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Large Flood Control Structures on English Navigable Rivers

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This article is based on a paper which was presented to the Fourth RCHS Waterways History Conference at Birmingham, 6 March 2004

'Well, it's their water, ain't it?' said the sluice-keeper, 'They ain't got no call to send it down here.'
'Quite', said Wimsey, recognising the spirit that had hampered Fen drainage for the last few hundred years. — From *The Nine Tailors* by Dorothy Sayers

This paper gives an overview of the types of large engineering structure which have been used to manage English navigable rivers, and describes in more detail a number of structures which have been built since the 1930s.

Engineering structures are essential on navigable rivers for routeing flows around locks, managing floods and maintaining tidal limits. However, during the 1920s significant concern was expressed over the state of rivers and land drainage. One of the problems was that there were too many small, locally-focused bodies involved with rivers, land drainage and flood management, which were often in dispute with each other. To quote Dorothy Sayers' sluice-keeper again:

> 'Why,' and a note of pride crept into his tone, 'they've had five law actions about this here sluice. Ah! They took one on 'em up to Parliament, they did. Cost a heap of money, so they say.'[1]

A Royal Commission was therefore set up to consider land drainage in England and Wales, and its report in 1927[2] led to the important Land Drainage Act of 1930. A major requirement of that Act was the setting up of new river Catchment Boards across England and Wales. It was these Catchment Boards, and their post-war successors, the River Boards, which had the breadth of vision and capability to plan and carry through major improvements in river management and flood control, including some of the structures discussed here. Such improvements almost always received significant financial support from the Ministry of Agriculture, which was the government department charged with responsibility for flood control.

These new arrangements led to the completion during 1937 of two large flood control structures: the Dog-in-a-Doublet Lock and Sluices on the tidal Nene east of Peterborough (TL275994), and the Allington Sluices at the tidal limit of the Medway Navigation, north of Maidstone (TQ747582). After the War, the serious freshwater flooding of 1947 provided a potent force for releasing funding for major engineering schemes to improve flood management, notably on the Great Ouse and on the Welland. Concern over the dangers of tidal inundation, particularly after the extensive coastal flooding in 1953, led to the building of navigable tidal surge barriers on the river Hull (1979: TA101296), and on Barking Creek (TQ455817) and other tributaries of the tidal Thames. On a much larger scale, the Thames Barrier (TQ415796) was officially opened during 1984. The Jubilee River channel (2002: SU905819 to SU977778), constructed parallel to the main navigable channel of the Thames as the major component of Maidenhead, Windsor & Eton Flood Alleviation Scheme, is the most recent major flood relief project on an English navigable river.

Overview of structure types

A brief survey will now be given of the types of structure. Terminology is complex and the author's choice of names has been aided by Lewin's valuable book *Hydraulic gates and valves*[3], which also provides detailed technical descriptions of many designs of hydraulic structures. The terms 'sluice' and 'weir' are often used to cover the entire structure at a site (for example, Allington Sluices and Bray Weir). The overall structure will usually comprise a number of individual component sluices and weirs.

Fixed weirs

A fixed weir is basically a bank across a river channel with a horizontal crest, over which water is designed

to flow. This contrasts with a dam, which is designed so that any surplus water flows safely over a separate spillway, and not over the dam crest. A simple modification of a weir is the fixing of vertically-grooved pillars along the line of the crest so that boards can be slotted in to temporarily raise all or part of the crest level. Weirs can be used for river flow gauging, but that topic will not be covered here.

Sluices and vertical-lift gates

Weirs on navigable rivers, and structures at tidal limits, are often equipped with sluice gates. The basic sluice is an aperture through which the flow of water is controlled by a vertically-sliding plate, which in one position can cut off the flow altogether. On river structures, the vertically-sliding plates of sluices are usually called 'gates', or 'vertical-lift gates'. 'Buck gates' is an old term, still used for small vertical-lift sluices which form part of weirs on the non-tidal Thames. 'Guillotine gate' is used for the gates on larger structures, such as those discussed below. It is also used on navigations such as the Nene, where vertical-lift gates are incorporated into pound locks.

Radial gates

These, as described by Lewin,

> ... consist of a skin plate formed into a segment with a radius about the pivot ... The skin plate assembly is supported by two or more radial arms at each side which converge downstream at the trunnions, where they are anchored to the piers and transfer the entire thrust of the water load to the civil engineering structure.

Radial gates are usually designed to be closed when the bottom of the skin plate lies on the sill (or cill) of the structure. The top of the plate then has sufficient freeboard to prevent water flowing over it — although during flood conditions the radial gate may be overtopped. Under normal conditions, an increasing flow of water is progressively released when the plate is lifted by a cable operated system. The cable drums on large radials are electrically powered, although the opportunity to crank the drums by hand (albeit lifting the gate slowly) is usually provided as an emergency fall-back. The terms 'deep sill' and 'shallow sill' are used to describe radial gates in weirs on the Thames, deep and shallow relating to the relative depths of water which such gates can retain when closed. At some weir structures, as at St John's, Lechlade (the highest navigation lock on the Thames: SU223991), 'falling radial gates' are installed. These are designed to operate with water flowing over the top of the gate.

Radial automatic gates

These are operated by changes in upstream water levels. The support frame of the radial gate is extended beyond the pivot point to carry counter-weights, which balance the weight of the gate itself. When the water level rises in 'displacer chambers', linkages to the counterbalanced gate cause it to lift and allow water to pass beneath it. Such gates operate automatically, without the need for an external power source. An example used for flood control on a navigable waterway is the Zouch Radial Gate[4] on the River Soar in Leicestershire (SK512233), which is 10 metres wide, and was completed in 1991.

Three-bay radial gate structure on the Thames at Sutton Courtenay (near Culham). The far gate is closed and the centre gate lifted clear of the water. Note trash lodged during overtopping when flood flows have occurred. (Photo: Henry Gunston, February 2004)

Rising flap (or drop leaf) gates

These are a fairly recent innovation. They can lie flat, close to the channel bed, and are pivoted at their upstream ends. To control upstream water levels, the gate flap is lifted, by cable or a hydraulic system. The gates are sealed against leakage on all sides, except the downstream end, which is designed to be overtopped by flow. An example is at Marsh Lane on the Jubilee River (SU915804).[5] Similar gates have been installed in recent years at weirs beside locks elsewhere on the Thames.

Stoney free-roller sluices

In the mid 1870s, F G M Stoney proposed that the inevitable friction between large guillotine gates and the 'gate slots' in which they ran could be greatly reduced if a frame carrying steel rollers was introduced between edges of the gate and the slots. The term 'free-roller' was used as the roller frame was not directly attached to either the gate or slot. Stoney was actively involved with the firm of Ransomes & Rapier, and his designs of free-roller gates were used on structures on the Manchester Ship Canal and the Weaver Navigation, and on the Richmond Half-tide Lock and Weir[6] on the Thames (TQ170751). Stoney's work will not be presented further here as it has been thoroughly reviewed by Crozier in a recent paper in the Transactions of the Newcomen Society.[7] The use of rollers on other large guillotine gate structures will be discussed below.

Tidal doors (or pointing gates)

These, in their simplest form, comprise a pair of mitred gates (like those on a typical pound lock, but without gate paddles) which point downstream at the tidal limit of a river. When the pressure of water from the rising tide outside of the gates exceeds the pressure of water from upstream, the gates close themselves. As the tide ebbs, the balance is reversed and the gates open to discharge the river flow, together with any water that has been impounded upstream whilst the gates have been closed. Although not on a navigable waterway, pointing doors are still in position at the North Level Outfall Sluice at Foul Anchor[8], where the Fenland North Level Main Drain flows out into the tidal Nene, downstream of Wisbech (TF467182).

Top-hinged flaps and cycloidal gates

Simple top-hinged flaps are found on land drainage outlet pipes set into river banks where it is likely that the outlets will be immersed by higher river or tidal water levels. Typically, a circular plate is hinged at the top so that, when the river rises, the pressure of water holds the flap closed. This prevents (or limits — depending on the effectiveness of the seal between flap and outlet pipe) water flooding up the drainage pipe. The principle has been applied on a much larger scale at the Marsh Road Sluices[9] at the tidal limit on the River Welland diversion channel at Spalding in Lincolnshire (TF260241). Here, as described in more detail below, tidal control is maintained by large, counterbalanced steel 'cycloidal gates', pivoted on a rolling horizontal axis. As with pointing gates, they are operated by water pressures generated by the differences between upstream and downstream water levels as the tides ebb and flow.

Tidal surge barriers and turnover gates

These structures are usually based on one large guillotine gate which, when lifted, allows vessels to pass beneath. This contrasts with the large structures discussed below, where navigation is via one or more pound locks which are sited alongside guillotine sluice gates, which are themselves only used to control river flows. Tidal surge barriers have been installed on the River Hull, and on Barking Creek and a number of other tributaries to the tidal Thames. The barrier at Hull[10], commissioned during 1979, has a gate some 30 metres wide by 10.6 metres deep. Five small subsidiary sluice gates are positioned across the width of the main gate to allow discharge of water from the River Hull into the Humber as the tide falls. An interesting design feature of the Hull structure, and also of Stoney's Half-tide Lock and Weir at Richmond on the Thames, is the use of 'turnover gates'. When these gates are raised to the top of their vertical travel, they are guided into a horizontal position for storage. In both cases, this design was selected to improve the 'architectural' appearance and visual impact of the structures by reducing their height. 'Rising sector gates', also used on tidal control structures, are discussed below in the context of the Thames Barrier.

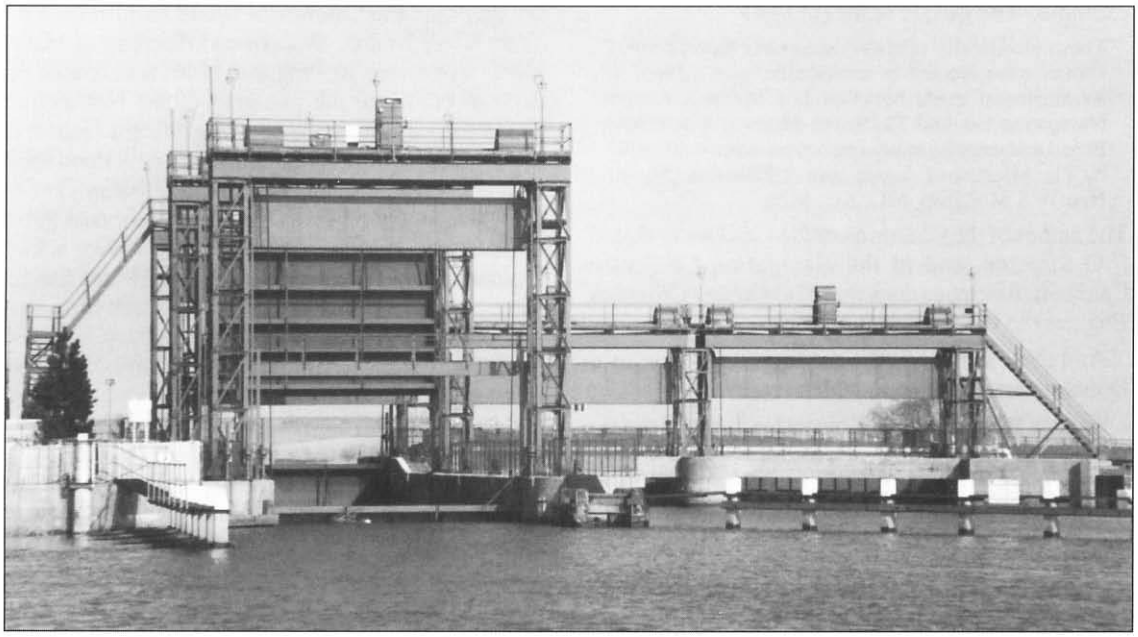
Large flood control structures

The structures discussed below, with the exception of the Thames Barrier, have design similarities. They comprise large structural frameworks (either of exposed steel or clad in concrete), the top cross-members of which are high above river level. Vertical members divide the structure into a number of bays,

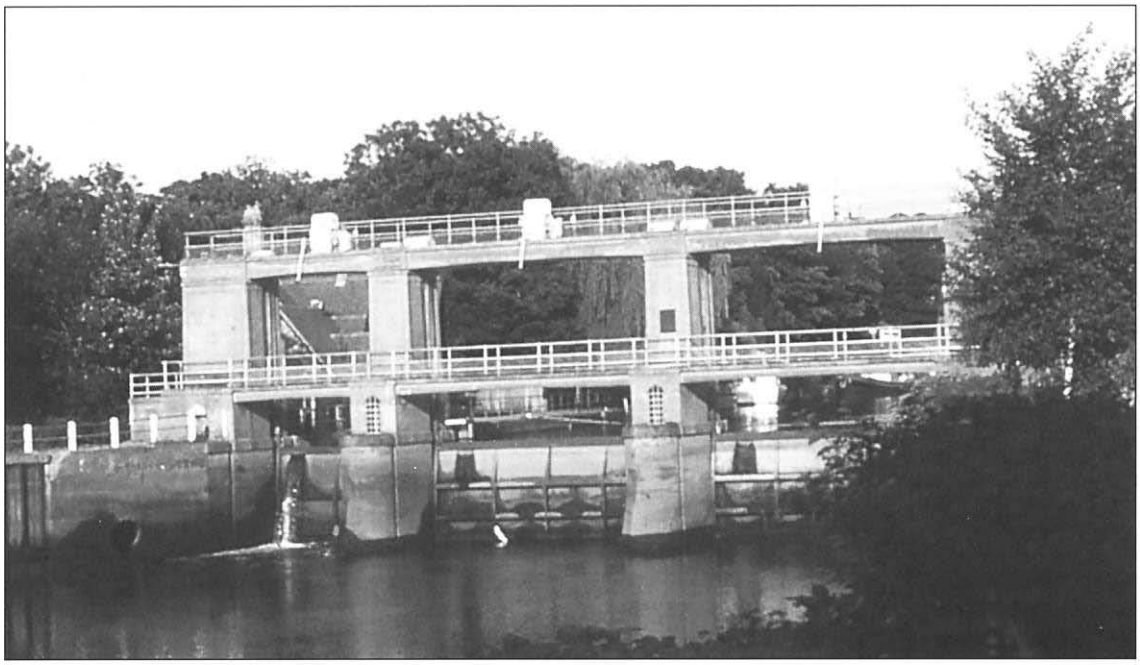
with a vertical-lift guillotine gate operating within each bay. A common feature is the placing of small sluice paddles in one or more of the large gates, to allow passage of river flows — and scouring of muddy deposits — when the main gates are closed. The height of the cross members, which carry the mechanisms to lift the gates, is necessary because large counterweights are used to balance the weight of the gates themselves. The support cables run over drums which are mounted on powered shafts at the top of the structure, with the gates hung on one side and the counterweights on the other. A 2:1 ratio system of cables and pulleys is often employed, so that the counterweights only move half the vertical distances of the gates. In many cases, the steelwork for the gates and surrounding structures came from Ransomes & Rapier of Ipswich, who also played a major part in design and installation.

Such large structures, often sited in flat areas, are very distinctive landscape features. The 'architectural' aspects of the appearances of the tidal structures at Hull and Richmond have already been noted. Lewin has presented an interesting paper titled 'The aesthetic and environmental impact of river control structures'[11], in which he considered large unclad steel vertical lift structures as 'industrial'. His point can be proved by visiting to the huge Dog-in-a-Doublet Lock and Sluices on the Nene (commissioned in 1937), downstream of Peterborough, especially on a cold February Fenland day! Firstly, there are large guillotine gates (with counterweights, and high supporting frames) installed on the two 30 feet wide sluices. Then there are three more guillotine gates (with even higher support frames) for the navigation lock, whose dimensions are 129 feet by 26 feet when the two outer gates are used. (The third gate, offset towards the upstream end of the lock, allows a smaller chamber to be operated.) As opposed to such 'industrial' steel structures, Lewin felt that the masonry-clad structures on the Weaver (where Stoney was involved), the Holme Sluices on the Trent (see below) and the Allington Sluices at the tidal limit of the Medway fitted better into the landscape.

Whatever the present-day views on the environmental impact of these large structures, the river managers and engineers who installed them were proud of their new works, and they enthusiastically attached commemorative plaques to them. Allington Sluices, which have two 30 feet wide guillotine gates, flanked by a narrower automatically operated gate



Dog-in-a-Doublet Lock and Sluices on the Nene below Peterborough, from upstream. The two sluice gates on the right are closed (note the raised counterweights), as are the main gates of the navigation lock, to the left. The centre gate of the lock is raised.
(Photo: Peter Brown, March 1995)



Allington Sluices at the tidal limit of the Medway, near Maidstone, from downstream. Note the small sluice doors in each main guillotine gate. (Photo: Henry Gunston, August 1998)

and a conventional navigation lock, present a fine example. The plaque reads (in part):

> These electrically operated automatic flood control sluices were erected in accordance with a Deed of Arrangement made between The Medway Lower Navigation Co. and The River Medway Catchment Board and were formally opened on August 4th 1937 by The Minister of Agriculture & Fisheries (The Rt Hon W S Morrison, MC, KC, MP).

The names of the Chairmen of the Catchment Board, F O Streeten, and of the Navigation Co, Leslie Caldicott, follow, as does that of G Cobley Crowther, Engineer to the Catchment Board.

And these structures are not forgotten. Dog-in-a-Doublet carries a plaque which reads:

> Anglian Water. Dog-in-a-Doublet Locks and Sluices. Golden Jubilee 1937–87. Plaque unveiled by Harold Clark, Chief Engineer, former Nene Catchment Board, 3rd September 1987.

Holme Sluices

The channel of the river Trent, flowing between the centre of Nottingham and West Bridgford, has long been prone to flooding. A major flood occurred in May 1932, shortly after the formation of the River Trent Catchment Board. Another major flood in February 1946 led to the commissioning of research at the Delft Hydraulic Laboratory in the Netherlands.[12] By this time the Catchment Board had become the Trent River Board. Widespread flooding in March 1947 (worse than in 1932 and 1946) accelerated the need to complete the planning of the Nottingham Flood Protection Scheme. A significant feature of the Scheme was the construction of a new flood relief channel to the east of Trent Bridge (of cricketing fame), across which was placed a major new set of sluices: the Holme Sluices (SK614394), which replaced the old Colwick Weir.[13] The Holme Sluices were a major structure, with five 40 feet wide steel guillotine gates, each 16 feet 6 inches deep, and were described at the time as 'probably the largest automatic battery of sluices in Great Britain'. For navigation, the smaller (Old) and larger (New) Holme Locks were retained on the south side of the new structure. The major widening of the former 'Holme Cut', whose alignment the new channel followed, allowed larger vessels to travel upstream to Nottingham itself.

In the best tradition, the Sluices were officially opened by the Duke of Edinburgh on 5 May 1955. The main civil engineering contractor was Sir Robert McAlpine, and Ransomes & Rapier were contractors 'for the automatic sluices'. The approximate costs of the two contracts were £150,000 and £44,000

respectively. Unlike the stark steel framework at Dog-in-a-Doublet, the large, five-bay structure at Holme Sluices comprised steel arched beams resting on concrete-clad pillars. No counterweights were used, and the structure has a distinctive neatness in style, despite its size. The gates themselves had strengthening steel frameworks on their downstream sides, and ran on rollers attached directly to the gates and running the flat surface of the 'gate slots'. This differs from Stoney design, where the roller frame was not attached to either gate or slot. New gates — of an improved design which reduced leakage — were fitted during the 1990s. Automatic control (as described in the late 1990s) was operated by the difference in upstream and downstream water levels, which was detected by float sensors. A five centimetre rise in upstream level caused the gate closest to the left bank to rise by around 50 centimetres. Once that gate had been progressively lifted through 4.7 metres, the second gate started to move, and so on across the structure. Finally, all gates were lifted a further 2 metres, allowing the river a clear path through the sluices.

Marsh Road Sluices at Spalding

As with the Trent, the formation in the early 1930s of a Catchment Board for the river Welland in Lincolnshire allowed the development of co-ordinated planning of river management, land drainage and flood control. This was particularly important for a Fenland river, where river channels are carried for part of their lengths at higher levels than the farmland around them. Although improvements to the channel system of the Welland, and its tributary the river Glen, had been discussed before the Second World War, it was not until after the major 1947 flooding (when there were major breaches in the river flood defences), and with the progressive availability of funding, that the Welland River Board was able to make serious progress. The most significant works of the River Welland Major Improvement Scheme[14] were two important upstream channels, the Greatford and Maxey New Cuts, and the Spalding Bypass Channel. The bypass channel — later known as the 'Coronation Channel' as it was opened during 1953 — was designed to reduce flows through the centre of Spalding during flood periods. The new channel was cut through the right bank of the Welland on the south side of Spalding, and passed to the east of the town. Major control structures with guillotine gates were installed near the upstream and downstream ends of the channel. Downstream of Spalding the Welland is tidal and limits to tidal flow are set by the navigation lock on the main river channel, and by the nearby Marsh Road Sluices at the downstream end of the Coronation Channel.

At Marsh Road there are two major sets of structures. Upstream of the road bridge is a three-bay set of guillotine gate sluices, with counterweights. Each gate is 30 feet wide by 19 feet deep. The most interesting design feature, however, is downstream of the road bridge. This is a set of three 'cycloidal gates', each 30 feet wide by 18 feet deep, which prevent the access of tidal waters into the channel. A cycliodal gate pivots on a horizontal axis, but instead of rotating on a fixed shaft, the gate 'rolls', so that the points of gate support change horizontally (at right angles to the axis of pivoting). To quote *The Engineer*:

> Cycloidal gates, often constructed with a toothed worm wheel sector on the gate turning on a fixed rack, have been used for many small tidal outlets, and it is claimed that they are more sensitive in action than simple pivoted gates. [Each gate at Marsh Road] rolls on five pivots; the pivots are semi-circular and run on fixed rail paths and the gate is held in position at each pivot by a wire rope and anchorage arrangement.

Holme Sluices on the river Trent below Nottingham, from upstream. The plate on the nearest span carries the name 'Ransomes and Rapier'
(Photo: Henry Gunston, July 1998)

The Thames Barrier viewed from downstream. The large rising sector gate in the centre is raised to its 'operating' position, whilst the gate to the left of it is in its 'rest' position, close to the river bed. (Photo: Henry Gunston, September 2004)

These gates are sensitive to very small differences between upstream and downstream water levels, and will open under a head of the order of a few inches. Balance boxes (or kentledge) are fitted above the gate pivots, carefully weighted with sand to allow the gates to operate sensitively. A cable and winch system allows each gate to be held open for maintenance purposes. These cycloidal gates at Marsh Road are a rare instance of the use of this design of gate on a large scale.

The Cowbit Road Sluice (TF246217), originally sited at the upstream end of the Coronation Channel, was a three-bay guillotine gate structure of similar design to that above the road bridge at Marsh Road. However, due to ageing, and the fact that it was no longer an essential structure, it was demolished during the early 2000s. The Spalding Bypass Channel was officially opened on 24 September 1953 by Sir Thomas Dugdale, the then Minister of Agriculture. Ransomes & Rapier were the contractors for the design and manufacture of the sluice gates.

The Thames Barrier

The Thames Barrier at Woolwich, officially opened by Her Majesty the Queen on 8 May 1984, is the largest flood control structure on a navigable river in England. Across a total channel width of 520 metres, there are ten gates, with their necessary support piers. There are four 'rising sector' gates, each spanning openings of 61 metres, and a further two similar smaller gates, which each span 31.5 metre wide openings. All these openings are navigable, but river traffic is controlled by lights which indicate to vessels which opening to sail through. There are also four falling radial gates (that is, designed to take flow over the gate), each 31.5 metres wide, which control non-navigable openings, three against the north bank and one against the south bank. Rising sector gates were chosen as they require no overhead structures which might have affected navigation by large vessels. The gate consists of a segment of a circle which is supported at its ends by heavy frames attached to a trunnion, shaft and bearing assembly positioned at the centre of the circle. When not in operation, the segment lies with its flat surface parallel to the river bed. When required to close, the segment is rotated by rocking beams on either side, driven by hydraulic cylinders in the adjacent piers. The segment moves against sealed surfaces on the sill and side walls, with its curved side pointing downstream. In its fully closed position, the segment seals its opening, with enough freeboard to prevent tidal waters overtopping it. For maintenance, the gate can be rotated further until its flat surface is again parallel with the river bed, but with the gate now suspended well above the water surface. The elegant pier roofs, with timber frames clad in stainless steel sheets, make a major contribution to the pleasing visual impact of this impressive structure.[15]

The 'New Wash Cut'

It would be wrong to conclude that the construction of new channels and engineering structures automatically provides a solution to flood control, as the fierce controversy during 2004 over the new Jubilee River indicated. (Shades of '... it's their water, ain't

it? ... They ain't got no call to send it down here.') In that context, the author would welcome the views of readers on the real geographical context of the fictional controversy over the building of 'The New Wash Cut' in *The Nine Tailors*, which was first published in 1934. The topic was obviously one which exercised Dorothy Sayers, as she devoted more than four pages in the novel to a discussion of the pros and cons of the case, presented through the mouths of 'an engineer' and the sluice-keeper.[16] This formed a significant diversion from Lord Peter Wimsey's relentless pursuit of crime. Was she thinking of the improvements on the Nene?

Notes and references

My thanks to many Environment Agency staff for valuable discussions 'on site' and by phone with over the years, and for very helpful guidance from Lewin's book *Hydraulic gates and valves*. I have also been grateful for inputs from Stephen Capel-Davies, Frank Law and David Noble of the Association for Drainage Authorities. Assistance from Adrian Browne, and from the libraries of the Centre for Ecology and Hydrology Wallingford, and of the Institution of Civil Engineers, has been much appreciated.

During the presentation at the Fourth RCHS National Waterways History Conference the 'Denver Complex' of control structures on the Great Ouse south of Kings Lynn, derived from the original Denver Sluice (TF587009) completed by Vermuyden in 1652, was discussed. However, the history and the diversity of both channels and structures which form part of the Denver Complex deserve more extensive separate coverage, so Denver is not included here. For further information see:

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Water Management on the Gloucester & Sharpness Ship Canal

Hugh Conway-Jones

This paper was presented to the Fourth RCHS Waterways History Conference at Birmingham, 6 March 2004

When walking beside the Gloucester & Sharpness Canal today, the water level appears to be so well controlled, it is difficult to appreciate how different things have been in the past. The canal does not have a separate reservoir, and both the supply of water and the removal of excess have caused many problems for the various canal engineers over the years. This paper highlights some of those problems and describes how they were overcome.

The northern end of the ship canal, planned to bypass the difficult stretch of the River Severn south of Gloucester, was constructed during the 1790s, but almost all of the original capital was spent after only five miles had been completed. Work started again in 1817, backed by a loan from the Exchequer Bill Loan Commissioners, and a junction was made with the Stroudwater Canal in 1820. Another financial crisis held up work for three years, and the canal was not fully opened until 1827. These last two phases of construction were supervised by Thomas Telford, acting as consulting engineer to the Loan Commissioners.[1]

Local feeder streams

The route of the canal crossed a number of streams draining from the Cotswolds to the Severn, but only a few of these were at a high enough level to be taken into the canal, and then there were restrictions on what could be done as local landowners had certain rights to the water. The most important potential source was the River Frome, from which some water was already being extracted to feed the Stroudwater Canal at Whitminster. However, the Gloucester Company's Act[2] explicitly prevented them taking water from the Frome unless consent had been given by the owners and occupiers of the mills at Whitminster and Framilode, and so this source could not be relied upon. The other major source was the River Cam, and it was decided to form embankments to raise its level to suit that of the canal, with the added advantage that this could become a navigable arm to a wharf at Cambridge on the Bristol road. There were no mill owners to worry about in this case, but the Canal Company did have to arrange an off-take so that local farmers would still have a supply of water for their cattle grazing on the Slimbridge New Grounds. Also taken into the canal were three smaller streams near Gloucester (the Sud, Tuffley and Shorn Brooks), together with flood water from a fourth (Daniels Brook) for which the normal flow was culverted under the canal to supply water for animals.

In the early stages of construction, the first objective was to complete the canal from Gloucester to the Junction with the Stroudwater Canal at Saul, but in view of the uncertainty about obtaining water from the Frome, it was considered necessary also to complete the canal to the Cambridge Arm in order to collect water from the River Cam. As this initial use would only involve local barges and canal boats, it was agreed to make the temporary junction at the existing level of the Stroudwater Canal, at which there would be about 14 feet of water in the Gloucester Canal (rather than 18 feet intended when the canal was fully open). In the event, the Frome mill owners agreed to allow water from the river to be used to help fill the canal, and the junction was formed on 28 February 1820.

Cambridge Arm questions

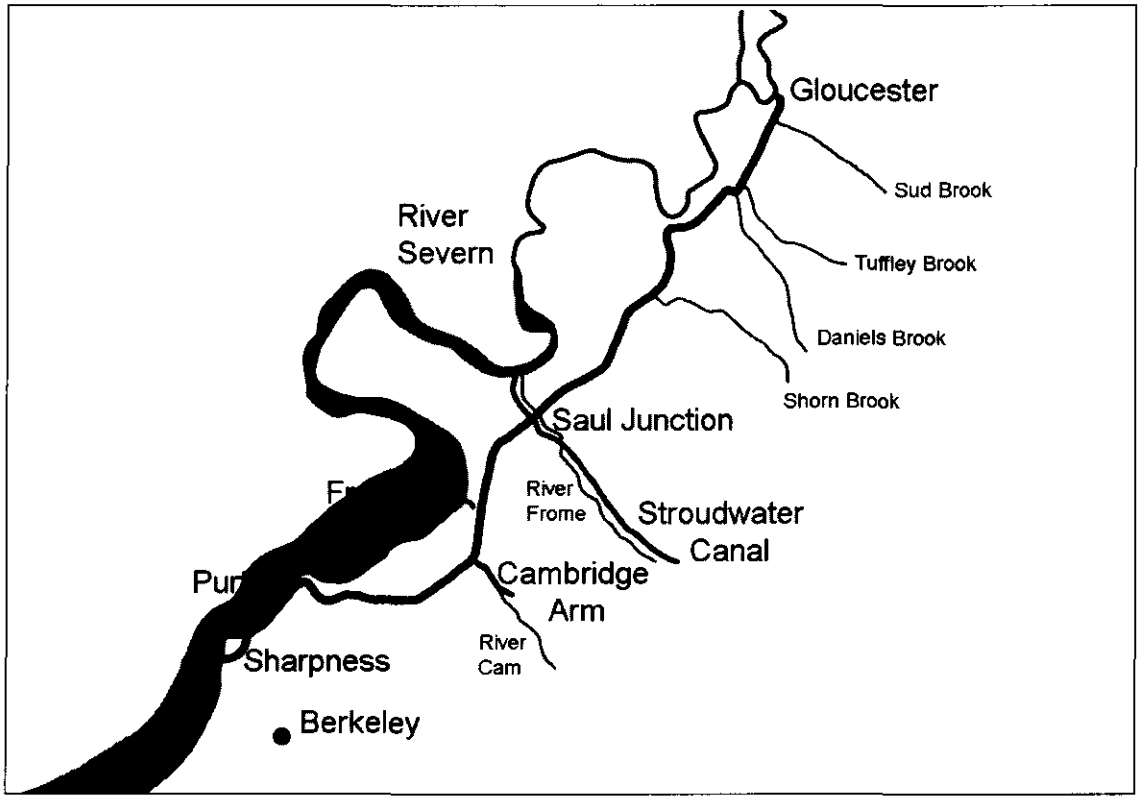
At the same time as the junction was made with the Stroudwater Canal, a wharf was opened at the end of the Cambridge Arm selling coal and bricks etc.[3] This has raised two questions. Firstly, how were boats able to reach the wharf when the water level was about four feet below its intended level? Secondly, if the Arm was so deep that this was possible, why was a lock soon built at the entrance to the Arm, particularly as the water level was due to be raised to its full height as soon as the canal was completed to Sharpness?[4] Recent research has shown that initially the Canal Company maintained boats on the Arm for the use of those renting space at the

wharf until a full supply of water could be obtained.[5] This indicates that the water level in the Arm was maintained by a weir at the entrance and that goods were transshipped there, or possibly that the Arm was navigable by shallow draft barges and that any excess cargo was transshipped to the local boats kept for that purpose. The need to have a different water level in the Arm should have come to an end when the main canal was completed and filled to its intended level. However, Telford evidently recognised that it would not always be possible to maintain the level in the main canal, and so in 1824 he authorised a lock to be built at the entrance to the Arm to avoid any need for transshipment in the future.[6]

As construction work on the canal was nearing completion in November 1826, Col Berkeley of Berkeley Castle objected to the siting of a waste weir that would discharge surplus water from the canal into a stream leading to Frampton Pill. He had recently spent £3,000 improving the drainage of his land and protecting his foreshore with breakwaters, and he claimed this would be wasted if surplus canal water was allowed to erode the soft shore around the Pill.[7] To placate this influential landowner, Telford recommended that the weir be built up level with the towing path bank, and a new waste weir was constructed below Purton.[8]

The supply from the River Frome

Some further tidying up jobs were needed during the early months of 1827, and then arrangements were made again with the owners of the mills on the Frome to allow water from the river to be used at weekends in filling the canal to its proper level. This supply was limited, however, as there were only two small sluices for it to flow through into the Stroudwater Canal on its way to the Gloucester Canal. At the official opening of the Gloucester Canal on 27 April, the water level was two feet below its nominal depth of 18 feet, and by July it had dropped a further 15 inches. The River Cam provided very little water in the dry weather as farmers had the right to take off as much as they needed for their cattle on the New



Map of the Gloucester & Sharpness Canal showing the streams that feed the canal and the location of waste weirs at Purton, Frampton Pill (removed) and Saul Junction.

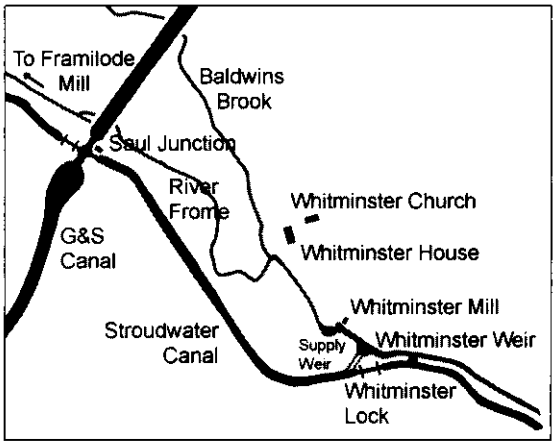
Grounds. After negotiations, therefore, agreements were reached with the millers and the Stroudwater Company to put in a third off-take from the Frome and to take any spare water from the river during the week, as well as at weekends, on the understanding that the millers could draw from the canal if there was a shortage in the river.[9]

This agreement worked well enough for a time, but it relied very much on the goodwill of all parties, and this was put to the test in 1831 when traffic on the Stroudwater Canal began to be affected by the accumulation of silt carried in from the Frome. The Stroudwater Company had only allowed their canal to be used as a water conduit on the understanding that the Gloucester Company would clear away any mud, but the latter did not respond as quickly as the former expected. To add to the pressure on the Gloucester Company, the owner of Framilode Mill, Mr Purnell, withdrew his permission for any more water to be taken from the Frome until a new arrangement was formally agreed, although in practice the water did continue to flow.[10]

The two canal companies then sought either an improved way of passing water from the Frome into the Stroudwater Canal or a means of bypassing the Stroudwater Canal, such as a long aqueduct beside the canal, a set of pipes or a pumphouse beside where the Frome passed under the Gloucester Canal.[11] An initial agreement was not approved by Parliament, and further negotiations were delayed because the Gloucester Company could not accept anything without the authority of the Loan Commissioners in London.

The Battle of Whitminster Weir

With no sign of an imminent settlement, Purnell decided to take the law into his own hands in April 1833 by ordering his men to close the sluices supplying the Stroudwater Canal. Mr Cambridge, who owned Whitminster Mill, did not approve of this unilateral action, particularly as Purnell's men had trespassed on his property. So Cambridge sent his blacksmith to open the sluices — but Purnell's men closed them again. Cambridge had the sluices opened and a fence put up with a sign saying no trespassing — but Purnell's men came by boat and closed the sluices. These events were repeated several times over the next two weeks until Cambridge ordered the complete removal of the sluice boards — but Purnell's men nailed in new boards. While Cambridge's carpenter was removing these boards, Purnell himself arrived and knocked the carpenter to the ground injuring his legs. When Cambridge himself visited the scene, he found Purnell had about 30 men there. So when Purnell arrived he was served with a legal notice not to trespass — but immediately led his men forward in defiance. The next day Cambridge led a gang of his men to remove boards — but they were physically restrained by Purnell's men, and when one man was hurt by an axe, Cambridge withdrew. After three weeks, these skirmishes were finally ended by the Gloucester Company's engineer, William Clegram. He brought 60 men from Gloucester at five o'clock one morning to break up the sluices completely. This allowed water to flow freely into the canal, and there was nothing Purnell could do about it.[12]



Map of water supply arrangements at Whitminster showing the original Whitminster Weir feeding the Stroudwater Canal above Whitminster Lock and the later supply weir feeding in below the lock.

These events finally convinced the Loan Commissioners that an alternative supply of water was needed, and on the recommendation of Thomas Telford, they allowed the Gloucester Company to order the construction of a 45 horsepower steam engine and pump at Gloucester.[13] At the same time, recognising that a wholly pumped supply would be expensive, negotiations continued with the mill owners and the Stroudwater Company, and a new Act was passed in 1834 which authorised the Gloucester Company to purchase the mills and so ensure control of water from the Frome.[14]

Waste weirs

While the troubles over water supply were going on, the Gloucester Company had also come under pressure from Lord Seagrave (the former Col Berkeley) to remove the waste weir at Frampton Pill, which evidently had to be brought back into use in spite of his earlier objections. A replacement weir was therefore built near Saul Junction, the weir crest being formed by boards that could be let down if the water level in the canal was getting too high.[15] The weir initially had a width of 33ft, and this was later increased to 77ft. The widening was probably done following the failure of the Lockham Bridge culvert under the Stroudwater Canal in January 1843. This failure allowed a considerable portion of the River Frome to flow into the Stroudwater Canal and thence into the Gloucester Canal, leading to concern that the waste weirs would not take all the excess.[16] In practice, it seems that flooding was just avoided on this occasion, but a widening of the weirs would have been a sensible precaution against any future such event.

Droughts, floods, and the size of ships

Traffic on the canal boomed in the early 1850s, and the greater use of the locks led to increased loss of water, so that it was not always possible to maintain the full depth in the canal. In the dry summer of 1854, a notice was posted daily at Sharpness specifying the draft to which vessels needed to be lightened to suit the level of water in the canal that day, and in October the level was as much as two feet below normal in spite of pumping day and night. This experience prompted the Canal Company to install a second pumping engine at Gloucester.[17]

By the 1860s, not only was traffic booming but the increasing size of ships in service meant that some were too big to pass up the canal to Gloucester. To meet this situation, the Canal Company constructed a new entrance and dock at Sharpness, completed in 1874, that could accommodate much larger ships. As the new large entrance lock would use even more water, arrangements were made to take more from the River Frome by increasing the size of the weir and culvert feeding the Stroudwater Canal.[18] During this period, the Canal Company also proposed to raise the level of the canal by six inches to allow larger ships to pass up to Gloucester. As this would reduce the margin between the normal water level and the canal banks, the waste weir at Purton was almost doubled in length to 130ft to help dispose of excess water during periods of high rainfall. To placate landowners worried about flooding, this dimension and the 77ft width of the waste weir at Saul Junction were written into the authorising Act. As a further concession, the weir board at the mouth of the Cambridge Arm was removed to lower the level of water in the brook, the board being no longer needed as traffic on the arm had virtually ceased.[19]

These anti-flood measures were nearly put to an extreme test in May 1886 when the River Severn at Gloucester reached flood levels while the stop gates there had been removed and not yet replaced. As the water rose, baulks of timber were inserted to prop the lower gates of the lock closed even though they had never been intended to stand any pressure from the river. The Engineer later calculated that at the peak of the flood when the river was two feet above the canal, the reverse load on the gates was 35 tons, but his emergency measures worked and the gates held.[20]

By the 1890s, some ships arriving at Sharpness were too big to fit in the entrance lock and so required the whole of the tidal basin to be levelled. Each time this happened, a huge amount of additional water was needed, and it was found necessary to install new pumping equipment at Gloucester. One of the old beam pumping engines was replaced by a horizontal steam engine and centrifugal pump in 1896, and as the need for more water continued to grow, the other was replaced in 1907.[21]

Blocking waste weirs

Two years later, a new concern arose over the role of the waste weir at Purton. It was noticed that a new channel of the River Severn was eroding into the long bank of the canal beside the river between Purton and Sharpness. In the belief that the problem was at least partly due to the excess canal water that flowed over the waste weir, the weir was blocked with baulks in 1909. The baulks were designed to be removable if necessary, but it was not expected that this would ever be necessary as the top of the lock gates at Sharpness was only two inches above the normal water level and would serve as a weir 60ft wide.[22] This blocking of the weir was contrary to the wording of the 1874 Act, but in due course it was authorised by another Act in 1935. By this time, memories of earlier difficulties with excess water had evidently faded, and the weirs at Purton and Saul Junction were permanently closed with concrete walling.[23]

All was well for about ten years, but the inevitable crisis came in March 1947. After unprecedented snowfalls, a rapid thaw with heavy rain brought large volumes of water flowing into the canal from the various feeder streams. As a thaw had been forecast, the canal level had been lowered by six inches in anticipation, but it wasn't long before the water was nine inches above normal and still rising. All possible sluices were opened, water was flooding over the lock gates at Sharpness and as the level continued to rise, men were sent to break down the waste weirs that had been blocked. When the level reached 18 inches above normal, water began to seep over the canal banks in places, but fortunately the level then stopped rising and serious damage was just avoided. Although the canal level started to fall, concern moved to the river at Gloucester which was being affected by melting snows further north. As the river rose over the next few days, additional planks were added to the top of the flood gates at the lock and a sandbag wall was built at each side of the lock. After an anxious few days, the river level peaked, and for the second time in a week flooding of the canal was just avoided.[24]

Post-war developments

Since 1947, much money has been spent on improving the water management of the canal. The pumping capacity at Gloucester has been increased considerably as the canal is a channel for carrying water from the Severn for supplying much of Bristol. An adjustable waste weir has been installed at Saul Junction, and there is improved control on the supply from the Frome into the Stroudwater Canal. In spite of these improvements, there have been other periods of concern following abnormal rainfall, and there is no guarantee there will not be difficulties in the future.

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Local Government and Inland Navigation

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Local authorities, either directly or through membership of one of the Passenger Transport Authorities, now have a significant involvement in the planning, provision and financing of local passenger train services. However, this only dates back to the Transport Act 1968. Their involvement in passenger road transport goes much further back: the first municipal bus service began in 1901;[1] the first municipal trams ran in 1883;[2] licensing of hackney carriages by local authorities became widespread following the Town Police Clauses Act 1847, and some towns may have obtained such powers earlier. In London, the Court of Aldermen was briefly responsible for regulating hackney carriages as far back as 1654–62, until Parliament transferred these powers to a separate body of commissioners.[3] Yet, the role of local government in inland water transport is far older even than this, having a continuous history stretching back over 800 years.

Medieval grants of conservancy

The first local authorities to become involved with inland waterways were those city and borough corporations which purchased charters from the medieval kings that included powers to exercise 'conservancy' of their river. The full range of these powers typically embraced regulation of fishing and flood prevention, as well as maintenance of navigation. They only extended to the tidal part of the river as this was the extent of crown ownership; beyond the tidal limit the ownership of the river bed belonged to the owners of the land on each side. In order to maintain these rights, it was often necessary to buy confirmatory charters from later kings.

The following are examples of municipal jurisdictions over navigable rivers granted by charter:

- The earliest seems to be the charter granted to the Corporation of Colchester by Richard I in 1189, which included jurisdiction of the River Colne up as far as the town. The borough assiduously ensured that its privileges were maintained by buying, at some considerable cost, further charters from most subsequent sovereigns for the next 440 years. The Borough of Colchester is still the navigation authority today.[4]
- Richard I also granted a charter in 1197 to the City of London Corporation giving it jurisdiction over the Thames. Confirming charters were purchased from King John in 1199, which extended the city's jurisdiction to the Medway, and from Henry III in 1227.[5] Although the city lost control over the river when its powers were transferred in 1857 to the Thames Conservancy (and then in 1909 to the Port of London Authority), the Lord Mayor still retains the ceremonial title of Admiral of the Port of London, a token link to the city's former privileges.
- The Corporation of Newcastle upon Tyne was granted conservatorship of the Tyne by Edward II in 1318–19. This extended from the sea up to Hedwin Streams at Newburn, 6 miles above the city. Its jurisdiction was transferred in 1850 to the Tyne Improvement Commissioners and then in 1968 to the Port of Tyne Authority.[6]
- A charter of Edward III granted in 1373 declared the town of Bristol to be a county by itself, separate from Gloucestershire and Somerset. This was followed by letters patent that defined the city's boundary, which included the shipping 'road' in the Bristol Channel from an island off Weston-super-Mare to the mouth of the Avon, and then the Avon itself up to the eastern edge of the city. At a later date its jurisdiction over the river was extended to the tidal limit at Hanham Mill, 14½ miles from the river's mouth. The city continued to exercise control over this section of the Avon until 1991, when the river and docks were leased to the Bristol Port Company.[7]
- In 1462 a charter of Edward IV gave the City of York Corporation conservancy of the Humber, Ouse, Wharfe (as far as Tadcaster), Derwent (to Sutton Bridge), Aire (to Knottingley) and Dun (to Doncaster). The city's jurisdiction over the rivers other than the Ouse had probably fallen into disuse

long before the Ouse Navigation Act 1727 made it clear that it no longer applied to the Aire, Derwent and Dun.[8]

The duty of the conservators was to maintain the navigation: to prevent man-made obstructions, such as the construction of fish- or mill-weirs or other encroachments, and the tipping of rubbish or ships' ballast; and to remedy deterioration caused by the collapse of the river banks or the growth of shoals in the river bed. Conservators could raise taxes from local landowners to restore the navigation to its previously-known condition, but not to undertake improvements, for example by dredging a deeper channel or by removing long-established weirs.

The few examples of river improvement and canal construction works undertaken during the medieval period were generally sponsored by the church or monastic houses, whose lordship rights could give them wide powers. It was probably the Archbishop of York, to which the manor of Beverley belonged, that canalised the Beverley Beck some time before 1344 (and possibly as early as the 12th century) to make it navigable from its junction with the River Hull to the town of Beverley, then the principal town of the East Riding, a distance of 1,400 yards. However, its subsequent maintenance was carried out by the town's governors — and it still is, the Borough of Beverley continuing to this day to have jurisdiction over the Beck.[9]

Tudor canal and river improvement schemes

After a turbulent 15th century, the relative stability and prosperity of the Tudor era slowly fostered a new interest in river improvement and canal schemes. With the monasteries dissolved and the church in confusion, they were no longer able to take the lead. So it was city and borough corporations that promoted all six schemes authorised by Parliament during the 16th century. The most important was the Act of 1539 which authorised the City of Exeter to make the River Exe navigable up to the city. Although it made no mention of constructing a canal, both the original Exeter Canal opened in 1566 and the extension opened in 1676 were built under its supposed powers. The canal is still administered by the city corporation.[10]

The only other 16th century Act to produce any lasting results, albeit nearly a century later, was the Act of 1571 which gave the Corporation of Stamford powers to restore navigation from Market Deeping to Stamford (8 miles), which was obstructed by 6 or 7 mill-weirs. Nothing was achieved until 1664, when the corporation leased its rights and the lessee put in hand the construction of the Stamford Canal. The corporation continued to renew and re-assign the lease until the canal started to fall into disuse in the 1830s/40s. Traffic ceased in 1863.[11]

The other 16th century Acts were ineffective or resulted in no action. Two were intended to improve or extend navigation to towns that were being bypassed by the growth in trade:

- In 1515 the City of Canterbury was empowered to extend navigation on the River Stour from Fordwich through Canterbury to Great Chart, a distance of 6 miles. From time to time until the early 17th century, it used these powers to try to maintain a navigation up to Canterbury, but apparently with only modest success.[12]
- In 1585 the City of Chichester was empowered to construct a canal from the Chichester Haven to Fishbourne, a distance of 1½ miles. No work was undertaken, the present Chichester Canal being a 19th century venture.[13]

The other two Acts were designed to facilitate supplies of food and other goods to cities:

- In 1550 the City of Chester obtained powers to make the River Dee navigable from Chester to up to Corwen (47 miles) to carry 'building timber, fuel, ... timber for making ships, ... wares, merchandise, corn and other necessaries' to the city. However, there would have been many vested interests to compensate and there is no evidence that any work was undertaken.[14]
- In 1571 the City of London was given powers to build a canal from a junction with the River Lee for a distance of 4 miles to a basin on the north side of the city, chiefly to avoid the need to carry corn from Hertfordshire all the way down the Lee and up the Thames. This was the first Act of Parliament specifically to authorise construction of a canal, but again no work was carried out.[15]

The age of river improvements

Then in the 17th century emerged the private 'adventurers' — sometimes acting alone, later often in partnerships — willing to invest their own capital in river improvement works in return for the right to collect navigation tolls. They were followed from the 1730s/40s by the incorporated joint stock

companies of undertakers, which, as the scale of the individual schemes grew larger, began to play an increasingly large part in the expansion of the inland waterway system.[16] However, some of the new river navigation schemes continued to be promoted by town corporations:

- By Letters Patent of 1619 the Corporation of Bath was empowered to restore navigation on the River Avon up to the town. Nothing was done, however. Then in 1712 it again acquired these powers through an Act of Parliament, but, having been unable to exercise them, in 1724 it assigned its interest to a company of proprietors.[17]
- The means by which navigation of the Thames was to be restored from Burcot to Oxford (6–7 miles) was, at the time, rather unusual. The 1623 Act provided for the undertaking to be directed by eight commissioners, half being nominated by the city council and other half by the university's vice-chancellor, who carried as much power in the city as its mayor.[18]
- Under Acts of 1669–70, 1751 and 1789 the Corporation of Thetford was the undertaker for improving and maintaining navigation on the Little Ouse until it became disused in the early 1900s.[19]
- The Mayor of Lincoln, along with the Bishop of Lincoln and others named in 'commissions of sewers', had been involved in a series of efforts to restore and maintain the Roman Fossdyke for at least 150 years before the city corporation obtained an Act in 1671 that gave it powers to restore navigation on the Fossdyke and River Witham between Torksey, at the junction with the Trent, and Boston. In fact only the Fossdyke and a short stretch of the Witham into Lincoln were improved, the work being undertaken by Samuel Fortrey in return for a lump sum of £500 and one-third of the tolls. In 1741 the city leased the canal for 999 years and ceased to have any effective interest.[20]
- Doncaster Corporation unsuccessfully sought powers to restore navigation on the River Dun up to Doncaster in 1704–5 and again in 1722–3. Eventually it succeeded in obtaining an Act in 1727, under which it became the undertaker for improving the River Dun below Doncaster. However, the corporation itself only put up 20% of the capital, the rest coming from individual councillors in their private capacity. A further Act in 1733 transferred the corporation's powers to an incorporated Company of Proprietors of the Navigation of the River Dun covering the entire navigation up to Tinsley, in which Doncaster Corporation and the Town Trustees of Sheffield each held 4% of the shares.[21]

Some of the corporations that had obtained powers of conservancy by royal charter also now began to promote Acts to allow them to undertake improvement works: Colchester in 1623 and York in 1727. However, the scale of some of these river navigation undertakings was becoming too large for them to be managed directly by the mayor and members of a city or borough corporation. From the end of the 17th century it became the practice to hand over the management of river undertakings to a separate body, all or some of whose members might be nominated by the relevant civic and municipal corporations. The device was also used where more than one local authority had an interest (following the example of the Oxford–Burcot Commissioners mentioned above). The riparian counties were also now sometimes involved, through representation by justices of the peace. The following are some examples:

- One of the first is the 18 undertakers, nine nominated by the Corporation of Leeds and nine representing Wakefield, empowered by an Act of 1699 to make the rivers Aire and Calder navigable up to the two towns.
- Commissioners comprising appointees of the Norwich and Yarmouth Corporations and the justices of the peace of the counties of Norfolk and Suffolk, were first established in 1660 to oversee the repair of Great Yarmouth harbour. From 1723 their powers were extended to include the improvement of navigation on Breydon Water and the rivers Yare, Waveney and Bure. Although they were jointly responsible for overseeing the receipts and disbursements, until 1866 Norwich Corporation alone was responsible for undertaking improvement and maintenance of the Yare from the city down to Hardley Cross; the Norfolk justices were responsible for the Bure; the Suffolk justices for the Waveney; and Yarmouth Corporation for Breydon Water. The commissioners were re-constituted in 1835 and again in 1866, when they were incorporated as the Great Yarmouth Port & Haven Commissioners; the individual commissioners continued to be appointed by the two corporations and the two counties. After 1866 work on the rivers, to which were added their navigable branches, was undertaken directly by the commissioners. This arrangement continued until the commissioners' powers in respect of the rivers

were transferred to the Broads Authority in 1988, and in respect of the port to the Great Yarmouth Port Authority in 1989.[22]

- The Corporation of York's Act of 1727, mentioned above, established the Ouse Navigation Trustees to oversee the maintenance and improvement of navigation on the Ouse. However, in this case they were all nominated by the corporation and were effectively a committee of the council; in fact the corporation became the trustees in 1835. In 1767 the upper limit of the trustees' powers became Linton Lock, when the Linton Lock Commissioners were established and took over the upper reaches of the river. The lower reaches of the Ouse from Goole to the junction with the Trent were transferred to the Aire & Calder Navigation in 1884. The remaining section from Linton Lock down to Goole was transferred to British Waterways in 1989. However, York Corporation continues to be the navigation authority of the one-mile Foss Navigation, which it bought from the Foss Navigation Company in 1853.[23]

The canal era

Although local authorities continued to be directly involved in river navigations, they played only a marginal role in the promotion and construction of canals during the second half of the 18th and first half of the 19th centuries, supporting or opposing Bills that affected them and occasionally investing in shares.

Aspirations for a canal revival

The second half of the 19th century was the era of awakening civic pride, most famously in Birmingham, under its mayor Joseph Chamberlain, who took the lead in establishing municipally-owned public services. Birmingham was one of the first civic authorities to begin campaigning for construction of new canals or reconstruction of existing canals to convey ships or barges of 200 tons capacity or more.[24] However, it was Manchester Corporation that led the way when it supported the promotion of the Manchester Ship Canal, voting to contribute a two-penny rate towards the costs of obtaining its 1885 Act. When, during construction, the project ran into financial problems, the corporation obtained powers to lend £5m, in return for which it was to appoint a majority of the canal company's directors until half the loan had been paid off. This situation continued to apply until control of the canal company and its extensive property assets passed to Peel Holdings in 1991.[25]

In 1915 Nottingham City Corporation took over from the Trent Navigation Company a 21-mile stretch of the river from Averham to Nottingham, with powers to build locks to provide access up to the city for trains of four 150-ton capacity barges. The work was completed in 1927.[26]

A rather different manifestation of municipal socialism was the purchase of the ailing Chichester Canal by the Corporation of Chichester in 1892, but it was forced to abandon it in 1928.[27] Equally doomed was the formation in 1895 of the Thames & Severn Canal Trust to take over and restore the leaking and bankrupt canal. The trustees were the County Councils of Gloucestershire, Wiltshire and Berkshire, the City of Gloucester, and the Urban Districts of Stroud and Cirencester, together with the Severn Commissioners and four canal companies. However, the Trust gave up its endeavour to re-open the canal and from 1901 the Gloucestershire County Council carried on alone. Although it did succeed after a fashion in re-opening the canal at considerable cost, the canal was eventually abandoned, the majority in 1927 and the rest in 1933.[28]

As late as 1926, the corporations of Gloucester, Leicester, Loughborough, Nottingham, Stoke-on-Trent, Wolverhampton and Worcester, and the Urban District Councils of Bilston and Brierley Hill were members of the National Council for Inland Waterways, the lobby group established to keep alive the proposal that had been advocated by the 1906 Royal Commission on Canals for a 200–300 ton capacity 'Canal Cross' linking the West Midlands to the Mersey, Trent, Severn and Thames.[29]

The twentieth century

The first half of the 20th century may also be characterised as the period when local authorities bought redundant canals in order to take over their water supplies and/or to obliterate them by piping them and filling them in. For example: the Bude Canal, bought by Stratton & Bude Urban District Council in 1902; the Glamorganshire Canal, bought by Cardiff Corporation in 1943; and the Wisbech Canal, taken over by Wisbech Corporation in 1944.[30] Mention may also be made here of the purchase of the residual stump of the Kensington Canal by the Westminster City Council in 1904, for use as a refuse loading basin.[31]

In contrast, during the second half of the century local authorities, particularly county councils, have played a significant role in the restoration of canals, in order to provide an amenity for their residents and an attraction for tourists. They have prepared the way for restoration by safeguarding canals in their county and district plans, and they have contributed to the cost of restoring and maintaining canals both dirctly and by acting as a channel for various forms of central government grant.

In earlier days, before local authorities' financial powers were capped by central government, some county councils went so far as to acquire abandoned canals, to ensure their retention as linear country parks and to restore them, in varying degrees to navigation: the West Sussex County Council bought the Chichester Canal in 1957;[32] Devon County Council acquired the Grand Western Canal from the British Waterways Board in 1971;[33] and Hampshire and Surrey County Councils, in 1973 and 1976 respectively, acquired the surviving lengths of the Basingstoke Canal lying within their counties.[34]

* * *

This survey is not claimed to be complete; nor does it attempt to indicate the scale of the physical works undertaken by local government bodies. Throughout, their motive was, self-evidently, to stimulate economic activity in their city, town, district or county, but there is no analysis here of what their efforts and investment achieved. Nevertheless it is clear that their overall contribution to the development of inland navigation over the past 800 years has been significant.

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I am grateful to Hugh Conway-Jones and Peter Brown for their comments on the original paper.

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Railway Contractor Becomes Railway Financier

Peto in the 1850s

John Cox

Samuel Morton Peto (1809–89) first became involved in railway finance during the depression which followed the 1830s boom, when two of the companies with which he had substantial contracts, the South Eastern (SER) and London & Blackwall (L&BR), were unable to raise sufficient capital to complete their projects. Peto and his partner at the time, Thomas Grissell, accepted at least £10,000 of bonds and shares from the SER and twice that sum from the L&BR in payment for their work. Although this was more support than most railway contractors would have been able to provide at the time and an indication of the financial resources of Grissell and Peto, in neither case was the contractor either the promoter or the largest source of funds for the scheme.[1]

In the early 1840s Peto went one step further, joining George and Robert Stephenson in reviving the scheme for a railway from Yarmouth to Norwich (Y&NR), which had failed to get off the ground in the 1830s boom. Besides taking overall responsibility for the execution of the works, Peto almost certainly contributed significantly to the financing of the project, although it is not possible to know to what extent, as the company records have not survived. The Y&NR directors were certainly sufficiently indebted to Peto to invite him to preside over the celebrations to mark the opening of the line, which were held at the Assembly Rooms at Norwich in April 1844.

By that time the country was on the brink of the Railway Mania, which made it largely unnecessary for companies to look to contractors for assistance. This did not prevent Peto from providing significant financial backing for at least one of the companies he worked for during this period, subscribing £25,000 of the capital of the Southampton & Dorchester Railway before he began work on the line in 1845. This was mainly to facilitate a prompt start in the execution of the contract, the company not being flushed with funds, but his investment still represented less than 5% of the company's total capital. Compared with

the value of the contracts he executed, Peto's support for the companies whose lines he built up to the end of the Mania appears to have been fairly modest and driven largely by contractual necessity. All this was to change in the decade that followed.[2]

During the depression which followed the collapse of the Mania in late 1847, Peto substantially assisted three of the companies whose lines he had began work upon earlier. He accepted £200,000 of bonds and other securities from the Eastern Counties Railway (ECR) to enable the company to complete its lines and probably acquired a substantial holding in the adjacent Norfolk Railway, which he was also constructing at the time. Both companies acknowledged his support, the ECR by making his new partner, Edward Ladd Betts, its Chairman and the Norfolk by giving Peto a seat on the Board after he had completed his contracts, and later making him Chairman. Another company Peto substantially assisted was the Birmingham & Oxford Junction, whose contract he had only taken in late 1847. By the time he completed this line five years later, he had accepted about £800,000 of shares, the largest part of the cost of the works. Peto was also drawn into investing £132,000 in the Mold Railway — more than half the company's capital — to enable Betts to complete a contract he had earlier embarked upon independently. The only company Peto worked for during the difficult post-Mania period which made only limited demands upon him was the Great Northern, despite providing his firm with contracts that were altogether worth more than £1 million.[3]

Even after the worst of the post Mania depression had passed, railway companies still found it difficult to raise the capital needed to complete works that had been suspended earlier, let alone to launch entirely new projects. A substantial initial investment from a major contractor, effectively underwriting a significant portion of the total capital, was a powerful incentive to potential investors. In 1850 Peto obtained his first contract in the post Mania period by offering to invest £20,000 in the Oxford, Worcester & Wolverhampton Railway (OW&WR). This company had been obliged to abandon the construction of its line at the depth of the depression, with nearly all the works still uncompleted. The investment proved worthwhile as far as Peto was concerned, as his OW&WR contracts in the end were worth nearly £400,000. They also came at a time when his firm was becoming short of work and had no new contracts in prospect. He also showed himself prepared to assist the OW&WR in other ways, agreeing to take all its unsold preferential shares and negotiating a loan on the company's behalf from Overend & Gurney, the London discount house with which he would become even more closely involved in later years. The OW&WR directors showed their appreciation by giving him a seat on the Board as soon as he had completed his contracts in 1854, making him Deputy Chairman shortly afterwards, a post he held until the OW&WR was absorbed into the West Midland system six years later. During his period in office Peto pursued an expansionist policy, promoting schemes for major extensions to South Wales and London, which, if successful, would almost certainly have provided his firm with further contracts. But in the end he had to be content with the short branch to Chipping Norton, and even then was obliged to raise nearly all of the £16,000 capital himself.[4]

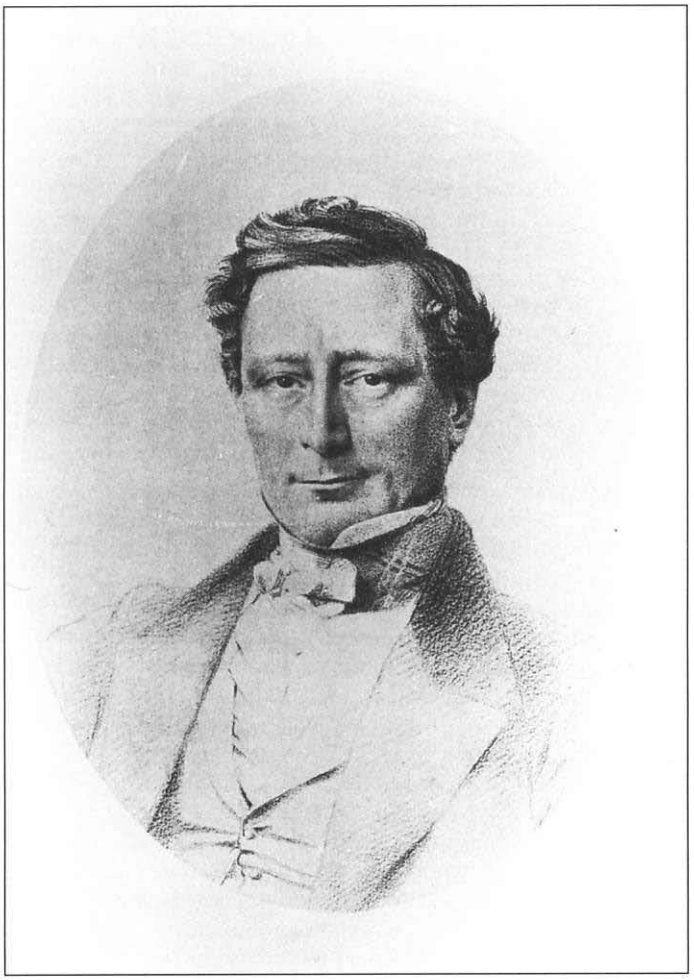
Peto's next undertaking, the Hereford, Ross & Gloucester Railway (HR&GR), was another scheme that had been suspended in the post Mania depression but, unlike the OW&WR, with practically no work carried out. After they had been unable to raise enough capital themselves to relaunch the project, the HR&GR directors approached Peto for assistance and he agreed in 1852 to provide half of the total capital of £275,000. He made this offer jointly with Thomas Brassey, who by this time was an even greater force than Peto on the contracting scene. The HR&GR was their first collaboration in Britain, although they had worked together slightly earlier in France and Norway. The contract was worth £230,000 and they agreed from the start to accept half of their payments in debentures, a third as credits against the calls on their shares, and only a sixth in cash. Soon after the railway was completed in 1855, Peto came to an arrangement with Betts and Brassey to take both of their portions, which made him by far the largest shareholder in the company. He proceeded to give further support to the HR&GR, allowing it to repay £33,000 outstanding on the construction account over a ten year period with 10% interest, and arranging in 1857 for a loan to repay debentures. Peto chose not to join the Board, however, preferring, as with the ECR, to have Betts installed in his place. This enabled him to exert considerable influence behind the scenes, right up to the time of the HR&GR's absorption into the Great Western system in 1862.[5]

In the same year as undertaking the HR&GR, the Peto, Betts and Brassey consortium provided a different form of financial backing for the London,

Tilbury & Southend Railway (LT&SR), agreeing to take a lease of the line at 6% for twenty-five years, the period being subsequently reduced to twenty-one years. This was the first leasing arrangement Peto undertook in Britain, although, again with Betts and Brassey, he had entered into a similar commitment to the Royal Norwegian Railway the previous year. Besides the long term guarantees provided by the lease, shareholders in the LT&SR had the prospect of interest on their investments during much of the time the railway was under construction and were also promised a half share of the profits throughout the period of the lease. The contractors had already subscribed £120,000 of the company's initial share issue, which along with the lease assured them of the contract without competition from other firms. The price initially agreed was £400,000 but this was increased by £25,000 after Peto had told the directors he needed the extra payment to be assured of making the 10% profit he expected from all his undertakings. This was a highly unorthodox move on his part but the contractor's power over the company was so great by then, that the directors could do no more than make a perfunctory protest.[6]

The LT&SR made Peto its financial advisor at the start, a position he proceeded to exploit to the full, persuading the directors not only to agree to payments in cash and debentures ahead of what was due for the works, but also to provide him with substantial cash advances on the security of the shares he held in the LT&SR and a number of companies he had carried out work for previously, including the HR&GR. The LT&SR also provided him with collateral for a personal loan of £20,000 from the London & Westminster Bank. All these transactions were recorded in the directors' minutes and justified as being in the best interest of the company, although it is hard to see how this could have been so, except indirectly by relieving the contractor's cash flow problems during the construction of the railway. In reality Peto was using the LT&SR as a private bank to obtain loans, in some cases upon questionable surety, some of the companies whose shares he deposited being lowly rated on the market.[7]

With the help of the LT&SR's engineer, George Parker Bidder, who was a longstanding friend, Peto also persuaded the LT&SR directors to embark upon a number of expensive additional works before he had completed the original project. These included a 'cut off' line to give direct access to the London & Blackwall terminus at Fenchurch Street, which involved a capital outlay of £200,000, and a warehouse at the Minories, which cost £30,000. Although the contractors stood to enhance their profits as a result, their long term interest liabilities were increased proportionately. This soon became a serious matter when traffic receipts failed to come up to



Samuel Moron Peto, 1809–1889
[from Henry Peto, Sir Morton Peto, *1893]*

expectations, making the lease a long term liability. When it became apparent that there would be no profits to distribute to the shareholders, Peto offered to pay an additional ½% on the lease in lieu, which the shareholders unwisely refused to accept. He then tried to increase the traffic on the line, seeking to attract London commuters with discounted fares, even going as far, with Brassey's assistance, as laying out an estate of villas adjacent to the station at Southend, to accommodate them. This was a bold concept but unfortunately for the lessees before its time, the distance to London being too great. The only remedy left was to make economies in the working of the railway, which led to complaints of poor service from passengers and objections from the shareholders, who considered that their assets were being depreciated. Despite several further attempts to dispose of the lease, it ran its full term, by which time financial difficulties elsewhere had obliged Peto to hand over his interest in it to Brassey.[8]

Personal connections probably helped Peto obtain the contract for the West End of London & Crystal Palace Railway (WEL&CPR) in 1853, one of the promoters of the scheme being his friend Joseph Paxton, the architect of Great Exhibition building in Hyde Park. Besides being one of the principal financial backers of that project, Peto had also strongly supported Paxton's original design. When it came to choosing a contractor for the WEL&CPR, which was designed to provide a direct rail link to the reconstructed Crystal Palace at Sydenham, Paxton may well have thought that should support Peto's tender, despite its high price of £310,000. The Board was almost certainly also influenced by Betts having signed the subscription contract for £60,000 and the advice it received from Bidder, soon after he had been appointed engineer, that the fledgling company could almost certainly, if the need arose, rely upon substantial financial assistance from the Peto, Betts & Brassey consortium. This was put to the test when the outbreak of the Crimean War in 1854 made it increasingly difficult to raise the sums needed to complete the line. Although the appeal to Peto went unheeded at this time, he was compelled to relent two years later when there was a serious risk that the works would have to be suspended, agreeing to meet all the remaining construction costs. This was on condition however, that the company handed him £80,000 of debentures ahead the work being carried out. Peto was elected to the Board on the completion of his contract in 1858, joining the Finance Committee, which two years later agreed terms for an amalgamation with the Brighton Railway. The deal proved a good one for the WEL&CPR shareholders, including the former contractors.[9]

Although Peto did not in the end execute any additional works for the WEL&CPR, the Bidder connection almost certainly helped him to secure another, albeit smaller, undertaking on the southern fringes of London in 1854. Bidder had earlier entered into a leasing arrangement with the Wimbledon & Croydon Railway and was probably instrumental in the company accepting a tender from Peto & Betts to build the line for £45,500. This was about a third of the cost per mile of the WEL&CPR, probably in part due to there being no financial commitments for the contractor. It may also explain why the line appears to have been built on the cheap, the Government Inspector twice refusing to sanction its opening, and soon after trains began running an embankment collapsed, causing a fatal accident.[10]

From the mid 1840s Peto had been involved in the development of Lowestoft as a port and holiday resort and at an early stage saw the need for a more direct rail link to London than the route through Norwich he had built earlier for the Eastern Counties (ECR) and Norfolk companies. He began by promoting a short branch off the Lowestoft line to Halesworth, which by 1854 had been expanded into the East Suffolk Railway (ESR), with its main line running along the coast to Woodbridge and incorporating branches to Leiston, Snape and Framlingham, as well as an extension northwards to Yarmouth. The Eastern Union company agreed to build a branch from Ipswich to link with the ESR at Woodbridge and to provide facilities for the new company on its Colchester–Ipswich line. To reach London however, the ESR also needed to make use of the Eastern Counties line from Colchester but this proved difficult, partly because Peto had been on bad terms with that company for some time. His active promotion of the ESR made matters even worse, as the new line threatened to siphon off a significant portion of the Lowestoft and Yarmouth traffic that currently passed through Norwich. When the ECR continued to prove unco-operative, Peto went ahead and promoted a line of his own from Colchester to join the LT&SR at Pitsea, with the aim of providing the ESR with access to London entirely independent of the ECR.[11]

The Pitsea project antagonised the ECR even more and its directors vented their anti-Peto sentiments in a sixty-three page pamphlet titled: *Petovia; being a review of a scheme for a railway from Pitsea to*

Colchester, and an exposure of the motives which prompted it, the absurdities that characterise it, and the inevitable failure that awaits it, which appeared in 1857. After denouncing the proposed line as expensive to build and unprofitable to operate, the pseudononymous author, who called himself 'A Tooth of the Dragon', went on to attack Peto as the promoter of overcapitalised projects, designed with the sole purpose of enhancing the profits of the contractor. Peto was even dubbed 'The Second Railway King ... the successor of the notorious Hudson, in the wholesale extent of his undertakings, the ingenuity with which he cooks prospectuses, in the magnitude of his audacity and the success with which he angles for dupes'. This was emotive language, the financial scandal following George Hudson's fall nearly a decade earlier still being a sensitive matter with many railway shareholders. Although it is not possible to know what effect, if any, these strictures had upon Peto, he shortly afterwards withdrew the Pitsea scheme, although not before extracting a commitment from the ECR to drop its opposition to the ESR and work the line when he had built it.[12]

The Peto, Betts and Brassey consortium agreed to lease the ESR on the same terms as the LT&SR, although this time with no reference to the distribution of any future profits. They once more obtained the contract without competition from other firms and again had a valuable ally when Bidder was appointed engineer. On his recommendation the directors agreed to increase the price of the works from his initial estimate of £7,000 per mile to £11,000 when Peto took the lease, and finally to £15,000, although the last figure did include double track south of Beccles. The EUC in the meantime had engaged Brassey to execute the Woodbridge–Ipswich link independently from the other two contractors, and he coordinated its construction with that of the ESR. The whole project was completed in 1859, by which time the LT&SR was already proving a financial liability for Peto and his fellow lessees and failing to provide the expected rewards for its investors. This led Peto to take the precaution of warning the ESR shareholders, when he addressed them at the dinner held at his own Royal Hotel in Lowestoft the following year to celebrate the completion of the ESR, not to expect major rewards from their investments in the early years. The warning proved unnecessary, as only two years later the ESR was absorbed into the larger Great Eastern system, which enabled the shareholders to dispose of their holdings and the contractors to free themselves from a potentially costly leasing liability.[13]

In 1853, whilst he was still engaged upon the construction of the OW&WR, Peto had been approached by the promoters of the Severn Valley Railway (SVR), with the request to support their scheme for an extension northwards to Bridgnorth and Shrewsbury. Although both he and Brassey invested in the SVR, Peto advised the directors against seeking parliamentary approval at the time, probably because he was personally fully committed to the HR&GR and LT&SR. When they chose to ignore his advice, he reacted forcefully, threatening to withdraw his financial support for the SVR and to oppose the Bill when it came before Parliament, which, as a sitting MP, he was well placed to do. Realising they had overstepped the mark, the promoters withdrew the Bill and endeavoured to placate Peto with a seat on the Board. He was subsequently made Chairman and given the wide-ranging brief to raise funds for the SVR 'in such a manner as he might think expedient'.[14]

Although Peto waited two years before proceeding, he proved very supportive of the SVR in the end, agreeing in 1855 to pay the parliamentary deposit and to act as trustee for the forfeited shares. He did insist however, that the company's capital should be reduced from £600,000 to £480,000, provision for this being made in a second Act, which was obtained the following year. He may also have been responsible for the replacement of the original engineer, Robert Nicholson, who had been party to the abortive attempt to proceed in 1853, by John Fowler, with whom he had worked on the later stages of his OW&WR undertaking. With Peto, Betts and Brassey between them holding nearly half of the SVR share capital, the directors had no alternative in 1858 but to give them the contract, despite having offered it earlier to another firm, Smith & Knight, when Peto's position as Chairman had precluded him from taking it. His resignation from this post entirely changed the situation and, although he partially compensated Smith & Knight by handing them a smaller contract he had already obtained for the WEL&CPR's Farnborough Extension, Peto had clearly manipulated the parties involved to his own advantage. The consortium agreed to build the SVR for £363,000, although most of the actual construction appears to have been carried out by Brassey's organisation. After considerable delay the railway was eventually completed in 1862, by which time the SVR, like the OW&WR, had been absorbed into the larger West Midland

Railway, probably making it easier for the contractors to dispose of their shares.[15]

During the 1850s Peto and his partners invested nearly £1 million in the companies that placed contracts with them, which included initial share subscriptions and securities accepted in lieu of cash for work carried out; they also entered into leasing arrangements providing capital guarantees of around £1½ million. For much of this time Peto was also providing substantial assistance for a number of the projects he had embarked upon in the previous decade. Whilst contractor finance on this level was a reflection of the economic times, the post Mania depression casting a shadow over the investment scene well into the 1850s, it was also an indication of the need of a large contractor like Peto for a steady supply of new projects to maintain the integrity of his organisation and workforce. The extent of his commitments was also a direct consequence of the financial weakness of most of the companies he worked for throughout the period. Although the demands made upon him were considerable, as has been seen, there were some compensations, notably the ability to obtain all his contracts without competition from other firms, and to a large extent upon his own terms. His financial muscle also enabled him to exert considerable influence over the management of the companies whose contracts he executed, whilst the scale of his share holdings would also have enabled him to speculate privately in railway stocks.

The end result of all these involvements was that Peto, whilst still remaining a major constructor of new railways, by the end of the decade had assumed the significant additional roles of railway financier and promoter, and was well on the way to becoming a major railway magnate.

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4. S C Jenkins & H I Quale, *The Oxford, Worcester and Wolverhampton Railway*, 1977, 16–25, 27–36, 60, 124; RAIL 558/1–2, 4. Excessive dependence upon Overend & Gurney was one reason for Peto's bankruptcy in 1866.
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7. RAIL 437/1. These included shares in the troubled Grand Trunk Railway of Canada.
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10. RAIL 751/2–3; R A Williams, *The London & South Western Railway*, Vol 1, 1968, 151. Peto did obtain the contract for the Western Extension of the WEL&CPR but subsequently handed this over to Smith & Knight as described later.
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The Press Mania during the Railway Mania, 1844–45

Goulven Guilcher

The great Railway Mania of 1844–45 was preceded by two previous similar but smaller manias, in 1824 and 1836–37. All were linked to a sudden frenzy for railway companies' shares.

Fifty-nine bills were deposited in 1824; more significantly thirty-nine companies were sanctioned by Parliament in 1836–37. J A Francis in his *History of the English Railway* (1851) could write about the mania in the thirties something that was equally true for that in the forties:

> The press supported the mania; the government sanctioned it; the people paid for it. Railways were at once a fashion and a frenzy.[1]

The mania had subsided by 1838, just as the next one was to subside in 1847–48. But 805 miles had been sanctioned in 1844, another 2,700 miles the following year and a further 4,538 miles in 1846.[2] A contemporary commentator estimated that a total capital of £100 million was requested for building the lines for the 240 bills submitted to Parliament at the end of 1844, no less than double the national income. However enormous this amount might have appeared to contemporaries it remains that a total amount of £167 million was actually invested in the 330 lines sanctioned by Parliament between 1845 and 1847.[3]

All experts were in great demand but some lines managed to save the cost of surveyors, engineers and negotiators with land-owners.[4] Indeed, some devious promoters had understood that the main point was to attract investors by filling them with wonder and by displaying dukes, earls and ministers as provisional directors.[5] Many of them had never had the slightest intention of building a railway line and paying interest to shareholders out of the receipts. At a time when money was plentiful they were just trying to offer the public a railway project which would appear attractive enough in which to invest their savings. The rest of the story may be guessed, with a large supply of ghost companies taking advantage of the lack of experience among many partners in this new capitalism and of the reluctance of the legislators to set rules for private firms.

The press and the railways

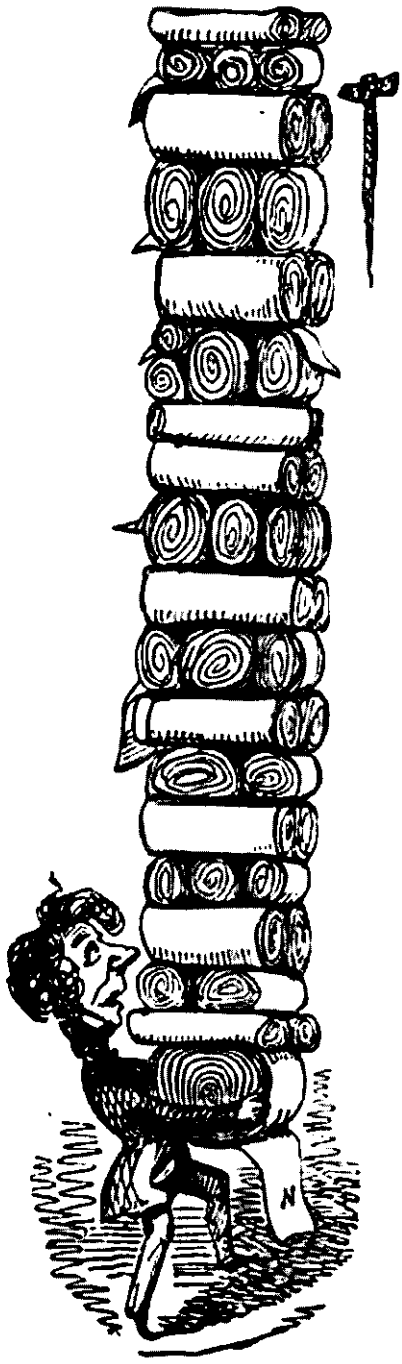
The compulsory notice in the *London Gazette* may be used to gauge the level of railway projects: the issue for 15 November 1845 reached a record of 583 pages just before the deadline for depositing the plans for the session. Whether the promoters were honest or dishonest, reliable or utopian, they had to employ some additional way to make their projects known. Thus modern promotional means had to be used for informing and convincing a broad and new public suddenly attracted by railways.

In order to communicate with the public, the promoters and all those whose activities were linked could use various means such as ad hoc books and pamphlets which included a selection of depositions from witnesses in favour of the project or against those presented by the rival companies, or a clever digest of witnesses heard by Parliament at the Committee stage. All this was very costly and strictly reserved for big companies, and it offered no guarantee about the actual circulation of the documents.

However, in the press you could enjoy vast possibilities and greater flexibility. According to the size of the company you could use only the local press or the national or specialised press. It would seem that the promoters spent freely on publicity all the more when they had no actual determination to open a line: their aim was to attract credulous investors, the money collected from the first victims being reinvested in the campaign for attracting many more.

The various forms of paid publicity

Paid publicity was the most common practice. It gave a special appearance to the press during the years of the Railway Mania, whole pages being filled with railways' advertisements grouped in narrow columns. Most of them were about railway projects (generally ending with a form of application for shares), including notices against rival lines, then came the requests for paying the legal deposit of 10% on shares subscribed, the calls for increases of capital or line extensions, and finally news from sharebrokers



'The Monster Newspapers': an illustration to an article about the enormous supplements to the newspapers because of the advertisements for railway projects, Punch, *vol IX (1845), 181*

and advertisements for guides for investors.[6] Illustrations, which were in the form of traditional woodcuts, were extremely scarce. Advertisements about the promotion of new lines varied very greatly from about ten lines in a single column, to a full page or two. The type was uniform, apart from the name of the company in capital letters, rarely bold. The text of the advertisement was in even smaller type than the articles in the newspaper according to a common practice. Readers were expected to have good eyesight.

As long as you just had to study advertisements about the issuing of shares, because they always followed the same pattern it was easy to read them quickly and sort out the interesting data. The more elaborate advertisements generally included a long list of the provisional committee mentioning their professional status, the bankers, lawyers, engineers and local agents. To this was added a long argument in favour of the line which required some attention. Thanks to the Railway Mania the promoters knew they had a large, almost captive, potential audience, but with the growing number of projects one might think they would have had recourse to special means for attracting investors' attention. However, apart from detachable subscription vouchers, these advertisements showed great uniformity without any original features.

The newspapers could also support the projects through the texts of the articles either because the editor or owner trusted them, because he had bought a number of shares in them, or by pure venality. It is sometimes difficult to determine which of these motivations was strongest but it appears that some types of publications were more likely than others to take bribes.

The reviews

The reviews were different from newspapers but appear very interesting because they dealt with railway subjects and even with the railway press. They took sides in the great debates about the broad gauge or atmospheric railways but with more perspective than the press, particularly the monthlies, and showed more restraint since they suffered less from the negative effects of the pressure from publicity.

The *Illustrated London News* as could be expected was more attracted by the spectacular or the ridiculous such as the rush for depositing the plans

at Parliament (30 November 1845) or the inconvenience of the break of gauge (20 June 1846). The selection of these features was far from innocent. In this magazine Albert Smith contributed a 16-part satirical column at the beginning of 1846: 'Tracts for the Trains'.[7] It should also be noticed that *Punch* was highly critical of the Railway Mania in general and of the sudden craze of the railway press.[8] In the specialised press the articles published in the newspapers and the reviews were often quoted, and commented upon in the best titles.

The great press: national and local newspapers

National and local newspapers welcomed advertisements from railway companies, and as a sort of natural influence the general tone of the newspapers was in favour of the Railway Mania.

In an article from *Chamber's Edinburgh Journal* (1845) it was even stated that the great press was corrupt and that the railway press was honest.[9] There is a lot to be said for this, particularly with regard to the railway press. One should first make a distinction between passive corruption or the inability to find fault with a mass of projects which provided such an enormous amount of publicity income, and active corruption on the other hand consisting of the publication of articles strongly biassed by a generous briber and highly favourable to his interests. It was even worse when the journalist or the editor knew that the company promoted in the newspaper was doomed or even a pure swindle to which he was linked. All these situations were to be found in the newspapers, servility being far more common than clear-headedness at this time of general frenzy.

All the newspapers were developing their railway section, some were even adding the word 'Railway' to their title in the hope of increasing their circulation. The *Morning Chronicle* and the *Morning Herald* throughout the Railway Mania were strong supporters of railway promoters, the latter attacking the very few newspapers which did not follow this trend, particularly *The Times*.

Although *The Times* remained cool-headed and warned its readers against the oncoming disaster as it wondered ironically at the enormous size of its rivals' railway supplements, the tone of its adversaries became more strident and the controversy grew more acrimonious. It culminated in a striking move from *The Times*: the publication on 17 November

'Portrait of the Railway Panic'
Illustration by John Leech in Punch, *vol IX (1845), 201, and* Punch Almanack *1846, 'November'*

1845 of a special supplement, 'The Railway Interest of the United Kingdom', summing up on pages 9–13 the financial data of all the projects, with a special column on page 4, both of which were compiled and written by W F Spackman. It concluded that such a monstrous speculation was a dangerous folly:

> The mischief has gone too far already ... It may be said that these 1,263 projects are nearly all smoke. But where there is smoke there is also fire.

These tables were a very elaborate work; the conclusions were indisputable.

This publication caused considerable turmoil. *The Times* was attacked at the same time by a number of railway newspapers, the *Railway King and Universal Advertiser*, the *Railway Times* and also the *Stock Exchange Express.*[10] All *The Times* had done was to have summed up the situation, but it was reproached with hindering the march of progress and civilisation by undermining the confidence of the public without any reason, and at the risk of causing a severe financial crisis. *Blackwood's Magazine* commented on this controversy without concealing the drawbacks of speculation and noted that the supplement of one newspaper (the *Morning Herald*) overflowed with advertisements for railway projects.[11] Others resorted to personal attacks: the *Railway Critic* and the *Railway Chronicle* reproached W F Delane, treasurer of *The Times*, with favouring a ghost company, the Direct London & Exeter Line, as well as with favouring the French branch of the Rothschilds against British promoters.

All the available railway capital for railway

WAITING FOR "THE RAILWAY TIMES."
(AFTER HAYDON.)

'Waiting for the Railway Times': drawing by John Leech in Punch, *vol 9 (1845), 161, after Benjamin Robert Haydon's famous painting (1831) about the debate on the Reform Bill. Both the gentleman and the labourer share the same intent.*
See Michael Freeman, Railways and the Victorian Imagination, *1999, 99–101.*

promotion fostered a vast corruption network in which the incriminating newspapers mentioned above were closely linked to the financial interests directly threatened by the attitude of *The Times*.

The specialised press

The specialised press was perhaps not entirely corrupted but its beginnings had not been auspicious since one of its main pioneers, Joseph Clinton Robertson, founder of the *Mechanics' Magazine*, who then launched the *Railway Times*, combined fraud and corruption to a rare extent.[12]

Between April and December 1844, in addition to *Herapath's Railway Magazine* and the *Railway Times*, founded in 1835 and 1837 respectively, there appeared six periodicals including three weeklies and two monthlies which lasted for over two years. From April to September 1845 eight new periodicals were launched including five weeklies, two dailies (the *Iron Times* and the *Railway Director*) and one title published three times a week. Except for one of them they lasted until 1846. In October 1845 at the height of the mania thirteen very ephemeral titles were launched, one twice a week, ten weeklies, and one every other week. Seven of them were to stop their publication in November or December of the same year, at the very beginning of the crisis, four in February 1846 and the remaining two in May 1846.

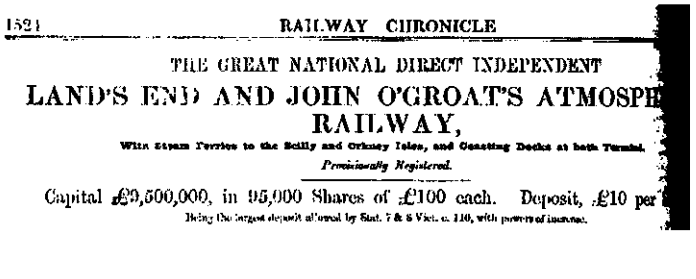
This enormous and sudden expansion of railway titles remains unique in the world. They displayed a great variety in format, periodicity, in the number of pages, in their editorial contents and their duration. Most of them sold for six pence. Out of these twenty-seven titles, two were Irish, the *Irish Railway Gazette* (Dublin, November 1844 – May 1850) and the *Irish Railway Telegraph* (Dublin, October 1845 – February 1846), and two were Scottish, the *North British Railway and Shipping Journal* (Glasgow, October 1845 – January 1850) and the *Scottish Railway Gazette* (Edinburgh, April 1845 – December 1862). This trend in the railway press remained almost exclusively centered in London for England; the provinces stayed aside, apart from *Lloyd's Liverpool Railway Times* (October–November 1845).[13]

Sometimes the owner or the editorial policy changed from one issue to another although the newspapers kept the same title. This was particularly true of the *Railway Times*, then edited by John Robertson (who had no connection with the notorious John Clinton Robertson).

It is very difficult to decipher the pseudonyms which were used by the journalists without any restraint, sometimes borrowed from a colleague. It seems established that 'Verax' at the *Railway Chronicle* was Henry Cole but experts are still debating to determine who might be 'Veritas Vincit'.[14]

By studying the copies deposited for calculating the Advertising Duty Accounts, in which advertisements were underlined by the owners of the newspapers, it appears that many articles were advertising matter extremely misleading for readers.[15] It was a simple and profitable way to inflate the contents of the text, a great concern for all editors who, deprived of the necessary team of journalists, had to order many articles from outsiders. They were thus enabled to edit thick issues which attracted readers in spite of the odd mixture of their contents. They also drew heavily on the great press and the reviews, another inexpensive way of filling the pages. The most dynamic and the best newspapers of the Railway Mania were the weeklies: the *Railway Record*, which was then to undergo a long decline until 1901, the *Railway World*, which disappeared in January 1847, the *Railway Chronicle* and the *Railway Bell*, both remarkable in their own way.

The *Railway Chronicle* is perhaps the most interesting of them all because of its contents and of the attention given to passengers. Its leaders and collaborators included fascinating people like C W Dilke of the Athenaeum, John Scott Russell, the great engineer who worked with Brunel on the *SS Great Eastern*,[16] and Henry Cole, a fierce opponent to the broad gauge who worked on many major projects including the Great Exhibition in 1851, edited for the *Railway Chronicle* very original panoramic illustrated itineraries of the main lines (*Railway Travelling Charts*) and wrote for the same newspapers exquisite illustrated guides for short railway excursions from London under the pen name of Felix Summerly. These two types of publications were of sufficient quality to be issued in volume form bringing extra


1521 RAILWAY CHRONICLE

THE GREAT NATIONAL DIRECT INDEPENDENT

LAND'S END AND JOHN O'GROAT'S ATMOSPH

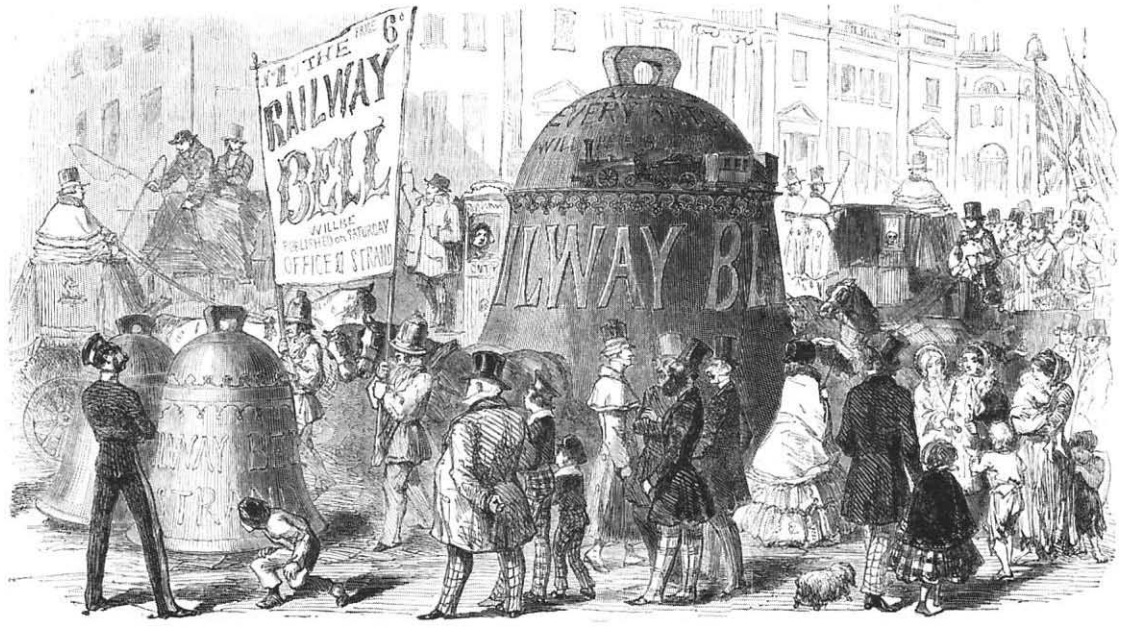
RAILWAY,

With Steam Ferries to the Scilly and Orkney Isles, and Coasting Docks at both Termini.

Provisionally Registered.

Capital £20,500,000, in 95,000 Shares of £100 each. Deposit, £10 per

Being the largest deposit allowed by Stat. 7 & 8 Vict. c. 110, with powers of increase.



Promotional procession in London for the Railway Bell, *mid 1845*

resources and a growing reputation to the newspaper. It was courageous enough to expose the dealings of dubious publications or suspicious characters. For example, it proclaimed that it was strongly opposed to offering an insurance against the risk of railway investment at a time when investors were already too numerous.[17] Its advertisements included projects which were known by the editors to be completely unrealistic like the Great National Direct Independent Land's End and John o' Groat's Atmospheric Railway 'in seven hours' but it did not hesitate to denounce this absurd proposal the following week.[18] It also criticised as fanciful the estimates for the imposing Great European Railways Company's advertisement which referred to 'a population of 236 million souls'.[19]

The *Railway Bell* attracted people's attention in a more striking way with its spectacular publicity and its large format. It chose a bell, the signal for the departure of trains, as a logo and set up monster publicity processions in the streets of central London. They were composed of an enormous bell on top of a cab from which issued bizarre music which made a frightening uproar, with a model train running endlessly around the top of the bell, followed by fifty sandwich-board men assuming the form of bells, bearing on their sides advertisements for the newspaper. Adolphe Joanne, the great French journalist and guide-book editor, was fascinated when he encountered this procession on one of his many visits to London.[20] Unlike some of its rivals this one did not offer free insurance for a week to any buyer, but it provided a little manual for the railway traveller in ten points, very witty and practical.

The aftermath

The panic following the Mania caused the almost immediate failure of the newspapers launched on the exclusive purpose of catching some of the advertising revenue. The benefit in the long run was very slim for the specialised press. The *Railway Record* was the only one to continue its publication for a long time; the other titles launched during the Railway Mania did not last more than 2½ years, most of them only a few months. The *Railway Chronicle* continued until December 1849 and a Scottish and an Irish newpaper until 1850, but in these countries the mania was not felt with the same force. Ironically the periodicals which were to become the reference publications later on, Herapath's *Railway Magazine* and the *Railway Times*, were born before the mania and had not yet acquired their good reputation. This disastrous episode of the Railway Mania was obviously detrimental to the whole of this specialised press.

"WHERE IGNORANCE IS BLISS, 'TIS FOLLY TO BE WISE!"

(NEW VERSION.)

"I say, Jim, Vot 's a Panic?"

"Blow'd if I know; but there 's Von to be seen in the City."

'Where Ignorance is Bliss, 'Tis folly to be Wise'
— I say, Jim, Vot's a Panic?
— Blow'd if I know; but there's Von to be seen in the City

The end of the mania in the railway press in London as the bubble bursts.
Drawing by John Leech in Punch, *vol IX (1845), 193*

It has already been noted that the reviews showed more restraint but the great press did not play its part. It should have acted as a intermediary, giving objective information and putting its readers on their guard. Unfortunately it depended too much on daily contacts with promoters and financial subsidies in various forms which some of them they would have been ashamed to acknowledge. Even *The Economist*, which introduced a special column 'Railway Monitor', refused to condemn the Mania, probably as a matter of principle.[21] Apart from *The Times* which behaved as a trustworthy newspaper and confirmed its reputation in the financial circles of the City, most newspapers failed in their task, vigorously encouraging their readers to invest in hopeless projects or pure swindles that were known by the editors to be such. Under the false pretence of not running against the trend of the market they caused the ruin of part of their readership who just believed that fate was against them. This lack of responsibility is even more manifest among newspapers for railway investors which promised so much and traded in breach of trust on a vast scale.

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Frodsham: a Station Moved Sideways

Gordon Biddle

In North America it is not unusual to physically move a wooden frame building to a new site, sometimes over significant distances, and at one time 'moving house' in country areas was more than just an expression. Because most British buildings are in brick or stone similar instances here are rare, although latterly a few half-timbered buildings have been moved bodily, notably the historic 16th century Old Wellington Inn in the Old Shambles, Manchester. Together with its adjoining 18th century neighbour it was moved to a new site when the Arndale Centre was built in the 1970s. In 2001 the listed brick water tower at St Pancras station was moved about ¼ mile, although it was sliced into three pieces to do it. There are rather more instances of brick and stone buildings being carefully dismantled and re-erected elsewhere. As long ago as 1863 the Midland Railway did so with Francis Thompson's Ambergate station of 1840, only for it to be totally demolished just over a century later, and there have been several other railway examples since, particularly on 'Heritage' lines, but so far as I am aware there have been no instances of bodily removal, other than of wooden or similar lightweight structures.

An exception is Frodsham, on the Great Western and London & North Western Railways' Birkenhead Joint line between Helsby and Warrington. There, the two storey building dates from 1850, built in a modest Tudor style in brick with stone dressings. In 1889–90 a new goods yard was provided and at the same time it was decided to widen the down platform to 12ft. At its narrowest point there was only 5ft 9in between the main building and the platform edge. The confined site did not permit slewing the tracks, so the only alternative seemed to be complete rebuilding further back, an expensive job which would also require temporary accommodation while the work was going on.

The joint lines' engineer was R E Johnston, who since 1866 had been in charge of all the two companies' joint lines radiating from Shrewsbury as well as the Birkenhead Joint line from Chester to Birkenhead and Warrington, and he had designed and built a number of the stations, including Birkenhead Woodside in 1878. He was a resourceful engineer, and at Frodsham he formed the novel idea of sliding the building back. Subsequently he described the process in a paper given to the Institution of Civil Engineers.

The building comprised station offices and the station master's living room on the ground floor, and other domestic accommodation on the first. Work began by excavating beneath the ground floor to make space for temporary timber supports and the wooden platform on to which the building was to be moved, leaving brick piers to continue holding it up until the timberwork was securely in place. Care was needed to ensure even distribution of weight, taking account of door and window openings and so on. Second hand sleepers were used for the main foundations, well bedded into the ground, with transverse baulks on top, overlaid with oak slides and transverse bearers, both planed smooth. The bearers and baulks in turn bore the weight of the building through wooden 'needles', short beams inserted through the walls and projecting on each side. The greatest care was taken to ensure that there would be no movement when the full weight of the building was transferred to the timberwork.

The brick piers were then cut away and the slides were well coated with axle grease before the 400 ton structure was slowly moved, bit-by-bit, by screw jacks borrowed from Crewe works and normally used for re-railing locomotives. The paving and ground beneath the platform had already been removed, leaving only the platform wall, against which the jacks were placed horizontally, their other ends bearing against the timbers. But in front of the booking office there was insufficient space, so timbers were laid through the platform wall and under the tracks to jacks set against the opposing platform wall.

Two men operated each jack with a 5ft lever. They were operated in unison on a signal from the foreman, a quarter-turn each time. 'This was the only way', commented Johnston, 'to insure unity of action on their part, and was continued until the building reached its final destination over the foundations which had previously been prepared.' The work was done on a Sunday, when traffic was light, taking eleven hours. 'Not a pane of glass was broken in any of the windows, nor was the clock stopped, although it was fixed in one of the main walls.' Furthermore, tickets

Frodsham, 3 June 1967 (Photo: author)

continued to be issued to passengers while the moving was in progress. When the building was in its new position it was underpinned with brickwork on its new foundations, and the temporary timbers were removed.

All the timber came from the companies' stores, to which it was returned for re-use. The total cost of this remarkable exercise was £313, including labour and materials, or about £26,500 in today's money. One cannot help wondering what the actual cost would be now, not to mention the duration of a total blockade of the line and the attitude of the Health & Safety Executive.

Later, a light cast-iron and glass platform canopy was provided, and a photograph taken in 1967 showed a single-storey wing at each end. Neither was on the drawings which accompanied Johnston's paper, and although they were carefully matched, the window glazing was different, suggesting that they also were later additions. Johnston does not record how far the building was moved, although if the platform was only 5ft 9in wide at its narrowest point it would need to be slid back 6ft 3in to gain the required 12ft width. A 1982 photograph suggests a platform of about that width. By that time the awning had been removed.

Johnston's ingenuity was demonstrated again at Shrewsbury station in 1903, when he added a third storey to the impressive Tudor frontage building: not on top, but underneath, in order to cause as little disturbance to the facade as possible. He retired in 1908 after 53 years' association with the joint lines.

Notes and references

I am indebted to our member Don Steggles for drawing my attention to the paper and for kindly providing me with a copy.

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The passenger launch *Iota* at Kirkham Abbey

Pat Jones

One of the pleasures which result from the publication of a book[1] is receiving letters from readers who are able to contribute snippets of information or photographs which the writer had overlooked. One such photograph is reproduced below.

Boating on the Yorkshire river Derwent at Kirkham Abbey had unusual connections with the York & Scarborough Railway's station, which was situated beside the west bank of the river there. Local people had long enjoyed the Derwent's quiet beauty, and the railway made it accessible to a wider public, who visited the river from Leeds and York, etc, on summer evenings and at weekends.

The railway's interests were furthered by the unofficial business activities of an enterprising employee. Robert Lazenby had become the station's signalman by 1885, by 1896 he had acquired mooring rights on its river frontage, from where he hired out rowing boats to tourists, and by 1921 the grounds of his cottage had become a 'tea garden'. Robert Lazenby died at the age of 65 in the summer of 1923, when his son Charlie — who was the village postman — took over the mooring and boat hire business (but not the tea garden). Later a second boat-hire business, offering a houseboat and moorings on the east bank in the shadow of the abbey ruins, competed with Charlie Lazenby for trade.

The railway's ever increasing volume of passenger traffic to Scarborough made it difficult to run both express and stopping trains on the same tracks, and on 22 September 1930 scheduled passenger services were withdrawn from all intermediate stations except Malton and Seamer.

After passenger services at Kirkham Abbey Station ceased, the motor launch *Iota* provided a river-bus service between Kirkham, Hutton Ambo, and Malton on Thursdays, Saturdays, Sundays and on Bank Holidays. Is this instance of a boat service replacing a railway service unique?

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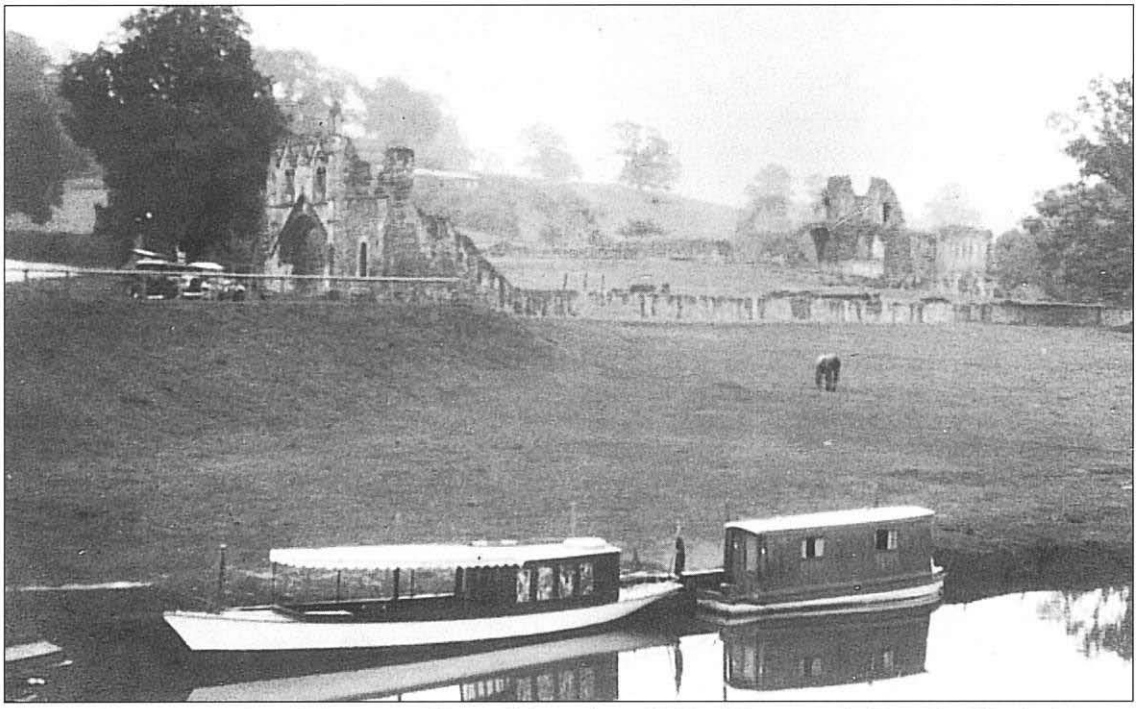


The passenger launch Iota *at Kirkham Abbey, about 1931 (Photograph: Dorothy Wiggins)*

Setting the Record Straight
or
The Perils of Delivering a Centenary Lecture in Celebration of *City of Truro* achieving 100 mph

Pat Lee

Introduction

Early this year, 2004, I received a phone call from the Coroner in Wellington in Somerset, asking if I would undertake to deliver a Centenary Lecture celebrating the Great Western Railway's record breaking run by *City of Truro* on 9 May 1904. This would be delivered at the Beam Bridge Hotel that is situated alongside the stretch of main line where the record speed was achieved, between Whiteball Tunnel, on the Devon–Somerset border, and Wellington. That seemed straightforward. All I would have to do is read about the event in one or two railway history books and condense the story into about 30 minutes delivery time. I agreed to do it.

What a fool I was! Why had the organisers not approached some well-known railway historian? That should have alerted me. Getting the Coroner to make the request suddenly assumed a different connotation, and above all I had broken a cardinal Army rule that one should never ever volunteer for anything. If there was a problem I would only have myself to blame; how awful!

Well, it only took a day's study to realise that a considerable number of people doubted that *City of Truro* had actually achieved 100 mph. They included some experts, although many of those avoided making a clear decision one way or the other.[1] This left me in a dilemma. How could I deliver a lecture celebrating an historic event unless I really believed there was an event to celebrate? Should I investigate or run for cover? I decided to take the former course.

Aim

The aim of this paper is to set out my investigation into all the evidence available regarding the claim that City of Truro achieved a speed of 100 mph on 9 May 1904 and determine whether or not the claim is justified.

I should add at this point that I would not be writing this paper at all except that an article had appeared in *The Times* on 22 May 2004 by Michael Binyon, their Railway Correspondent, in which he referred to 'the unofficial breaking of the 100 mph record' and 'an extraordinary run to get bullion to London as fast as possible'. The fact that he was wrong on both points and that the paper chose not to print my letter of correction stirred me into action!

The event and the problem

On 9 May 1904 a 'City' class 4–4–0 locomotive, designed by Churchward and named *City of Truro*, hauled an 'Ocean Mail Special' train from Plymouth carrying the mail bags that had been brought by liner from New York and were destined for London. It was the GWR's intentions to prove that their route provided the fastest service and thus protect their Post Office contract from their rival London & South Western Railway; see off competition from Liverpool; and also fix the timetables for the faster passenger services to the West Country that would be introduced in July.

To record the event they invited Mr Charles Rous-Marten, a freelance railway journalist to undertake the task. He was then the country's acknowledged expert on recording timings and speeds, and described his journeys in the *Railway Magazine*, *The Engineer*, etc. It is those articles, as published in the above-mentioned magazines[2], plus a letter written by him to Mr James Inglis (General Manager of the GWR) and reported in the *GWR Magazine* in November 1922, that are the principal remaining contemporary sources of written evidence readily available. These claim that *City of Truro* achieved a speed of 100 mph and a top speed of 102.3 mph before it was suddenly forced to slow down by workmen standing on the track.

Some West Country papers mentioned the very fast journey. The *Western Daily Mercury*, 10 May 1904, said, 'Five minutes were occupied between Wellington and Taunton (10.50am), the speed now being terrific, and at times being between 99 and 100 miles an hour.' The *Western Morning News*, 10 May 1904, said, 'on a portion of the journey between Wellington

and Taunton, the running averaged 99 to 100 miles per hour!' The latter report was repeated word for word in the *Wellington Weekly News*, 11 May 1904.

So why has there been so much controversy over the years as to the accuracy of the claim made by Rous-Marten: a controversy that continues today on a web-site that is devoted to proving that this record (and some other well-known ones) is false? Mature members of the RCHS may recall the article by Mr Kendall that appeared in the September 1960 edition of the *RCHS Journal* which concluded by sitting on the fence. Recycling that article would not be acceptable on 9 May 2004! I would have to face the critics in the audience who might fall into any one or more of the following groups:

- Those who dislike or distrust Rous-Marten.
- Those who require more confirmatory quarter mile timings.
- Those who need a second source of speed information.
- Those who question the accuracy of the timings and/or quarter mile post positioning.
- Those who cannot accept that the locomotive could produce the horsepower needed to achieve the speed claimed and/or would simply shake or bounce itself to bits at very high speed.

The critics

The human factor

Charles Rous-Marten, born in 1841, travelled out to New Zealand on the *Palmyra* on 28 October 1857. There he pursued his career as a journalist who just happened to have a passionate interest in railways. He was evidently very competent at his job since he eventually became the Editor of the *Evening Post* and the *New Zealand Times*. He also wrote about, and recorded, train performance and developments 'down under' and two of his log books are displayed in the Wanganni Museum in that country. In 1890 he returned to live in London where he became the UK correspondent for several New Zealand papers. At the same time he used his skills and knowledge of railways to become a regular contributor to the *Railway Magazine*, writing every month detailed articles entitled 'British Locomotive Practice and Performance'. It was these detailed reports that made his reputation as a painstaking, thorough, competent and critical railway recorder who showed no favour to any particular railway company. Some people, who appear to have known him, say that he could be difficult to work with and others judge him from his correspondence to be 'too big for his boots' to the point of rudeness. One must remember that in 1904 he was 63 years old so he would be set in his ways and if he did not suffer fools gladly one might well expect him to be a bit sharp at times.

Did he ever make mistakes? Yes; for example his report on the *City of Truro* record journey itself contains a careless error regarding the train's speed between Burlescombe and the entrance to Whiteball Tunnel and another regarding the carriage of gold on board. No one is perfect.

I conclude from that background of competence and experience as a journalist that he would never do anything that might prejudice the privileged relationships he had come to enjoy with the key managers in the railway companies. Every word he wrote in his articles would be read by a huge number of professional railwaymen as well as a larger group of amateurs. Mistakes or false claims would be used at once by competing companies which envied, say, the GWR as well as by anyone wishing to discredit Rous-Marten. In short, he would never dare to enter a false reading of his stop-watch, claim a mechanical impossibility, or not admit to being unsure about some conclusion that he could not justify. It would simply destroy him overnight. I leave the last word to Mr Collett, Locomotive Superintendent of the GWR, who knew him and described him as 'the most careful recorder of his time', which implies accuracy and honesty.[3]

Lack of sufficient quarter mile timings?

The record claim rests on the last two quarter mile timings before the brakes were applied. These were 9.2 and 8.8 seconds which implied average speeds of 97.8 and 102.3 mph respectively; or taken together, an average of 100.0 mph for the half mile.

Three points need to be considered:

1. In 1904 there were no specific conditions laid down that required satisfaction in order to claim a record. One can respect these critics and of course further times would have been desirable as Rous-Marten himself was the first to agree. However that does not make the claim invalid.
2. The fact that the times reflect the average speed over each quarter mile, means that, with a train that is still accelerating, the speed at the end of each quarter must be greater than the average. Note Rous-Marten's bitter disappointment that the ultimate top speed possible was never determined.

3. Since Rous-Marten was hoping that each successive quarter mile time would be shorter he would have no incentive to falsify any time as he called it out to his GWR recorder sitting alongside. Moreover he could not know in advance just how long this burst of speed would last.

In sum, the claim based on the two last times could be perfectly valid and there is no reason to suspect their honesty.

Lack of a corroborative source?

Debatable. Of course a recorded corroborative source of speed measurement makes any record claim easier to prove. The problem is that there was a source but the original written record has never been found. A Post Office letter sorter on the train, a Mr William Kennedy, timed the train independently and confirmed a top speed of 100 mph. The full story is covered in the *RCHS Journal* referred to earlier in this paper. Both Mr Kennedy's son and a Post Office official confirm the story and thus the claim made. However, unless he had two stop-watches, I have to question his ability to record successive quarter mile times; and to write them down as well would be difficult without assistance. My feeling is that he probably did measure one of those last two quarter mile times and that it confirmed Rous-Marten's figure. In a court of law that would be dismissed as hearsay evidence; but if the original evidence was seen by two witnesses it should be accepted.

Accuracy of quarter mile times?

Much correspondence has been devoted to possible inaccuracies in the quarter mile timings. Four issues arise:

1. To what accuracy could stopwatches be read? The limit in 1904, according to the British Horological Institute, was plus or minus one fifth of a second. Obviously that limit becomes increasingly significant as speed increases.
2. How constant would the time-keeper be in pressing the buttons of his watch or watches? Rous-Marten must have been using two since no mechanical watch exists that can display split times. He had had a lifetime's experience and practice in operating his watches so he would have been constant to a high degree. However, even if he faltered in one simultaneous press of the buttons then the next would correct the error and the average over the two readings would be true.
3. Might he see the quarter mile post too late? Remember that he was sitting in a mail van that had single panel windows only; visibility was restricted and the mile posts were beside the Up line on which he was travelling. My view is that such criticism would be valid if this was the first run he had made on this particular stretch of line. However it was not. He had made and timed several runs on that stretch; six in the past month. He knew that higher speeds would be expected running down the gradient and in spite of the many curves would know where to expect each post.
4. How accurately were the mile posts located? When first put in they would be spot on but when put back after being knocked down or replaced they could, according to the Permanent Way Institution, be up to plus or minus five yards out of position.[4] Such errors would affect an individual timing but like the 'fingers-on-the-buttons' problem discussed above, would be corrected by the next measurement. The effect on speed would only be about plus or minus one mile per hour depending on the trains actual speed: far less than the stopwatch error above.

The conclusion to be drawn from these points is that a precise speed record cannot be claimed from any single reading. All that can do is point to a speed that lies somewhere between an upper and a lower limit. What the actual speed might be is discussed later in this paper.

The power of the locomotive and its mechanical strength

This is the basis of the latest attempt to say that *City of Truro* could not possibly have achieved the speed record claimed. It is set out in a web site entitled 'Which was the World's First Genuine 100 mph Steam Locomotive?'[5] The nub of the argument rests on the assertion that the locomotive could not achieve and sustain the indicated horsepower needed to reach the record speed.

Well it is a very long time since I studied applied mathematics and I cannot claim to have demolished this argument with certainty. However my calculations show that 100 mph was perfectly possible. Calculate the horsepower that *City of Truro* was producing on the actual day of the run by using the 'steady state' power output achieved pulling its train up Hemerdon Bank. (148 tons at 27 mph up a gradient of 1 in 41 equals 1,045 horsepower?) That power is, I think, enough to achieve 100 mph downhill at Wellington but I would welcome any correction

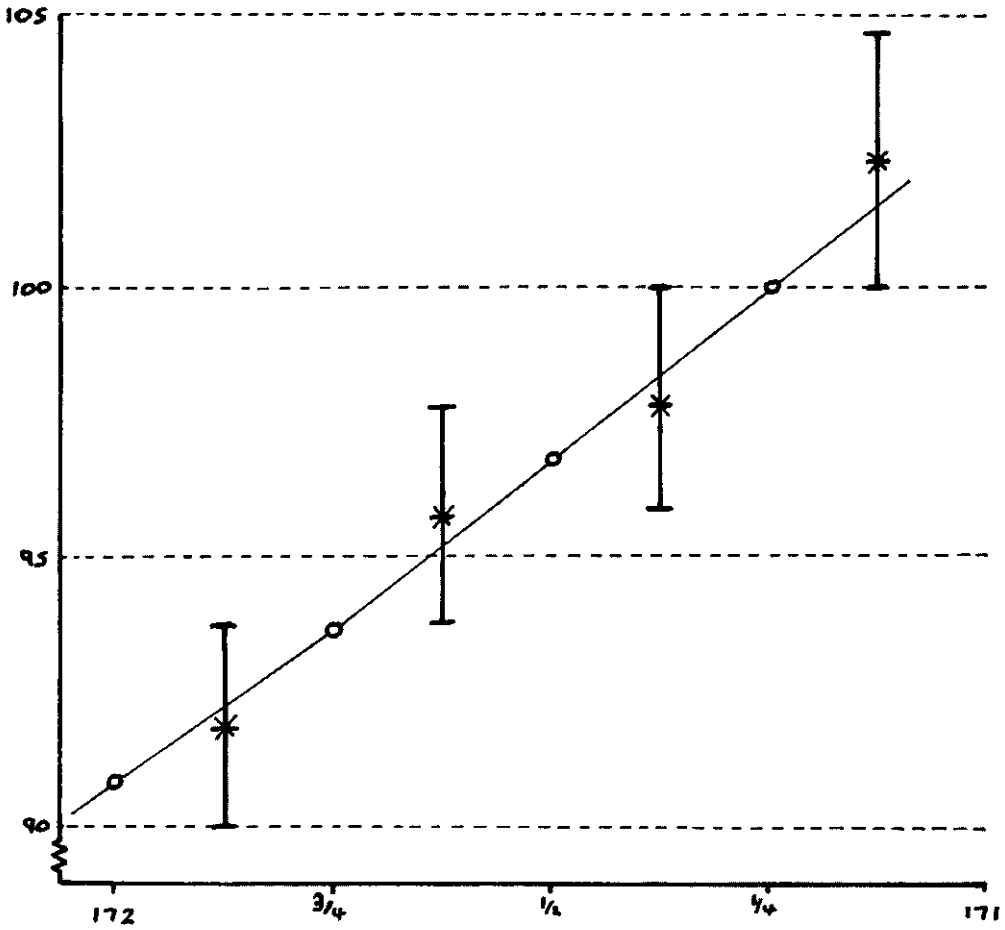
by practising applied mathematicians or engineers.

Which of us is wrong? Probably both of us. My calculation is questionable whilst his assertion ignores the fact that a steam locomotive is able to produce up to twice its indicated horsepower for an extremely limited period: not more than one or two minutes. *City of Truro*'s epic run down the bank from Whiteball Tunnel lasted 90 seconds. Once again I must leave the final decision to the experts.

Dealing finally with those who assert that at 100 mph the motion of the pistons, mechanical links, springing, etc, would cause *City of Truro* to bounce off the track, I say simply that it did not. Remember that engineering design in the 1900s was still of thinking of a safe number and doubling it!

Determining the actual speed achieved

The only results readily available are of course Rous-Marten's eight quarter mile timings that were published in the *GWR Magazine* in 1922, so my first step was to plot these on a graph showing distance along the horizontal axis and speed up the vertical one. It was immediately apparent that simply joining the points together in order to show the speed at any point along the track would be nonsensical because that would show a train that was accelerating and



Graph showing the timed speeds of City of Truro, *9 May 1904*
Vertical axis: speed (mph) — horizontal axis: mileposts
The stars show Rous-Marten's quarter mile timings, and the I *lines through them show the possible stop watch error of plus/minus 0.2 seconds*
The circles show the speeds averaged over half a mile

slowing quite wildly as it came down the bank. Remember that the slope of the line on the graph represents the rate of acceleration of the train. So my next step was to show the maximum margins of error in timings or mile post positions for each of the eight readings. These margins increased with speed but they produced an 'envelope' within which I was confident that the actual distance/speed path must lie. [The graph on the previous page is a simplified version, showing only the speeds achieved between mileposts 172 and 171.]

At this point I only had two other certain cards to play. Firstly, common sense told me that a train weighing some 250 tons and moving at between 80 and 100 mph has enormous momentum. Any change in its motion short of slamming on the brakes can only occur smoothly. Secondly, not one of the reports of the train's descent of Wellington Bank mentions any unusual change in its motion until the brakes were applied. They all applaud its smoothness. 'Nor was there any sudden spasm of abnormal velocity,' as Rous-Marten put it in his account in *The Engineer* dated 20 May 1904.

So remembering, as discussed above, that one inaccurate timing ought to be compensated for by the next one, I took Rous-Marten's figures in pairs and thus was able to plot the average speed over each 'rolling' half mile. This gave me a set of seven points on my graph and this time they presented a smooth path with only two points, those representing the speeds as the train passed the 172 and 171¾ mile posts, not lying exactly on the line I had drawn. Even those two points were only off the line by minus and plus one fifth of a mile per hour respectively. As a final check I did the same exercise with the three-quarter mile times but they simply confirmed the line I had just drawn.

Did I now have the proof I needed to deliver my lecture to celebrate the first steam locomotive to achieve 100 mph with total confidence? Yes! I now had every confidence that if Rous-Marten had possessed a modern electronic stopwatch with a split timing facility his last two quarter times would have translated into speeds of 98.5 and 101.7 mph respectively and by the time that the brakes were applied the train would have been travelling in excess of 103.5 mph.

As a final footnote to this account I must include mention of a remarkable piece of work carried out by a member of my audience on 9 May 2004. He had also been struck by the variation in speed shown by Rous-Marten's raw data and suspected that the variation might be connected with the effect of wheel flange friction as the train with its 27 axles pressed against the outside rail on the several curves down the bank. His large scale drawing of the line and dynamic calculations were most convincing and reflected the same variations as Rous-Marten's raw data. It is relevant to know that I was advised by the Permanent Way Institution that the cant of the track would be set to match the highest speed of passenger trains in timetabled service (75 to 80 mph?) but could not say what that was. It would certainly be interesting to know for sure as this fresh approach might provide additional evidence of Rous-Marten's expertise at timing.

Was there gold on board?

Several accounts of the record breaking run by *City of Truro* state that, in addition to over 1,000 sacks of mail, the train was also carrying gold specie and explain that this was in part payment by the USA for the concession to build the Panama Canal. This claim is based perhaps on an entry in the Shipping News column of the *Western Morning News* dated 10 May 1904. Under the heading of 'Arrivals and Departures — The Kronprins Wilhelm' it states 'The liner brought 84 passengers, 1,088 bags of mail and specie value 62,756 dollars for Plymouth.' Alternatively the story may be based on Rous-Marten's article in the *Railway Magazine* for June 1904 entitled 'Railway Speed' in which he says 'And its success meant that the mails ... as well as the bullion representing the American payment to France on account of the price of the Panama Canal all reached London'.

Just the tale to spice up a book or a lecture! After all in 1902 the US Congress had voted the sum of $40 million to President Theodore Rooseveldt for the purchase of the Canal concession and now work by US engineers had commenced on 4 May 1904, just five days before our record run. I wrote an appropriate paragraph and then, having noticed that the Ocean Mail train had been moved forward upon its arrival at Paddington in order to facilitate the transfer of the mail bags into Post Office vans I wondered what sort of van was waiting to carry the gold. I asked the Bank of England for information and also to confirm the amount of gold received. They could not answer the former but regarding the latter, to my surprise, said that they had no record of any gold being received from America on 9 May 1904.

Advised by the Bank, I checked the Report of the

Director of the [US] Mint for 1904. In it was a list of all gold shipments through the Port of New York and this showed that the liner *Kronprins Wilhelm* that was loaded on 2 May was carrying $3,001,938 in gold bullion, all of which was destined for France. The only gold shipment to England in the fiscal year ending 30 June was the small sum of $3,030 on 5 January.

Just in case there was gold on the train that was being shipped between private banks I then checked both *The Economist* for 10 May that contained a report on all gold movements by its US correspondent and the *Banker's Magazine* for June 1904 that also carried a similarly titled report. Both confirmed that there were no inward movements of gold to the UK; it was all going to France.

Finally, as if there was any need, I noted that in 1903 the GWR had built two special bullion vans: each was 36 feet long, 8 feet wide, no windows, one door and designed to carry 16 tons on two heavy bogies. (Later the company built three more.) If the GWR had been expecting a gold shipment on 9 May then one of those vans would have been included in the formation of the Ocean Mail train. It was not. I rest my case.

Conclusion

I conclude by confirming that volunteering for anything remains unadvisable, but can become quite exciting. Never believe all you read; authors and reporters can be careless or mistaken. But of one thing I am absolutely certain: on 9 May 1904 *City of Truro* became the first steam locomotive to exceed 100 miles per hour. I hope that I may have convinced you too!

Notes and references

1. Books consulted included: E T MacDermott, rev C R Clinker, *The History of the Great Western Railway*, Vol 2; O S Nock, *The GWR in the 20th Century*, *GWR Steam* and *Great Locomotives of the GWR*; A Vaughan, *Grime and Glory 1892–1947*; W A Tuplin, *Great Western Steam* and *Great Western Saints and Sinners*; and *The Times GWR Centenary Number.*
2. The articles by Rous-Marten are in:
   - *The Engineer*, 13 May, 20 May & 10 June 1904;
   - *Railway Magazine*, June 1904, December 1907 and April 1908; and
   - *GWR Magazine*, November 1922 — this gives the eight quarter mile timings.
3. Quoted in an article in the *Railway Magazine*, April 1932; the quote is reproduced in full in W A Tuplin, *Great Western Saints and Sinners*.
4. Personal conversation with the Secretary of the Permanent Way Institution.
5. The website is http://germansteam.info/tonup.html, compiled by Bryan Benn.

Class Distinction

'A case of considerable importance was decided in the Glasgow Small Debt Court on Monday. A boy named John McNab sued the Glasgow and South Western Railway Company under the following circumstances:- He had purchased a second class season ticket to enable him to attend school and travelled by a particular train. The Company withdrew the second class carriages from that train and insisted that he should travel in a third class carriage or pay the difference between second and first. He accordingly raised an action for breach of contract. The Company pleaded that, from a passage in their regulations, they were entitled to make what alterations they pleased in their trains. The sheriff decided against the Company and he held that, although they might alter the hour of the train or even withdraw it altogether, they could not as in this case, when they continued the train, withdraw the class of carriages at the time the contract was entered into.'

(*Manchester Guardian*, 1 January 1859)

[With thanks to Maurice Berrill for contributing this item.]

Liverpool to Manchester: Alternative Proposals
3. Tramways For Freight

Alasdair Munro

The last in the series of articles for improved transportation in south Lancashire between 1880 and 1914

The Proposed Lancashire Plateway Scheme

Alfred Holt, a Liverpool shipowner, hoping to achieve lower rates for the carriage of goods to Liverpool for shipment to his vessels for China, first suggested his 'Proposed Lancashire Plateway Scheme' in 1880. A Bill was put forward but withdrawn when it was realised that many proposals had been rather hastily thought out.

It envisaged a pair of wide plates laid along the roads with an outside guiding flange on which carts of various gauges could easily be transferred from the roads. This would eliminate unloading and reloading and the flexibility of the system would allow its use by trains of about ten carts of a wide variety of sizes and weights. They could be coupled together and hauled by steam locomotives with flanged wheels as they would not leave the metals. Wheels would be small for slow running at speeds of about 10 mph. Holt suggested that costs increased in proportion to the cube of the speed so that cutting speeds to one half would cut costs by considerably more. This, he argued would not necessarily mean slower deliveries as time would saved by the elimination of breaks of bulk and elimination of delays caused by passenger trains. Further advantages of slow speeds would be that signals would be unnecessary and wear and tear on vehicles would be reduced.

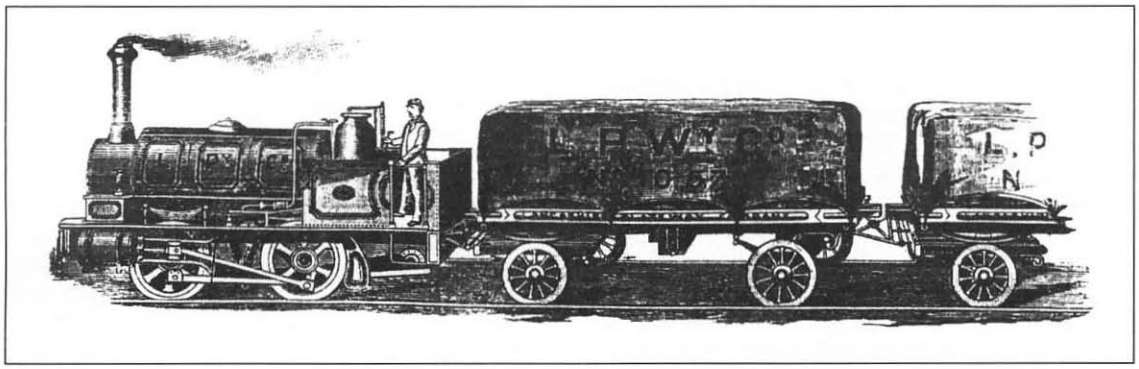
The routes originally proposed were:

1. South Liverpool to Warrington, South Manchester, Ashton-under-Lyne, Stalybridge and Oldham.
2. North Liverpool to St Helens, Ashton-in-Makerfield, Bolton, Bury, Rochdale and Oldham.
3. Ashton-in-Makerfield to Wigan, Chorley, Blackburn, Church and Accrington.
4. Chorley to Preston.

It was a network of 145 route miles in total, much of the first two routes serving very similar areas, which was the main factor in the Bill's withdrawal.

Shortly afterwards (about 1883) a modified network of about 85 route miles was suggested:

1. A main line from Liverpool to St Helens, Ashton-in-Makerfield, Pennington, Bolton, Radcliffe, Bury, Middleton, Oldham and Ashton-under-Lyne.
2. Pennington to Urmston, Stretford and South Manchester.
3. Radcliffe to Heywood and Rochdale.



Alfred Holt's plateway
(From Alfred Holt, Plateways, *1899)*

4. Ashton-in-Makerfield to Wigan, Chorley and Blackburn.[1]

The Liverpool Chamber of Commerce invites proposals

In 1894 the Liverpool Chamber of Commerce's Manchester Ship Canal Committee had expressed concern that railway carriage rates tended to favour railway ports such as Hull and Fleetwood which were taking much of Liverpool's trade with the South Lancashire towns. Light railways were seen as a possible way of cutting transport costs, and in 1896 the Chamber formed a Light Railway Committee. In 1898, it reported on the seven papers submitted in response to its invitation for schemes for light railways to link Liverpool and Manchester.

Alfred Holt's 'Proposed Lancashire Plateway Scheme' revived

Two alternative routes were suggested: the earlier (modified) route and the other a shorter line (about 31½ miles in length) which would commence at a point opposite Huskisson Dock, Liverpool, and terminate at 'a spot in Manchester adjacent to the main thoroughfares'. Holt believed that a network would soon extend all over the country but the Committee felt that the plateway was already an obsolete system which allowed the wagons too much free play.[2]

Nevertheless, the following year Alfred Holt published a short pamphlet, *Plateways* in which he described his previous proposals fully and hoped that they would still be implemented in the future.[3]

E R Calthrop's 'Lurry Platform Carrier Railway'

Another proposal came from the famous light railway advocate, E R Calthrop, who advocated a standardised form of light railway. He saw 2'6" as the ideal gauge as this allowed optimal loadings (though he accepted that in difficult conditions 2'0" was sometimes necessary). Rolling stock should consist of transporter trucks with an axle-load limited to 5 tons to reduce wear on lightweight rails.[4]

To test his theories, the Barsi Light Railway Company (India) had been formed in 1895 and the 21½ mile line from Kurduvadi to Barsi had opened in March 1897.[5]

He now proposed a 'Lurry Platform Carrier Railway' — a 2'6" or metre gauge line along existing highways or, in some cases, roads specially constructed. An extra rail would be laid alongside existing railways in the Liverpool dock areas to make them into mixed gauge. Break of bulk at termini would be minimised by the use of transporter trucks which could carry lurries (lorries). Horse traction would be used at termini and locomotives on the main lines.

The committee believed that this scheme would meet with great opposition and, as it was intended to rival existing railway lines, was unlikely to be authorised under the Light Railways Act which was specifically intended to help the development of transport in underdeveloped areas.[6]

Though not recommended, Calthrop was soon able to implement his plans in Britain, with the opening in 1904 of the 2'6" gauge Leek & Manifold Railway on which transporter trucks were introduced to this country.[7]

R H Scotter's 'Terminal Light Railway Scheme'

A very similar scheme — the 'Terminal Light Railway Scheme' — for a network of 2'6" gauge railways throughout Lancashire was submitted by R H Scotter but differed only in minor detail from E R Calthrop's. He, too, advocated the use of transporter trucks but proposed that all the dock lines should be completely relaid on the narrow gauge except for the line along the Dock Road and its sidings to Riverside Station and to the goods stations where there would be transfer facilities for narrow gauge trains. Scotter pointed out the various advantages of narrow gauge lines around the docks: they could be built with curves as sharp as 2 chains radius, be constructed on narrow quaysides and through sheds and could use traversers.

G F Ransome's 'Haulage by Road Locomotives Scheme'

This would have dispensed with rails altogether and used road trains of a condensing locomotive and four trucks on existing streets leaving Liverpool from Wapping Dock by Mersey Street, Canning Place, Hanover Street, Ranelagh Street, Lime Street, London Road, Prescot Street, Kensington and Prescot Road to Old Swan and through Prescot.

The committee doubted the ability of the locomotives to cope with the very steep gradients which would be encountered in Prescot and in Prescot

Street, Liverpool, and believed that wear and tear on the locomotives would be excessive. There would be a maximum speed limit of 4 mph, which was no greater than a fast canal barge, and Ransome's estimate of these trains carrying 100 tons a day was far short of what the Committee's envisaged.

J Tertius Wood's 'Tramway and Canal Scheme'

This scheme saw existing canals as an adequate basis for transport in the region if they could be linked by a standard gauge railway with steam locomotives hauling transporter trucks carrying carts or canal boats.

The projected line would be 38 miles long leaving the Mersey Docks & Harbour Board lines in north Liverpool running alongside the Leeds–Liverpool Canal with which it would connect at Aintree, passing north of St Helens where there would be a short line to the Sankey Canal. There would also be connections to the junction of the Leeds–Liverpool Canal (Wigan branch) and the Bridgewater Canal near Leigh and with the Bury & Bolton Canal. The line would terminate at the Rochdale Canal at Failsworth — a route which, it was hoped, would attract a great deal of coal traffic.

Colonel A H Holme's 'Goods Railway Scheme'

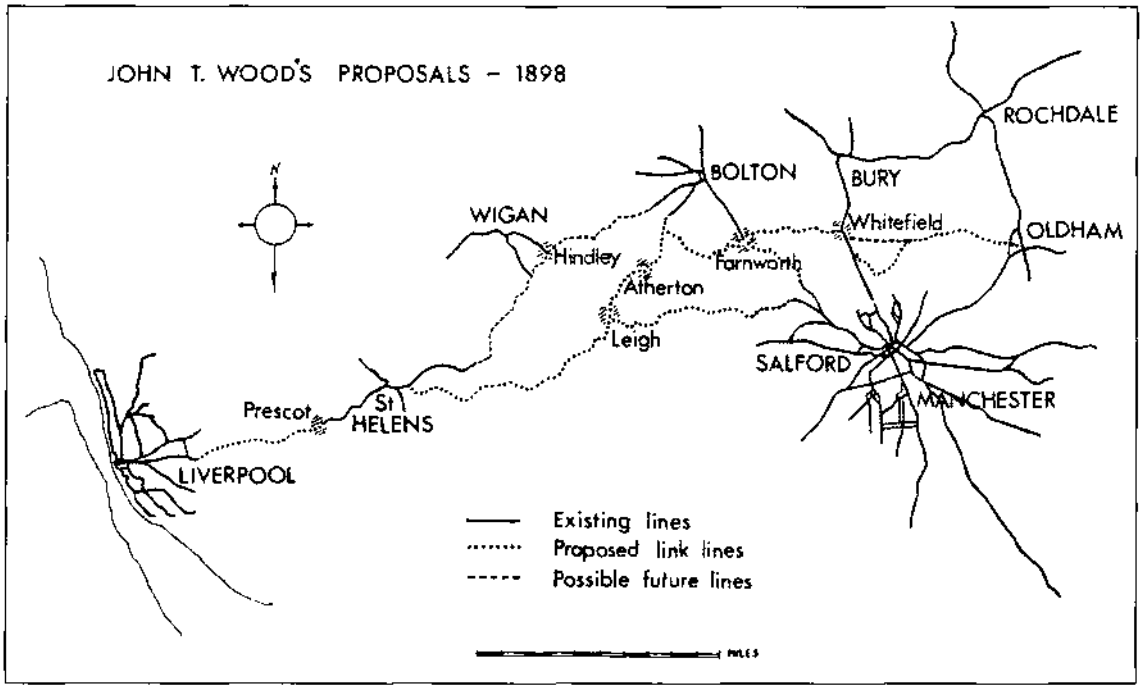
This proposed standard gauge lines connecting with the Mersey Docks & Harbour Board's existing lines. New lines would be built on either side of the streets running inland from the docks passing under the lifts of warehouses. The main line would avoid interference with other traffic by passing under the built-up area of Liverpool in a tunnel. The main marshalling yard would be constructed at Herculaneum Dock (Dingle) and the line would run more or less parallel to and a little to the north of the Cheshire Lines Committee railway.

Although there were few innovative features except that it would be dedicated to goods traffic, this was the Committee's recommended scheme, but it was never constructed.

John T Wood's 'Tramway Scheme'

It was the 'Tramway Scheme' proposed by John T Wood (not to be confused with Tertius Wood) which was to prove the most practicable and which came closest to implementation in the south Lancashire tramways.

Liverpool Corporation was already intending to extend its tramway from the Old Swan terminus to



Knotty Ash. John Wood suggested a new line which would link Knotty Ash to the St Helens network. From the St Helens terminus at Haydock a line would run eastwards through Newton-le-Willows, Leigh, Atherton, Farnworth, Whitefield, Middleton and Oldham, with branches from Leigh and Farnworth to link with the Salford system. At Farnworth, it would connect with Bolton's trams, at Whitefield with Bury's and at Prestwich with Manchester's. A possible future line would connect the St Helens system to Bolton's at Westhoughton. Freight trains from Liverpool through to most South Lancashire towns would be possible, though not, of course, over Wigan's narrow gauge lines whose termini it would pass at Hindley and Platt Bridge. Trains would be hauled, where possible, by electric locomotives and by steam over sections not yet electrified.

To avoid running goods trains over already densely-trafficked tramways through crowded city streets, a freight-only line was proposed from the South Docks along Hanover Street, Ranelagh Street and Brownlow Hill, with a large marshalling yard near to Knotty Ash.

Wood referred to the fact that the St Helens & District Tramways Company used 'steam engines as their motive power and also run occasional goods wagons'. (Presumably this was for the company's own needs as there was certainly no extensive goods traffic on the system.) Wood felt that, since the main line passed through so many colliery districts, steam would be the most economical form of traction, although this would depend on the form of power adopted generally by other networks along the system.[8]

Linking the tramways of south Lancashire

John T Wood's idea of linking the existing tramways soon partially materialised. On 25 June 1902 Liverpool Corporation's extension from Old Swan to Knotty Ash and a line, operated by Lancashire Light Railways Company (LLR), from Knotty Ash to Brook Bridge, Prescot, were opened. The Knotty Ash to Prescot line which was authorised by a light railways order of 10 March 1899 would connect at Prescot with the New St Helen's & District Company's line. (This company had taken over operations in St Helens in 1898.)

Although through running was not possible until there was a physical connection at Knotty Ash, there was immediate co-operation between Liverpool Corporation, the two tramway companies and the Cheshire Lines Committee to allow through ticketing between Southport (Lord Street) and the Prescot and St Helens area, transferring between railway and tram at Knotty Ash & Stanley Station.

Meanwhile rapid progress was being made to fill the gaps between the tramways of the other South Lancashire municipalities. The South Lancashire Tramways Company (SLT) was formed for that purpose on 6 August 1900 and in 1906 became part of a new company, Lancashire United Tramways, which included LLR and acquired a controlling interest in the New St Helens & District Tramways Company.[9]

The construction of a network of about 75 route miles of tramways was authorised by the three South Lancashire Tramways Acts of 1900, 1901 and 1902, though many were never built.

The 'main line', authorised by the 1900 Act,[10] was opened in stages between 20 October 1902 and 4 April 1903 from the Haydock terminus of the New St Helens Company through Ashton-in-Makerfield, Platt Bridge, Hindley, Hindley Green, Atherton, Tyldesley, Boothstown and Worsley to Swinton with branches to Winton, Bag Lane, Atherton and various short lines in Atherton.

Through running was now theoretically possible between Liverpool and the South Lancashire towns (St Helens, Bolton, Bury, Rochdale, Salford and Manchester). Through running into Wigan was precluded by Wigan's use of the narrow 3'6" gauge but the line met Wigan cars at Hindley and Platt Bridge termini.

Between 1905 and 1913 a few more extensions did open (Tyldesley – Boothstown, Brookhouse – Walkden, Lowton – Lowton St Mary's Station, Walkden – Swinton – Worsley – Boothstown, Worsley – Winton, Walkden – Little Hulton – Buckley Lane Ends) giving greater notional access to South Lancashire towns. A few lines in Farnworth, Kearsley and Barton were leased by SLT.

Apart from a short-lived service from Liverpool Pier Head to St Helens from 18 May 1903 to 13 December 1905 and an unsuccessful attempt to revive it in the late twenties[11], the potential for inter-urban services was never developed as SLT operated only a few local passenger services. This is perhaps not surprising as the circuitous main lane and very slow speed limits prevented any serious competition with the much more direct and faster railways except during emergencies such as rail strikes or for leisurely

excursions. A journey from Liverpool Pier Head to Deansgate, Manchester, was possible by tram but involved a 37½ mile journey of about 4½ hours travelling time with changes at Prescot, St Helens, Ashton, Atherton and Swinton (or Worsley).[12]

Of more significance are a number of lines authorised but never built. The 1900 Act authorised a line from the St Helens boundary at Parr on through Newton, Lowton St Mary's and Atherton to the authorised terminus of the Bolton system at Hulton Lane. If this and the proposed Leigh – Boothstown sections had been constructed there would have been a much more direct southerly route from Liverpool to the cotton towns (similar to John T Wood's proposal) avoiding the devious route through Atherton and Haydock.

The South Lancashire Tramways Act 1901[13] granted powers for a line which would have provided a second route into Liverpool, leaving the Prescot Light Railway just west of Brook Bridge, along a private right of way to Derby Road / Archway Road, Huyton, then along Roby Road and Broadgreen Road, terminating beyond Bowring Park at the Liverpool boundary to meet a line authorised (though not built) from Old Swan to the City boundary along Broad Green Road.[14]

Freight by tramway

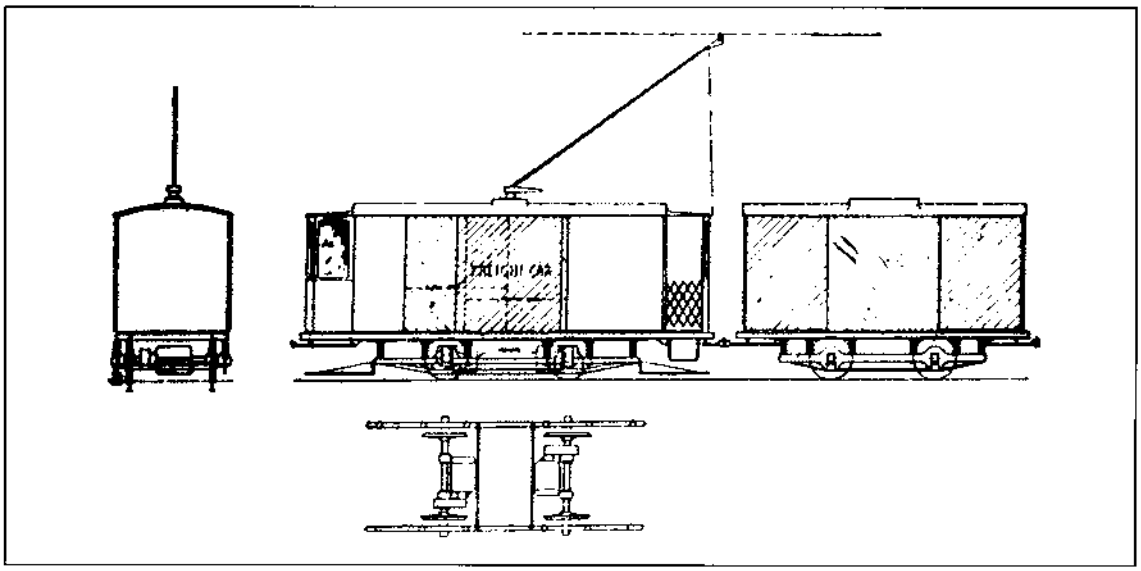
Proposals for the carriage of freight, however, were revived from time to time. Almost as soon as through tramway links between Liverpool and the south Lancashire towns were authorised, the idea of using them for freight was again put forward. In a lecture delivered to the Liverpool Engineering Society on 29 January 1902, Alfred H Gibbings suggested that connections should be laid from the tramways to dockside warehouses to enable freight to be moved directly to south Lancashire towns where special lines and sidings could be laid in some cases with small depots to allow transference of goods to road vehicles for the more remote destinations. He considered that this would be much cheaper than the cost of transshipment between existing modes of transport.

Two types of rolling stock were suggested: one, a modification of a type used in Pittsburgh, was an enclosed single truck car and trailer; the second would have to be some kind of container truck to minimise the costs of break of bulk which differences of gauge would necessitate — although most South Lancashire systems were standard gauge, Rochdale and Wigan had 3'6" lines whilst Blackburn, Accrington and Darwen's were 4'0". This would also be needed to facilitate and reduce the cost of transshipment to mills and warehouses away from the line where it was necessary although many nearby sites could be served by spurs and sidings. Gibbings considered Cowan's Patent: a container on rollers which could easily be moved from one truck to another and a similar vehicle used on the Donegal Railway which had 5'3" and 3'0" lines. His preference, however, was based on a type used on the South Eastern Railway's cross-channel services: a larger container lifted by crane between different modes of transport.

The locomotive would have maximum traction bogies (according to the illustration) and the trailers would have equal wheel bogies. These would carry a detachable van (a type of container). To meet 'environmental' concerns and to minimise the need for shunting and marshalling, trains would consist of a motor car with no more than a single trailer.[15]

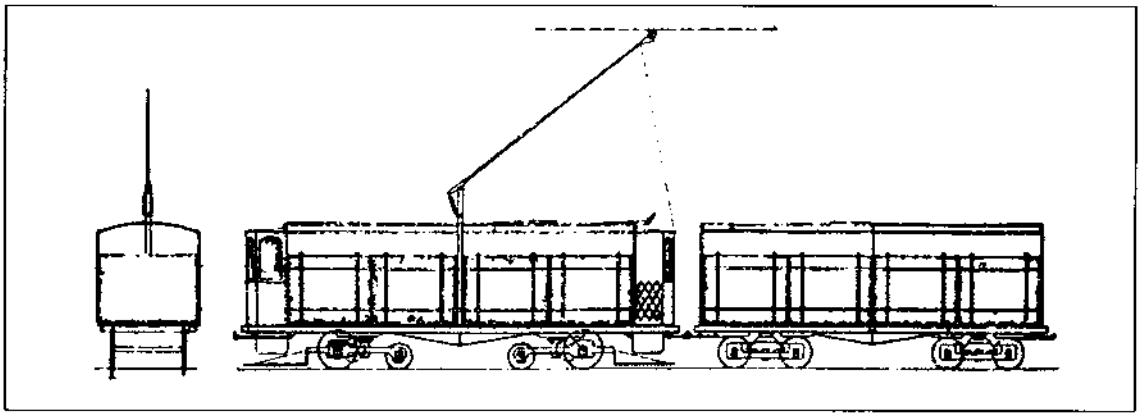
In September of the same year a sub-committee was set up by Liverpool City Council to consider the practicality of running freight trains on street tramways in Liverpool and other south Lancashire towns. It proposed that trains should run within the dock estate, subject to Mersey Docks & Harbour Board (MD&HB) agreement, and that they should be connected to the SLT line at Knotty Ash. To avoid running through the city centre, entirely new lines would be constructed from the North Docks along Merton Road and Breeze Hill (in Bootle) then Cherry Lane and through West Derby and from the South Docks through Toxteth, Wavertree, Rathbone Road and Old Swan.

Liverpool City Council agreed to the suggested link lines, SLT was willing to double its track to cope with the extra traffic, and MD&HB was happy to co-operate. On the other hand St Helens Corporation was unenthusiastic about goods traffic through the town[16] but was not entirely opposed, and on 25 July 1902 signed a second lease with the New St Helens Company allowing freight traffic except between midnight on Saturday and midnight on Sunday.[17] The main objection came from Bootle Corporation. In rather acrimonious correspondence between the two Town Clerks, Bootle proposed a link from the northern end of the docks (which would have attracted less traffic) from Regent Road to Knowsley Road (on which passenger services already ran), Linacre Lane, Hawthorne Road, Aintree Road, and the 'new



Proposed vehicles for the 1902 freight scheme

(A H Gibbings, 'Conveyance of goods on electric trolley lines', Liverpool Eng Soc Transactions, *1901/2)*



road to the Gaol' (Hornby Road) to Rice Lane, which was considered unacceptable.[18] There was also much opposition from the citizens of Liverpool who rejected the proposals at a town meeting. The scheme was put into abeyance for ten years.[19]

On the other hand, the proposals could have benefited industries along the route such as British Insulated & Helsby Cables in Prescot who, in March 1903, requested a siding into their works.[20]

St Helens Corporation agreed to freight traffic in January 1902 but later realised that the power station would have to be manned at night. The SLT Act 1900 forbade freight between 5am and 11pm The Corporation believed that SLT's estimated traffic would require trains at five minute intervals all night, and in early 1903 consent was withdrawn.

SLT appointed T Upton as Goods Manager but freight was limited to parcels traffic which commenced on 9 March 1903.[21]

Revival of interest

By 1913 complaints about the slowness and cost of moving cotton between the port and the manufacturing towns were increasing; interest in the through operation of tramways for both passengers and freight, which had been a practical possibility for many years, was revived. Mr C R Mallins, Liverpool Tramways' General Manager, gave full details of the implications of such a scheme in a report

to the City Council. His recommendations were very similar to those of 1902 except that the possible use of 'trackless trolley vehicles' was considered as a much cheaper alternative to trams. Although no other town had previously used its tramways for the carriage of freight on such a large scale, Mr Mallins believed that the dependence of the cotton mills on the port would make such a scheme worthwhile in Lancashire. The cost of carrying raw cotton from Liverpool to Bolton was 8/4d or 3.125d/ton-mile which Mr Mallins believed could be reduced to 2.75d.

The frequency of passenger services on the Liverpool to Knotty Ash route (four minute intervals off-peak and ninety seconds at peak times) precluded the line's use for freight and new freight-only lines would be needed to link the north and south docks with Knotty Ash. However he was cautious and suggested running three or four freight trains daily for an experimental period before any commitment was made to large scale improvements. If successful, the following freight-only lines would then be constructed:

- From Brunswick Dock (at the south end) along Hill Street, Upper Hill Street, Parkway, Selbourne Street, Beaumont Street, Earle Road, Wellington Road, Rathbone Road, St Oswald Street to join the Knotty Ash Line at Old Swan.
- From Brocklebank Dock (at the north end) along Millers Bridge, Balliol Road, Breeze Hill, Walton Village, Cherry Lane, New Hall Lane, Broad Lane. Almonds Green, Town Green, Leyfield Road, Honeys Green Lane and Eaton Road to Knotty Ash.
- A new double track line along the dock road was also considered desireable. Although it might still be possible to use the MD&HB's lines which ran within the dock estate parallel to the Dock Road but this would considerably increase traffic along it. Spurs would lead from the main line along the docks onto the main quays to speed up transport of goods between the docks and nearby warehouses.

The two links from the docks to Knotty Ash would generally be single track lines with passing loops.

Mallins envisaged trains of two wagons with capacity for 25 tons each. They would be hauled by electric locomotives except within the dock estate where it was proposed that battery locomotives should be used rather than electrifying the lines as had been previously proposed.

It was thought practicable to operate 144 trains daily even before SLT carried out its promised improvements to the track. This would require 14 locomotives and 28 wagons. When the line was improved to its full capacity freight trains could be run at ten minute intervals with 36 locomotives and 72 wagons.[22]

As well as linking the Lancashire towns, only an eight mile break from Littleborough (Summit) to the Halifax terminus at Hebden Bridge prevented continuity with the West Riding network. Whilst Bradford's trams were 4'0" gauge, that does not seem to have been an insuperable problem as dual gauge cars with adjustable wheels operated a service between Leeds and Bradford.

* * *

Any hope of implementing these grandiose schemes was ended by the First World War.

Liverpool Corporation Tramways acquired the former Liverpool & Prescot Light Railway in the early 1920s.[23]

The end of this great tramway network came when the South Lancashire Transport Act 1929[24] sanctioned the conversion to trolleybuses, the last SLT trams running in 1933.[25]

Notes and references

It has not proved possible to establish who drew the map reproduced on page 45. The editor apologises for any infringement of copyright.

1. The Incorporated Chamber of Commerce of Liverpool, *Report of a Special Committee on Light Railways*, 1898; Alfred Holt, *Plateways*, 1899 (Liverpool Printing and Stationery Co); Adrian Jarvis, 'The Port of Liverpool and the Railway Companies', *Docks, Railways and the Movement of Goods* (papers presented at a Research Day School. University of Liverpool / National Museums & Galleries on Merseyside, 12 November 1994), 74
2. Liverpool Chmbr of Commerce, *Report*, 1898, op cit
3. Alfred Holt, *Plateways*, op cit
4. Liverpool Chmbr of Commerce, *Report*, 1898, op cit
5. W J K Davies, *Light Railways*, 1964, 153 and 273–5
6. Liverpool Chmbr of Commerce, *Report*, 1898, op cit

7. Ernest F Carter, *The Railway Encyclopaedia*, 1963, 176
8. Liverpool Chmbr of Commerce, *Report*, 1898, op cit
9. E K Stretch, *The South Lancashire Tramways Company 1900–1958*, 1972 (Manchester Transport Museum Society), ch 2 & 4; T B Maund & M J Ashton, 'The Tramways of St Helens', *Tramway Review*, no 179, Autumn 1999, 103; Liverpool Corporation Tramways, Annual Reports of the General Manager, 1902–4; 'Road Passenger Transport in South Lancashire', *Modern Transport*
10. 63–64 Vict 243
11. Liverpool Corporation Tramways, Annual Reports of the General Manager, 1902–4; Maund & Ashton, op cit, 103; Stretch, op cit, 19,30
12. John Lingard, *Where to go by Tram*, 1924: Manchester Transport Historical Collections
13. 1 Edw VII 267
14. J.B.Horne & T B Maund, *Liverpool Transport*, vol 2, 1982, 54
15. Alfred H Gibbings, 'Conveyence of Goods on Electrical Trolley Lines', *Liverpool Engineering Society Transactions*, vol 23, 1901/2
16. Liverpool Corporation Tramways, Annual Reports of the General Manager, 1902–4
17. T B Maund & M J Ashton, 'The Tramways of St Helens', *Tramway Review*, no 183, autumn 2000, 255
18. Correspondence between Liverpool and Bootle Corporations, 19, 24 & 26 November 1902; Liverpool Records Office
19. Report on the Conveyance of Goods on the Tramway System, 5 December 1913, Liverpool Council Proceedings 1913/4
20. T B Maund & M J Ashton, 'The Tramways of St Helens', *Tramway Review*, no 183, autumn 2000, 259
21. Stretch, op cit, ch 5
22. Liverpool Corporation Tramways, Annual Reports of the General Manager, 1902–4
23. Stretch, op cit, Ch 5; T B Maund & M J Ashton, 'The Tramways of St Helens', *Tramway Review*, no 180, winter 1999, 259; E K Stretch, *St Helens Tramways*, 1968 (St Helens Corporation Transport), 26–7; T B Maund, 'The Liverpool & Prescot Light Railway', *Tramway Review*, no 165, summer 1996, 173–5
24. 19–20 Geo V 83
25. T B Maund, 'The Liverpool & Prescot Light Railway', *Tramway Review*, no 165, summer 1996, 216; 'Road Passenger Transport in South Lancashire', *Modern Transport*

From a Railway Historian's Notebook

Rex Christiansen

The eighth in the occasional series

Researching railway history can produce some surprises. It happened when I thumbed nearly 1,000 pages of the GWR *Holiday Haunts* guide for 1939 and found almost at the end, several pages of Tide Tables. They included those for the momentous morning of Sunday 3 September. They showed that the tide in the Thames Estuary had begun to flood upstream shortly before Neville Chamberlain spoke to the Nation and announced Britain had declared war on Nazi Germany.

Holiday Haunts carried Tide Tables for Liverpool, London and Bristol, stated to be 'Ports and Seaside Resorts Served by the GWR'. The Guide added 'When arranging a weekend visit or organising a Works, Office or Choir outing to a seaside resort it is often desired to select a date when the state of the tide is advantageous. The Tide Tables for April to September will therefore be extremely helpful.'

Those for Liverpool and London were supplied by the Liverpool Observatory and Tidal Institute, which now, as then, dominates the ridge of Bidston Hill at Birkenhead. It is a familiar sight to passengers on the West Kirby and New Brighton branches of Merseyrail — both built by the Wirral Railway and electrified by the LMS only 18 months before the outbreak of war. The Observatory, now the Institute of Oceanographic Sciences, played a vital wartime role, predicting tides for allied invasions in several parts of the world, including the D Day landings in Normandy.

Trials for Cleansing Rivers and Canals in Shropshire, 1796

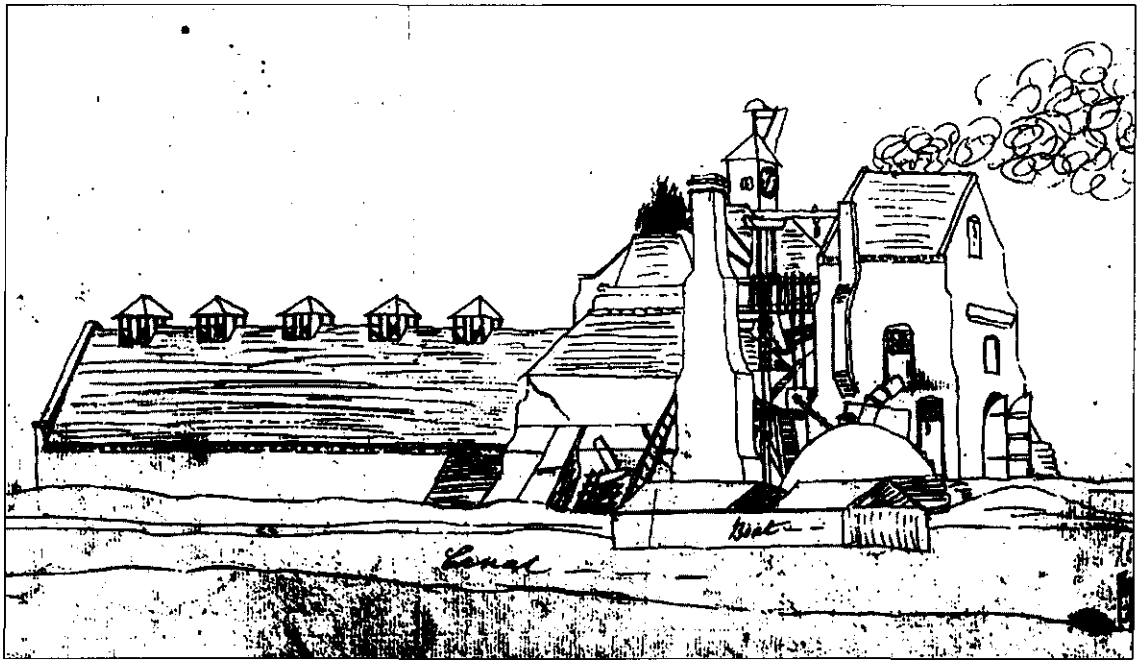
Paul Luter

During the bi-centennial celebration in June 2003 of William Reynolds, the Ketley-based ironmaster (1758–1803), a quantity of drawings in his engineering sketchbook in the Science Museum, London, were brought to the author's attention. These were reproduced in an article by H W Dickinson, 'An 18th Century Engineer's Sketch Book', in *Transactions of the Newcomen Society*, vol 2 (1921/2), 132–140.

A set of sketches[1] dated September 1796 shows a general elevation, plan and section scale 1:50, together with various details, of a machine invented by Augustine de Betancourt Molina[2] for cutting weeds on rivers and canals. Dickinson associated these with another sketch (reproduced below) dated September 1796 which depicts a rather ark-like boat moored on a canal right outside a blast furnace complex. The furnace has been identified as William Reynolds' Queenswood furnace, the only one so close to the Shropshire Canal.[3] A different source, the Brierly Hill tunnel accounts, contains a scale drawing of some iron jointed plates made at Reynold's Ketley furnace for Mr Betancourt, dated January 1796.[4]

Further research has linked these drawings to a mechanical engineering development tested on the river Severn and the newly opened Shropshire Canal system. As early as 1794 the Shropshire Canal Company had appointed a person to keep a watchful eye on the weeds growing in the canal.[5]

In addition, every day between the autumn of 1789 and December 1800 for a period of eleven years William Reynolds had a record kept of the depth of



Drawing 57 in William Reynold's sketchbook, dated September 1796, probably of the Queenswood Furnace on the Shropshire Canal. Note the interesting boat, thought to be the experimental boat for dredging weeds from waterways.

(From H W Dickinson, 'An 18th Century Engineer's Sketch Book' in Transactions of the Newcomen Society, *vol 2 [1921/2])*

water in the River Severn at Coalport. Both Joseph Plymley's *The Agriculture of Shropshire* (1803) and Mr Aikin's *Valleys and Watercourses* (1818) discuss these measurements, which were essential to Betancourt's scheme. For example, the river's depth varied from seven feet on 1 January 1796 decreasing gradually to five feet by 5 January 1796. The level continued to descend to just three feet nine inches by 13 January 1796 and for the rest of the month only during 14–17 January did the river return to a level above five feet. The level was suitable again for a boat of the size constructed only between 1–3 and 6–13 February and would have proved impossible from 20 March to 9 May, when the river was less than three feet deep.[6]

During this time Augustine de Betancourt started to work with William Reynolds, although Reynolds was actually relinquishing some of his business in the north-east of the Coalbrookdale coalfield.

In January 1796 the two began working together to perform maintenance on a float wheel designed to drive a river mill at Coalport where the initial concept was modified by Betancourt. They then commenced working on a new boat for cutting weeds.

The design and operation of the machine

On 1 May 1796 Betancourt Molina replied to Samuel More, then President of the Society for the Encouragement of Arts, Manufactures and Commerce acknowledging the receipt of a letter dated 27 April informing him that the Society had adjudged its premium of forty guineas to him for inventing the contrivance for cleansing rivers and canals. The Mechanics Committee had examined the drawings of the boat between January and April 1796; Betancourt's drawings and calculations have survived for us to see today.[7]

The Mechanics Committee reported that the mechanism itself was bolted to the barge as can be seen in the accompanying diagram (reproduced opposite) and that X, which measured ninety degrees, was made of wood and was fastened to an upright post and beam, which in turn was fixed to the bottom of the barge. Every five degrees there was a notch or hole in X where an iron pin could be located. The adjustment of this pin in turn fixed the perpendicular action of IJ and was set according to the plane where weeds were growing. The cross beam supported G and moved upon an axis X to its lower end and was set in proportion to the depth at which the machine was to cut. Two iron pieces fastened to the beam I and to the cross post J received a bolt L, which slotted into the teeth of the part F. An iron bolt passed through the two iron parts at K, by which point I was brought to a position perpendicular to the plane where weeds were growing. An axis was fixed at the top of the IJ crossbeam on which turned the lever N.

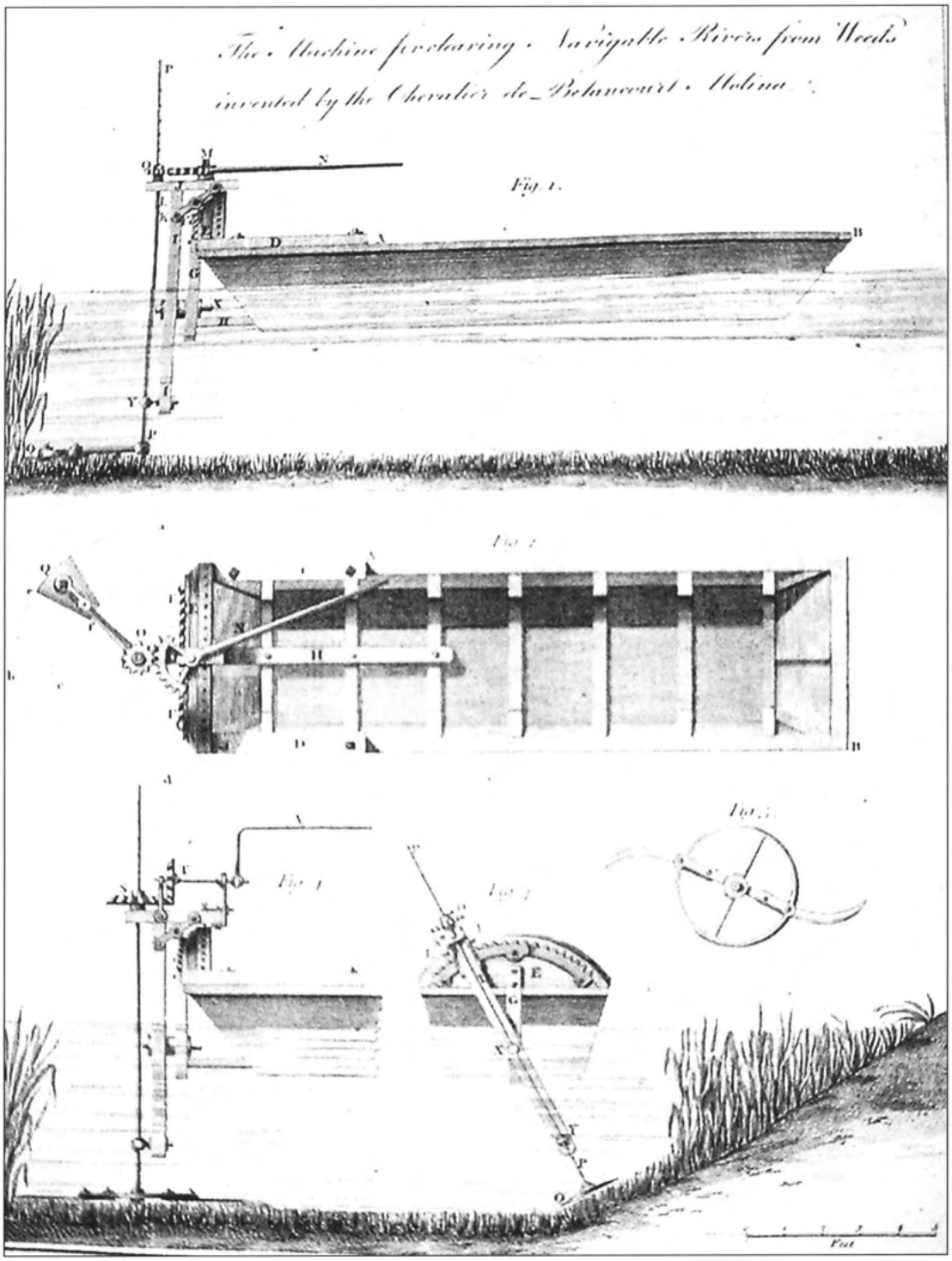
The cutter, operated by a handle, was sharp and was said to cut weeds very effectively. Two alternatives blade assemblies were depicted, one with a side-to-side action and one with a rotary action. Betancourt stated that the machinery was most effective when the depth of the water was first ascertained and the correct adjustments made to the blade. The cutter was best set at a depth six inches above the bottom of the river or canal. The angle of the slope of the sides of the channel was one of the essential measurements for the effective operation of the machine. The speed of the blade was also mentioned as being something of note. The blade would require a skilled operator.

Betancourt was careful to explain to the Society that he was developing a machine which would not destroy the texture and fibres of grasses which would have prevented the banks being washed away. He also saw the potential danger of the machine, which could create an accumulation of earth at the bottom of any river or canal navigation and render it impractical. The boat was pulled from the towpath using a team of horses, a rope being attached to a harness.

Several men were needed to operate the boat. Firstly a pilot; secondly a man to wind and adjust the hand-wound barrel to operate the scything mechanism under the boat. A third man may be needed on the bank to inform the pilot of any obstacle and to inform the barrel operator of any adjustments needed to the mechanism. Fourthly a man would be positioned at the rear of the barge to draw up the loose weeds with a hook or net.[8]

Construction and trials

On 4 March 1796 the Brierly Hill tunnel accounts tell us that under the supervision of a young engineer named Daniel Rose, a senior assistant at the Horsehay Works, the parts for the boat were being prepared for transportation to the River Severn in four sections and carefully marked with white lead oil. The accounts contain a sketch showing the shape and arrangement of the plates ready for transportation.[9]



'The Machine for Clearing Navigable Rivers from Weeds'
(Transactions, *vol 14 [1796], Mechanics Committee, plate 5, RSA Archive, London)

The iron boat trialled on the River Severn was flat-bottomed and was between 18 and 20 feet long, 5 feet 6 inches wide and 2 feet 6 inches deep. The measurements were adapted later to suit different navigations.

During February 1796 through to the end of April, Betancourt and Reynolds waited for the river level to return to a height at which the boat could operate, and by May/June they had decided to move the trials onto the Shropshire Canal. This proved a wise decision as the river did not return to a level above three feet for the rest of the year.

There is no doubt in the author's mind that the fact that Reynolds' drawing, mentioned at the outset of the article, was dated September 1796, just five months after the invention was officially recognised, reinforces the deduction that the boat had been trialled not only on the River Severn, but also on the Shropshire Canal, and even on Reynolds' privately-built Ketley Canal.

The reason for the development of this machine and Reynolds' role in its construction is consistent with the development of the Severn Navigation and with the wishes of its committee to maintain the navigability of its waters.

* * *

After 1815 Betancourt used a machine embodying the same principles when improving the navigation of the River Volga and the construction of navigable waterways in the Nijni Novgorod area.[10]

Although Augustine de Betancourt Molina was a man of international importance at the time of William Reynolds, he and his invention have been largely forgotten in the context of waterway history. However, Betancourt's role in tackling the problem of weeds on rivers and canals was seized upon quickly by the highly-respected William Reynolds.

The author would very much like to hear from other members regarding any accounts of the use of this invention on other rivers or canals.

Notes and references

1. Drawings 94, 99, 100, 102 and 103.
2. Augustine de Betancourt Molina was born in 1758 in the Canary Islands. He was a polymath, a brilliant engineer and a great artist, regarded by many historians to be the Spanish equivalent of Leonardo da Vinci. He studied at the École des Ponts et Chaussées in Paris and founded the Escuela de Ingenieros de Caminos y Canales in Madrid.

   He travelled to England, visiting Boulton & Watt but was not shown their steam engine. On his way back to London he saw a double-acting steam engine working in a flour mill, from which he deduced how it worked and Watt's innovations, knowledge he put into practice when he returned to the continent.

   He built Spain's first optical telegraphy system connecting Madrid and Aranjuez; he was also the first to fly a hot air ballon in Spain. On the eve of the French invasion of Spain he went to Russia, where he undertook various civil engineering works and founded the Corps of Civil Engineering. He died at St Petersburg in 1824.
3. The Queenswood furnace was situated at the most southerly tip of the parish of Wombridge 300 yards from the Hollinswood furnaces and only 600 yards from the sixth largest ironworks in England at Old Park furnaces. It was also just under 1,000 yards from the furnaces formerly owned by John Wilkinson at Snedshill. The furnace was situated very close to the bank of the Shropshire Canal. A small wharf was built by William Reynolds to serve this important site. The furnace was built about 1795 and by 1802 was making high quality pig iron for Boulton & Watt, which was 'found to answer very well'. In 1803 the Queenswood furnace was valued at £840. It was still in existence in 1814.
4. Shropshire Archives, 6001/334
5. In 1794 the Shropshire Canal Company agreed to pay William Rochelle, a Quaker from Nantucket Island, USA, 60 guineas to keep the canal free from weeds and to keep marker posts in good repair, replacing them if lost. This shows how concerned the Shropshire Canal Company was about the problem of weeds.
6. On 17 September 1870 the *Ironbridge Weekly Journal* reported that a level of 2 feet 3 inches was insufficient for trade to be attempted even downstream.
7. *The Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce*, vol 14 (1796), plate 5: RSA Archive, London. The Society received its Royal Charter in 1847.
8. Minutes of the Mechanics Committee, Society for the Encouragement of Arts, Manufactures and Commerce, May 1796
9. Shropshire Archives, 6001/334
10. A R Armas: *Agustin de Betancourt, Fundator de la Escuela de Caminos y Canales*, 1968 (translation published by the Institure of Civil Engineers, 1996), 286–7

From the RCHS Photographic Collection

No 24: JGS 322

The location of this view was Bere Alston, in Devon, looking south. The main London & South Western Railway lines to Plymouth are on the left and the Plymouth, Devonport & South Western Junction railway line to Callington is on the right. The locomotive is an LSWR class O2, an 0–4–4T. The date is probably the mid 1930s as the signal on the right was later replaced with a Southern Railway upper quadrant arm. There were four bridges numbered 683 on the SR: two on the SECR, and one each on the LBSCR and LSWR. This was LSWR bridge number 683 and the numbering ran in sequence towards Plymouth. Thanks are due to Alan Brackenbury, John Edginton, Gerald Jacobs, Tony Jervis, Roger Merry-Price and Matthew Searle.

Stephen Duffell

No 25: TT 51/24, 26

The Transport Trust photographs held by the RCHS all supposedly relate to buildings with a 'transport' history, be it rail, canal or road. These are views of a bridge in Manchester in the Deansgate / Whitworth Street area. Which bridge is it, who built it, when, and for which railway company?

If you can identify it, please contact Stephen Duffell, Hillcroft, Ford, Shrewsbury SY5 9LZ, telephone 01743-851154 or e-mail duffell@tesco.net.

Correspondence

The society's 'house colour'

(*RCHS Journal*, November 2004, 695)

Grahame Boyes' letter has stirred a memory of the choice of blue for the Society's 'house colour'. At the first Council meeting, as Hon Secretary I was asked to obtain a supply of printed letter-headed notepaper. I asked, 'What colour?' Clinker suggested green, but I saw Baxter shaking his head. Greville said he didn't mind what colour was used provided it wasn't red or black. So I visited a local jobbing printer and chose a serifed typeface in royal blue, which I thought looked appropriately dignified for what we hoped would become a learned society, and blue has remained our house colour ever since. **Gordon Biddle**

Engineering dynasties: Cubitt

(*RCHS Journal*, November 2004, 658–9)

I refer to the Cubitt paragraphs in Professor Buchanan's article.

First, there is no evidence that Joseph and Jonathan were brothers. It would seem that Joseph (the father of Sir William and Benjamin Cubitt), was a son of Richard Cubitt (c1729–1800) and his wife Martha, née Temple, who were married at Worstead in 1746. Jonathan (the father of Thomas, William and Lewis Cubitt) was a son of William Cubitt (1725–1802) a butcher, of Swannington, and his wife Mary, née Hall, married at Mattishall in 1747. In 1772, the churchwardens and overseers of Swannington certified that William, Mary and their two sons, Thomas and Jonathan (the latter aged eleven), were inhabitants of Swannington and indemnified the parish of Lammas, whither the family had moved, from any liability arising from their change of settlement.

Joseph and Jonathan did not follow the same trade. Joseph was a miller, successively at Dilham, Southrepps and Bacton Wood. Jonathan was a carpenter and joiner, so described in 1793 when he, late of Buxton (which adjoins Lammas) and since of Great Yarmouth, as an alternative to bankruptcy, assigned his estate and effects to a trustee for the benefit of his creditors. Following Jonathan's death in 1807, his creditors were advised to send their accounts to an address in Norwich in order that they might receive a dividend.

Joseph Cubitt, besides four daughters, had not two but seven sons, of whom Sir William (1785–1861), baptised at Dilham, was the eldest and Benjamin (1794, not 1795 –1848), baptised at Southrepps, was the fifth. Further, Joseph (1811–1872) was not Sir William's only son, as he had another, William, by his second wife, in 1830.

Jonathon was the father of certainly four, not three, sons — those Buchanan named plus George, born in 1793.

It should be said at this point that all the places named above are in Norfolk.

Buchanan missed the opportunity of extending engineering in Sir William's family to a further generation; for William (1849–1935), son of Joseph, was a partner in the firm of Llewellyn and Cubitt, colliery engineers, at Pentre, South Wales.

The tree accompanying the paragraph, doubtless of necessity selective, is also defective, as this letter indicates — and why, for example, in Jonathan's family, show only William (1791–1863) as leaving issue (in addition to the son he had daughters) when there was issue of his brothers Thomas and Lewis?

It must not be assumed because men bore the same surname, hailed from the same county, were believed to have followed the same trade and were of similar ages in their generations, that they were of the same family — or 'dynasty'. Buchanan has fallen into this trap over the Cubitts; but he is not the first and I am sure will not be the last.

David Cubitt

Professor Buchanan states that William Cubitt became a partner at Ransomes in Ipswich. In this, he is following, for example, the *Oxford Concise Dictionary of National Biography* and the *Biographical Dictionary of Civil Engineers* (volume 1, 1500–1830) published in 2002 by the ICE.

His obituary in the *Proceedings* of the Institution of Civil Engineers says that:

> he in the year 1812 sought and obtained an engagement in the then rising works of Messrs Ransome, of Ipswich, where he soon became chief engineer of the concern, to which he afforded great assistance. He remained there for nine years, and during that period was engaged in several engineering works of interest, such as improvements in the port of Ipswich, and in the gas works of the town. His

engagement under the Messrs Ransome led eventually to his becoming interested in the concern, a position which he held until the year 1826 ...

The obituary seems in error (or is at least misleading) when it states that William remained with Ransomes for nine years. The firm's surviving records imply that he worked for them full time until 1817, though it is possible that he continued to do some work for them after that date. His advertisements in the local paper do not mention Ransomes; he is described 'Civil Engineer' though the detail of the advertisements make it clear that this included mechanical engineering and surveying. Further evidence is provided by the list of payments in an account of the first (1817) experimental gas works at Ipswich which although built on Ransome's premises mentions 'WC's commission' and 'extras to WC & Co'.

An ambiguity in the last sentence quoted from the obituary has led to the conclusion that he was a partner in Ransomes from 1821 to 1826. However, it is much more likely that 'concern' refers not to Ransomes but to Ipswich's gas works of which he was a shareholder and its first Clerk and Engineer from 1821 until 1826. Ransome & Son was a partnership, and the firm's records (and its products) do not mention any other partner in the 1820s. Also, when during that period Cubitt arranged contracts for the construction of prison treadwheels, there seems no evidence that Ransomes received preferential treatment, as surely they would have done if he had been a partner; indeed, the very first such contract, at Bury St Edmunds in 1819, was let to John Penn of Greenwich. **Peter Brown**

Construction site narrow gauge — the 'Potters Bar Widening'

(*RCHS Journal*, July 2004, 633)

Having lived nearby when the East Coast Main Line was quadrupled between New Barnet and Potters Bar in the late 1950s, as mentioned by John Scivyer, we offer some notes on the narrow gauge construction railway. The main contractor was Charles Brand & Sons Ltd, who operated an extensive system of two feet (or 60cm) gauge. The commencement of work was authorised in June 1955 and — at its greatest extent — the construction railway system ran between the southern portal of Hadley South Tunnel and the northern portal of Potters Bar Tunnel. The narrow gauge railway operated within the new double-track bores of the Hadley South, Hadley North and Potters Bar Tunnels, where it was used to remove spoil and carry in the concrete blocks used for tunnel lining. On the surface, it connected to a large concrete block production plant and also to an area for dumping spoil. The block plant was situated beside the old Great North Road (A1000) above the Potters Bar Tunnel. A temporary bridge crossed this main road to provide narrow gauge railway access to the north end of the tunnel. West of the Main Line, between Hadley North and Potters Bar Tunnels, were a large 'marshalling yard' for narrow gauge trains, a locomotive servicing point and a branch to a spoil dumping ground.

The diesel locomotives used were mainly built by Ruston Hornsby (fitted with exhaust fume extractors when working in the tunnels), and spoil was transported in a large fleet of four-wheeled 2 cubic yard 'V' skip side tipping wagons. Each 'ring' of concrete blocks for tunnel lining was 18 inches wide, and comprised a long 'invert' unit at the bottom, with 19 'voussoir' blocks above it to complete the ring. The voussoirs were transported on four-wheeled flats, and the inverts on specially shaped cradle wagons, carried on bogies. Ten flats and one bogie cradle were required to carry the components of one ring.

The new tunnels and associated works were formally opened by Sir Brian Robertson, Chairman of the British Transport Commission, on 20 May 1959, and — from memory — Charles Brand's narrow gauge railway was progressively removed during the first half of that year. (Some technical details come from 'New tunnels near Potters Bar in the Eastern Region of British Railways' by A K Terris and H D Morton in the *Proceedings of the Institution of Civil Engineers*, April 1961, 289–304.) **Henry Gunston & Bob Vice**

Early electric traction

(*RCHS Journal*, November 2004, 697)

The Deutsches-Technik Museum in Berlin is an excellent institution, with a particularly strong railway collection that includes a rare exhibit from the start of the railway age: an original Penydarren tramway waggon. It does not, however, contain the Siemens electric locomotive. That is housed in the Deutsches Museum in Munich.

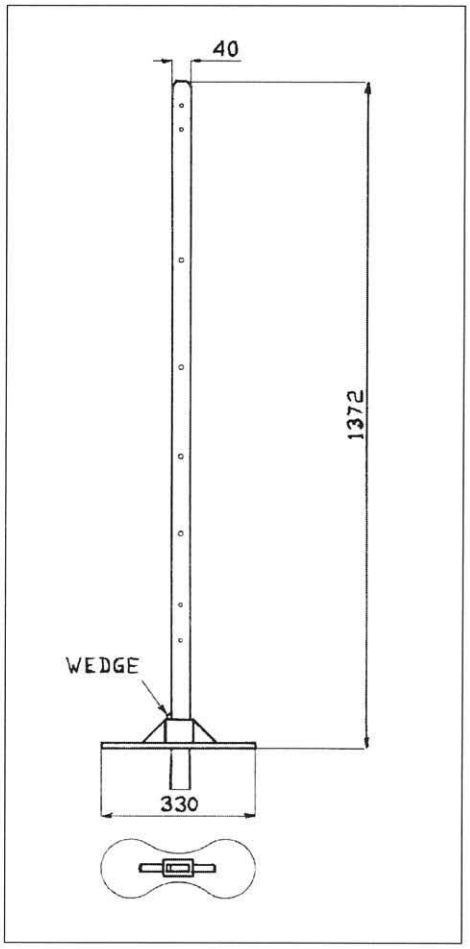
Anthony Burton

The abandonment of the Grand Western Canal

(*RCHS Journal*, November 2004, 678–681)

I read with interest the article about the abandonment of the canal. In 1997 my wife and I purchased the land that includes the Nynehead Lift. Since then we had 100m of the old canal below the lift dredged to the original dimensions to help create the canal environment. We also started an archaeological excavation under the auspices of the Somerset Industrial Archaeological Society and with the assistance of the Grand Western Canal Trust Volunteer Working Group which has been ongoing from January 1998 till early this year. The work done so far has not yet been published.

Nightingale Green is now known as Tone Green and is on the road heading north from Bradford-on-Tone to Oake. It was the site of one of James Green's standardised cast iron road bridges and a wharf. (Map reference ST169233) Part of the canal to the west was dredged by the landowner in about 1960 but is now badly weeded and silted up. Green's bridge was removed and the road lowered by the Milverton Highways Board in the 1870s after the canal was closed but later flooding and the necessary relief brought about its replacement with the present brick arched structure. This part



of the canal line is on private land and not easily accessible to the public.

The piece of ironwork in your illustration is part of a stanchion from a fencing system. We have recently found, in the woodland adjacent to the lift, a complete unit. It includes a flat bar (the post), pierced with 8 holes for the heavy gauge wire also found, 1¼ inches wide x ½ inch thick x 57½ inches long, wedged into the butterfly shaped socket with a metal wedge. The socket I think is cast iron, but the post is wrought iron. We have found several of the sockets and have always thought them to be associated with a later period than the canal (perhaps the railway) as, knowing Green's and the Canal Company's attention to cost, they would have not used expensive wrought iron for a barrier when cast iron would have been cheaper in those days. Green actually commented on the durability and cheapness of cast iron for certain work. **Denis Dodd**

The Balaklava Railway

(*RCHS Journal*, July 2004, 599)

An article in the July edition refers to the unique railway built during the Crimean War. The whole of the work involved — including costing, assessment of workers (he estimated 580, but recruited 560 in the UK) and of materials required, hiring of ships (he calculated 23 were needed), the construction of the railway and operation of it for some months — was actually carried out by James Beatty, an engineer employed by Peto, Brassey & Betts. He had been recalled by the company from a project in Canada especially to undertake this task. The whole formidable and daunting task was delegated to Beatty. On arrival in the Crimea, he discovered that he had first to improve the harbour facilities at Balaklava and build warehouses because perishable goods for the army were rotting on ships due to their inability to get alongside a wharf. The roads — such as they were — had become virtually impassable to horses. The savage winter made the task greater, whilst cholera and typhoid reduced the workforce. He was able to recruit some local labour and obtain a little help from the Army to overcome these setbacks and to tackle the unforeseen task of harbour works. Tragically, he died after an illness caused by injuries sustained during the operation of the railway.

The whole incredible and fascinating story — based on Beatty's diaries and letters — is set out in *Beatty's Railway* by Phillip Marsh. It is only available from the distributors, Leisure Products, Stoke on Trent. **Ted Gibbins**

Construction site narrow gauge — Orfordness

(*RCHS Journal*, July 2004, 633)

Further to recent letters, I seem to recall that a narrow gauge railway was constructed and later dismantled on the Orfordness peninsula, Suffolk, during the early 1950s. I believe the line was about six miles long starting from a terminus on MOD property at Slaughden, Aldeburgh. Due to the inaccessible and secret nature of the peninsula and the works (for the Atomic Energy Research Establishment?) I have never seen any details. As there are ample supplies of shingle on site presumably the main traffic was cement; was there also a 'passenger service' for workmen?

Only recently since acquisition of the property by the National Trust has restricted public access been possible. In 2003 I attended a lecture about Orfordness by a NT warden but no mention was made of these works or the access railway.

Does any member have any information about this line or, possibly, have seen remains during a recent visit? **Richard Tyson**

Engineering Dynasties: Stirling

(*RCHS Journal*, November 2004, 658–9)

I feel that one or two of the families who played a part in transport history have been overlooked — although as one of the last twigs of the family tree, I may be a little biassed.

The Stirlings of Dundee and its environs included at least two noteworthy engineers, Reverend Dr Robert Stirling who invented the eponymous hot-air engine and his son, Patrick Stirling the designer of the Stirling single locomotive. There were numerous other engineers in the family, Robert's brother James ran the Dundee foundry and the two brothers used hot-air engines to blow the cupolas. Although they were about twice as economical on fuel as steam engines, the materials of the day could not withstand the temperatures. James went on to work as a civil engineer in various transport projects, Robert eventually became Father of the Church of Scotland (mainly due to his longevity rather than his piety!). Stirling hot-air engines are still used today but not in a transport capacity. The Stirling single is of course preserved at York.

Three of Patrick's brothers also worked on locomotives, James in the UK as locomotive superintendent of the Glasgow & South Western Railway and the South Eastern Railway, William and Robert who both worked on railways in South America. Patrick's son Matthew became locomotive superintendent of the Hull & Barnsley Railway.

Robert and James' father, Patrick and grandfather, Michael were both blacksmiths and agricultural engineers but they hardly qualify as transport related and my own involvement with nuclear submarines is possibly stretching the definition. This does add up to seven engineering generations, however.

Ian Stirling, C Eng, FIMechE, MIEE

Reviews

Paddington Station: its History and Architecture — Steven Brindle

174+8pp, 240x190mm, 144 illustrations including colour, 20 maps & plans, hardback, English Heritage, Kemble Drive, Swindon SN2 2GZ, 2004, ISBN 1 873592 70 1, £25

Paddington: a 150th Anniversary Portrait — Tim Bryan

112pp, 170x235mm, 139 illustrations, 6 maps & plans, paperback, Silver Link Publishing, The Trundle, Ringstead Road, Great Addington, Kettering, Northamptonshire NN14 4BW, 2nd edition, 2004, ISBN 1 85794 238 8, £15.99

Stephen Brindle, English Heritage Inspector of Ancient Monuments, has consulted inter alia the Brunel collection at Bristol University and Network Rail's unique collection of historic drawings at Swindon to produce an authoritatively detailed account of Paddington, copiously referenced. Chapters cover Brunel and the GWR, the first terminus, the building of the present station, 'Maturity 1855–1947', the station at work, 'Decline and Revival 1947–2001' and a comprehensive commentary on the station's architecture including the goods depot and ancillary buildings.

There is an extensive bibliography and index. The splendid illustrations include a number of early drawings and Brunel's sketches. It is the greater pity therefore, that the author is let down by a particularly small, thin, grey typeface that is tiring to read, especially the microscopic superscripted annotations.

The book reveals much new material, like the fact that the railway never owned the freehold until after nationalisation. Brunel justified his private arrangement with Matthew Digby Wyatt for the architectural detailing by acidity comparing the cost of an official architect at Euston and Kings Cross with an engineer's. In 1853 the Board criticised him for delays, which Brindle says was unfair when Brunel was simultaneously engaged on the Cornwall Railway, Chepstow and Saltash bridges and his *Great Eastern* steamship. But was it? Brunel's maritime enterprise was nothing to do with the Great Western. The reason behind building Paddington's transepts is also examined. They were not for transversers but for curious descending sections of platform — purpose unknown. Could they have been for transfer of heavy luggage across the tracks via a boarded crossing but superseded by the retractable bridges instead?

W Lancaster Owen was the New Works Engineer not the architect for the 1870–80 extensions. In 1862 it was the GWR which absorbed the South Wales Railway, not the Ruabon Coal Company, created by senior officials. Nothing is said about the role of W W Grierson, the Chief Engineer, in building the fourth roof span in 1916. But these are minor grumbles. Although not so eminently readable as Jack Simmons' *St Pancras* and Robert Thorne's *Liverpool Street*, as a work of scholarship, Steven Brindle's book stands securely in the same rank.

We have to wait for the last chapter before learning how 'The Lawn' got its name unlike in Tim Bryan's book. The former curator of STEAM, the Museum of the Great Western Railway at Swindon, Bryan has scoured many sources for what is essentially an album of fine, clear photographs with extended captions. The text includes a brief history; the station's facilities; passenger and goods traffic; staff; royal occasions; enlargements; two world wars; and modern developments, stopping short of the recent redevelopment of The Lawn. This is in Brindle's book, to which otherwise Bryan's forms a perfect pictorial complement.

GORDON BIDDLE

Canal Arts and Crafts — Avril Lansdell

55pp, A5, approx 100 photographs, paperback, Shire Publications, Cromwell House, Church Street, Princes Risborough, Buckinghamshire, HP27 9AA, 2004, ISBN 0 7478 0586 5, £5.99

This excellent little book was first published in 1994, reprinted in 1997 and finally, in 2004, appeared this completely revised and updated edition with top quality photographs, mostly in colour. Our member, Tony Condor, has written the foreword and clearly had a lot to do with finding additional information and relevant illustrations. The style of the book is very much in the current idiom of reduced verbiage, but with greatly increased pictures which in no way detract from this enjoyable publication. To read this book is to understand how things were done, how people lived and where to go to see the artifacts.

HUGH COMPTON

The Railways of Great Britain: A Historical Atlas — Colonel M H Cobb

646pp, 330x295mm, maps plus appendices and indexes, hardback, 2 volumes in slipcase, Ian Allan, Mail Order Department, 4 Watling Drive, Hinckley LE10 3EY, 2003, ISBN 0 7110 3002 2, £100 (incl p&p in the UK)

Weighing in at over 6 kilos for the pair of volumes, this is truly a monumental work. It has occupied the author for a quarter of a century, with the acknowledged assistance of many names within our Society. The base is a sectioned reproduction in grey of the old one-inch scale Ordnance Survey maps c1970 for virtually the whole of England, Wales, and Scotland excepting only those completely rail-free areas. Many would find the atlas invaluable merely for this resource. The railway system (from its beginnings up to privatisation in 1994) is overprinted in colour, with names and opening/closing dates for both lines and stations, with tunnels, water troughs and some other features named. There is an introduction, family trees of the various companies and a bibliography. There is a detailed index keyed to locations on the maps.

Colonel Cobb's background as a professional mapmaker is reflected in the excellent standard of the cartography: clear, accurate and nicely reproduced. The colouring distinguishes the four main grouped railway companies. The use of lighter shades of each colour for some earlier constituents is not entirely satisfactory, and those more interested in the pre-grouping picture may have some difficulty. Some graphic indication distinguishing open and closed lines would have assisted. The decision to adopt a standard map scale throughout certainly has advantages although, as the author acknowledges, it can be over-generous in rural areas and rather crowded in towns. There is separate coverage of the Underground which helps to clarify the complexities of London, and enlargements for Glasgow and Carlisle. The review copy had one or two pages creased in production and the binding does not look sufficiently robust always to withstand hard use — but only the fittest enthusiast would want to carry it out into the field!

Despite the wise decision only to give dates to the nearest year, it is inevitable in a work of this magnitude that there will be errors and omissions. Many of these are already listed on a loosely inserted addendum sheet and the knowledgeable reader will find others. The compiler seems less comfortable with the earlier phases of railway history. For example, the alignment of the initial lines to Machynlleth, Fleetwood and Barrow-in-Furness and of the pre-ship canal layout south of Warrington could be improved. Accuracy is the Achilles heel of any major reference book, as the cost usually precludes any subsequent corrected editions — and addenda are cumbersome and cannot readily deal with graphic amendments. E-publication has opened up new possibilities for the future and one can only applaud the bravery of the author, publisher and sponsor in bringing this book to the market in traditional form.

At £100 the cost is high, but the value for money test is readily passed. This atlas will repay hours of detailed browsing and it is probable that we shall not see its like again. Buy one now.

RICHARD DEAN

The Metropolitan Railway — David Bownes

128pp, 233x165mm, 204 b&w illustrations, paperback, Tempus Publishing, The Mill, Brimscombe Port, Stroud, Gloucestershire GL5 2QG, in association with London's Transport Museum, 2004, ISBN 0 7524 3105 6, £12.99

This album of informatively-captioned images showing most aspects of the Metropolitan has been compiled by the Senior Curator of photographic and 2D collections at the museum. It presents many old friends but also includes some relatively unhackneyed items. Rolling stock is given due but not excessive attention whilst infrastructure, publicity, staff (and their sometimes difficult or primitive working conditions) are suitably portrayed. There is also a possibly unique example of the newly-formed London Passenger Transport Board using the inspired 1915 invention 'Metro-land' in a 1933 poster. We can be sure that whoever was responsible for this error of judgment was roundly admonished from on high.

The surviving images of the Metropolitan presently in the care of the museum are few in number compared with the host inherited from the Underground Group and London Transport. This publication contains a high proportion of the former but has required augmentation with photographs taken after April 1933. Helpfully, most of the well-reproduced illustrations are given a reference number and may be ordered from the museum. ALAN A JACKSON

Dining at Speed: a Celebration of 125 years of Railway Catering — Chris de Winter Hebron

144pp, 238x172mm, 16 photographs, 38 facsimiles, paperback, Silver Link Publishing, The Trundle, Ringstead Road, Great Addington, Kettering, Northamptonshire NN14 4BW, 2004, ISBN 1 85794 211 6, £16.99

On-train dining began in 1868 in the USA, from where it spread in 1879 to Britain and in 1880 to mainland Europe. The subsequent development of train catering, right up to the present day, in each of these railway cultures is presented here as three separate parallel histories, but set out in a way that brings out the similarities and differences between them. This works well and one wishes that the author had extended his study to include the dissemination of the idea to the railways of the Empire.

The book's strength is in its analysis of why, not just how, train catering developed in the ways it did. For example, it asks why the refreshment stops at York, Normanton, Preston, etc, which were a carry-over from the stage-coach era, survived so long. It argues that the reasons were not technical but social — the technology for building and equipping a suitable vehicle had existed in the 1850s. The idea of dining on a train had to wait for a generation that was relaxed about train travel and no longer considered lunch as only for women, children and invalids. From there the story becomes one of adaptation to the changing demands and opportunities of, for example: wartime; periods of economic austerity and prosperity; and the changing social structure of the long-distance passenger market.

For the author, true 'dining at speed' is a relaxed multi-course meal, silver-served in a separate dining car. However, he does also give due regard to the lesser forms of train catering that were introduced later, such as counter service in buffet and bar cars and, in recent times, at-seat service to businessmen while they continue to work on their lap-top computers and mobile phones. The text alone justifies a recommendation of this book, but it deserves better illustrations. GRAHAME BOYES

The London & Birmingham Railway between Birmingham and Coventry (including the Coventry–Leamington Line) — John Boynton

112pp, 270x215mm, 144 illustrations including 32 colour, 5 maps, paperback, Mid England Books, PO Box 323, Kidderminster DY10 4YY, 2004, ISBN 0 9522248 7 9, £14.95 post free

This strange book covers the final twenty of the 112 miles of 'the foundation stone on which this country's — and the world's — railway network is laid' (the author's words). As Coventry never was an important railway centre, Rugby might have been a more logical starting point, although geographically and in topics the author goes much further than the title suggests. His breezy comments range from opinions on early engineers to shortcomings in the interior design of Pendolinos. However, despite some contradictory, questionable and repetitive statements there is much useful material. Unfortunately, it is not easy to locate from the skimpy index.

Most of the excellently reproduced illustrations are of trains. 14 of the 32 colour plates, for instance, are close-ups of diesel or electric trains. The comment on J C Bourne's historic engraving of the Blythe viaduct 'which, in the absence of a train or any obvious railway features, is of limited railway interest' says it all. Five roughly chronological chapters cover 1823 to 2003, each opening with a 'diary' of principal dates and containing extensive quotations from numerous sources. An illustrated description of the lines before electrification and rationalisation changed them so much would have made the book a useful record. GORDON BIDDLE

William Mackenzie: International Railway Builder — David Brooke

200pp, 235x154mm, 23 b&w illustrations, 9 maps, hardback, The Newcomen Society, Book Sales Department, PO Box 421, Elmswell, Bury St Edmunds, Suffolk IP30 9XF, 2004, ISBN 0 904685 14 4, £28.50

William Mackenzie was born in Lancashire in 1794 and died in Liverpool in 1851. At his death he was a very wealthy man, having made all his money in civil engineering contracting. He built canals and harbours but his principal activity was building railways. He is most well known for building railways in France — usually under Joseph Locke as engineer and frequently alongside Thomas Brassey as what we would now call joint venture partner. Projects on which Mackenzie worked in the U K included the

Liverpool & Manchester, Grand Junction, North Union, Midland Counties, Glasgow Paisley & Greenock, Chester & Holyhead and Liverpool, Ormskirk & Preston railways. His projects with Brassey included the Paris & Rouen, Rouen & Havre, Dieppe & Fecamp, Orleans, Tours & Bordeaux, Amiens & Boulogne and Barcelona & Mataro railways.

Little was known about Mackenzie until his papers, including detailed records of his business, were discovered in 1988. The author of this book draws heavily on this source but has also researched other sources thoroughly. The descriptions of Mackenzie's work in France are distinctive and fascinating. It is well known that British money and expertise were used to begin the establishment of the French railway system but this may be the first detailed account of how it was done. Technicalities are explained clearly both as to construction and funding. How the projects were managed is also covered. How the relationships between engineer and contractor worked when under pressure is well illustrated by the account of the collapse of the great viaduct at Barentin northwest of Rouen. Mackenzie and Brassey had to rebuild it at their own expense.

There is not much about Mackenzie the man or about his personal life. But this does not diminish the book as an important work of history covering the achievements of one of the great men of the early days of railway building. There are full references to sources throughout the book, a bibliography and an index.

MARTIN BARNES

The Cruden Bay Hotel and its Tramway — Keith Jones

44pp, A5, 47 illustrations (10 coloured), paperback, Grampian Transport Museum and Great North of Scotland Railway Association, available from D Flett, 7 Sutor's Park, Nairn, Invernesshire IV12 5BQ, 2004, ISBN 0 902343 12 2, £5.50 post free.

The Great North of Scotland Railway's remote hotel at Cruden Bay, near Peterhead, had two distinctions. Opened in 1899, it was the first of the railway hotels to be built specifically to attract golfers, pre-dating the better-known hotels at Turnberry and Gleneagles. It was connected to Cruden Bay station, half-a-mile away, by the first electric tramway to be operated by a main-line railway company.

This history of the hotel, golf course and tramway is supported by an interesting selection of illustrations, including a colour reproduction, spread over the two centre pages, of the large pictorial poster depicting a golf tournament at Cruden Bay, which the LNER commissioned in the 1930s.

The hotel's season proved to be too short for it to be a financial success and it was not re-opened after World War Two. The hotel itself was subsequently demolished but the original GNSR golf course pavilion survives, as does one of the two tramcars, now restored and on display in the Grampian Transport Museum.

GRAHAME BOYES

The Wrexham and Ellesmere Railway — Stanley C Jenkins & John M Strange

144pp, A5, 103 photographs, 10 maps, paperback, Oakwood Press, PO Box 13, Usk, Monmouthshire NP15 1YS, 2004, ISBN 0 85361 617 5, £10.95

In the same way as this little line filled a gap in the late Victorian network, so this book, written in the usual branch line history mode, fills a gap in existing writings. Nominally independent until grouping, the line was worked by the Cambrian from its 1895 opening but the company's board had heavy representation from the Manchester, Sheffield & Lincolnshire as part of a scheme to extend its traffic into Wales in alliance with the Cambrian. Although the branch did carry some Jellicoe specials over tenuous single lines from South Wales, it is doubtful whether either the GWR or LNWR ever lost much sleep over the venture and, in any event, the line fell into the GWR camp at grouping. The line was so busy with ordnance traffic during the second world war that the passenger service was suspended between 1940 and 1946. It closed to passengers in 1962.

There are useful insights into goods traffic and tonnages carried and interesting information about rural road cartage arrangements between the wars.

The book is copiously illustrated and enhanced by clear extracts from large scale OS maps; the whole is well produced in Oakwood's usual format.

ROGER DAVIES

150 Years of the Great North: Tales of the Little but Good

60pp, A5, 15 illustrations (2 coloured on covers), paperback, Great North of Scotland Railway Association, available from D Flett, 7 Sutor's Park, Nairn, Invernesshire IV12 5BQ, 2004, ISBN 0 902343 13 0, £4.95 post free.

Published to mark the 150th anniversary of the opening of the first section of the Great North of Scotland Railway, this is a compendium of ten articles previously published in the Association's journal, *Great North Review*. Their subjects include the fatal collision that occurred in the GNSR's first week of operation, the proposed 'Circumbendibus' link with the Caledonian Railway at Aberdeen that was dropped in favour of the more direct route via a new Aberdeen joint station, spring bank holiday traffic in 1899, royal train journeys to Balmoral, fish traffic and omnibus services.

Of particular note is the account of the rivalries between the railway promoters of Inverness and Aberdeen, coupled with the need to gain the support of Elgin and the intermediate smaller ports. This culminated in the passing of the five Acts of Parliament during the mania session of 1845–6 which authorised most of the lines that subsequently became the GNSR — an interesting example of regional railway politics. GRAHAME BOYES

The Forth and Clyde Canal: a History — T J Dowds

128pp, A5, 14 photographs, one map, paperback, Tuckwell Press, The Mill House, Phantassie, East Linton, East Lothian, Scotland, 2003, ISBN 1 86232 232 5, £9.99

Canals in Scotland were fundamentally different from those of England, each often being an isolated concern. Only in the central belt were there attempts to form a network similar to that south of the border. Perhaps this is one reason for the relative paucity of published works on the history of individual Scottish Canals. Little of substance has appeared in print since the seminal work of Jean Lindsay in 1968. In this short book, the author, a tutor in history at Strathclyde University, sets out to correct this deficit.

At the time, the Forth & Clyde Canal was the greatest single venture ever undertaken in Scotland. Thus the book begins with a scholarly explanation of the Scots economy in the early 18th century and asks why plans for a canal were put forward. Why was it built in the 1760s and why was completion delayed until 1790? Early chapters answer these questions and detail the canal's promotion, the rivalry between Glasgow and Edinburgh in seeking control of the enterprise, obstacles to construction, and the administrative and financial problems of the canal company and their solution. Later chapters outline the canal in operation before its decline and inevitable closure in 1963. A brief summary of the revival and restoration of the waterway in the 21st century and the construction of the innovative Falkirk Wheel to reinstate the link with the Union Canal completes the story.

The final chapter, a conclusion that is a précis of what has gone before, is perhaps unnecessary in such a short work but the appendices are interesting and there are useful lists of sources and suggested further reading. The map, although showing locations where construction problems arose, otherwise lacks detail. More photographs of canal structures would have enhanced this otherwise admirable and well-timed book. JOHN HOWAT

A Waterway to Wantage — Reg Wilkinson

44pp, A5, 21 b&w illustrations and maps, soft covers, published by the author at 28 Harcourt Green, Wantage OX12 7DJ, 2004, no ISBN, £3.75 post free

The 55 mile long main line of the Wilts & Berks Canal ran from the Kennet & Avon at Semington to the Thames at Abingdon and passed through no town. It did, however, have short branches to serve the communities of Chippenham, Calne, Longcot and, the subject of this booklet, Wantage.

The wharves, bridges, locks, milestones and the canal-related buildings that remain within a few miles of Wantage and Grove are described. The best pages relate the impact which the waterway had on Wantage and the trade it opened up. Traders are named and several newspaper advertisements and notices are quoted. Although the typeface is ill-chosen, the illustrations make for what is an adequate, unpretentious little volume. STEPHEN ROWSON

The Rainhill Trials — Christopher McGowan

379pp, 215x140mm, 35 illustrations, hardback, Little Brown, Time Warner Book Group, Brettenham House, Lancaster Place, London WC2 7EN, 2004, ISBN 0 316 72480 7, £16.99

A misleading title but an enthralling book, written by a professor of zoology. The Rainhill trials are not part of the story until half way through the book. The reader should not take fright as the author is an anecdotal and entertaining writer. He seems to be chatting to the reader as he describes, in a most accessible manner, the workings of early locomotives and, more importantly, the characters and backgrounds of their creators.

Engineers today have the help of precedent but the Rainhill men were true pioneers. No punches were pulled and Dixon, George Stephenson's partner, was particularly vituperative. He described the progress of Burstall's *Perseverance* as 'cranking away like an old wickerwork pair of panniers on a cantering cuddy ass'. When contemplating the Hackworth locomotive, Dixon said that 'he must return to his Methodist preaching and own that he has been taught a lesson of humility'. Although Hackworth was blind to the inherent shortcomings of his own locomotive, the railway directors acted with exemplary fairness in purchasing his engine *Sans Pareil* for £550, using it for 15 years on the Bolton–Leigh branch.

It is refreshing to read a railway-oriented book not written by a railway historian. The description of Robert Stephenson's erection of the Britannia Bridge over the Menai Strait is masterly and the fact that there are 40 pages of fascinating notes betrays the depth of research that has gone into the writing of this interesting, unusual and worthwhile work.

BILL HOLLINSON

How Steam Locomotives Really Work — P W B Semmens and A J Goldfinch

348pp, A5, 124 plates, 70 figures, paperback, Oxford University Press, Great Clarendon Street, Oxford OX2 6DP, 2003 (hardback 2000), ISBN 0 19 860782 2, £8.99

The authors of this book evidently have a comprehensive knowledge of the theory underlying the design and operation of all parts of a steam locomotive. They also have a wide experience of how the theories were applied, enabling them to give examples of different practice all over the world. There are chapters covering details of the processes that take place in the locomotive firebox, in the boiler and in the cylinders. Others describe how the propulsive and other mechanical forces are distributed, the braking systems and the operation and maintenance of locomotives in service. The explanatory figures are uniformly helpful but some of the plates suffer from their small size and lack of contrast, making it difficult to distinguish the features they are intended to illustrate.

After studying this inexpensive work the reader will not be able to design a steam locomotive from scratch: but he will know what all the various parts are for, how they work and why they look the way they do.

STEPHEN BRAGG

On the Rails — Anthony Burton

208pp, 270x230mm, 150 illustrations, numerous diagrams, hardback, Aurum Press, 25 Bedford Avenue, London WC1B 3AT, 2004, ISBN 1 85410 981 1, £20.00

This book, well illustrated with photographs of historic locomotives and working replicas of others, together with railway engineering and architecture, traces the early development of railways and their subsequent spread around the world during the 19th century. It goes on to examine the quest for greater speed and luxury as the 20th century progresses, the rise of diesel and electric power, to the detriment of steam, and today's high-speed trains such as Eurostar and the TGV. It is an adjunct to a ten part television series on two centuries of railway history, shown on the Discovery Channel. The author, together with a television team, travelled extensively to North America, India, China and Africa, as well as within the UK, during its production to see and photograph historic engines and spectacular railway scenes.

There is an appendix showing the works of Thomas Brassey, a short chronology and a useful index. However, it might be felt that this book is more for the coffee table than for the serious railway historian, or even enthusiast. Perhaps a useful present.

RODNEY HARTLEY

Steam and Speed: Railways of Tyne and Wear from the Earliest Days — Andy Guy

156pp, 204x240mm, about 200 illustrations (some in colour), 8 maps & plans, paperback, Tyne Bridge Publishing Newcastle Libraries Information Service, City Library, Princess Square, Newcastle-upon-Tyne NE99 1DX, 2003, ISBN 1 857951 61 1, £12.95 (p&p £1, cheques to 'City of Newcastle-upon-Tyne')

The rather flashy title, 'Steam and Speed', does scant justice to a book that includes a comprehensive historical review of the development of waggonways, as well as the early experiments in steam traction, in the northeast of England. Although work did go on elsewhere, the sheer scale of the operations and trials in the Tyne and Wear districts was unparalleled. The description of developments between 1600 and 1825 takes up most of the first half of the book. The work of the Stephensons is put in the context of the contributions of other pioneers. Of particular note is the reference to the *Steam Elephant* on the Wallsend Waggonway, much of the evidence for which has only been unearthed in the last decade.

The period 1830 to 1850 saw railways arriving on Tyneside from all directions and it is interesting to read how the earlier major terminus in Gateshead was supplanted by Newcastle Central on the other side of the river. The remainder of the book covers the development of the Tyneside network between 1850 and 1900, and the eventual decline, particularly of mineral traffic) in the 20th century, although the Metro has revived local passenger traffic by rail. There is a useful gazetteer of remaining railway sites.

The book is produced on art paper and profusely illustrated with watercolours, drawings and photographs: most of them are taken from local collections so may well be unfamiliar to the general reader.

STEPHEN BRAGG

From Steam to Stone, Volume 1: The Footplate Years; Volume 2: Onwards into Management — David Butcher

Volume 1: 240pp, 127 photographs, 2 maps, ISBN 0 85361 623 X
Volume 2: 232pp, 125 photographs, ISBN 0 85361 624 8
Each volume: A5, paperback, Oakwood Press, PO Box 13, Usk, Monmouthshire NP15 1YS, 2004, £14.95

This is the autobiography of one who rose from engine cleaner and fireman via an Eastern Region Traffic Apprenticeship (which he passed in 18 months instead of the normal 3 years) to hold, among other posts, those of Yard Master at New England, Peterborough, and, eventually, Area Manager at Westbury on British Rail's Western Region. While at Westbury he was instrumental in developing stone traffic from the numerous quarries within his area. He left railway employment to become involved in the commercial side of quarrying where his knowledge of railway operating became invaluable. The author was, for a time, employed by the West Somerset Railway, before, in early 1994, being offered a second career by British Rail during the privatisation process.

David Butcher describes in some detail, his struggles to achieve change in commercial practice within the monolithic British Rail organisation, and how at times he had to 'bend the rules' to accomplish his aims. He also touches in some detail upon labour relations in the various establishments in which was employed, and his methods of dealing with sometimes difficult situations.

This is a work which does its author credit, giving a highly readable insight into railway life during times of radical change. Production is to the publisher's usual standard. It would, perhaps, have been better for the two volumes to be combined. An index would also have been useful. RODNEY HARTLEY

Loch Lomond and the Trossachs in History and Legend — P J G Ransom

245pp, 215x138mm, 50 b&w photographs, map, paperback, John Donald, 10 Newington Road, Edinburgh EH9 1QS, 2004, ISBN 0 85976 586 5, £9.99

This book would make an excellent companion to a trip around the Loch Lomond area. It abounds with stories of the history of the area, its previous inhabitants and the famous who passed through, with plenty of romantic tales of clan rivalries, highland raids, the 1715 and 1745 risings, and colourful characters like Rob Roy MacGregor. For those unable to make the trip, this is a good armchair substitute.

But what of the more serious historians of transport: is there anything here for them? Indeed there is.

Transport history permeates the volume and virtually all modes are represented. The author traces the use of tracks and pathways, use of loch and river for navigation by oared and sailed boats, the role of steamers and of piers to facilitate boarding, the connection to the railway network and the advent of bus services and the private motor car. The book constantly reminds that the vast majority of this travel was for pleasure excursions, to view the picturesque and visit the sites made famous by fictional works, like the poems and novels of Sir Walter Scott. The book provides some excellent instances in the history of tourism. The author also deals with uses of water for Glasgow's water supply and later for hydro-electric power.

To the railway buff, the most interesting chapters will be that on the arrival of the railways in the area in the 1850s and their acquisition of some of the steamer services in the 1880s and that which explains Crianlarich's centrality to the local railway network. It is a good read, well written and indexed, and with a useful bibliography. JOHN ARMSTRONG

Stephenson Power: the Story of George and Robert Stephenson — Ken Smith

40pp, 240x205mm, 50 photos & line drawings, paperback, Tyne Bridge Publishing, Newcastle Libraries & Information Service, City Library, Princess Square, Newcastle-upon-Tyne NE99 1DX, 2003, ISBN 1 857951 86 7, £4.99 (plus £1 p&p, cheques to 'City of Newcastle-upon-Tyne')

George Stephenson was born into humble surroundings and became literate only in his late teens. He showed a knack for machinery early in his career. Along with other pioneers and Robert, he improved the design of the steam locomotive culminating in the father/son collaboration on *Rocket*. George's greatest railway engineering achievements were of course the Stockton & Darlington and Liverpool & Manchester Railways. An oft-forgotten invention was the miners' safety lamp, described here in detail. Robert became one of the great railway engineers of the Victorian era, his triumphs including Newcastle High Level, the Royal Border, the Britannia and the St Lawrence (Montreal) Bridges. He died in 1859 and was buried in Westminster Abbey. This well-produced little book with a useful chronology describes succinctly the life and achievements of these two great engineers. WARWICK BURTON

A Towpath Walker's Guide to the River Weaver Navigation, Volume 2: Three Walks around Frodsham Bridge, Sutton Weaver and Northwich — Colin Edmondson

28pp, A5, 13 illustrations, 8 maps, paperback, published by the author at River View, Leighs Brow, Barnton, Northwich, Cheshire CW8 4HT, 2004, no ISBN, £3.50 plus 50p p&p

Unlike most books of waterside walks, the volumes in this excellent series are written following thorough and original archival research. The level of historical detail more than compensates for the somewhat amateur presentation and printing. The three walks are Frodsham port to Frodsham Lock, the site of the Clifton swing bridges to Sutton Locks, and Northwich bridges to Hunts Lock. The walks are easy to follow, despite the lack of maps showing the whole of each walk. The interpretation of the features is assisted by the inclusion of extracts from late 19th and early 20th century OS maps. PETER BROWN

Canal Narrowboats and Barges — Tony Conder

56pp, A5, 107 photographs, paperback, Shire Publications, Cromwell House, Church Street, Princes Risborough, Buckinghamshire HP27 9AA, 2004, ISBN 0 7478 0587 3, £5.99

This is a useful, compact guide to canal carrying boats, focussing mainly upon narrow boats, although there is coverage of barges and river navigations. Chapters cover the evolution of vessels, their construction and types, boat-builders and cargoes, through to the present day. Illustrations are mostly in colour and, although some have appeared elsewhere, there are many new photographs, some from archives and some from the author's own collection. A particular and welcome emphasis lies upon the more recent past with boats still afloat and in museums. The text is informative, succinct and well-balanced. JOSEPH BOUGHEY

Oxfordshire's Lost Railways — Peter Dale
Herefordshire and Worcestershire's Lost Railways — Peter Dale
Bedfordshire's Lost Railways — Keith Scholey
Buckinghamshire's Lost Railways — Keith Scholey

All 48pp, 174x240 mm, 48 black and white photographs, paperback, Stenlake Publishing, 54–58 Mill Square, Catrine, Ayrshire KA5 6RD, 2004, £7.50 including p&p. ISBN 1 84033 312 X, 313 8, 271 9 and 275 1 respectively.

These are elegant albums of old photographs with detailed captions and an historical introduction in each case. Dates of all line and station closures are given. The pictures are all of stations, some where the railway is not lost but the station is.

The photographs range from the 1870s until the last years of use of stations now closed. Many of them are beautiful pictures in strong contrast and fine detail — the classic glass-plate pictures with old engines fronted by the station staff in crisp uniforms and with huge moustaches and crippling collars. A few of the pictures are rather grey and grainy. The character of the different counties comes across in their distinctive landscapes, buildings and traffic.

Some gems:

- in Bedfordshire: Sandy in 1928 with a LNWR mixed goods headed by a 'Prince of Wales';
- in Buckinghamshire: a series of pictures of Verney Junction in its heyday;
- in Oxfordshire: evacuees arriving at Chipping Norton on 1 September 1939;
- in Herefordshire: Pontrilas busy with people and trains in 1909; and
- in Worcestershire: Bewdley in 1915 with a carriage board proclaiming 'Through Carriage between Birmingham and Woofferton via Smethwick'.

MARTIN BARNES

British Railways Pictorial: First Generation DMUs — Kevin Robertson

80 pages, 280x210mm, 170 photographs, paperback, Ian Allan, Riverdene Business Park, Hersham, Surrey KT12 4RG, 2004, ISBN 0 7110 2970 9, £12.99

It is sobering to remember that British Railways' Modernisation Plan was published 50 years ago. One of the quickest and most obvious results was the mass introduction of diesel multiple units (DMUs) across the country, from the four-wheeled railbuses on branch lines to six-car units on cross-country routes. This book is the second in an intended series of 'pictorials'. Apart from a brief overview and a very useful numerical list of them all, it is devoted to well reproduced photographs of the units in service, mostly in the 'green livery' period of the 1950s and early 1960s. There are some nostalgic interior shots with Formica panels, proper teacups in the buffet cars and be-hatted female passengers happily smoking! A by-gone era indeed. The most obvious market may be amongst modellers rather than dedicated DMU enthusiasts who will find earlier books, to which the author generously refers, more satisfying.

BRIAN WESLEY

Gloucester to Bristol: including the branches to Nailsworth, Dursley and Thornbury — Vic Mitchell & Keith Smith

96pp, 236x166mm, 180 photographs, 39 maps, 6 timetables, 1 gradient profile, hardback, Middleton Press, Easebourne Lane, Midhurst, West Sussex GU29 9AZ, 2004, ISBN 1 904474 35 7, £14.95 post free

This book charts the history of the Midland Main Line from Bristol to Gloucester and its branches. It has a few succinct and very helpful pages of historical text, illustrated by some fascinating maps illustrating the development of the railway layout in Gloucester. This shows, amongst other things, how the Great Western exchanged through carriages for Gloucester by means of a turntable on the avoiding line. It is also interesting to note that the layout today has reverted almost exactly to what it was in the 1850s.

The bulk of the book is made up of good illustrations of each station on the line and its branches, which are most helpfully accompanied by a reproduction of a large-scale OS map of each station in its heyday.

WARWICK BURTON

Lincoln's Excavators: The Ruston Years 1875–1930 — Peter Robinson

216pp, A4, approx 150 photographs plus technical drawings and document reproductions, Roundoak Publishing, The Old Dairy, Perry Farm, East Nynehead, Wellington, Somerset TA21 0DA, 2003, ISBN 1 871565 42 1, £24.95 plus £2.49 p&p

The Ruston Company of Lincoln was at the forefront of new technology towards the end of the 19th century and designed and built the first 'steam navvies' used in the UK. This is an elegant and profoundly well-researched and illustrated book about the company and its products.

We have all seen the pictures of the Ruston steam navvies at work on the MS&LR London extension and some of us have seen the paintings by Benjamin Leader which show them at work on the Manchester Ship Canal excavations which can now be seen at Tatton Hall in Cheshire. 57 of these machines were used on the MSC — and 70 on the building of the Panama Canal. They transformed excavation, the key task, on all railway and canal projects from manual to mechanised within a few years. All the GWR cut-offs of the first decade of the 20th century used them, as did the rural extensions of the London 'underground'.

The company remained in the vanguard of development of excavation machinery well into our own time. After its alliance with the American Bucyrus company, their range of RB machines ruled the sector. From 10 RBs upward, they dominated the market. In motorway building, a man with a shovel was referred to as a '1 RB'.

This book includes pictures, technical descriptions and accounts of the use of Ruston excavation machines in railway and canal building around the world as well as in quarries of all types. Not in the mainstream of railway and canal history, but one of the few books which is significant to both of our sectors of interest.

MARTIN BARNES

Hampshire Narrow Gauge, including the Isle of Wight — Vic Mitchell & Keith Smith

96pp, 236x166mm, 127 b&w photographs, 19 maps & plans, hardback, Middleton Press, Easebourne Lane, Midhurst, West Sussex GU29 9AZ, 2004, ISBN 1 904474 36 5, £14.95

Here are pictures and sometimes plans of ten commercial systems, of which only the passenger carrying Hythe Pier railway still operates, five defunct military lines and nine recreational railways, not all extant. An introduction is limited to a mention of some lines not covered, including more than thirty industrial railways in the Isle of Wight. Over 40% of the space is devoted to the leisure field, including the no-expense-spared Exbury Gardens railway, so that descriptions of other lines tend to be thin and patchy. Where coverage is more extensive, as for Dean Hill Munitions Depot and Hurst Castle, most of the photographs are very recent. The omissions and lack of historic photographs suggest that the authors might be investigating ground less familiar than that covered by previous volumes in the series.

DENNIS HADLEY

Cash Carriers in Shops — Andrew Buxton

32pp, A5, 51 photographs & diagrams, paperback, Shire Publications, Cromwell House, Church Street, Princes Risborough, Buckinghamshire HP27 9AA, 2004, ISBN 0 7478 0615 2, £3.50

Cash carriers, surely well-remembered by the older among us, are railways with a difference! They date from the 1880s in the US, slightly later in Britain, aiding centralised accounting (and preventing fraud) in large shops, until cash registers and self-service brought about their decline. (A few still operate, and not only in museums.) Three basic systems are discussed in this attractively-illustrated monograph: cash-ball, where the ball ran on rails of 3 inch 'gauge' complete with 'points'; cable and wire (the Rapid Wire was the most common system in Britain); and, quickest in operation and environmentally friendly because less noisy and usually enclosed, pneumatic tubes. A topic for our Pipelines Group, perhaps? A bibliography and list of places to visit enhances the value of the survey of an overlooked transport facility.

PHILIP SCOWCROFT

Lancashire's Lost Railways — David James
Cheshire's Lost Railways — David James

Both 48pp, 175x240mm, 50 and 48 photographs, paperback, Stenlake Publishing, 54–58 Mill Square, Catrine, Ayrshire KA5 6RD, 2004, ISBN 1 84033 288 3 & 1 84033 287 5 respectively, £7.50

These two books consist of photographs, one to a page, with a narrative about the history of the relevant line and names of branch stations and dates of closure. Most of the photographs are new to this reviewer and many date from pre-grouping days, but some are rather dark. Curiously, seven are of stations still open and one of the branches covered (Delph) was in Yorkshire. Few are in the Liverpool and Manchester conurbations, suggesting that these areas will be covered in future books in this series.

The Lancashire book includes 27 branches with up to three pages on each. In the Cheshire book there is a more generous space allowance because fewer branches have closed and some closed stations on lines still open are added. Views of Chester Northgate and the Lymm and Bollington lines comprise half the illustrations in this book.

Both texts contain enough inaccuracies and misleading statements to deter historians. But they may well be attracted by the photographs. Maps would have helped. ALLAN BRACKENBURY

The Blackpool Highflyer — Andrew Martin

333pp, 220x140mm, no illustrations, paperback, Faber & Faber, 3 Queen Square, London WC1N 3AU, 2004, ISBN 0 571219 01 2, £10.99

Andrew Martin has made a considerable impact with his two recent books of detective fiction. The 'Necropolis Railway' was well received and this latest adventure of fireman Jim Stringer has been critically acclaimed in several broadsheet reviews. Technically, however, it seems to suffer from two faults, one of which may spoil the read for the transport enthusiast and the other for the detective novel aficionado.

The story revolves around Wakes and other special trains to Blackpool from Halifax. On a Whit weekend special, approaching Kirkham at speed, the eponymous Aspinall 'Highflyer' locomotive is derailed by a grindstone placed on the track and one mill girl is killed in circumstances for which Jim feels some responsibility. The book is well sown with red herrings and sub-plots; has there been another derailment or an accident of nature, are two anarchists implicated, why is the ticket inspector on the train attacked, and what is the ticket scam involving the Stringers' strange new lodger? The mill town and seaside atmospheres are nicely evoked but it seems the story is being bent to accommodate the historical facts rather than being used to illuminate the plot.

The railway details are correct but do not come alive because the author explains what is going for the ordinary reader. This makes for a laboured read for the enthusiast let alone the lover of the Lancashire & Yorkshire Railway. The other fault lies with the central narrating character, Jim Stringer. He has to speak lucidly and intelligently, avoiding the dialect and syntax of other characters, and therefore appears intelligent and educated. Yet for the story he must be the dumbest of the dumb, fooled by everyone and seeing suspects at every turn. This conflict is never resolved, even though, at the end of the book, the mystery is. WILLIAM FEATHERSTONE

Swindon to Newport — Vic Mitchell & Keith Smith

96pp, 242x172mm, 121 photographs, 30 maps, hardback, Middleton Press, Easebourne Lane, Midhurst, West Sussex GU29 9AZ, 2004, ISBN 1 904474 30 6, £14.95

What is now a vital part of the London to South Wales trunk route was constructed in five portions between 1840 and 1903. This book gives it the customary Middleton Press treatment: a brief historical introduction, then photographs of different dates, large scale maps and signalbox statistics for each station along the route. The New Passage branch is not covered. Special attention is given to the Severn Tunnel, including the pumping engines at Sudbrook and the car carrying arrangements that existed until the Severn road bridge opened in 1966. This book is up to the usual Middleton Press standard.

ALLAN BRACKENBURY

The Welsh Highland Railway, Vol 2: Halfway to Paradise — John Stretton

128pp, 240x170mm, 251 b&w photographs, map, paperback, Past & Present Publishing, The Trundle, Ringstead Road, Great Addington, Kettering, Northamptonshire NN14 4BW, 2004, ISBN 1 85895 233 6, £15.99

This book is described on the cover and the title page as 'A Past and Present Companion' and 'Railway Heritage from the Nostalgia Collection'. The latter is a misnomer. The past is illustrated by photographs of the railway mostly in a state of dereliction: the present by positive reconstruction, certainly not sentimental recollection. It is largely a collection of photographs contrasting, where possible, the abandoned derelict track of the railway and recent views from the same locations after reconstruction. These reveal the colossal amount of work achieved in the reconstruction of the WHR from Caernarfon to Rhyd Ddu and the amount of work still to be carried out. It is another book in the ever-increasing 'Then and Now' category. It is divided into sections, three describing the route from Dinas to Waunfawr, onwards to Rhyd Ddu and to Portmadog, and sections by Dave Kent (history) and John Keylock (Heritage) and an update by David Allan. A section describing locomotives and trains is followed by a brief index. Despite the abundance of illustrations, the book seems over-priced, even by today's standards. The captions are all informative and contain considerable historical information. JOHN MARSHALL

Branch Lines to Enfield Town and Palace Gates — Jim Connor

96pp, 168x233mm, 122 photographs, 22 maps, ticket facsimiles & timetable extracts, hardback, Middleton Press, Easebourne Lane, Midhurst, West Sussex GU29 9AZ, 2004, ISBN 1 904474 32 2, £14.95

This is an album of captioned pictures and OS map extracts covering the line from Hackney Downs to Enfield Town and the closed branch from Seven Sisters to Palace Gates. 19 pictures date from before WW1 and 9 from the grouping era, but the majority are post-nationalisation with 1960s views comprising a third of the book. Stations feature prominently but their architectural similarities limit the book's visual appeal, as does a lack of variety in the suburban trains depicted. These limitations may deter the casual reader but will not those with particular interests in these lines and localities. TIM EDMONDS

The New Romney Branch Line — Peter A. Harding

32pp, A5, 50 b&w illustrations, 8 maps, paperback, published by the author at Mossgiel, Bagshot Road, Knaphill, Woking GU21 2SG, ISBN 0 9523458 8 9, £3.50

This is a new edition of a booklet originally published in 1983 and one of the established series on Southern Railway branch lines. The first half of the book provides an outline history of the branch line — which is more complex than might have been expected due to the combination of late Victorian railway politics and the later, but largely fruitless, era of light railway speculation. In the second half of the book, the author provides a detailed description of the route, its motive power, signalling and train services. ADRIAN GRAY

Bedford to Wellingborough — Geoff Goslin

95pp, 240x173mm, 127 illustrations, 25 maps & 3 diagrams, hardback, Middleton Press, Easebourne Lane, Midhurst, West Sussex GU29 9AZ, 2004, ISBN 1 904474 31 4, £14.95

This book, in the well established and useful Middleton Press format, covers the old Midland Railway main line from Hitchin as far north as Wellingborough and the Higham Ferrers and Northampton (St John Street) branches. Every station on the routes covered is given at least two photographs and the maps seem particularly sharp and relevantly captioned. Despite some unfortunate cropping, many of the illustrations are fresh and interesting, those of the Oakley Junction crash for instance. A book worth its price. But why no page numbers especially since the contents and index only include the photographs and not all the illustrations?

WILLIAM FEATHERSTONE

Short reviews

Gallery of Steam — Steam Railway Magazine

172pp, 257x257mm, 155 colour and 8 b&w photos, hardback, Haynes Publishing, Phoenix Mill, Thrupp, Stroud, Gloucestershire GL5 2BU, 2004, ISBN 0 84425 160 8, £16.99

An album of 'atmospheric' photographs, mainly in colour, selected from the pages of Steam Railway Magazine. Most are of preserved British steam locomotives in action, on both heritage and main lines, but there is a handful of overseas and industrial shots. The quality is excellent but there is little for the historian.

London's Canals — Derek Pratt

56pp, 209x148mm, 33 photographs, 5 maps, paperback, Shire Publications, Cromwell House, Church Street, Princes Risborough, Buckinghamshire HP27 9AA, 2004, ISBN 0 7478 0601 2, £5.99

This is the fourth edition of a guidebook first published in 1977 but now revised and updated in colour as a Shire Album. It covers walks besides the capital's waterways starting with the Grand Union Canal from Brentford northwards to Denham, a quick look at the Slough Arm, then along the Paddington Arm and the Regent's Canal through to Limehouse. Next comes the river Lee up to Waltham Abbey followed by a mention of some of London's former waterways such as the Croydon Canal. The volume concludes with notes on further reading, some useful addresses and an index.

Railways in British Crime Fiction — Philip L Scowcroft

Crime and Detective Story Magazine, Supplement No 9, 49pp, A5, paperback, CADS, 9 Vicarage Hill, South Benfleet, Essex SS7 1PA, 2004, ISSN 0965 6561, £4.00

This little book is based on seven papers by Philip Scowcroft published in the *RCHS Journal* between 1977 and 1998. The material has been significantly expanded, revised and reorganised. References to railways in crime fiction are numerous and all indicate something about the workings of the railways of the time (usually quite accurately). This book starts with Wilkie Collins writing in the 1860s and mentions over 120 subsequent writers. All the well-known crime writers are here and many little-known as well. The author applies his own detailed knowledge of railway history to his commentary upon the fictional works.

Brecknell Willis & Co — David Hartland

96pp, 236x166mm, approx 120 photographs, hardback, Middleton Press, Easebourne Lane, Midhurst, West Sussex GU29 9AZ, 2004, ISBN 1 904474 2921, £14.95 post free

This is a detailed account of a company which designed, manufactured and supplied power collectors for trains, trams and trolley buses around the world. Based in Bristol, they were at the forefront of development of this small but important bit of electric transport technology from the beginning until the present day. Electric transport vehicles need some way of getting the power from the static wires to the moving vehicle. Brecknell Willis have led the field for how to do this since it first became important and this book describes how they did it with copious good pictures and readable technical explanations.

George Stephenson — Hunter Davies

304pp, 30 b&w photographs, paperback Sutton Publishing, Phoenix Mill, Thrupp, Stroud, Gloucestershire GL5 2BU, 2004, ISBN 0 7509 3795 5, £8.99

First published in 1995, this revised edition includes a new introduction. The author, like many of his contemporaries, bewails the fact that his biography, meant for the general public, has been out of print for many years due, he feels, to publishers being more interested in minor literary or aristocratic personages of the Victorian age than in its great engineers. Be that as it may, Davies's account examines Stephenson's private life in greater depth than most previous biographers and is presented in absorbing detail.

Note

The Great North of Scotland Railway Association is now making its 1993 publication *Great North Memories: The LNER Era* available to non-members. It is available from the Association at 7 Sutors Park, Nairn, Invernesshire IV12 5BQ at £3.00 post free.

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