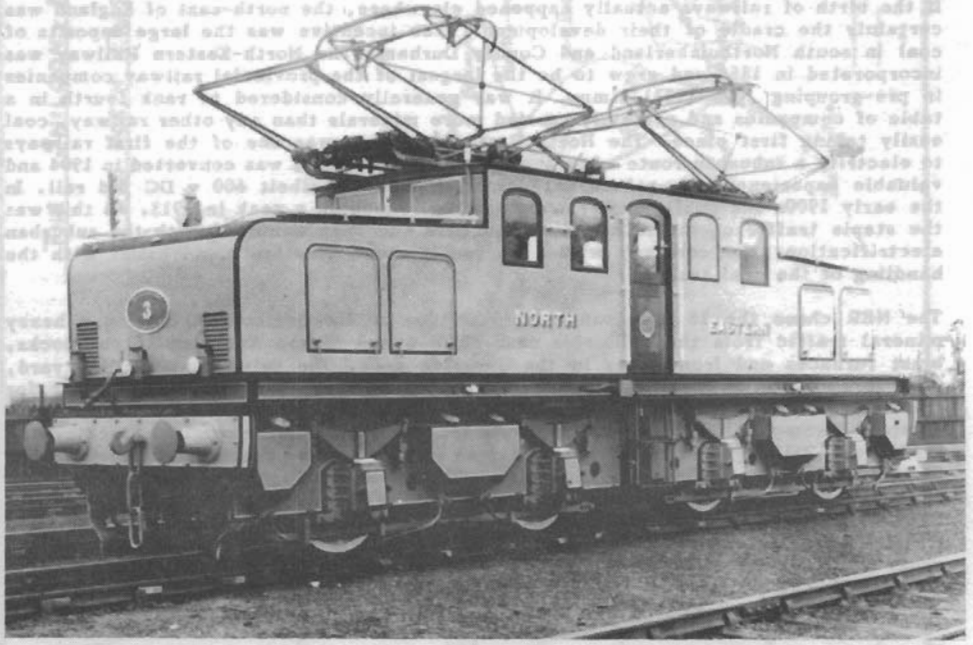
# ELECTRIC RAILWAY SOCIETY JOURNAL

## (INCORPORATING THE ELECTRIC RAILWAY)

Vol 30 No 180 Nov-Dec 1985 £3.75 per year




First of the ten 1,100 hp Bo-Bo electric locomotives built in 1914 at Darlington Works for the North Eastern Railway and used on the Shildon–Newport Line between 1915 and 1935.
Photograph courtesy of the National Railway Museum York.



London indoor meetings are held at Fred Tallant Hall, 153 Drummond Street, N.W.1 at 7.00 p.m. on the first Wednesday of each month from September to June. Light refreshments are available from about 6.30 p.m.
Birmingham meetings are held in the new lecture hall of the Museum of Science and Industry, Newhall Street, starting at 7.30 p.m.

# THE NEWPORT - SHILDON ELECTRIFICATION OF THE NORTH-EASTERN RAILWAY

by Stephen Williams

The electrification by the North Eastern Railway of the line from Newport to Shildon was the first mineral line electrification undertaken by a British railway company and 1985 marks both the 70th anniversary of the inauguration and the 50th anniversary of the cessation of electric operation. These facts led to the choice of Journal cover photograph for 1985 and to the writing of the following article.

If the birth of railways actually happened elsewhere, the north-east of England was certainly the cradle of their development. The incentive was the large deposits of coal in south Northumberland and County Durham. The North-Eastern Railway was incorporated in 1854 and grew to be the largest of the provincial railway companies in pre-grouping (pre 1923) times. It was generally considered to rank fourth in a table of companies and certainly carried more minerals than any other railway, coal easily taking first place. The North Eastern Railway was one of the first railways to electrify a suburban route when the Tynemouth loop line was converted in 1904 and valuable experience was gained with electric traction albeit 600 v DC 3rd rail. In the early 1900s the coal industry was booming, reaching a peak in 1913. As this was the staple traffic of the NER and, as success had been achieved with the suburban electrification, the company wished to see if electrification could assist with the handling of the coal traffic.

The NER chose the 18 mile route from Shildon to Newport which carried a heavy mineral traffic from the collieries near Shildon and Bishop Auckland to the docks, blast furnaces and iron works in the Teesside area. The Erimus marshalling yard, near Newport, was brought into use at the end of 1908 as a distribution point for coal and other supplies for shipment and for Teesside industries. The scheme comprised some 50 track miles. The route from Shildon was the original Stockton and Darlington Railway opened in 1825 as far as Simpasture and from there the Clarence Railway opened in 1833 as far as Carlton. The route then took the west curve on to the Ryhope-Bowesfield Junction line (opened in 1877) and finally the freight tracks of the Darlington to Middlesbrough line into Erimus yard. This was the 1830 Middlesbrough extension of the Stockton and Darlington Railway. The sections of the route were opened as follows: Middridge Sidings-Bowesfield - 1 July 1915; Shildon Yard-Middridge Sidings - 30 October 1915; Bowesfield-Erimus Yard - 12 November 1915 and finally Erimus Yard-Newport East - 1 January 1916.

During the electrification of the suburban lines there had been a close association between the railway company and the firm of Merz and McLellan, consulting engineers, and this was continued with the main line scheme. The NER had decided not to generate power itself but to purchase it from the Cleveland and Durham Electric Power Company. This avoided large capital expenditure on power station plant and had an important bearing on the whole scheme. The system of electrification adopted was 1500 v DC overhead. The work was carried out under the supervision of the railway company's then chief engineer, Mr C A Harrison. Two rotary converter substations were built at Aycliffe and at Erimus. High tension current was supplied as 3 phase AC at 20,000 v to Aycliffe via overhead transmission lines and at 11,000 v to Erimus by underground cables. Aycliffe substation contained two 800 kW rotary sets, each set consisting of two 400 kW rotary converters connected in series. Erimus substation also contained 2 sets, however one set was 1200 kW. A hand-operated travelling crane was fitted in each substation.

The overhead contact wires on the main portions of the track consisted of two hard-drawn copper conductors, each of 0.155 sq in section, but on certain portions of the sidings, where loads were not so heavy, a single contact wire only was used. The wires were supported by a solid steel auxiliary catenary wire to which they were attached by sliding clips. This auxiliary catenary was in turn suspended from the main stranded steel catenary by means of steel wire droppers. The main steel

catenary wire was supported from the steel structures by means of special insulators, double insulation being used throughout. Two auxiliary stranded copper feeder wires, one for each track, were carried on the top of the steel gantries and were connected in parallel with the main contact wires at frequent intervals. Their purpose was to increase the conductivity of the overhead equipment. Gantries, consisting of two steel masts and a cross girder, were placed at 330 feet intervals. It was found, however, that winds whipped the wires off the pantographs so intermediate gantries were put in. The British standard has been 210-220 feet thereafter.

To operate the electric service 10 Bo-Bo locomotives were built. These were numbered 3-12 and the steam locomotives bearing these numbers had to be renumbered. They were built at Darlington works and much of the design work was done by R J Robson under the direct supervision of the Chief Mechanical Engineer, Vincent L Raven. The electrical equipment was supplied and fitted by Siemens Bros, Stafford. The locomotives had a central cab with sloping ends which were partitioned off from the cab and which contained the electrical equipment. The doors were normally kept locked. Length was 39 feet 4 ins over buffers and the weight was 74 tons 8 cwt. Wheels 4 feet in diameter were fitted to two double bogies with a total wheelbase of 27 feet. Two pantographs were fitted and these were raised and maintained in position by compressed air; pressure for which could be built up by hand pump. A cock was fitted on this system the removable handle of which formed the key to the doors in the sloping ends. The handle could only be removed by lowering the pantographs, thus ensuring that access could not be gained to the electrical equipment while the pantographs were in contact with the overhead wire. The cabs contained two master controllers, one at each end, various auxiliary switches and the control valves for the Westinghouse brakes and the compressed air-sanding with which the locomotive was fitted. A hand-brake column was located in the centre of the cab.

The motor equipment for each locomotive consisted of four totally enclosed motors, each driving an axle through single reduction gearing. Each motor was wound for 750 volts, the pair of motors in each bogie being connected permanently in series. Each motor was capable of developing 275 hp at one hour rating and 182 for continuous rating. The equipment could exert an average pull of 28,000 lb when starting under normal rail conditions. The motors and gearing were designed to run at a speed of 45 mph without exceeding the limits of safety, but the normal speed on the level when hauling a train of 1,400 tons was 25 mph. The motors were suspended by means of a cross-beam suspension bar with bearings and reaction springs. These with the motor suspension bearings on the axle provided the motors with four points of suspension. The air for ventilating the motors was supplied from fans driven by two dynamotors fixed to the floor of the cab. The shaft of each dynamotor was extended and fitted with a fan which supplied air to the pair of motors on one bogie. The dynamotors supplied the current for operating the whole of the control circuits and the lighting and heating in the cab. The speed was 1,500 rpm. Each of the two pantographs had two collectors each fitted with an aluminium rubbing strip making contact with the overhead contact wire. Thus, there were four rubbing strips per locomotive which, with the double contact wire, made eight points of contact. Each pantograph was raised and maintained in contact with the wire by means of an air cylinder so that in the event of a failure of the air pressure the pantographs were automatically lowered. Part of an existing engine shed at Shildon was adapted for the use of the electric locomotives. It is worth noting that No 9 was exhibited in the 1925 Railway Centenary Procession.

The locomotives could perform four round trips in 12 hours each consisting of a trip from Shildon to Newport with a train of 1,400 tons followed by a trip from Newport to Shildon with a train of empties weighing 800 tons. The distance travelled, therefore, was about 150 miles. Until 1922 the maximum load was only 1,000 tons, but from November 1922 this was increased to 1,400 tons, exclusive of brake van, and with a maximum of 70 wagons. The time allowed for the 15 miles from Middridge Sidings to Erimus yard was 57 minutes. There was a difference of 340 ft in height between Shildon and Newport and the gradients, therefore, were in favour of loaded

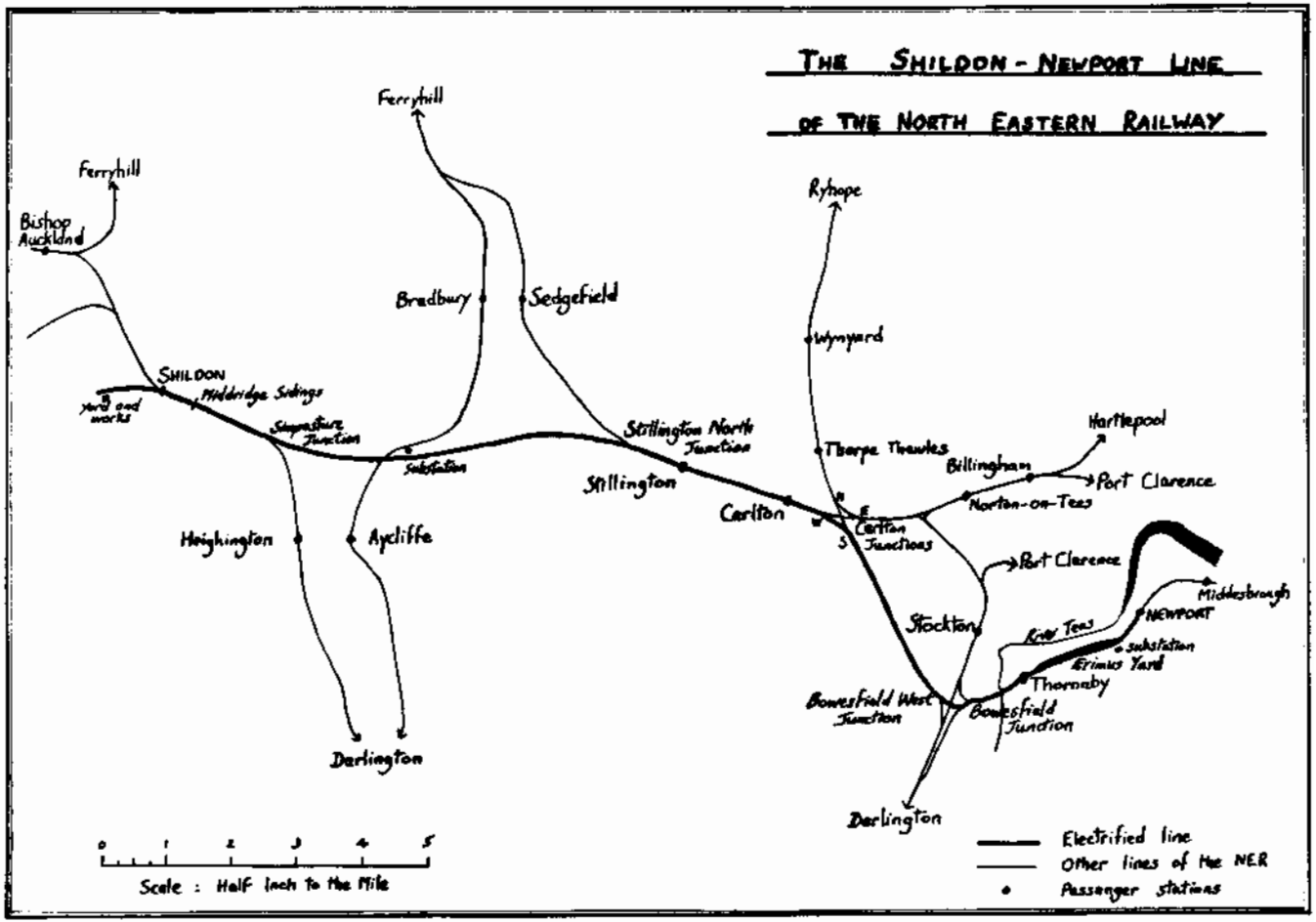
trains, only ¼ mile being on a rising gradient on a trip to Newport. The steepest gradient was 1 in 103. Drivers had to be careful to keep trains under control when descending with fully loaded trains.

Just prior to electrification the line was worked by NER class T2 (LNER Q6) 0-8-0 steam locomotives, 30 of which were built in 1913 so that war-time operation could be maintained. The T2's were designed by Raven and could be driven "all-out" at anything up to maximum mineral train speeds. In maximum output the electric locomotives were not greatly superior to the T2's. The electric locomotives could handle 800 tons of empties up the line against 700 for the steam loco. The T2 was a 3 cyclinder engine with 200 lbs boiler pressure. It had a maximum tractive effort at 85 per cent boiler pressure, 41,700 lbs or 18.3 tons. The weight on the coupled wheels was 71 tons 12 cwts only slightly less than the electric locomotive with 74 tons 8 cwt. (The total running weight was 115 tons 14 cwts.) The two locomotives were designed to be of equal strength. As a result of comparative tests conducted by Raven on the line it was found that the electric locomotive handled the load better than the steam; there was less time taken. Five electric locomotives did the work of thirteen steam. In 1922 mileage run by the electric locos was 116 train miles per day per engine in traffic as compared with 55 for the steam engines in 1914. Electric locomotives were cheaper to maintain, running almost twice the distance between repairs, which in themselves were cheaper than those for steam engines.

The scheme got off to a bad start because of restrictions on the shipment of coal imposed by the First World War. During the twenties the traffic did not increase as expected and the coal strike in 1921 badly affected its financial position. Traffic decreased to an extent that in 1934 when extensive renewals of the overhead equipment were becoming necessary it was decided to abandon electric working and revert to steam. Shildon Yard closed on 7 January 1935 and the remainder of the route was de-electrified on 8 July 1935.

After closure the locomotives were stored at Darlington until 1947 except No 11 which was at Doncaster from 1941 for modification. Thereafter, the locomotives were stored at Gosforth car sheds (Newcastle) until 1950. On 21 August 1950 nine locomotives were withdrawn and eight sold for scrap. No 5 was broken up at Darlington works as the bogies were needed for spares for the modified loco. No 11 was rebuilt as a banking engine for the Manchester-Sheffield line. However, it was never used there and was sent in August 1949 to Ilford depot on the former LNER GE section electrified line from Liverpool Street (London) to Shenfield. It was renumbered 26510; its hp was increased to 1256 and tractive effort to 37,600 lb. One central pantograph replaced the former pair and electric headlamps and additional sand boxes were fitted. The cab door position was altered. It was rendered obsolete when the GE lines were converted to 25 kV AC and was withdrawn in 1964.

Traffic continued to use the Shildon-Newport line until 1963 when the section between Simpasture Junction and Stillington North Junction was closed. The trackbed can still be followed reasonably well today. However, there is not a great deal of evidence to remind us of this early electrification scheme which set a precedent for Britain and which could have led to much greater events had the NER gone ahead with its main line electrification, but that is another story!


THE SHILDON - NEWPORT LINE
OF THE NORTH EASTERN RAILWAY
Ferryhill
Ferryhill
Bishop Auckland
Bradbury
Sedgefield
SHILDON
yard and works
Middridge Sidings
Simpasture Junction
Substation
Stillington North Junction
Stillington
Heighington
Aycliffe
Darlington
Rythope
Wynyard
Thorpe Thewles
Billingham
Hartlepool
Port Clarence
Norton-on-Tees
Carlton
Carlton Junctions
Port Clarence
Stockton
Middlesbrough
NEWPORT
River Tees
Substation
Erimus Yard
Thornaby
Bowesfield West Junction
Bowesfield Junction
Darlington
0 1 2 3 4 5
Scale : Half Inch to the Mile
Electrified line
Other lines of the NER
Passenger stations