by Corus. The ME, Peco and Karlgarin profiles are based on dimensions and drawings kindly supplied by Micro Engineering Company, Pritchard Patent Products Ltd and The prototype profiles come from R Hudson catalogue (kindly provided by Roy Link) and information kindly Karlgarin Models respectively.

Note that model rail profiles will inevitably have thicker webs and feet than equivalent scale prototype profiles due to considerations such as strength and manufacturing tolerences. The most important aspects visually in a model are overall height, rail head width and foot width.

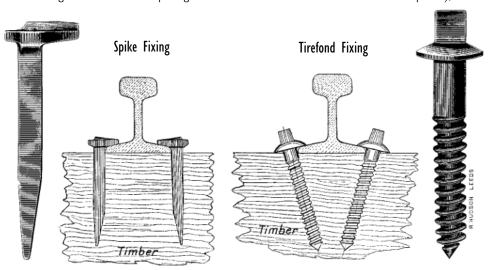


the surrounding sleepers, which would be older and, potentially, deteriorated. Such deterioration would manifest itselfinitially in the centre of the sleepers (as holes) and at the ends (worn corners, splits etc.). I have not seen any evidence for the ends of sleepers to be tied with a steel band to prevent them splitting, as is done on some standard gauge and, certainly, overseas railways. Perhaps shorter sleepers are less prone to this. Sleeper spacing on plain track is not always uniform. Many railways used a closer spacing of, say, 2ft at the sleeper joints, with 2ft 6in. or even 3ft in between. Spacing tended to be wider in the earlier years and was often decreased in subsequent relaying. Sidings often had a wider sleeper spacing than the main lines possibly by design but, more likely, as a consequence of not being relaid to a closer spacing as is common with the main

lines. Some railways, in their later impecunious lives, sometimes put an additional sleeper under a bad rail joint as an additional support. Sleepers could be (and occasionally were) directly under rail joints as the fishplate did not prevent flat bottom rail being attached to the sleeper with spikes etc., unlike bullhead rail which requires a chair.

FASTENINGS

Most railways used either dog spikes or fang/coach bolts to fasten the rails to the sleepers. Quite a few used bolts at joints and selected sleepers with spikes in between. Note the Talyllyn used chairs with flat bottom rail! In plain track, soleplates (also known as bed or baseplates), seem to be either used on all sleepers or not at



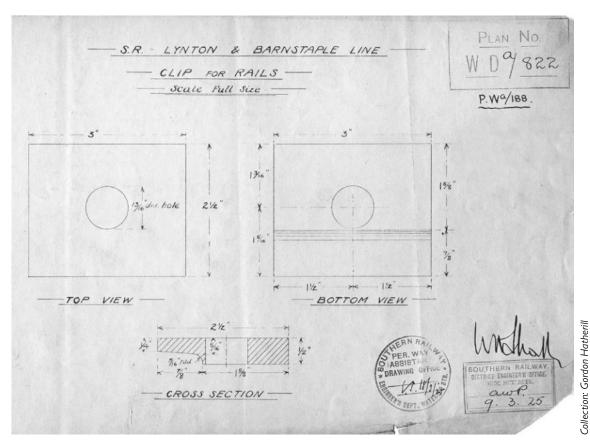
all. The L&B had new coach bolts and soleplates throughout when relaid by the Southern in 1923. The number of fixings varied, sometimes 4 spikes were used to hold each rail to all sleepers whereas, sometimes, 4 were only used at rail joints or on curves with 2 used elsewhere. The VoR used 4 hole soleplates throughout but with only 2 spikes on straight track and 3 on curves (2 inside, I outside). When sleepers deteriorated one can often find that more spikes are added, usually nearer the edges of the sleepers, in an attempt to find sound wood. Spikes often became loose and would fall out. For example, there is a picture of Parracombe halt in the Brown Prideaux and Radcliffe book

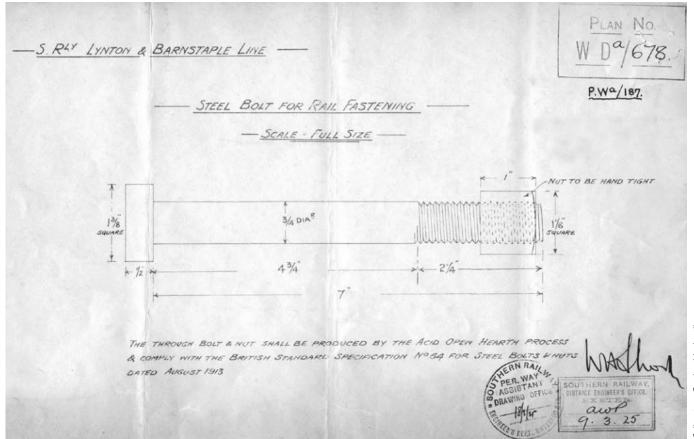
Upper, Lower & Top previous page:

When the Southern Railway took over the Lynton & Barnstaple line in 1923, repairs were urgently needed. The trackwork was refurbished throughout (retaining the original rail) with new timber sleepers and bolted rail fixings.

A steel baseplate was placed under the 40lb rail, held in place by two clips and steel through bolts. This required the timber sleepers to be drilled to take the bolts.

Later still, concrete sleepers, manufactured by the SR at their concrete works at Exmouth, were experimented with.





on the L&B which shows some sleepers with no spikes left holding the rail at all! Sharp curves may or may not have check rails. If used, the rail joints on the check rail would rarely line up with the joints on the adjacent running rail which is, probably, deliberate to avoid double joints. Check rails would either be spiked (usually 4 spikes) to the sleepers or coach bolts used. Note the VoR used special sole plates for check rails. Check rails were usually bolted to the running rail, with distance pieces at distances of about 3 or 4 sleepers apart, but between sleepers. Tie bars would often be used on curves to hold the track in gauge. These tend to be round rods with threaded ends which are inserted through a hole drilled in the rail web with bolts and washers each side. For example, the VoR used three per rail length on sharp curves. Some railways (e.g Furzebrook Railway on the Isle of Purbeck) even used additional supports on the outside of curves, made of what looks like wood. If so, it would need to be quite tough such as oak. These supports seem to be fitted snugly up against the rail web and under the rail head and be bolted to the sleepers. I assume these are intended to prevent the rail tilting outwards and, thereby, spread the gauge.

CANT OR SUPERELEVATION

One of the main justifications for narrow gauge over standard gauge was that much sharper curves could be used. Curves could be as sharp as $2\frac{1}{2}$ chains (55yds) radius which equates to 115.5cm in 7mm scale. Such curves required cant or superelavation to avoid the chance of the trains coming off the track at speed. This could be quite considerable; so much so that the Southern reduced the amount on the L&B during relaying in 1923-1927 as they thought it was excessive. However, this had to be readjusted later after some derailments.

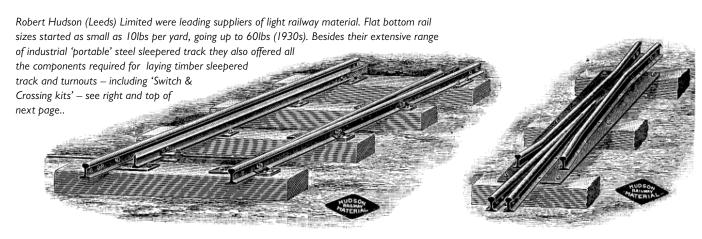
BALLAST

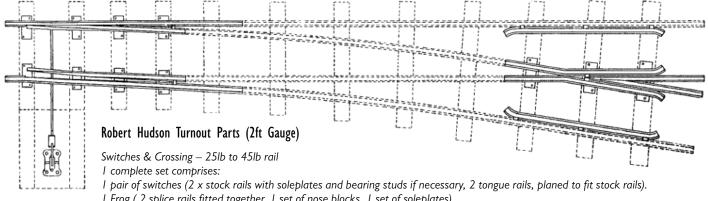
I have not been able to find much information about ballast sources. The pictures I have seen of railways under construction tend to show quite lumpy ballast, quite unlike the uniform sieve that was used on British mainline railways from grouping onwards (1923+). Sometimes this was made from excavated material found along the construction site. Such ballast was too lumpy and needed breaking up according to Major Druitt on the first official inspection of the VoR. Later on, the VoR opened out a cutting to extract extra ballast. However, they also used river shingle from two areas on the lower sections of the route. Therefore, even on a relatively short railway, there would be variation in the colour, size and shape of the ballast. Similar lumpy ballast can be seen in pictures of the L&B under construction but later pictures show it to be more like

mainline quality. I assume this was supplied from standard sources by the Southern during relaying. The surviving or rebuilt British NG railways in the preservation era also use uniform ballast. After a period of use the stone sizes in the ballast would become less distinct. This is probably partly due to settling and also to an accumulation of debris and plant growth, which is all covered by a patina of dirt.

POINTWORK (TURNOUTS)

Point work was nearly always assembled on site from components which were either bought in or made at a depot. Such components would include right and left hand blade and stock rail pairs, crossing vee assemblies (frogs) and the operating gear. The blades, stock rail pairs and crossing vee assemblies are relatively short and the rails within them are nearly always straight. The intermediate rails and check rails would be cut from standard lengths and curved to fit either on site or the whole assembly initially made off site and then transported to the site in pieces. This was certainly common main line practice. If one studies photographs of prototype points and look at where the joints are, the standard components are quite clear. Note, also, how the curves are actually formed from a combination of angles and straights of the standard components with curves only in the plain rail in between. That said, and before anyone writes in, there will be exceptions to this as, for example, where the ends of the crossing vees have been curved to fit. Note that some military railways (especially the French) made whole points in sections for ease of transportation. A few years ago I spotted one of these in a display of ex French military equipment outside a Maginot line fort in Alsace. This had the rail joints between the 3 sections in a straight line through all 4 rails to aid transportation of the complete point with sleepers. As mentioned before, point blades (tongue rails) were nearly always straight from the heel joint. The blades are planed to give a snug fit into the adjacent rail, which may also be planed. The planing leaves a full width rail foot to give something to clamp the tie bar onto. The heel joint itself usually comprises a fishplated joint, although often a large cast distance block is used with bolts going right through to the outer rail. The blades were rarely that long, usually extending over 4-6 sleepers for 2ft gauge, although they tend to get longer (and cover more sleepers) the wider the gauge. Some railways used slide chairs which would be bolted to the rail web. Otherwise sole plates would be used. The VoR used sole plates with a large one piece plate under both rails under the tip of the point blades and bolted the stock rails to the sleepers through the rail foot and sole plate. The VoR also, generally, used a tie bar between the stock rails just after the point





I Frog (2 splice rails fitted together, I set of nose blocks, I set of soleplates).

I pair of guard rails, with distance pieces and bolts but without the stock rails.

I switchbox complete with all fittings.

7mm Scale

Crossing Angle v. Radius

below are the theoretical radius of curves (in feet) for switches and crossings.

Rail Gauge	I in 2	lin 2½	I in 3	I in 3½	I in 4	I in 5	I in 6	I in 7	lin 8	I in 10
24 in. (60cm)	16	25	36	49	64	100	144	196	256	400
30 in. (75cm)	20	31	45	61	80	125	180	245	320	500

Note the difference between the two gauges and remember that the larger the radius, the longer the turnout. The route through the crossing should always be straight, as shown above, never curved.

blades. Sometimes the crossing vees were assembled on a large metal plate. Certainly the ALR used this style of point. These were of bolted construction – welding came much later in the 1950-60s - and then only on the standard gauge. If formed of rail only, the components would be through-bolted, usually with the addition of cast iron blocks between the components to ensure everything lines up correctly and the flange ways are correct. Point check (or guard) rails are often bolted to the adjacent rails with 3-4 metal distance pieces to set the flange way width. Such bolts sometimes have the (generally round) heads on the inside and sometimes on the outside. Large square washers may or may not be used, with variations, even on adjacent points. (e.g. L&B) Unlike mainline track (which used wider profiles), the sleeper profile used in points was usually the same as that used on plain track. Due to the small size there were far fewer sleepers used than their mainline equivalents and the lengths often appear haphazard or jump in steps, unlike the mainline, where the sleepers generally smoothly increase in size. Spacing varied to match the point, ensuring the blades, heel joint, crossing vee, intermediate joints and check rails, all had adequate support. A common practice was to use 2 long sleepers either side of the operating tie bar to which the point lever or operating crank is also attached. I have found in modelling such pointwork that points need quite careful planning to get them to look right and fit the location, especially if tight radii are wanted. In Britain the narrow gauge railways that operated an official passenger service were required to have full signalling and interlocking point control with catch points etc. These would, certainly, have ground frames and operating rods, cranks, point locks etc., and some even had signal boxes. Such equipment would be similar sizes and standards to that used on the mainline except when it came down to the tie bars which would, obviously, be shorter to match the gauge. Those railways that operated on a 'one engine in steam' principle or were

(or became) purely mineral lines could often get away with no signalling and simple point levers. As I am modelling the latter this is an area I do not intend to elaborate on in these articles.

In part two I will cover the materials and techniques used to model plain track.

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Narrow Gauge Railways in South Caernarvonshire [I C Boyd (Oakwood Press 1972)

The Vale of Rheidol Light Railway, C C Green (Wild Swan 1986)

The Ashover Light Railway, R Gratton & S R Band (Wild Swan 1989)

Narrow Gauge Railways in Mid-Wales, | I C Boyd (Oakwood Press 1986)

The Lynton and Barnstaple Railway, Brown Prideaux and Radcliffe (Atlantic 1996)

S Scale Model Railway Society website (www.s-scale.org.uk)

The Track Handbook (Corus Rail November 2002)

ACKNOWLEDGEMENTS

Thanks to Gordon Hatherill, Robert Gratton, Roy C Link and Andrew Neale for providing material for illustrating this article.



VoR pointwork at Devil's Bridge, circa 1960. The tongue rails slide on special baseplates, firmly fixed with 'tirefond' bolts.

Full interlocking was provided on the running line turnouts, linked to catch points, as shown here. The rodding that runs horizontally across the photo leads to a ground frame with locking levers — only accessible if you have the train staff

Beyond the catch points, further turnouts are operated by simple weighted levers.

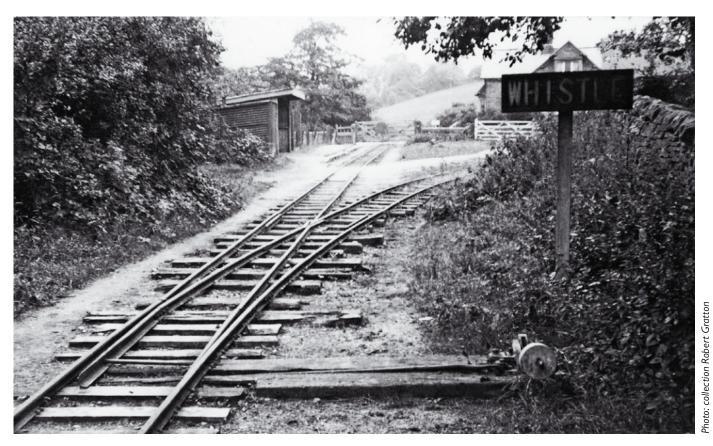
Photo: collection Roy C Link

This view of GLYN and train at Chirk in the early 1920s clearly illustrates flat bottom trackwork laid and maintained to a reasonable standard. Note the crossing assembly is mounted on a steel plate – a form of construction that is useful to the modeller.

While modellers use the terms 'points', 'blades' and 'frogs' the railway industry more typically (though not exclusively) referred to these as 'turnouts', 'tongue rails' and 'crossings'. The place where the tongue rails (blades) are attached to the running rails, to form a pivot, is the 'heel joint'.



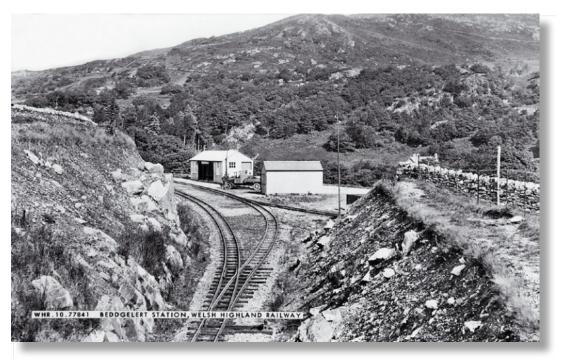
Photo: collection A Neale



Above: This 1941 view of Wooley Station on the Ashover Light Railway clearly shows how the turnouts were laid. As is noted in the text, the tongue rails are perfectly straight up to the heel joint, with no 'curve' on that for the diverging route. Like some other lines, the ALR crossings were mounted on a steel plate. Check rails are quite short, again typical of the prototype. No locking was provided for the turnout – just a weighted 'throw' – though this latter was the more elaborate form where the lever was parallel with the track. Signs of deterioration abound in the photograph, with rotting sleepers and other signs of neglect. The whistle board warned drivers of the approaching gated level crossing, over Dark Lane. Originally the siding, which could hold about four bogie wagons, served a coal wharf, complete with office. This closed in 1934.

An official view of pristine trackwork at the new Beddgelert Station on the Welsh Highland Railway soon after the opening in 1923.

The Light Railways Act of 1896 allowed the construction of railways, both standard and narrow, to less stringent requirements than before. The objective being to open up areas previously not accessed by rail. A flurry of lines were projected, many of which were never built. Those that were, such as the Welshpool & Llanfair, Leek & Manifold, Welsh Highland and Ashover, met with varied success.



Finescale 7mm NG Trackwork

Part Two — John Clutterbuck Describes Track Construction

The type of track typically used in the type of track typically used in the common carrier type of British narrow gauge railways such as the Lynton and Barnstaple, Welsh Highland, Vale of Rheidol etc., and also to similar British style railways outside of the UK. In part one I outlined the prototype features of such trackwork I hope to be able to recreate. In this article I want to outline the basic techniques for plain track construction. Firstly I would like to claim no originality for any of the ideas in these articles. As an avid reader of model railway literature and observer of layouts over the years I am sure many of the techniques I use have been absorbed consciously or unconsciously



Photo: John Clutterbuck

from better modellers than I. The main reason I started writing these articles is that I am building what will, eventually, be a large layout in my loft – with predominantly narrow gauge trackwork in OI4, plus some standard gauge in Scale7. My modelling tends to be sporadic and the focus often changes between trackwork, scenery, rolling stock, electrics etc. With parts of the layout now over I8 years old (and likely to take as long again to finish it) I am finding I have forgotten how I did things, so I started writing myself instructions and these articles are the result.

TECHNIQUES

Although many of the techniques described are required because of my use of I4mm gauge floating track in a hostile loft environment, I am sure some are appropriate for more traditional track construction on cork etc., and in gauges other than O14. Certainly, I am not trying to prescribe any one set of methods; I am the first to break my own rules and will often try a different approach to see if it's better. If someone finds something useful that they can combine with their existing techniques then that is more than enough reward for me. I would gladly welcome feedback and such ideas from others.

I think it is also fair to say these are not quick techniques and many will feel they haven't got the time to expend. However the only real skill required is patience, and this will be rewarded with (in my opinion) track and point work that looks realistic and provides a perfect base for that carefully constructed rolling stock I'm sure you have. As I mentioned in part one, the trackwork and scenery are 'on stage' all the time, so deserves equal if not special attention. To me, the fact that these methods in part replicate how real track is built, provides a further degree of satisfaction. However, I doubt if

this compares with the satisfaction from the real thing, as practised by the many volunteers on the NG preservation scene.

PLANNING

Before laying your track I would suggest planning carefully where all the rail joints will be, based on the standard rail size of your prototype (usually 24ft, 30ft or 33ft). Consider the rail and baseboard joints as being co-incident. If possible plan baseboard construction with the rail joints in mind. I have tried to make all my baseboard joints at right angles to the rails, which has resulted in a very odd set of baseboard sections. Note that there is no harm making some of the real (or dummy) joints slightly longer or shorter to fit, but try to avoid having very short or very long lengths and joints within points (apart from where they should be). Point work (turnouts) will be outlined in Part three.

MATERIALS

Before construction can begin some materials need to be prepared as follows.

SLEEPERS

As outlined in part one most British practice NG railways used sleepers of either $9\text{in}\times41\text{/2}\text{in}$ section which in 7mm scales to $5.25\times2.6\text{mm}$ (0.21in \times 0.10in) or cut down mainline sleepers of 10in \times 5in which scales to $5.8\times2.9\text{mm}$ (0.23in. \times 0.11in.). Getting close to the width is the most important aspect, the depth less so. However, in the prototype it is quite common to see some sections of track with the ends exposed. Consider if and where you would like to model this. For this type of track construction it is important to use a reasonably strong and hard wood as the sleepers contribute to the strength of the track. Balsa wood is far too soft. However I did successfully use it to represent a section of track with some really decayed sleepers interspersed with new replacements (in a stronger wood).

If your prototype uses cut down mainline sleepers then the best source would be to look for ScaleSeven sleepers, (Exact scale walnut sleepers can be now obtained from Perfect Miniatures of Sudbury Suffolk). For 9 inch wide sleepers it's a bit more difficult. There are quite a few American suppliers of fine wood sections and ready made sleepers (ties) such as Kappler (www.kapplerusa.com) and Mt Albert (www.mtalbert.com) some of which are available through UK suppliers (including the 7mm Narrow Gauge Association sales dept). Unfortunately those intended for O scale narrow gauge are usually far too narrow for British narrow gauge railways as American narrow gauge railways tended to use 7in wide sleepers (ties). Furthermore the American O scale is 1:48 not 1:43.54 as used in the UK so the quoted scale sizes will be slightly smaller. However try looking at the actual sizes of strip intended for other scales and you may well find something that serves. For example, if my calculations are correct, 9 inches in 7mm is approximately 20 inches in HO (1:87), 15.75 inches in 4mm (1:76), 13 inches in S (1:64), 10 inches in American O (1:48) and 6.5 inches in Gauge 1 (1:32).

Most of my NG sleepers are made from 5×2 mm pine strip I obtained some time ago from Hobby's. I also obtained some 6×2 mm basswood from the same source for my mainline sleepers. Recently I have discovered that one of the main coffee shop chains (the one with the circular green sign) has coffee stirrers which make perfect sleepers. These are approx 5mm in width and 2mm thick but this varies quite a bit. Note: most other coffee chains have



stirrers that are more like 6mm x Imm which are more appropriate for the cut down mainline sleepers if you don't mind them being very shallow. However, they are useful to represent the commonly used sleeper inserts between the rails at crossings. If you need vast amounts and don't fancy being blacklisted from such coffee emporiums, a web search for 'wooden coffee stirrers' reveals quite a few suppliers in the UK who could supply in bulk, but finding out the exact size may prove difficult – I doubt if such suppliers are in tune with the needs of the narrow gauge modeller!

I tend to make large batches of sleepers in advance using a simple jig to cut several strips at once to length. Rather than be left with short pieces at the end that are no use I leave longer lengths than can be used for pointwork (to be described in Part three). Once I have a suitable pile of sleepers I tip them into a foil tray (scavenged from some forgotten culinary delight) and pour on some wood stain (I use Colron 'dark Jacobean oak'). Jiggle them around with a suitable tool until they are all covered with dye and then fish them out using old tweezers etc. I put them in an old cardboard shoe box lid to dry until needed.

For that old split or decayed look so typical of cash strapped railways in their later stages of life (and before restoration) you could try distressing batches of sleepers with a scriber or knife etc. I have read about a product called 'Weatherlt' in a military modelling book which seems to produce an aged wood look on bare wood, e.g. without using any stain. However, I think that it still needs mechanical distressing for splits etc.

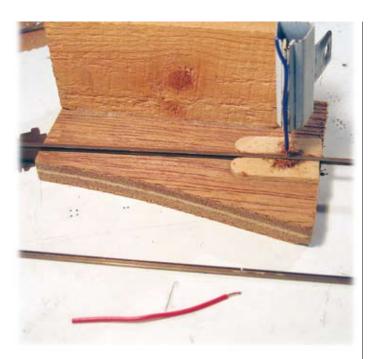
RAIL

I use short independently powered rail lengths which combined with the mounting of the track on a floating foam base, solves the expansion and contraction problems in my loft.

See part one for information about the choices of available model rail. I wish the new Karlgarin code 82 rail had been available when I started my big extension some years back. However, it wasn't and I went for Peco IL-II5 being the best compromise at the time and will most likely stick with this now. Mixing the two will look odd especially as my mainline is complete and I've only got new sidings etc. to do. The other way around would perhaps have been OK. For my lightweight quarry track I will probably use ME code 70. I would have liked to have used steel rail if it were available but it would probably rust too much in my loft anyway. Recently I have seen comments that rubbing the top of the rail with graphite not only helps with electrical pickup but makes nickel silver look more like steel. Note that some rail sections may require filing of the foot when producing vees, check rails and switch blades, depending on the flangeway clearances required. This may possibly apply to the new Karlgarin rail.

I always blacken my rail in advance. This will minimise the amount of paint required later which would mask the detail of the track and fishplates as well as gum up the points. I perform this in batches, keeping some unblackened rail aside to be used for point construction. To enable long lengths of rail to be blackened I made a trough 38in long from a length of 20mm plastic pipe with a narrow strip cut off longitudinally (see photo I). I sealed the ends by carefully warming each end with a hot air gun and turning up and squeezing the corners together with pliers, then sealing it all with glue. IMPORTANT: wear thick gloves and do it outside!

Before blackening scrub the rail well with Flash or Ajax etc. to remove any residues – which will stop the metal black acting on the metal. Then rinse well, place the rails into the trough and pour in some metal black. WARNING: THIS IS TOXIC. Carefully agitate the



rails and turn over using stainless tweezers to ensure all sides of the rails are covered, being very careful to avoid spilling the metal black. Carefully pour the metal black into a spare glass container (for later use) and rinse everything well in plain water – then wash your hands properly – there's few enough fine scale modellers without losing any through poisoning!

POWER FEEDS

Supplying power to rails was one of my original big problems. Short of soldering flexible wires to the outside of rails, which I feel is far too ugly, most other methods would eventually fail due to the inevitable expansion and contraction in my loft. My latest method is both unobtrusive and for several years now completely reliable. In essence it relies on an individual power feed made through a sleeper to each short section of rail with the soldered joint glued to the sleeper and spikes used to mask the joint. The wire itself passes through a larger hole in the baseboard below. This ensures that there is no stress on the soldered joint whilst still allowing the track to float.

The exact location of the feed is always in the middle of a sleeper and must to be determined during assembly for each new rail laid as described later.

Firstly, the rail is held upside down in a small vice, and a razor saw used to carefully cut through the rail foot and a tiny bit into the web; no more or the rail will be too weak. Each supply wire is cut from single 0.6 mm core copper wire and is only long enough to go through sleeper and baseboard with enough extra to attach power wire from below - I use approx 8cm lengths. Strip insulation from either all of the wire or just 1cm (this can make wire identification easier from below, especially if different colours are used for section and common rail). Flatten about 1mm of the end of the wire using small pliers. Solder the flattened wire end into the slot in the bottom of the rail. I use a simple jig (see photo 2) for this, made from scrap wood, lollipop sticks and a bulldog clip. This clamps the rail and also helps stop a large blob of solder forming on the web. Remove from the jig (if using) and, if required, carefully clean any excess solder from the rail web with a scraper, etc.



SPIKES ETC

Although I feel many commercial spikes are over scale, the main reason I made my own spikes was because I need very short spikes (2-3 mm), which do not protrude below the sleepers – thereby allowing the track to float. Furthermore, the thought of trimming spikes to length did not appeal. After various experiments I now make all my spikes from standard (No 26) office staples as follows. This is best done as a batch production process as practice definitely makes perfect.

Although not immediately obvious, the outside of staples are covered with a plastic film which should be removed by brushing the strip of staples with fine sandpaper (3). This makes blackening them easier later.

Break the strip of staples into approx. I5mm lengths. Cover each length with a piece of masking tape and fold down over the sides. This will hold the spikes together during cutting.

This is more fiddly to describe than do but you need to sandwich

a small piece of brass etc., sheet between the lower jaw of some good sized tin snips and the inside edge of the staple strip tails – whilst holding it tight with your fingers (4). The upper blades will then cut a strip of spikes with a head defined by the width of the brass sheet. You will need to squeeze the staples tight to the blade whilst cutting to avoid



wander — possibly cutting just a few staples at a time, gradually moving the snips along the strip. Trying to cut corners by using long strips tends to produce long spikes at the end of the strip which will have to be discarded.

You will now have a set of spikes stuck to a piece of tape. Turn the

staple strip over and make a second strip from the other half. Discard the remaining plain strip (I have yet to find a use for this)

IMPORTANT: now study the head width carefully and tear off and discard any that are too long or too short. I reject quite a lot but, as the raw material is cheap, I don't find this a problem.

Photos: John Clutterbuck

I cut the spikes to length whilst still on the strip of tape (5). Note you should only use short spikes for point

construction if making them on a board (to be described in part three)

Finally rub the spikes off the strip of tape (6). Don't leave them on the tape for a period of time, as it makes them too sticky to use (yes – done that!)

I then dump my pile of spikes into a jar of metal black. If they don't blacken all over then it is due to some residual plastic coating. I have a large quantity like this and, to be honest, they look fine



when used — even when unpainted (7). I use a magnetic retrieving tool to get them out and transfer them to another jar, then save the metal black for further use. Rinse them several times in water in the other jar. Finally, tip the spikes out onto a tissue to dry and store until needed.

Note that spikes were staggered either side of the rail to avoid splitting the sleeper, with the spikes on the other rail staggered the opposite way to counteract any twist. Many prototypes used clips or fang bolts either on all sleepers or just at joints and some intervening sleepers. These could be represented by scale cosmetic nuts and bolts such as Grandt Line. Grandt Line also produce cosmetic spike heads but, on the assumption they are made of plastic, they would not provide the strength required for this type of track construction. However, since these articles were first published KBscale have explored producing scale L&B clips to match either Peco IL-115 or Karlgarin code 82 rail (or possibly both).

I do not use sole plates except within point work. I make these from some thin card of a rust brown colour (from an old greetings card) which I stiffened using shellac. If you need large quantities then you could investigate some of the cosmetic tie plates, sold by some of the American manufacturers such as Grandt Line. Etched sole plates would also be worth investigating.

PLAIN TRACK ASSEMBLY

I always assemble my plain track 'in situ' so it can be customised to suit the location. I find it best to work along the track, laying the turnouts when I get within a couple of (prototype) rail lengths, then

filling in the intervening section. Unfortunately, you'll have to wait for part three for turnout construction.

I lay all my track on thin Imm foam (I think the stuff I have is meant for parquet floors) as it is meant to float. The foam is stuck down with Copydex, a natural latex based glue. I had fears about its longevity, so contacted the technical people at Henkel, who assured me it will last indefinitely.

I then mark sleeper and rail joint positions using a felt tip pen (12). I use a strip of wood about 24in long with marks on it at the appropriate intervals, together with rail joints (the sleepers are closer together here). Work out the best positions for the real and dummy rail joints and power feeds. I use quite short rail lengths of either 2 or 3 prototype lengths adapted to either align baseboard edges and avoiding very short sections. The power feeds are fed through a convenient sleeper for each rail (I tend to use the same one).

I glue the sleepers into position with Copydex and leave to dry. I don't worry too much about perfect alignment as I think a slight variation looks quite prototypical (8). Think about whether you want new or old trackwork and use distressed and/or new sleepers as required. If you add some sleepers that are meant to be new 'patched' replacements, then I suggest marking the trackbed alongside so you don't forget which are which, when you come to final ballasting and weathering etc.

Look along the track to ensure it looks reasonable before everything dries too much. Copydex can be rubbed off easily unless quite old.

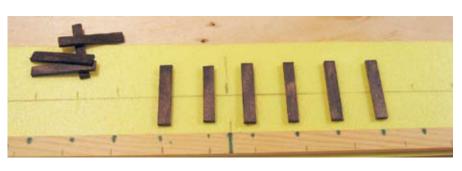
I then curve the rail, to match the formation and cut to length, so the ends match the marked rail joint. It is important to ensure each rail is bent to the correct curve to



ensure there is no stress in the assembled track as this is likely to give trouble later.

Then file the gluing vees at the ends - these are shallow vees about 2mm long filed either side of the web at the rail ends - using a triangular needle file (9). Try to avoid filing the rail head or foot. No vees are required at baseboard joints, where the rail ends should be finished square.

The rails should be located into position and held to gauge. (10) I use home made gauges (11) but





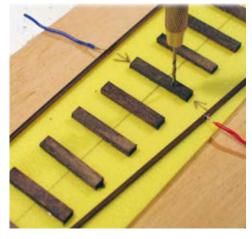


KBscale now produce roller gauges for O14 as well as the original RCL gauge. If locating rails adjacent to some already laid, then use small clamps or bulldog clips, to ensure the rails are in line (12). Mark each rail foot with a scriber in the centre of the feed sleeper and also press 2 points in the sleeper, exactly either side of each rail foot, at the feed location.

Remove the rails and scribe the underside of the rail coincident with the mark on the rail foot. Cut the rail and add a power feed wire

as described previously.
Repeat with the other rail.

Prepare a small amount of slow setting ероху glue, then drill 1.5 mm holes in the sleeper for the power feeds, exactly between the 2 scribed marks for each rail (13). If you are using a foam

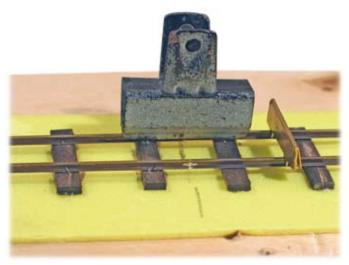


base you will need to hold the sleeper whilst you do this. The wire for one rail can then be fed into the hole. Just before pressing home I dab a tiny amount of epoxy onto the wire so the rail and wire will be firmly bonded to the sleeper. The small soldered slot is hidden when the spikes are added.

Before spiking, check each rail is still to the correct curve. Then clamp each rail to the previous rail with a clamp (e.g., peg or bulldog clip) or with a baseboard joiner if at a baseboard joint. This will ensure there is minimum stress at the joints.

I use four spikes per rail/sleeper at real or dummy rail joints and two per rail/sleeper elsewhere – check your prototype. See the note under spikes about alternative fixings.

Using a pair of gauges, get both rails into the correct location on the sleepers and don't forget the stagger! Use a No 76 (0.5mm) drill bit to make a small hole for each spike, just through the sleeper, if you are using floating track. Don't drill all the sleepers in one go, only those which you are going to spike next. Using a pair of fine pliers, grip the head of a spike, dip the tail into the epoxy and then



push into the hole (14). You may need to experiment with a larger drill bit if the spikes don't want to go in easily, or a smaller one, if they don't hold.

Pushing too hard on the floating foam base may make the rail lift and pull other spikes out a bit. Therefore, don't attempt too many spikes in a rail length until the first spikes have set. With curved track, I generally spike one rail down with spikes every 2-3 sleepers and leave it to set before laying the second rail, again with only every



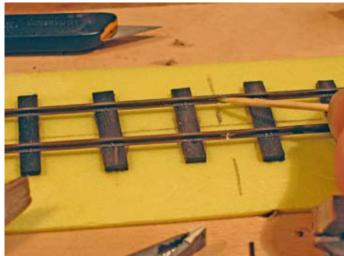
Photos: John Clutterbuck

2-3 sleepers spiked. With straight track it is often possible to spike both rails in the same session but, again, only every 2-3 sleepers. I generally leave the gauges on while it sets. Once set, recheck the gauge and fill in the remaining spikes, adding the cosmetic fishplates. This also allows minor adjustments to be made to the gauge.

If you have problems with rails lifting off the sleepers, then try using taut lengths of masking tape about 3in long, stuck to the roadbed each side, but avoid hiding spikes, which have a habit of popping up, if you can't see them. I also, sometimes, use small weights on blocks of wood about 3-4in long, which rest on the rails themselves. Such measures are generally only required on curves, especially if you use any superelavation.

Don't worry if sometimes the spikes do not go in cleanly and the sleepers get damaged. Mis-aligned, missing or additional spikes are quite prototypical.

Whilst preparing a sample length of track for the article photos I tried using a thick superglue gel instead of epoxy. I found it difficult to quickly insert the spikes before the glue sets and felt it was not



Photos: John Clutterbuck as strong as the epoxy track. It's also very easy to get glue onto the pliers and then onto the fingers which is not a good idea with superglue!

> A REMOVAL TIP: I find gently gripping them in side cutters and pulling them upwards, is any easy way to remove spikes if required.

FISHPLATES

use plastic cosmetic fishplates at most rail joints but on top of an epoxy joint

that provides some strength, as I will attempt to explain. This allows for the expansion and contraction that inevitably occurs in my loft.

Most of mine come from RCL (now KBscale) but these are quite fragile and can split right in the middle, if not handled with care. Such split ones I use for the purely cosmetic joints. As described previously, the rail ends for functional joints should have gluing vees filed in the rail ends, to allow a quantity of epoxy glue to form a hidden joint which is covered by a cosmetic fish plate.

When locating the adjacent rail, use a small length of wire or a pin to dab a tiny amount of epoxy onto the rail web, each side into the joint, ensuring a little glue gets into the filed vees (15). Using tweezers, place a pair of cosmetic fishplates into position with nuts on the outside (round bolt heads on the inside). I then wrap a small piece of doubled up kitchen paper around the rail/fishplates and squeeze gently with the tweezers to soak up any excess glue. Check fishplates are in the correct relative position to each other and the rail end, and then clamp with an adapted clothes peg or a flattened crocodile clip (16). If isolation between rails is required check using a meter and then leave it to set hard before attempting further rails.

I also scribe the rail tops with a scraper for dummy rail joints in intermediate positions and add cosmetic fishplates with a tiny smear of epoxy. These generally don't need clamping. I find a razor saw generally makes too wide a cut. Sometimes I scrape the rail head slightly on one side of the joint, or on the inside and outside of the rail head on opposite sides of the joint, to make it look like separate rails. I would suggest experimenting on a length or rail first. Snippers and track cutters can also be used to impress a perceived joint in the rail head and/or foot.

I have recently obtained some 4mm scale 'locking fishplates' from Exactoscale which look pretty good but I have yet to try them. They are probably too short but may be easier to use than the above, especially for point construction. Grandt Line also produce dummy fishplates for code 70 which are probably worth a try. These are available via the 7mm NGA sales dept.

BASEBOARD JOINTS

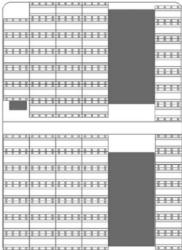
Using a floating track base opens up the issue of what to do at baseboard joints. I found that whatever methods I used to permanently fix the rail ends, such as soldering the rails to PCB or screw heads, it didn't take too long before the ends became misaligned, probably due to the expansion and contraction. Furthermore, in my opinion, such joining methods are very visible and leave an ugly and totally unprototypical gap.

It finally occurred to me that, instead of trying to hold the rails rigidly to the baseboard (which I'm not doing elsewhere), I should try and hold them to each other just as the prototype does.

I did not want to resort to the standard commercial rail joiners as I feel they look quite out of proportion. I have ,therefore, found a way of making joiners from the steel covers of old floppy disks (scavenge them while you can). My joiners are close to scale fishplate size and can masquerade as such, whilst firmly holding the rail ends. They are not perfect but, to my mind, much less visible than rigid fixtures - furthermore, there is no ugly gap. The trick is to leave enough space on one side to slide them back (AND TO REMEMBER TO DO IT) when assembling or disassembling. These allow the track to float across the baseboard ends as elsewhere with the rail ends held in positive alignment.

To make them I stick a paper template onto a sheet of the floppy disk metal using a low tack adhesive (e.g., Photomount)(17). I then press out the bolt heads using a scriber; this is easy as the metal is so thin. I then cut the individual joiners out with tin snips and remove the paper. The final step is to fold the joiners into a channel, using flat nosed pliers (18).

I found that the floppy disk shield metal was completely impervious to metal black, so I now heat the finished fishplates with a small blowlamp until red hot and then leave them to cool. This seems to blacken them guite well. Check and adjust the fit of the fishplates - by sliding them onto a length of rail approx. 100mm long with a small section in the middle, about 12 mm long, with the head filed off down to the top of the fishplate level. This enables them to be squeezed





from the top, using flat nosed pliers, closing the joiner neatly around the rail foot. Whilst still on this piece of rail, the tops of the fishplates can be filed to ensure they are level. Squeeze very gently, with the fishplate off the rail, to close them further, if required. They only have to be tight enough to stay in place and keep the rails in line. They are not intended to conduct electricity as each rail should be independently powered anyway (19).

BALLASTING

If, like me, you want to use floating track, then the flexibility of the foam base needs to be maintained. The traditional method of laying ballast, wetting and dribbling on PVA, tends to produce a hard ballast which compromises the flexibility.

However, I have discovered that Copydex dilutes in water quite well and can be used in much the same way, but I would suggest that the diluted glue is dripped onto ballast that has been wetted with some detergent added — not sprayed all over as some do with PVA. Fortunately, any drips that get onto the sleepers rub off fairly easily, even when dry.



CONCLUSION

If you have followed some of the above, then you should now have some ballasted track with correctly coloured new or distressed sleepers, weathered rail, blackened spikes and fishplated joints at prototypical spaces. It is up to you how much more weathering it needs – perhaps some diluted washes or dusting with powders to add a bit of extra weathering but, certainly, it should not need drenching in thick paint, which will obscure the fine detail I hope you have managed to obtain.

You will also find this track is stronger than it looks. Using steel spikes secured with epoxy to hard wood sleepers means it is

probably comparable in strength to plastic flexi track. However, the weakest area will be the joints. As long as the rails were curved properly beforehand, so there is no inbuilt stress, then they should give no trouble. A lot of my track is yet to be ballasted so I find I get a realistic compression of the track when a train goes along which the joints seem to cope with quite well. I have yet to have one fail on me. The only trouble I do have is when I forget to slide over the joiners before separating the baseboard sections. Fortunately, I don't do this very often.

In part three I will outline my techniques for building point work.



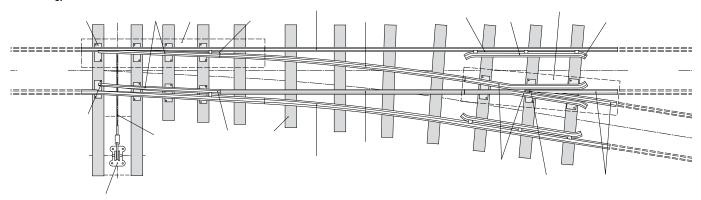
A rare colour photo of Stretton on the Ashover Light Railway. Photo: collection Robert Gratton

Finescale 7mm NG Trackwork

Part Three — Turnout Construction Described by John Clutterbuck

Y FOCUS IN THESE ARTICLES is on the type of track typically used in the larger type of British two foot narrow gauge railways such as the Lynton and Barnstaple, Vale of Rheidol or Ashover, and therefore, my techniques are targeted towards I4mm gauge. However these could equally apply to slightly larger gauges with a suitable adjustment of dimensions. In Part one I outlined the prototype features of such trackwork and in Part two I covered the construction of plain track in model form. In this final part I want to outline techniques for model turnout construction. As I mentioned in Part two, these are not a prescriptive set of methods and I myself often try to find better ways of doing things to improve the result. Hopefully other modellers will find some useful ideas here which can be combined with, or adapted from their own methods. I would gladly welcome feedback and further ideas from others.

Terminology - not to scale



One key aspect of my approach is that I 'dry build' the main components of the turnout directly onto a template first. I then remove them, add the sleepers and assemble it properly. I find it easier this way to ensure everything fits together properly on a nice flat surface, without the sleepers getting in the way.

TERMINOLOGY

It has become clear to me over the years, and especially in preparing this article, that railway trackwork is a terminological minefield. This especially applies to turnouts (switches). Whatever term I use there will be others who disagree, especially as each railway often had their own specific terms. Furthermore, modellers have developed their own set of terms, many of which differ from prototype practice (e.g. points for turnouts). So for the purposes of this article I have used terms largely based on British mainline practice, as the focus is on 'mainline' narrow gauge railways. However, although the correct terms for the 'switch' and 'crossing' are simply that, I have tried to use the term switch and crossing 'assemblies' when I am specifically referring to the final modelled assembly of multiple pieces. See diagram above (which is not to scale).

The following extract from 'British Railway Track' (Permanent Way Institute 1943) should help:

All sets of switches consist of four rails, two of which are known as stock rails, or back rails, and two as switch or tongue rails. The switch rails are planed and the details of the planing vary with the type of switch. One stock rail and one switch rail fit together and are called a switch. The two outer rails of a pair of switches are the stock rails, and the two inner rails the switch rails. The switch rails are fixed together, by stretcher bars, and can be set to give a passage for traffic to either one track or other. The switch rails pivot about a point known as the "Heel".

TEMPLATES

Up until now I have tended to draw all my templates by hand. However, REVIEW readers have permission to photocopy the Robert Hudson I in 6 turnout diagram, re-drawn here. This would make a perfect template especially as it is already to 7mm scale. Therefore, I have used it as the example in this article (see drawing top of page 28). The sleeper lengths have been increased to 4ft 6ins. On the page opposite are a RH and LH turnout developed

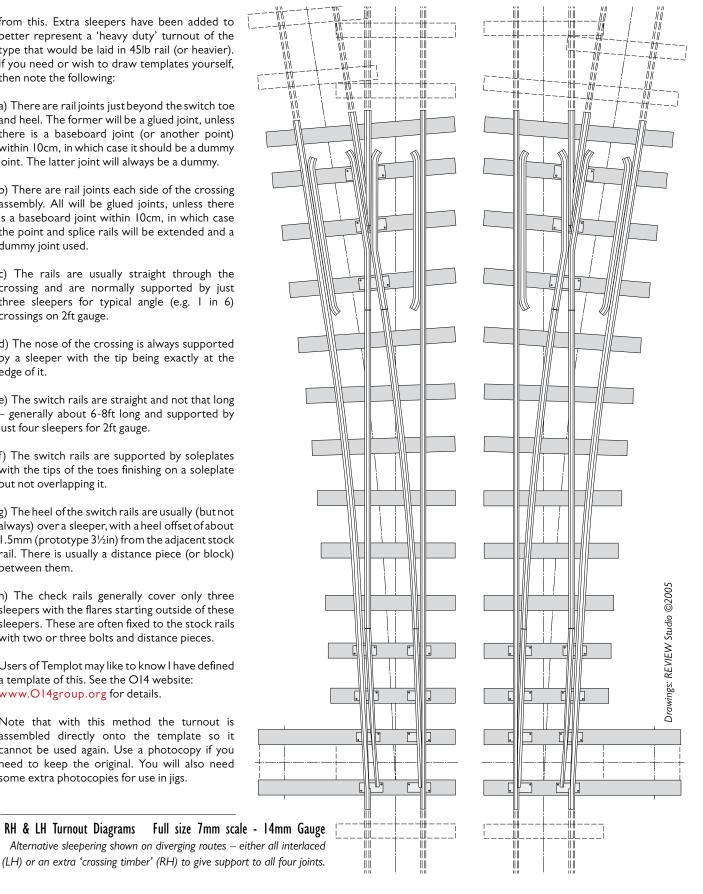
from this. Extra sleepers have been added to better represent a 'heavy duty' turnout of the type that would be laid in 45lb rail (or heavier). If you need or wish to draw templates yourself, then note the following:

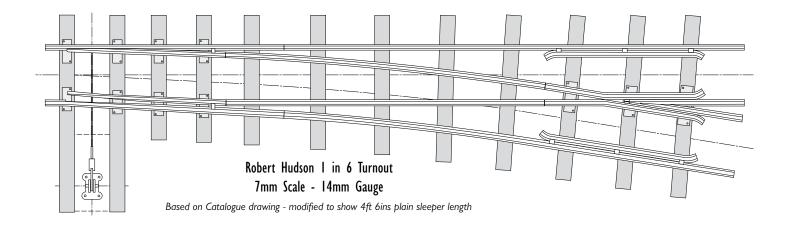
- a) There are rail joints just beyond the switch toe and heel. The former will be a glued joint, unless there is a baseboard joint (or another point) within 10cm, in which case it should be a dummy joint. The latter joint will always be a dummy.
- b) There are rail joints each side of the crossing assembly. All will be glued joints, unless there is a baseboard joint within 10cm, in which case the point and splice rails will be extended and a dummy joint used.
- c) The rails are usually straight through the crossing and are normally supported by just three sleepers for typical angle (e.g. I in 6) crossings on 2ft gauge.
- d) The nose of the crossing is always supported by a sleeper with the tip being exactly at the edge of it.
- e) The switch rails are straight and not that long - generally about 6-8ft long and supported by just four sleepers for 2ft gauge.
- f) The switch rails are supported by soleplates with the tips of the toes finishing on a soleplate but not overlapping it.
- g) The heel of the switch rails are usually (but not always) over a sleeper, with a heel offset of about 1.5mm (prototype 3½in) from the adjacent stock rail. There is usually a distance piece (or block) between them.
- h) The check rails generally cover only three sleepers with the flares starting outside of these sleepers. These are often fixed to the stock rails with two or three bolts and distance pieces.

Users of Templot may like to know I have defined a template of this. See the OI4 website: www.O14group.org for details.

Note that with this method the turnout is assembled directly onto the template so it cannot be used again. Use a photocopy if you need to keep the original. You will also need some extra photocopies for use in jigs.

RH & LH Turnout Diagrams





WORK PLATFORM

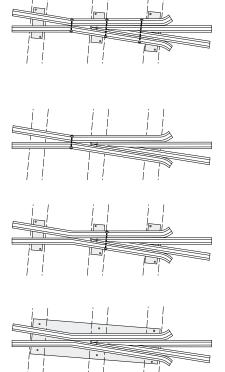
You need to find a piece of board, on which to assemble the turnout, which is at least 10cm wider all around. It will end up having lots of holes drilled in it, although it can be used again. I use old pieces of melamine shelving. Place a piece of thin card, a bit bigger than the turnout, onto the board and then cover this with the template. Now, tape both of them down firmly onto the board. This piece of card will be used later, as a template for drilling the holes in the baseboard for the power feed wires. Don't add sleepers yet – that comes later.

MAKING THE TURNOUT COMPONENTS

The next step is to make all the main components of the turnout, using the template for guidance. Note that masking tape should be used wherever tape or taping down is mentioned. It not only allows for easy removal but is not greatly affected by the heat of soldering.

CROSSING ASSEMBLY

Up until now I have usually silver soldered the crossing assemblies of my turnouts. I know many modellers may be put off silver

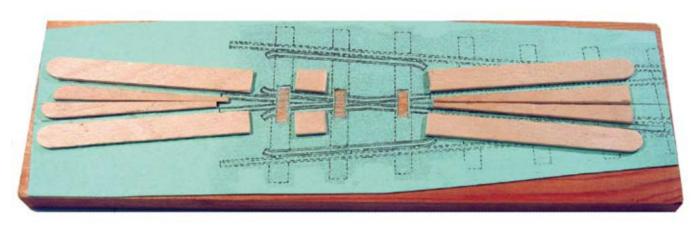


soldering and it obviously requires more care and forethought in the use of jigs etc., due to the high temperatures involved. Therefore, for this article, I have explored using some of the new generation tin/silver soft solders which, being stronger than the traditional tin/lead variety, should give a reasonably strong joint. As a result, I have also found it easier to make the jig and add extra detail to the crossings.

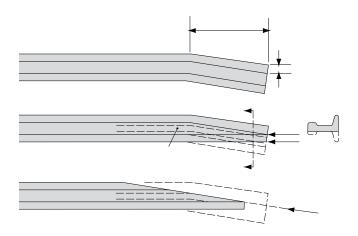
All the soldering on the illustrated example was done with Carrs 22I Tin/Silver solder and Frys Powerflow Flux, using a well heated and clean 25W iron and trying to avoid dallying.

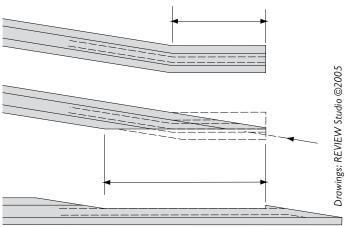
As outlined in Part I, a prototype crossing is composed of a point rail and a splice rail. In the prototype, these are both planed so the splice rail fits alongside the point rail and are joined with bolts — often with blocks at the nose. The point rail is always on the side of the primary route through the turnout and the splice rail on the secondary route. Our crossings are going to be assembled in a similar manner.

You need to decide on the type of crossing you want to construct, e.g. with or without soleplates, with or without through bolts, or a single large plate. I made two examples, neither of which is strictly prototypical – one with soleplates and one through bolt; and one with two through bolts and no soleplates.



Photos: John Clutterbuck





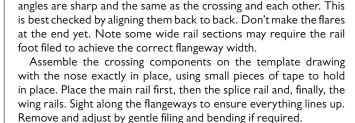
Make the jig from a scrap piece of flat plywood, MDF etc., as shown (I). Then cut 4 lengths of unblackened rail each about 10cm long. If the turnout is going to be near a baseboard joint then make two of them longer by the appropriate amount.

Take one of the lengths for the main rail, file the end square and make a slight bend 4mm in from the end, and offset by about 0.5mm towards the centre of the gauge, as in the diagrams above. File the rail head straight over this length so the side is back to the web at the end. This provides a strong end to the crossing nose. File the side of the rail foot so it is also straight. I use a 4in smooth file and have found that repeated forward strokes with the file tend to produce a cleaner finish than forward and backward strokes. You will get the best results from top quality files. As they can be quite pricey, look after them – treat them like the precision cutting tools they are and protect them from contact with other files and tools!

Now file the other side of the rail (head and foot) to the angle of the crossing, to form a point at the nose. File slowly and place in the jig frequently to check the angle. Note that I use a scrap piece of board with another copy of the template stuck on and a nail driven in next to the nose, to support the rail whilst filing. When finished, blunt the tip of the nose slightly.

Now on the same side, file most of the side of the rail foot along the length of where the splice rail will fit. This should be about 18mm long for a 1 in 6 turnout.

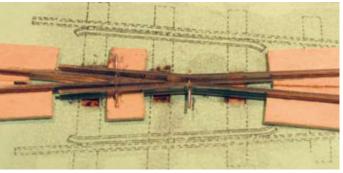
Take a second length for the splice rail and make a slight bend 5mm from the end and file it straight, as for the main rail but on the opposite side . File the foot straight too. File a taper on the other side of the splice rail to fit the main rail, which should end in a sharp point. Do this slowly and frequently check how it fits against the point rail.



Make the wing rails from the remaining two lengths. Ensure the

When you are happy everything fits together, place the rails in the jig and mark the rail tops where the through bolts will be used, as shown (2) and then drill 0.6mm through all the rails.

If you are using soleplates or a large single plate, cut them from brass strip, polish them and place them in slots in the jig. Clean all the rails thoroughly and thread them onto short pieces of soft 0.6 copper or brass wire. Carefully line everything up in the jig, ensuring that the flangeways are exactly Imm wide (pack with a strip of wood if needed) and when you are happy, stick down with tape at the ends of the rails. Make sure you sight along each of the





rails from both ways before soldering (3). Now add flux and solder sparingly with a hot iron – try to add just enough solder to ensure all the joints are made but no more. Whilst the solder is still fluid, press a small scrap of wood across the rail tops to ensure they are level. Remove the assembly from the jig, clean and flux the bottoms of the rails and carefully run a thin seam of solder to join the rail feet. Do not linger as you don't want to unsolder the main joint. I find a desoldering wick useful to remove any superfluous solder blobs. Finally, wash the assembly to remove flux residues and rub the whole assembly face down on a fine piece of abrasive (e.g. wet



and dry) on a flat surface to clean up the rail tops. Use a scraper, fibreglass pencil etc. to clean up any further extraneous solder. The crossing now needs to be either cut to the correct length using the template as a guide or left deliberately long for nearby baseboard joints. As with all these cuts, always cut fractionally over length using track cutters and finish with a file unless your cutters are very sharp and you are confident you can cut straight. Now, file shallow gluing vees in the appropriate rail ends and tape the assembly down in the correct position on the template. The finished crossings are seen above.

HEEL HINGES

In most narrow gauge prototypes, the heel offset is generally consistent (across differing switch lengths) and relatively narrow (2in - 3in). In the past I have tried using modified rail joiners as hinges, but I frequently had problems with power supply to the switch rail. My eventual solution not only provides a good power supply but also looks like the large cast iron distance block that is often used in the heel on the prototype (notably the L&B). Furthermore, it

provides a very flexible joint that requires little force to operate. It is extremely delicate during the final stages of assembly but seems quite robust once complete and in situ on the layout.

The raw materials required are 1/16 in \times 0.005in phosphor bronze strip and similar width strips from old business cards and are made as shown (4). When I started making hinges I used to try to make them 4mm long. I experimented with making them longer (5 and 6mm) to give a bit more to solder on to but they were getting a bit too prominent for my liking. Have a practice and check your prototype; however, note that they always come out a bit longer than the size you are aiming for.

OUTSIDE STRAIGHT STOCK RAIL

Cut a length of blackened rail for the outside straight stock rail, slightly over length. If there is to be a baseboard joint or another turnout within say 10cm, then leave the rail longer and add a dummy prototype joint at the correct place once all is in situ.

Using a scriber, mark the inside foot of the rail at the switch toe and heel positions. Now file the side of the rail foot of the closure rail fully down to the web (but leaving the head alone) for about 20mm from the toe and then taper up towards the heel. Holding the rail for this can be quite tricky. I try to clamp the other rail foot in a mini vice. Alternatively, try placing the rail foot in a horizontal slot in a piece of board, cut with a razor saw. Don't file too much away at this stage as it can be adjusted later. Use draw filing to ensure the taper is smooth. A slight undercut will give a better fit and provide some tolerance to debris. Note that narrow gauge turnouts did not normally use any joggle.

Now make 2 marks 5mm apart (i.e. +-2.5mm) on the inside rail

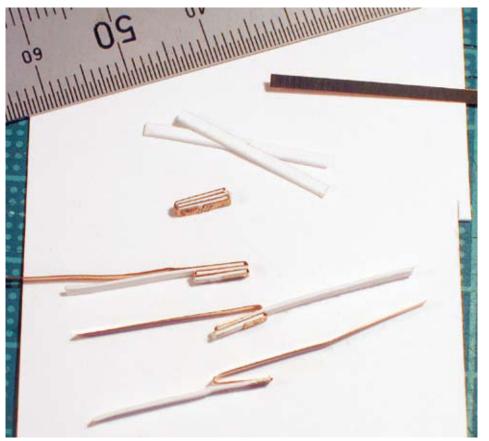
foot either side of the heel mark for the hinge. Remove the rail foot between these marks without touching the rail head, so you are left with a clean vertical 5mm slot in line with the web, into which a hinge fits snugly. I usually start with a good quality needle file and finish with a sharp triangular scraper.

According to your prototype, you may wish to punch simulated bolt heads using a centre punch etc., from the inside of the hinge slot. Use a scriber, sharp knife or very fine razor saw to mark the rail top for a dummy rail joint just beyond the switch. Now check the rail against the template, straighten if required and trim to the exact length.

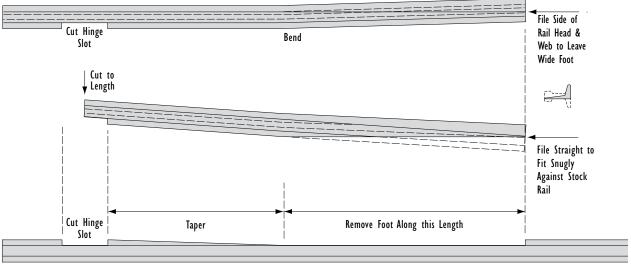
SWITCH RAILS

Prototype switch rails are usually fairly short and straight throughout for gauges up to 2ft 6in, if not larger. Start by cutting a length of unblackened rail, longer than the switch rail itself (e.g. 10cm), so it is easier to handle. Make sure the toe end is square.

For a 45mm long switch rail form a slight bend 16mm in from the toe (or 14mm for 40mm switch rails, 18mm for 50mm). The bend should be towards the centre of the track. Place the rail on its side on the edge of a piece of



SWITCH RAIL



STOCK RAIL

board (or in a fine saw cut), with the end towards you and the bend uppermost. File a taper between the toe and the bend on the side of the railhead only, i.e. leaving the rail foot alone. The toe end should be filed nearly all the way through the web and leaving a nice wide rail foot (see above). As always, a good quality file helps. Straighten if required so the inside edge of the rail is completely straight.

Turn the rail over and file a taper on the rail foot, from the hinge towards the toe, so there is no rail foot for last 20-25 mm and the rail head tapers to a fine point. Keep checking the rail is straight and the fit against the stock rail and adjust either switch rail and/or the stock rail as required, until a good fit along the length of the taper is achieved. It helps to check the fit from the underside as well. Note that it is very easy to make the taper on the rail head too long and shallow. It should only be as long as the original bend, e.g. 16mm for a 45mm switch rail. Finally, smooth the inside edge of the rail with a fine needle file.

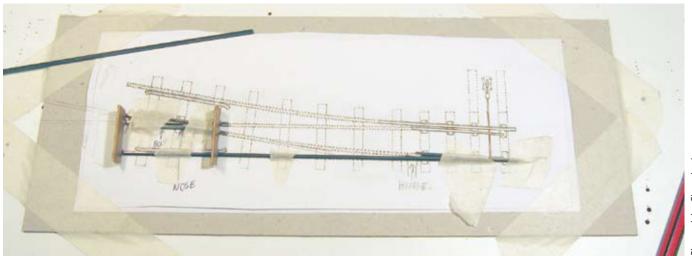
Cut the switch rail to length so the end is just near the middle of the hinge slot. Now file away the last few mm of the half of the rail foot using a small flat needle file to accommodate the hinge, avoiding touching the rail head. Straighten if required and recheck the fit against the stock rail. Then polish the underside of the switch and closure rails with fine abrasive paper to remove all rough edges.

PREPARE CURVED INSIDE CLOSURE RAIL

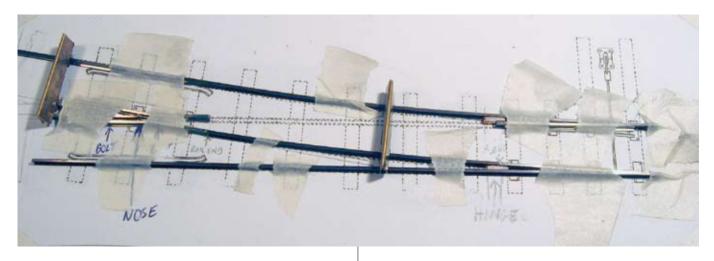
Place the outside straight stock rail exactly in position on the template, using track gauges at the start and end of the crossing assembly and tape down leaving the switch clear of tape. Place a hinge into the slot and the switch rail into its correct position and also hold with tape. See (5) below.

Cut a length of blackened rail slightly longer than required for the curved closure rail. File the back of the rail foot, as for the switch rail, so it will fit against the other half of the hinge. Now gently bend and adjust it until you are confident the curve is correct, all the time ensuring the switch and crossing assembly are still in the correct position. Once you are happy, mark the exact length with a scriber and cut slightly over length. Then repeatedly check, file and/or bend until it fits exactly, leaving a small insulating gap between it and the crossing assembly.

File a gluing vee at the crossing assembly end of the rail. Place the inside closure rail exactly into position onto the template and tape it down. Also mark the exact position of the rail ends on the



Drawings: REVIEW Studio ©2005



template for later guidance, in case they differ.

PREPARE CURVED STOCK AND STRAIGHT INSIDE CLOSURE RAIL

Now make the outside curved stock rail, inside closure rail, and switch rail in the same manner. However, note that the outside curved stock rail has a prominent kink at the toe but is always straight from the this to the heel. The inside edge of the switch rail forms a straight line through the switch. Any curve generally starts after the rail joint (which is a dummy in our model). Furthermore, it is generally straight adjacent to the crossing.

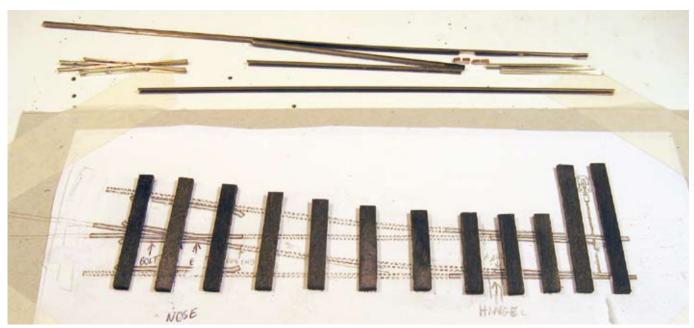
The construction (6) proceeds as follows, in a similar manner to the

bove. However note that some rails are left over length:

- I. Cut the stock rail 10mm over length (5mm at each end) at each end or leave it extra long if baseboard joints will be nearby.
- 2. Mark the switch toe and heel locations.
- 3. File the stock rail to accommodate the switch rail.

- 4. File the hinge slot and punch simulated bolt heads if required.
- 5. Bend a kink at the toe (this rail only) and bend the rail beyond the heel to fit template. Note it is straight between the toe and the heel
- 6. Mark a dummy rail joint on stock rail beyond the heel.
- 7. File the switch rail to fit the stock rail.
- 8. Cut the switch rail to exactly the same length as the other switch rail and file at the heel end to accommodate the hinge.
- 9. Cut the closure rail 5mm over length and file at the heel end to accommodate the hinge.
- 10. Adjust the curved stock rail to fit and tape it down on the template, using track gauges against the crossing assembly and straight stock rail beyond the toe.

With the rail preparation complete carefully remove all the tape



Photos: John Clutterbuck

and rails. Finally drill a small hole in the foot of each switch rail at the correct position for the stretcher bar.

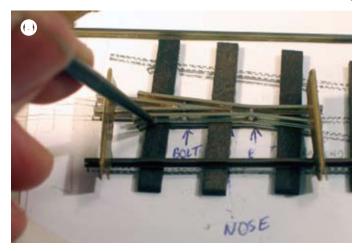
TURNOUT ASSEMBLY - SLEEPERS

Cut a set of sleepers to match the template and stain them as required. However, note that I only discovered when making up a set piece turnout, that the sleepers on the original Robert Hudson example are too short when compared with the scale 4ft 6in (31.75mm) sleepers I use on my layout. Check with your prototype and adjust the lengths accordingly. Note the drawing on page 28 has been corrected to show 4ft 6ins long sleepers.

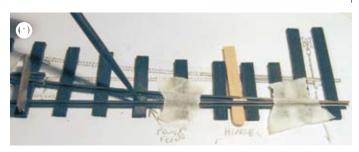
As outlined in Part 2, I use 5mm x 2mm strip wood with one of the best sources being the stirrers from one of the main coffee chains. Stick these into position on the template using PVA etc. and leave to dry (7). Be especially careful to ensure the correct location of the sleepers under the switch rails and crossing nose.

CROSSING AND STRAIGHT STOCK RAIL ASSEMBLY

Place the crossing assembly exactly into position and hold with small



strips of tape, allowing room for track gauges and leaving the end sleepers clear for marking. Place a loose sleeper under the hinge positions if this is between sleepers as on the R Hudson example;



place the straight stock rail into position using track gauges across to the crossing assembly and also tape down. Place a hinge into the



slot, add the switch and inside closure rails, and also hold with small strips of tape.

Now, using the point of a scriber, mark the centre of the sleepers exactly either side of the rail foot at key places around crossing assembly (8). This will aid locating the crossing assembly later. Also scribe a small mark for the power feed wire on the inside closure rail foot and mark centre of sleepers either side of rail foot at same place. Do this on the same sleeper for the outside stock rail (9). Add 0.6mm solid cored power feed wires as detailed in Part 2.

Now solder a power feed wire to the underside of the crossing



assembly (10). Blacken, wash and dry the whole assembly.

Finally, drill 1.5mm holes to take the wires between the marks on the sleeper and underneath the crossing assembly between the sleepers. Note that all these holes should go right through the assembly board to allow the wires to pass through.

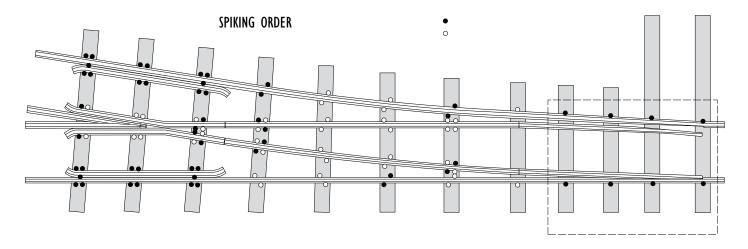


SOLDERING THE HEEL HINGE

You need to make a small jig for soldering the stock, switch, closure rails and hinge (11).

Place the stock rail upside down in the jig, then the switch rail and,





finally, the closure rail, ensuring it is aligned with the switch rail. Secure them all with tape. Insert the hinge into the slot ensuring that the open end is towards the toe and the side gap is between the switch and closure rails. Don't worry if the hinge is proud of the rail bottoms as this will be filed down later (12). Place a strip of wood against the rails and another over the top, to allow them to be held tight with one hand. Add flux and then solder them quickly together using a hot iron, adding just enough solder for a good joint but without flooding it (13. When cool, but before removing, carefully file the underside of the hinge flush with the rail bottoms, then polish smooth with fine abrasive paper. Do NOT use your best files for this as the solder will ruin them.

Now gently remove the completed assembly from the jig. I usually find the switch rail ends up being soldered to the closure rail but a bit of slight wiggling usually breaks this butt joint, leaving the switch rail soldered just to the hinge. Wash carefully to remove any flux residues.

SOLEPLATES (BASEPLATES)

Nearly all narrow gauge turnouts have soleplates under the switch rails. You could use metal but I prefer to make them from thin card of a suitable colour stiffened with shellac. This has the added advantage that it can hold graphite. This not only provides

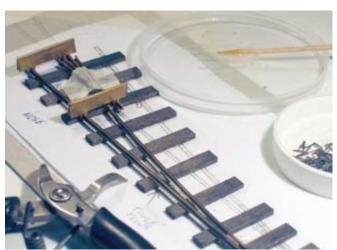
 permanent lubrication but simulates the black grease so often used on the prototype. I managed to find some rusty brown coloured card that is ideal. For many of my turnouts I used a large single 2I x 3mm soleplate at the toe end (VoR) and individual 7 x 3mm for the other sleepers up to the heel. For the Robert Hudson example use 6.5×2.5 mm.

Stick the soleplates onto the sleepers for this side only – the other side will be done later (14). The outside edge of all the soleplates should be in line. Rub the centre of the soleplates with a very soft lead pencil (e.g. 5B). Not only does this provide real lubrication but looks surprisingly like black grease once finished.

SPIKING

Prepare a tiny amount of slow curing epoxy. Carefully place the closure rail, stock rail and switch assembly into position, feeding the power feed wires through holes, taking care not to distort the hinge. Dab a tiny amount of epoxy onto the last Imm of the wires just before pressing home. Now locate the crossing assembly into position against the marks on the sleepers and, similarly, add a small smear of epoxy onto the sleeper under the crossing nose, just before pressing home. Use track gauges to ensure correct positioning and use tape to hold it as required, but leaving room for spikes.

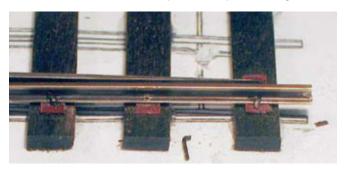
Following the diagram above, spike sequences I-7, as described in Part 2, using short staple spikes. I use 4 spikes at rail joint ends (actual or dummy) and for the point, splice, wing and check rails with 2 spikes elsewhere. However, only add single spikes to begin



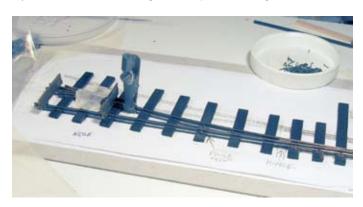
Photos: John Clutterbuck

with, on the inside of the gauge where the check rails will be. Drill a hole with a no. 76 (0.5mm) bit for each spike ensuring that the hole is deep enough to take the full length, i.e. the hole will go into the board a little. I always use a mini electric drill for this. Only drill the holes for one or two sleepers at a time until the key places are all spiked. Holding the spike in small nose pliers, dip its tail in epoxy, and then insert it into the hole and press home (15). Note that prototype spikes are staggered to avoid splitting the sleepers.

The stock rails over the soleplates are spiked through the rail



foot with outward facing spikes. This makes this vulnerable part of the switch much stronger. Drill a hole vertically in the corner between the rail foot and the rail web and down into the sleeper; a mini electric drill is best for this and you may want to use a scriber to mark a starting point to prevent the drill from wandering. You may find you need to open up the hole slightly in the rail foot, but try and leave the hole through the sleeper at the original size so the



spike is still gripped well. You want to use spikes with a good size head, and to bend the head over so it comes down to the soleplate. If they bend over too much then snip off the excess and then press home (16).

Now add epoxy to the gluing vee between the closure rail and the wing rail. Add a set of RCL/KBscale cosmetic fishplates and hold with a clamp (17) as detailed in Part 2. Check this is electrically isolated and then leave everything to set hard before attempting the other side.

CURVED STOCK RAIL ASSEMBLY

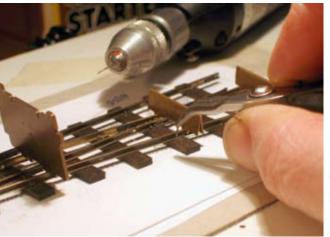
This follows a similar sequence to the straight stock rail assembly. Firstly, place the curved stock rail into position using track gauges and tape it down. Now place the hinge in the slot, using a loose packing sleeper to support it if required, and locate the switch rail, also holding it down with tape. Place the inside straight closure rail into position with the slot against the hinge and mark the exact length of the closure rail at the crossing end. As before, cut slightly over length and then file to length repeatedly checking for fit, but allowing for an insulation gap.

Mark the rail foot and sleepers for the power feed wires and the exact ends of the rails. Remove the tape and rails and file gluing vees



at the ends. Cut slots and fit power feed wires as before. Assemble the curved closure rail, switch rail, hinge and inside straight closure rail in the hinge soldering jig as before, then solder, file, polish and clean-up.

Drill 1.5mm holes for the power feeds between the marks on the sleepers. Glue the soleplates into position and rub with 5B+ pencil. Place the hinge assembly into position carefully feeding power feed



Photos: John Clutterbuck

wires through holes and adding epoxy to the top of the wires just before pressing home (18).

Now spike sequences 8-12 repeatedly, checking gauge is correct especially across switch rails and crossing assembly (19). As before, drill through the rails over the soleplates and use outward facing spikes. Finally, add epoxy to the gluing vee between the closure rail and the wing rail and add a cosmetic fishplate, and hold with a clamp. Leave the track gauges on in key places and leave until the epoxy has set.

CHECK RAILS (GUARD RAILS)

Cut check rails to length from unblackened rail; make sure the ends are square and form flares at end. They are generally of equal length. Check for fit against the stock rails. Where the spikes prevent a



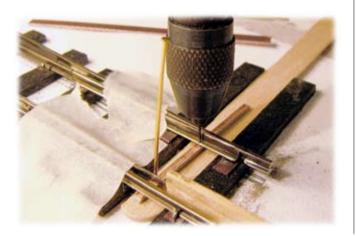
snug fit, file small nicks with a triangular needle file. Now blacken the check rails which ensures the rail ends are also blackened (20).

Carefully check positioning and clearances before spiking, ideally with check-to-flange (13mm) and over-check (12mm min) gauges — mine are home made. Now placetiny dabs of epoxy on the sleepers where the check rails will sit. Place them in position and proceed to spike initially with a single spike (sequence 13). Check the over-check and check-to-rail distances, and adjust before adding the final spikes (sequence 14).

PREPARE STRETCHER BARS (TIE BARS)

I wanted stretcher bars that would look something like the prototype ones but would not compromise the flexible switch hinging. I used to make them from 1/16in wide phosphor bronze strip, wrapped with cigarette paper and epoxy – a rather complex and messy process. More recently I have switched to 0.6mm double sided fibreglass PCB as supplied by C&L and 0.7mm simulated hex bolts from Galtran (www.galtran.com). The RCL tie bar rivets or brass pins may do equally well as long as the hole can be made in the switch rail foot and still leave some metal around it. These stretcher bars might not look very strong but don't forget that these hinged switch rails require very little force to operate them.

Firstly, slice the PCB strip lengthways with a razor saw to give two strips, each about Imm wide, and clean up the edges with a file. Move the farthest (from the lever) switch rail hard up against the stock rail, and slide one of the strips into position, packing it underneath with strip wood so it is tight up against the rails. Use



tape to hold it all in place. Use a sharp scriber to mark a starting point over the stretcher bar, as close to the centre of the wide switch rail foot as practicable for your pivot. Now, using a drill size that will give a sliding fit on your pivot, carefully drill through the switch rail and stretcher bar. A mini electric drill is best for this.

Insert a pin into the hole to hold them together, and move the switch rail across to the correct switch offset (2mm to represent $3\frac{1}{2}$ in). Insert a suitable packing piece and tape it down again. Now, ensuring the stretcher bar is perpendicular to the switches, drill through the other switch rail foot and into the stretcher bar (21).

Remove the stretcher bar and cut to final length, allowing enough length for the actuator, and to extend about Imm the other side when fully open — check your prototype. Create insulating gaps in the upper and lower copper, between the two holes. For the upper surface I use a half round file to remove the copper in the middle, and feather it out towards the edges. I feel this is less obvious than a slot. Note that you must leave plenty of copper around the holes underneath for soldering.

Now, cut a length of 0.7mm brass wire for the point rod, making it long enough to reach the operating linkage. This should be either under the point lever or hidden beyond. Flatten the end, bend it, punch rivets if required, and solder it to the stretcher bar. Solder a small hidden piece of wire underneath if you want a stronger joint. Cleanup as required with a fibreglass brush. Note the stretcher is fitted after removal of the turnout from the assembly board (22).

FINISHING OFF - SPIKES ETC.

Now is the time to add any of the remaining spikes. I select spikes with small heads and use them to represent the bolt heads on the inside of the soleplates, drilling a hole with my mini electric drill first. You could use Grandt Line or Galtran simulated bolts instead.

HEEL FISHPLATES

Most narrow gauge railways used a loose heel secured with fishplates. Some used full 4 bolt fishplates, whereas many used only 3. Some had bolts on the inside and some on the outside. Sometimes the outside of the closure rail had just bolt heads and sometimes there was a full fishplate, even though there is no actual joint in the rail. Check your prototype photos.

Select two individual RCL cosmetic fishplates with/without bolt heads and, if required, cut to give 3 bolts. Rub the inside rail web of the hinge joint with a fibreglass pencil to give a key. Smear a tiny amount of a general purpose flexible glue such as Loctite Clear Glue, Evostick etc. onto the fishplate and quickly position onto the hinge joint. Use tape if needed to hold in place. Leave it to dry before moving the switch rails.

Finally, add fishplates to the dummy rail joints in the stock rails. I usually use epoxy for this.

CHECK RAIL CLAMPS

Some railways (notably the L&B) bolted the check rails to the stock rails with distance pieces and large washer plates on the outside. However, not all turnouts were the same – check your prototype photos. These clamps can be simulated by cutting RCL

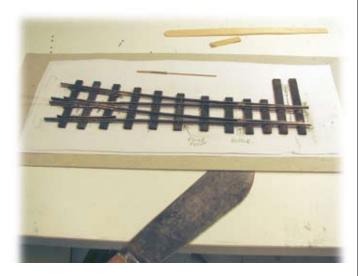
cosmetic fishplates into 4 (use any spare ends from the 3 bolt heel fishplates).

GAUGE TIE RODS (if using)

Quite a few railways (notably the VoR) used gauge tie rods on the track just beyond the toe. Some also used them between the switch rails, which are best represented with round micro strip secured with epoxy. However, for the former I prefer to use solid cored insulated (preferably brown) wire. I cut this to be 2mm wider than the gauge \pm 2 x rail head thickness and then carefully cut the insulation off for 0.5mm at each end. This is best achieved using a knife and gently rolling the wire with the blade. Then square off the ends with a file. Drill holes (No. 65) in the stock rail webs, insert the tie rod and secure with a tiny smear of epoxy, ensuring the metal core of the wire is not in contact with the rails.

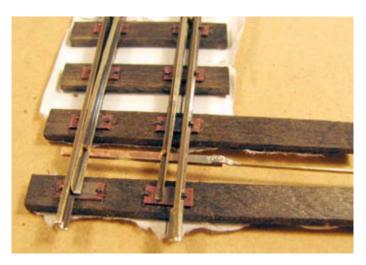
REMOVAL OF TURNOUT

Do not try to remove the turnout until you are sure all the glue has fully set.



Firstly, cut the template and underlay card close to the turnout and rail ends. Using a flat knife or suchlike between the card and the board, carefully prise the turnout away, taking special care to feed the power feed wires through (23). Then carefully remove the turnout from the card. Now cut away the paper between the sleepers where the stretcher bar will go and trim any overlong spikes using side cutters – protect your eyes when doing this.





Locate the stretcher bar in place and add your chosen pivots through the holes in the switch rails and stretcher bar. With the turnout upside down, and using a strip of wood to support the pivot, solder them quickly to the underside of the stretcher bar with a clean hot iron (24). Now paint the top of the stretcher bar and any visible areas of the point rod and the top of the heel hinge (25) (if required).

INSTALLATION

The card used as an underlay for the template, will have clear marks where the spikes were made and holes for the power feeds. This can be used as a template for drilling the holes for the power feeds in the baseboard. I find it helps to draw in the rails at the ends and highlight the wire holes.

ACTUATORS

I operate my turnouts via the point rod using a simple linkage to the under baseboard actuator made from brass U channel which is slid on to the point rod and soldered when correctly positioned. This is either hidden under a point lever, or beyond under scenery etc., in which case the rod needs to be threaded through a suitable tube (26). You need to use actuators that provide a positive lock but do not impose unnecessary force. I am currently using home made actuators utilising memory wire, however, they have not proved reliable – so I am switching to Tortoise motors.

CONCLUSION

I hope those who have followed these articles have found them



Photos: John Clutterbuck



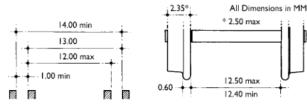
useful. I am sure many will feel it will take far too much time and effort to make track this way. However, you do not have to follow all of my techniques. If you do not suffer extreme temperature problems then you can skip the foam base, which will allow you to use longer rail lengths and build turnouts in situ. Finally, consider how much time you spend on a kit and how long it appears on a layout especially if you exhibit it - the track is on stage all the time! If these are the only reasons putting you off, then I strongly urge you to try making a sample length of track on an old piece of board. The materials are cheap (apart from the cost of the Coffee whilst purloining the sleepers!) As to the time required, I managed to construct over 35 yards of track and 12 turnouts within a 2 year period with no more than 2-3 hours per week and even less in the summer. The only skills required are care and patience. Your reward will be track that looks a lot closer to the prototype than the commercial offerings and properly complements your finely detailed rolling stock, structures and scenery. Of course, once you have taken the plunge, there is no reason why you cannot represent 2ft gauge prototypes properly with 14mm gauge.

ACKNOWLEDGEMENTS AND THANKS

Thanks are due to the many modellers and authors whose work I have studied over the years, without which I could never have started on this. I now appreciate the amount of time and effort required in preparing articles for publication. Some individuals deserve

special mention as they have contributed directly or indirectly to this series. Gerry Cork, Mark Kendrick and Iain Campbell supplied many useful pictures to support my initial research. Mick Nicholson provided much useful advice and information regarding both model and prototype track and help with the terminology. Roy Link, as always, has applied his superb editing and publishing skills to my articles, and supplied much useful information and items from his archive, which have improved them tremendously. Finally, I must thank my son David for the loan of his digital camera throughout most of this series, and my dear wife Marion and daughter Laura for proof reading.

I have received many kind comments since these articles were first published in the REVIEW. Roy has now sold most of his back issues and to satisfy popular demand we have collaborated to produce these articles as a PDF booklet. I am very happy that this is now available free for personal use via the new OI4 group website (www.OI4group.org) and hope it will encourage others to accurately model narrow gauge track.



RCL Track and wheel standards - the only established and proven standards for 0-14. Twice full size. © KBscale

OI4 TRACK STANDARDS

With more modellers working in OI4, I feel a discussion on track standards is appropriate.

I am using the 7mm scale I4mm gauge trackwork standards that were originally published in REVIEW Issue I4 – which were developed by Roy Link for his range of RCL products (now KBscale), see above. More recently, Roy has also published these on the OI4 yahoo group (http://groups.yahoo.com/group/OI4/), which is worth joining, if you are interested on taking up OI4.

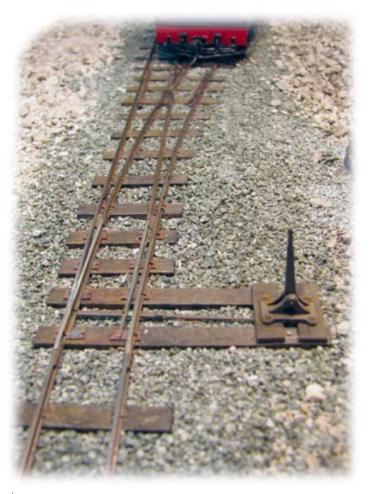
As I mentioned in part one I am trying to work close to true scale, mainly for appearance but, also, to give good running. However, unlike standard gauge (for which I use Scale7), there are no prototype 'standard dimensions' for 2ft narrow gauge; some are true 2ft, and others are Ift III½in and some are 60cm. There was even Ift I0in as used on the Penrhyn. Even with identical gauges, there was variation in the flangeway/checkrail widths and check rail clearances, which can cause rolling stock incompatibility. For example, I understand that current FR stock will run on the VoR, but not vice-versa, as the VoR stock back to back measurement does not clear the FR checkrails, as these are closer to the stock rails than on the VoR.

A while back I compared the RCL standards with regard to the prototype. There is only 0.5in (1.27cm) full size difference between exact 2ft (60.96cm) as represented by I4mm and Ift II½in (59.69cm), with 60cm falling in between. I doubt if anyone could notice this difference on a 7mm model. What are more noticeable, are over scale flangeway and checkrail widths. On the prototype these were typically between I.2in. (30mm) – I.6in. (40mm). The

RCL standards specify a Imm flangeway width which scales to I.7in (43.7mm) which to my mind is pretty close and certainly not worth inventing a new set of standards for (it may even match those of the VoR).

I know Roy has stated that his standards may only be suitable for industrial prototypes and has suggested a proper set of standards should be developed for common carrier type railways. However, these standards have given me excellent running and look correct and operate well against Scale7 trackwork which, on my layout, includes a small section of mixed gauge with crossing.

Therefore, I would advocate that KBscale/RCL standards are used for all 7mm scale I4mm gauge prototypes. At least that would ensure compatibility of rolling stock — and give kit manufacturers clear guidance (Anyone remember the S4/P4 wars?). However, it is important to note that the use of RP25 profile wheels is essential for these standards, especially if using Romford wheels with I4mm axles, as standard Romford wheels have too large flanges and also come out over gauge.



Above: One of John Clutterbuck's O14 turnouts — built as described in this document. Below: O14 track and turnouts on Roy C Link's 'NG Sand & Gravel' layout. Components are from the old RCL range of O14 kits - now available from KBscale.

