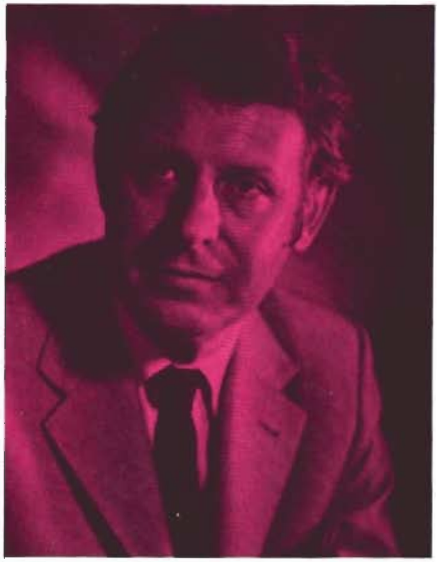

Electric all the way
London to Glasgow


PERTH AND INVERNESS
GLASGOW
Motherwell
EDINBURGH
Haymarket
Carstairs
Kilmarnock
Lockerbie
CARLISLE
Dumfries
Penrith
Oxenholme
Lancaster
PRESTON
Bolton
LIVERPOOL
Wigan
MANCHESTER Victoria
Warrington
Piccadilly
CREWE
STAFFORD
WOLVERHAMPTON
BIRMINGHAM
Coventry
Gloucester
Watford Junction
BRISTOL
LONDON
Anglo–Scottish Electrified Route
Diesel Hauled (through services)
Other Electrified Routes

Foreword



The extension of the electrification of the main line from Crewe to Glasgow marks another important stage in the continuing improvement of rail transport between England and Scotland.

The project has involved a comprehensive improvement of the track itself, with complete resignalling, as well as the electrification of the line, so that this 400 miles long trunk route is now among the most modern in the World. Bear in mind, too, that the train services have continued to run throughout the period of very substantial building and construction work.

In round figures the rebuilding of 200 miles of route has cost £38m (£200,000 a mile) and the electrification £36m. There have been some small changes in the scope of the scheme, and substantial inflation but these factors apart, the whole of the work has been completed within 3 per cent over the estimates made in 1968.

Daytime journey times have been reduced substantially below those achieved before the project started—by 100 minutes between London and Glasgow, by 100 minutes between Birmingham and Glasgow, and by 60 minutes between Manchester/Liverpool and Glasgow—and frequency of service has been improved. In addition it is a great advance environmentally. The electric traction poses no pollution problem; it exploits indigenous fuels; there have been no demands on scarce land resources; and the passengers will experience quieter, cleaner and more luxurious rail travel than ever before.

There is still more to come. By 1977/8 the use of the first Advanced Passenger Trains will reduce journey times between London and Glasgow to 4 hours, and the use of High Speed Trains on the East Coast Main Line will mean that London will be reached from Edinburgh in under 4½ hours.

For more than a century British Rail has on this Anglo-Scottish route provided an efficient, reliable and convenient service in all weathers. With these latest improvements in traction, signalling, track and rolling stock, that service will be even better.

Richard Marsh

CHAIRMAN, BRITISH RAILWAYS BOARD

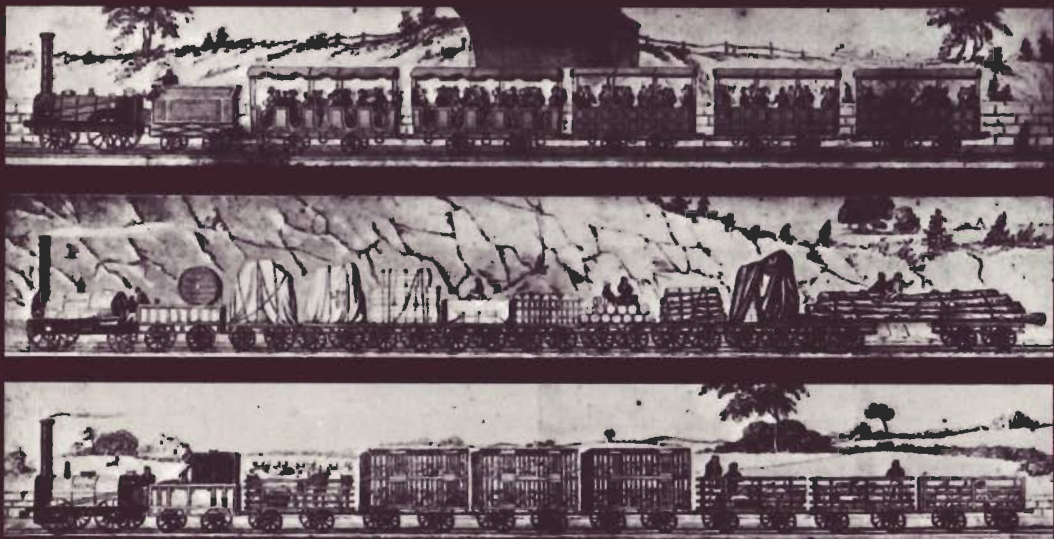
The need for further Electrification.

Extension of electrification to Scotland via the West Coast route was the logical sequel to the previous electrification project completed by British Rail in 1967 to link London, the West Midlands, Liverpool and Manchester.

Since it was completed in 1848, the West Coast Main Line between London and Glasgow has been the country's most important rail route; equally long established is its tradition of superior service and smooth efficient operation. If these qualities were to be maintained against the growing opposition from motorways and air lines, conversion to electric traction was essential. A high-speed, modern rail route was necessary to enable British Rail to provide its customers with the high standard of service they expect.

This booklet includes an account of the history of the Anglo-Scottish route, and the methods developed and employed by the London Midland and Scottish Regions of British Rail and their contractors to convert this vital rail route to electric traction.

Picking up the London Mail.



Passenger, Freight and Livestock trains on the Liverpool & Manchester Railway 1837.

From Highway to Railway.

Historically communications between the capitals of England and Scotland have always been of great importance, but with the coming of the Industrial Revolution in the 18th century they assumed a new significance. In 1712 Stage Coach passengers had to endure a $13\frac{1}{2}$ day journey from London to Edinburgh; by 1776 improved roads reduced this time to 4 days. Journey times had been further reduced in 1818, to 59 hours by Mail Coach and 61 hours by Stage Coach. In the 1830's the fastest time was $45\frac{1}{2}$ hours.

The First Modern Railway

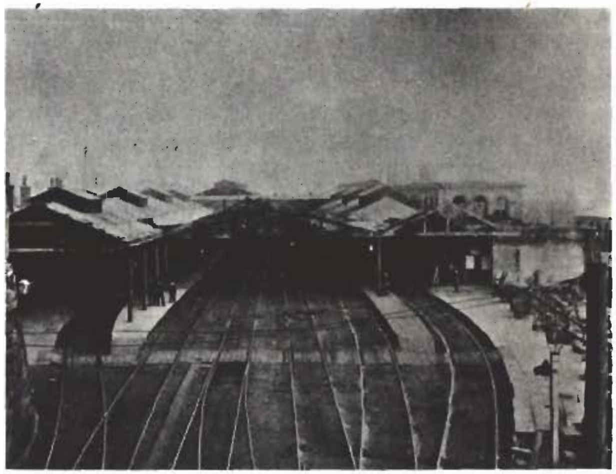
The London-Glasgow route began, at almost its mid point, when the Liverpool and Manchester Railway opened in 1830.

The effects which the new railway would have on local manufacturing costs were not lost on neighbouring towns and connecting branch lines quickly followed. First of these was the Warrington and Newton Railway, opened in 1831, followed by a line to the North, the Wigan Branch Railway, opened in 1832 from Parkside to Wigan.

Then a scheme to link Preston and Wigan was proposed and when this was completed in 1838, there were 38 miles of railway north of the Liverpool and Manchester line. There were also developments to the South. A line was being constructed from Birmingham to Warrington to connect the Midlands with Liverpool and Manchester via the junction at Newton. This was the Grand Junction Railway completed in 1837, and the following year, when the London and Birmingham Railway was completed, it became possible to travel by rail from the new station at Euston to Preston in through carriages in eleven hours. The single first class fare was 54s. 6d.

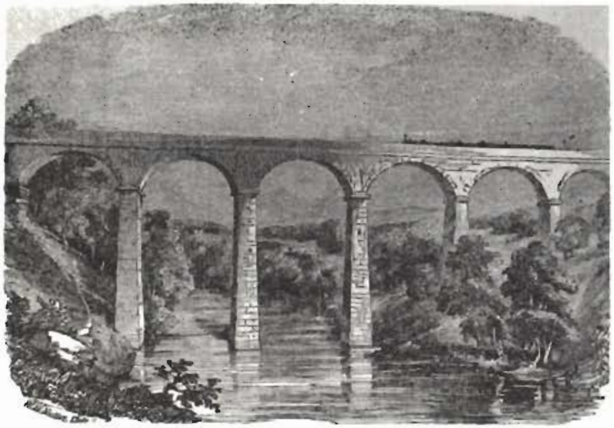
Two years later, the Euston–Glasgow route was opened—but passengers had to travel by ship for part of the journey. Glasgow-bound passengers went to Liverpool where they transferred to a steamship which took them on to their destination. In favourable circumstances the combined rail and sea journey could be completed in $26\frac{1}{2}$ hours. A year later, in 1841, the recognised sea route was from Fleetwood to Ardrossan, with rail connections between Preston and Fleetwood, and between Ardrossan and Glasgow.

Extensions to Glasgow's Central Station 1904.



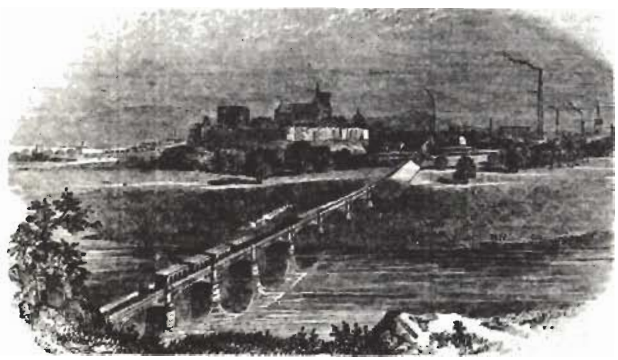
Preston Station in the mid-19th Century.

The First Euston Station. Arrival and Departure Platforms 1838.



Lowther Viaduct, Lancaster & Carlisle Railway.

Travel in the 1850's.



Carlisle in the early days of the Railway.

Through Services

North of Preston the rail route to Scotland was making steady progress. Another company was incorporated, the Lancaster and Preston Junction Railway, to build a railway to link the two towns. This link was completed in 1840 and through services introduced between London and Lancaster.

During the time in which the railways were pushing northwards through Wigan and Preston to Lancaster, another rail route to Scotland was being developed using a series of connecting lines which followed the London and Birmingham route from Euston as far as Rugby, thence branching north-eastwards through Derby and Normanton. By 1840, when the West Coast route had reached Lancaster, one could travel from Euston to York on this alternative route.

A controversy which had been simmering for the previous five years now came to the boil. Many people believed that only one railway line would be required between England and Scotland, and the debate arose from the choice of route. The first suggestion, made in 1835 was for a line between Lancaster and Glasgow, and in the following year George Stephenson proposed a route from Lancaster to Hest Bank and then across Morecambe Bay on an embankment to Kent's Bank. It would then follow the coast through Ulverston, and Millom, to Carlisle. The cost of crossing Morecambe Bay proved prohibitive, although it was claimed that the sale of reclaimed land would have off-set most of this.

Direct Line

There were those who favoured a more direct line between Lancaster and Carlisle via Penrith, but there was disagreement over the actual route to be followed. Eventually two Commissioners were appointed by the Government to examine and report upon the various projected lines. Their report, issued in 1841, recommended a link between Lancaster and the Caledonian Railway.

Shortly after the publication of this recommendation a company was formed to extend the railway from Lancaster to Carlisle. Some difficulty was experienced in raising the capital and substantial amounts were provided by the existing railway companies already operating between London and Lancaster.

The projected route of the Lancaster and Carlisle Railway was probably more severe than anything previously encountered by the early railway engineers. It was 70 miles in length, through steeply rising hills and across deep valleys. For their engineer, however, the

Lancaster and Carlisle Company chose a man of great ability, Joseph Locke, who added to an already outstanding reputation by completing the line in only 27 months.

Engineering works on the line included some on an unprecedented scale, carried out mostly by men using hand tools, horse drawn vehicles, and blasting powder. More than 350,000 cu. yards of earth and rock were excavated at Shap, 410,000 cu. yards from the cutting at Wreay south of Carlisle, and the embankment at Birkland, near Oxenholme, required 140,000 cu. yards.

Little Change

The stone bridges and viaducts which Locke designed to span the valleys and streams of Westmorland and Cumberland are mostly still in use, their surroundings in many cases little changed since they were built over a hundred years ago.

On September 22, 1846 the first 20 miles of the Lancaster and Carlisle railway—to Oxenholme, then called Kendal Junction—were officially opened, and the line was completed in its entirety in December the same year.

The West Coast Anglo-Scottish route was now approaching completion. In June 1847 the Trent Valley Railway was opened, providing a direct route from Rugby to Stafford, eliminating the detour through Birmingham and Wolverhampton.

Scottish Developments

The Caledonian Railway was first in the field for rail communication from Carlisle to Scotland. The Company's Act received the Royal Seal of approval in 1845, with an authorised capital of £2,100,000. The route was from Carlisle to Garriongill, near Motherwell, via Lockerbie, Beattock and Carstairs, near Lanark. From Carstairs there was a branch to Edinburgh. The route to Glasgow, terminated in the St. Rollox area of the city at Glebe Street station, using the tracks of earlier railways from Garriongill.

A series of other railways, later absorbed by the Caledonian, were to continue the line to Stirling, Perth and Aberdeen. Edinburgh and Glasgow were reached in 1848, as was Perth, and the line to Aberdeen was ready by 1850.

Grandiose Plans

Such grandiloquence and Royal usage may have blessed the Caledonian's early days, but the company very quickly fell on hard times and money was tight for some time to come. The grandiose plans for

Pride of the Caledonian Railway, No. 903 "Cardean" makes ready to leave Glasgow Central in 1906 with a London train.

OPENING

OF THE

LANCASTER & CARLISLE RAILWAY,

On Tuesday, the 15th December, 1846.

Admit the Bearer to the 2d CLASS CARRIAGES.

The Opening Train will leave { LANCASTER at............11 / KENDAL JUNCTION at....12 / PENRITH at............2 }
and return from Carlisle the following morning at half past 8.

A Train will leave Carlisle at Twelve, arriving at Penrith in time to return with the "Opening Train."

Official Invitation to the Opening of the Lancaster & Carlisle Railway 15 Dec. 1846, altered by the Railway Company from 1st to 2nd class.

a truly incredible station of palatial proportions in Edinburgh foundered on this money crisis and the Caledonian provided the capital city of Scotland with a wooden shack for a station instead!

Glebe Street did not long remain the Glasgow terminal. The Clydesdale junction line from Motherwell to Gushetfaulds, near where the Freightliner terminal for Glasgow is now, opened in 1849 and trains switched to this route, terminating in South Side Station. Anglo-Scottish trains were diverted back to the north side of Glasgow again in November 1849 when Buchanan Street Station opened and this was the terminus for these services until 1879 when Glasgow Central opened.

The original Glasgow Central was expanded considerably in the early years of this century when the Caledonian had become a truly prosperous concern covering large areas of Scotland. It was from this enlarged station, which remains similar in appearance today, that the Caledonian's most famous locomotive No. 903 'Cardean' ran daily for years on end with the 2 p.m. 'Corridor' express to London Euston.

In 1923 the Caledonian joined with other companies to form the London Midland and Scottish Railway. Maroon became the colour of express engines, replacing the blue of the Caledonian and the black of the London and North Western, its English counterpart formed from the previous smaller companies on the Euston–Carlisle section of the West Coast Main Line. For years $8\frac{1}{4}$ hours had been the best daytime schedule between London and Glasgow and it was not until the 1930's that this was cut.

Fastest Journey

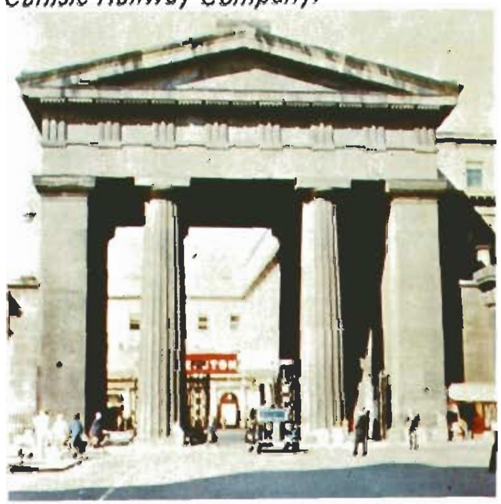
'The Coronation Scot' ran between Glasgow and London in $6\frac{1}{2}$ hours, the best regular time achieved by steam. It was hauled by streamlined locomotives of Sir William A. Stanier's 'Coronation' class, which continued to work on the route in unstreamlined form until the early 1960's. The most dramatic steam run occurred in 1936 when a special 'flyer' hauled by a 'Princess' Pacific made a test run between Glasgow and London in $5\frac{3}{4}$ hours, but this was a one-off effort although one of the 'Coronations' managed Glasgow to Euston in six hours three minutes 20 years later, arriving in London 37 minutes early with 'The Caledonian', a light eight coach train.

The first runs with a regular daily timing of six hours each way for the 401 miles started in May 1970 with diesels taking over from electric locomotives at Crewe. These timings are now eclipsed by the five hours of 'The Royal Scot' with electric power throughout.

Interior of the old No. 1 Signal Box at Preston.
The Coronation Scot, London–Glasgow, at speed in 1939.

Shield of the Caledonian Railway Company.

Shield of the Lancaster & Carlisle Railway Company.



Old Euston. The Doric Arch.

Scottish "Blue Train".

Early Underground Train.

Liverpool–Southport d.c. powered train in the mid-1920's.

The Manchester Pullman.

The First Electrics.

Electric railways were developed in this country as an answer to air pollution on the London underground system. Smoke and steam from coal burning locomotives made conditions for travellers almost unendurable. In 1890 the City and South London Tube introduced electrically hauled trains. They were not only cleaner than their steam powered predecessors, they were also capable of rapid acceleration, a highly desirable quality on suburban lines where trains had to start and stop at frequent intervals.

In the next 20 years several main line railways adopted electric traction, using the third rail system, for suburban services, and by 1914 electric trains were operating on North Tyneside, between Liverpool and Southport, Manchester and Bury, and in the London area. Two railways preferred an overhead contact system and this was introduced on the lines between Lancaster, Morecambe and Heysham, and between London Bridge, Victoria and Crystal Palace.

Between the wars the Southern Railway extended the third rail system to cover all suburban routes and principal lines to the South Coast. Another third rail system was installed on the Wirral lines in Cheshire, and between Manchester and Altrincham the line was electrified using overhead equipment. Although the four big railway companies were all considering the feasibility of main line electrification opinions differed on the best system to adopt.

Main Line Electrification

There was no accepted standard but in 1932 a Government Committee recommended that future main line electrification projects should use 1,500 volts d.c. for overhead systems, and 750 volts d.c. for conductor rail systems. Two schemes using the 1,500 volts system were commenced, the important commuter route in the South-East between Liverpool Street and Shenfield, and the lines linking Manchester–Sheffield–Wath, but the work was halted by the outbreak of war in 1939, and only completed in 1949 and 1954 respectively.

After the war a new system of overhead electrification emerged. Developed by French Railways it used 25,000 volts a.c. and the British Transport Commission, then planning large scale main line

Towards the end of an era; an electric locomotive overtakes a steam hauled train.

electrification of the trunk routes between London, the West Midlands, Liverpool and Manchester, investigated its potentialities. It concluded that the costs of installation and power supply would be cheaper than the 1,500 volts d.c. system and that electric locomotives using a 25,000 volts a.c. supply would give a superior performance.

Having obtained permission from the Government, the Commission began to install the 25,000 volts a.c. system over 400 route miles, 1,480 single track miles of railway between London, the West Midlands, Liverpool and Manchester.

The work began in 1957 and by 1960 the line from Manchester to Crewe was opened for electric train services. In January 1962 work was completed on the Liverpool–Crewe route and in the next three years was extended south to London. Electric traction was introduced over the whole of the route with the exception of the lines to Birmingham and Wolverhampton, by November 1965. A completely new timetable of high speed electric services was launched in 1966, and the following year the network of electric services was enlarged to cover the West Midlands when the project was finished in that area.

Electric hauled Company train.

Big Impact

The consistently high standard of comfort, convenience and reliability made possible by the use of electric traction, combined with smooth-running modern rolling stock on continuous welded rail made a considerable impact on the public.

The new services were an immediate and spectacular success and passenger traffic has now risen by over 80 per cent on these routes.

In Scotland the first use of electricity for rail traction was in 1842 on the Edinburgh and Glasgow Railway, using a battery locomotive—but this intriguing early experiment failed for reasons which have caused problems for engineers in later years too, mainly the difficulty of obtaining sufficient power for a long period from batteries. Little is known of this venture. But other than the use of electricity on the local authority tram routes in several cities and on the circular underground line in Glasgow it was not until 1960 that electric traction came to be applied on a permanent basis to railways in Scotland.

Harecastle Tunnels old and new. The new Tunnel (right), was part of a diversionary line constructed during electrification of the route.

In November of that year electric multiple-unit trains started operation between Airdrie and Helensburgh and branches. This route had been considered for electrification at 1,500 volts d.c. in the 1930's but by the 1950's when the scheme was approved it was for the now standard 25,000 volts a.c. system, except on certain sections of limited bridge and tunnel clearance where 6,250 volts is the supply.

Difficulties over the voltage changeover equipment in the trains caused a temporary withdrawal, but re-instatement came the following year. From then on the 'Glasgow Electrics' or 'Blue Trains', as they were known were a positive success with passengers soaring in number from 170,000 a week to more than 400,000.

On Time

Punctuality was spectacular too at more than 90 per cent on time. This figure was maintained when local electric services expanded in 1962 to take in the commuter routes from Glasgow Central to Neilston, Cathcart and Motherwell via Kirkhill. And 90 per cent plus also became the 'on time' hallmark of the electrics on the Glasgow Suburban Electrification Stage II to Paisley, Gourock and Wemyss Bay, inaugurated in 1967. Increases in the number of people travelling proved the popularity of the electrics and now around 40 million passenger journeys a year are made on the 116 route miles of electrified system in and around Glasgow.

Completion of Glasgow–London electrification ties in with local electrification on the Lanark branch and the Hamilton Circle to raise route mileage of electric railway in Scotland to 230. Increased efficiency, means the extra services for Lanark and Hamilton can be covered by the existing 110 electric multiple-units built for the earlier Glasgow electric lines. And the electricity supply control room at Glasgow Cathcart, provided for the first local trains in 1960, has been modified to take on the extra lines including the Anglo-Scottish main line as far south as Tebay, Westmorland.

Further developments are planned for the future, notably a proposal which would provide links between the electric lines north and south of Glasgow for the first time.

Electric traction has proved itself in Scotland and England as a system capable of providing a far better train service to carry more traffic.

It is important to remember that this boost to the transport scene is being achieved without upsetting the environment as the railway routes are on land in use for railways since the last century—they have 'grown into' the countryside and our towns and cities have been built around them. And in these days of increased awareness of the need to conserve world energy resources, notably oil, it is interesting to note that by 1977 some 45 per cent of all train-miles on British Rail will be by electric traction.

Coventry station re-built during electrification of the line from Birmingham to London.

New cars from factory to distributor on specially-designed rail vehicles.

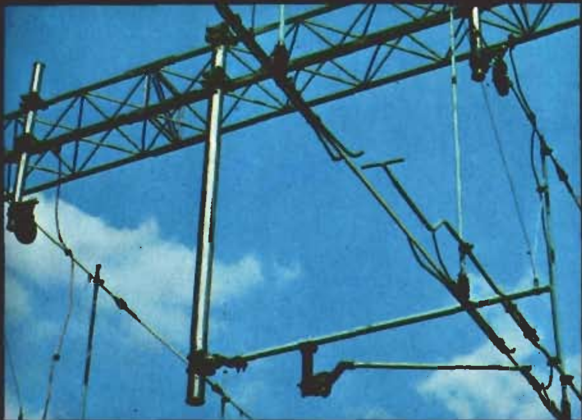
Manchester Piccadilly Station.

A self-propelled tamping and lining machine used for track maintenance.

Excavating foundations for lineside structures.

Erecting overhead equipment from a wiring train.

Erecting gangs maintain contact via short-wave radio.



Overhead wiring pattern.

Laying telecommunication cable.

Installing new signalling equipment.

Building a New Railway.

A period of meticulous planning precedes the electrification of a main line railway in order to co-ordinate the multiplicity of engineering operations which are required, and to maintain facilities for freight and passenger services whilst work is in progress.

Planning begins with a detailed examination of the route to establish which tracks are to be electrified. The heights of all bridges over the route are carefully checked, as many of them will require to be raised or completely rebuilt to provide headroom for the overhead equipment. Wherever possible, Highway Authorities' future plans for re-alignment or widening of bridges are incorporated with the bridge-work programme. Where Highway Authorities have proposals for bridges to be constructed subsequent to the completion of the electrification scheme, provision is made where practicable to minimise the headroom of these bridges.

Power Supply

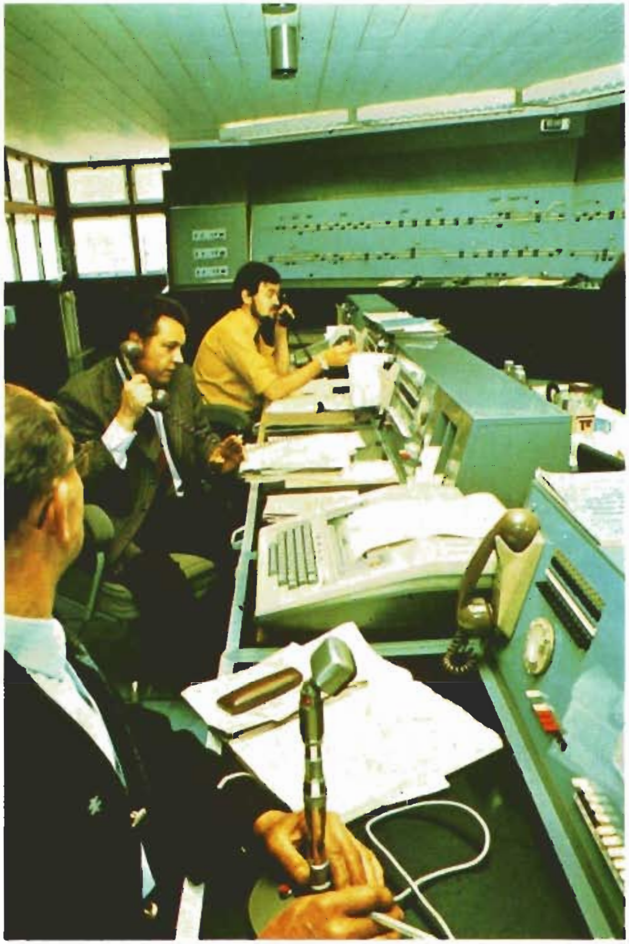
At this stage the design of the power supply equipment is prepared, together with arrangements for feeding the current to the overhead equipment. This information and the results of the route examination are used to produce a plan showing the proposed arrangement of overhead conductors and the position of supporting structures.

The suggested location of each individual structure and its foundation along the line is then examined, and any necessary modifications made.

The design of the overhead equipment, in addition to the lineside structures includes attachments, supporting assemblies of headspan wires (used to carry conductor wires where a number of tracks run close together) and cantilever arms (supporting the conductor wires over individual tracks) and the design of the wiring pattern. These items are now completed and the material required is scheduled for use in the actual construction.

New Signalling

Before work commenced to complete the electrification of the Anglo-Scottish main line through to Glasgow, British Rail began to install a



Controllers, Carlisle Power Signal Box.

Illuminated diagram Carlisle Power Signal Box.

completely new signalling system over the route from Weaver Junction northwards, replacing the mainly semaphore type of signalling until then in use.

Modern electrical and electronic equipment, with multi-aspect colour light signals are now in use, incorporating British Rail's standard automatic warning system of train control on the main passenger lines. Four new power signal-boxes at Warrington, Preston, Carlisle, Motherwell, together with the existing modern centre at Glasgow Central which was altered to cover a bigger area, control all train movements over a total 630 single track miles of electrified railway between Weaver Junction and Glasgow. A similar system has been in use over the rest of the route from London since 1966.

In the new power signalboxes an illuminated diagram shows all the signals and points throughout the area controlled from the box, and the position of all trains. The old 'mechanical' type of signalling required the movement of levers to operate individual signals and points.

Now press buttons have replaced the levers. By pressing the appropriate buttons the signalman can set up signal routes on long stretches of line many miles away. If conditions are safe for them to do so, all points along the route will move to the required positions, and when all other safety requirements have been met, the signals will clear automatically.

The design of the signalling system makes it impossible for the signalman to make an error which would prejudice the safety of trains.

Powerful Lights

All running signals throughout the electrified main line are now of the multiple-aspect colour light type. Their powerful lights indicate the running conditions of the line ahead to the drivers of approaching trains. A total of 1210 new running signals have been erected as part of the re-signalling scheme.

Each of the new power signalboxes is the centre of a comprehensive telecommunications network which includes a telephone at each signal from which drivers can call the signalmen. Linking these lineside telephones and other stations and depots with the power signalboxes has required 381 miles of telecommunication cable.

Higher Speeds

Railway electrification using the overhead system requires, as well as an extensive programme of civil engineering bridge work, considerable modifications of the track to permit the increases in the speed and number of trains.

Before the electrification project began the track between Weaver Junction and Glasgow was in the course of being re-laid, with continuous welded rail, a job that required over 80,000 tons of new rail, one million concrete sleepers and more than one million tons of new stone ballast.

High speed running on continuous welded rail gives passengers a smooth and comfortable ride, with little noise or vibration. Wear and tear on rolling stock, and track maintenance costs, are considerably reduced. Track maintenance is almost wholly mechanised, using equipment which includes huge mobile tamping and lining machines operated by electro-hydraulic control systems. Irregularities in track levels are detected as the machine moves along and automatically corrected by levelling and consolidating the track, smoothing out local deviations in the alignment of the rails.

Associated with the electrification project, such major track alterations have been made, with existing tracks at a number of locations being completely re-modelled, including Warrington, Wigan, Preston, Carstairs and Rutherglen. This has produced a simplified and more efficient layout.

In order to raise the permitted overall line speed, curves in the track totalling some 237 miles have been re-aligned and recanted.

More Headroom

One of the main tasks has been the alteration of bridges over the line to provide the necessary headroom for overhead equipment. A minimum of eight inches electrical clearance is required between this and any structure such as a bridge abutment or deck, and six inches between the overhead line equipment and the tops of passing trains. To obtain these clearances 154 bridges had to be completely reconstructed, 55 being raised bodily by between 12 and 18 inches. In some

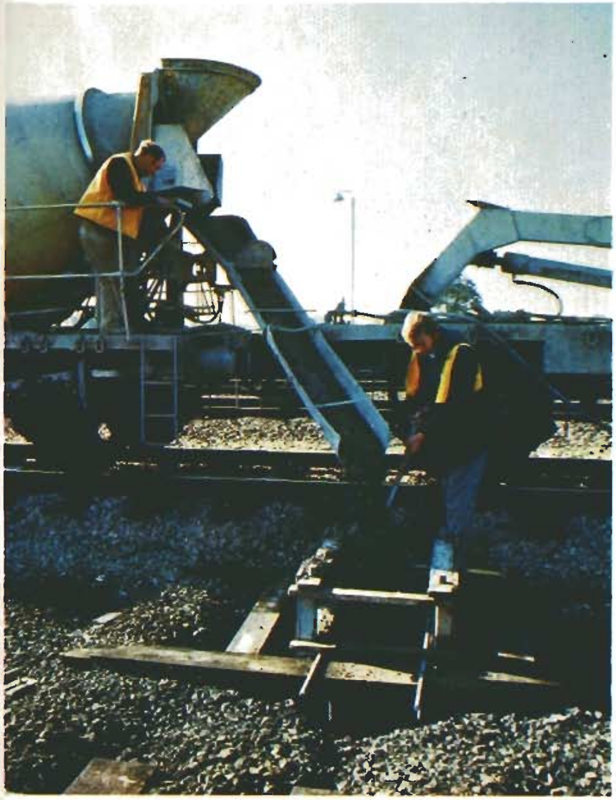
Bridge reconstruction work in progress.

New Footbridge Lockerbie Station.

Wigan's new Station.


Installing new track layout at Rutherglen.


Bridge reconstruction, Scottish Region.


Pouring concrete for structure foundations.

cases clearance was obtained by lowering the tracks beneath the bridges. Altogether a total of 341 bridges required attention of some kind. According to the type and location of the bridge the work necessary took between one month and 12 months.

The resignalling which has been carried out in association with the electrification project has included the construction of a considerable number of lineside buildings. Four new power signalboxes and 98 other buildings to house equipment controlling power supplies to the overhead equipment and to the signalling system have been built. The existing station at Wigan was completely re-built to provide modern amenities of a standard consistent with the improved electrified services which have been introduced. Other stations modernised include Warrington, Carlisle and Oxenholme.

Biggest Job

The erection of overhead equipment above the 235 route miles, 630 single track miles, of railway between Weaver Junction and Glasgow from which the electric locomotives obtain their power supply has been the biggest job in the electrification project, and it was mechanised to a high degree.

A number of works trains were prepared, each carrying the necessary equipment to complete one series of operations in the erection work. To prepare the foundations for the masts supporting the overhead wires, trains carrying mechanical diggers and earth-boring machines were used. Concrete for the foundations was mixed and poured from a train of continuous mixing units. The steel masts, located approximately 60 metres apart along the track, were placed in position from a train of specially adapted steel carrying wagons equipped with a crane. In four years of continuous work 18,026 foundations were prepared and 15,637 steel masts weighing variously between five cwts. and four tons were erected. From them 1650 miles of wire has been suspended.

Research and development work by British Rail has reduced the cost of overhead equipment since the original 25,000 volts a.c. project was completed in 1967. A simplified form of overhead wiring has been developed and has been used on the present project. It consists of two wires only, the uppermost of which is now made from steel reinforced aluminium instead of the copper alloy previously used. Another economy is the introduction of head span wires to support the conductor wires over multi-track layouts, instead of steel portal structures.

New locomotive and coaching stock in use on Anglo-Scottish route.

Drivers Console Class 87 Loco.

More Power–
Greater Comfort.

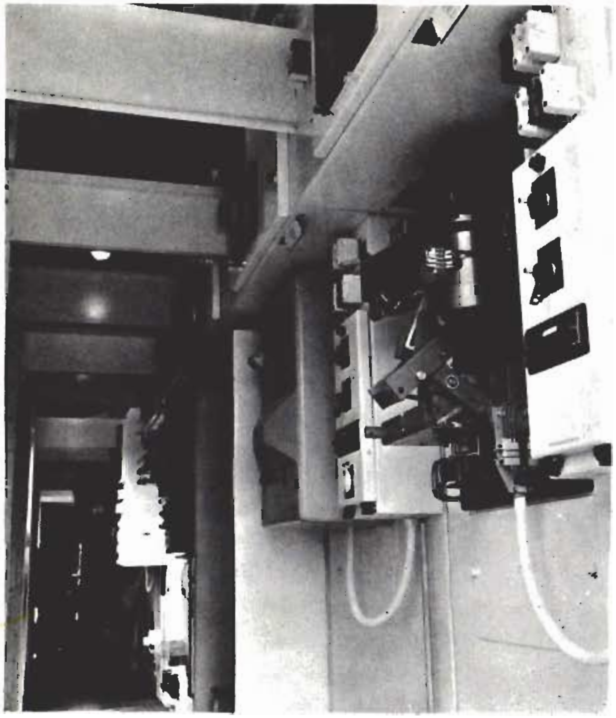
British Rail have developed a new, more powerful type of electric locomotive for use on high-speed services between London and Glasgow.

The new locomotive, designated Class 87, is the third generation of electric locomotives built for work on 25,000 volts a.c. electrified main lines. In appearance it is similar to its predecessor, Class 86, and its design combines the successful features of the latter, together with new developments in electric traction design. It will be capable of hauling 600 tons Inter-City expresses at a maximum speed of 100 mph. Two locomotives working together will be able to haul freight trains of 1300 tons.

The four traction motors which power the locomotive have been designed for operation over the severe gradients encountered on the West Coast main line, especially at Shap in England, and Beattock in Scotland. They are suspended from the bogie frame, each motor

Fabricating headspan wires for overhead equipment.

New locomotives under construction at the Crewe Works of British Rail Engineering Ltd.



Interior of Feeder Station, Parkside.

powering one of the locomotive's four axles through a flexible drive. Air brakes have been fitted to the Class 87, coupled with a rheostatic brake, a device which uses the traction motors for braking purposes. With this system the motors act as dynamos and the current generated is dispersed as heat. The locomotive has also been equipped with a push button operated electro-hydraulic parking brake.

Although the driving cab layout remains the same as on previous a.c. locomotives there have been some improvements resulting from engineering and scientific developments. Impact resistant, electrically heated windscreens, incorporating a de-misting and de-icing system have been fitted. A combined central valve mounted on the desk in front of the driver operates a complete clearing system which includes two-speed pneumatic windscreen wipers, and a travelling water-jet for washing purposes.

Forced ventilation has been introduced, together with automatic control of the cab temperature in order to improve the comfort of the driver.

Safety

The Class 87 locomotive is the first production type to include a new safety feature developed by British Rail. It is a drivers vigilance system and basically it consists of a two position foot-pedal, incorporating an electric switch, audible signal device and relay unit.

The pedal must be kept depressed by the driver when the central lever is in the 'drive' position. After 60 seconds a continuous audible signal commences, and if the pedal is not released and depressed to reset the system an emergency brake application will occur within seven seconds.

British Rail Engineering Ltd. are building 35 of the new electric locomotives. More than 1000 drivers, senior men with steam and diesel traction experience, were trained to drive electric locomotives, including the new Class 87, at special schools in Liverpool, Crewe, Carlisle, and Glasgow.

Air-conditioned Coaches

'The Royal Scot' and some other electrically hauled express passenger trains now in use on the Anglo-Scottish route between London and Glasgow are composed of fully air-conditioned coaches. Other air-conditioned vehicles will be added later.

The air-conditioning equipment maintains the coach interior temperature at between 21 degrees and 23 degrees centigrade. Filtered air, heated or cooled as necessary circulates through ducts in the floor and ceiling, and is changed completely every four minutes.

Full Insulation

To ensure that the air-conditioning functions effectively, and to reduce noise inside the coaches, the new vehicles are fully insulated. Windows are double glazed and sealed, the outer pane being tinted to reduce glare, and internal doors are self-closing.

There are five different types of the new coaches in service, three for first class and two for second class travellers. They include two open saloon vehicles, a compartmented corridor coach, and two vehicles which have a guards compartment in addition to passenger accommodation.

The number of seats varies between 24 and 64 according to the type of vehicle. Two toilets are provided in the open saloons and the corridor coach, the other types having one toilet. Each toilet is fitted with electric razor points, and foot operated controls for the water supply to the wash basins and toilet flush.

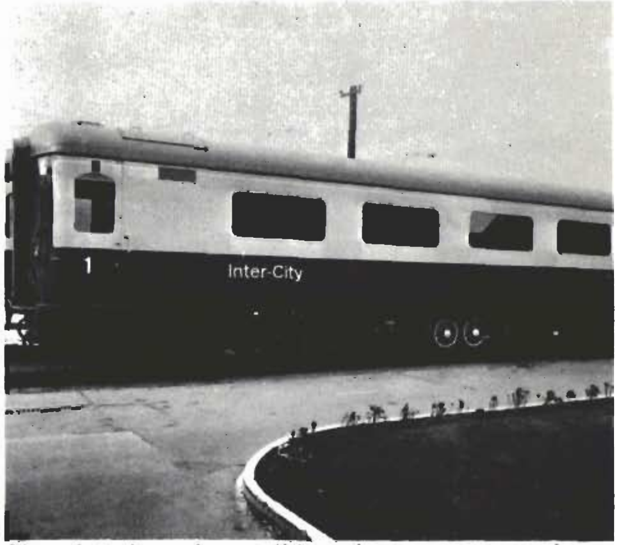
Seating accommodation has been carefully designed to ensure a comfortable ride, even on the longest journeys. Individual seats are provided in the second class accommodation, and those in the first class can be adjusted by passengers into the position they find most restful.

Storage Space

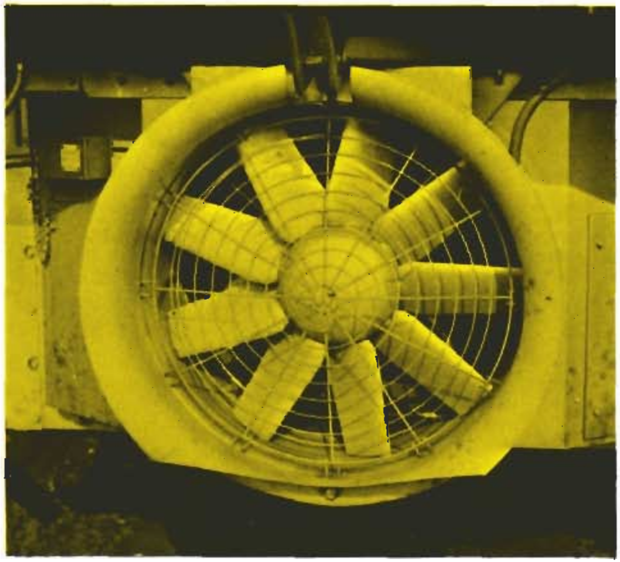
In the open saloon vehicles luggage space is available between the seats and on overhead racks and second class saloons have additional storage space in racks at the ends of the vehicles.

British Rail Engineering Ltd. built the coaches at their Derby Carriage and Wagon Works. The seat covering material, curtains and carpets were supplied by leading British manufacturers.

The bodyshells of the new vehicles are mounted on bogies of a well-tried design which are fitted with air brakes. This arrangement, combined with the smooth-riding qualities characteristic of the continuous welded rail now in use throughout the Anglo-Scottish route, provides passengers with a high standard of comfort.



New 1st class air-conditioned passenger coach.



Air conditioning equipment on new passenger rolling stock.

Electric all the way.

The combination of electric traction, modern signalling and improved track conditions, completely changed the face of Anglo-Scottish rail services when the first time-table for all electric trains between London and Glasgow was introduced on May 6 1974.

The main effect of the complete modernisation of the route has been a considerable acceleration in train speeds. Between London and Glasgow, the journey times for 'The Royal Scot', the fastest train of the day, have been reduced to five hours exactly, with only one stop en route. Other trains average five hours and 10 minutes for the 401 miles journey, representing a reduction of approximately one hour on previous times.

This overall improvement in speed has been matched by a significant increase in the number of trains available for travellers on the Anglo-Scottish route. From London to Glasgow there are now eight daily trains, three more than previously, and services from Glasgow to Euston have been similarly increased. Departures from Euston are spread throughout the day between 07 45 and 17 45, and trains from Scotland to England between 07 10 and 17 30. To provide a service to South-West Scotland one train in each direction uses the route via Dumfries and Kilmarnock.

Buffet Car Service

Euston East Colonnade.

Arran Lounge, Glasgow Central.

Buffer Stop Bar, Euston Station.

1st class dining car.

Arrival and Departure Indicator, Euston.

Morning tea served in a 1st class Sleeper.

Sleeper Reservation Counter, Glasgow Central.

Travel Centre, Birmingham New St.

On the train the conductor/guard helps with travel enquiries

Higher Speeds

The higher train speeds have made possible the introduction of a day-time service 'The Clansman' linking London, Birmingham, Perth and Inverness. Connecting trains enable passengers from the South-West and South Wales to use this new service to the Scottish Highlands. Using the complementary return service from Inverness, day-time travel from Thurso to London is also possible.

Similar improvements, both in speed and frequency, have been made to the services between Scotland and important provincial centres on the London Midland Region.

Passengers between the West Midlands, Glasgow and Edinburgh have a choice of four daily trains to and from Birmingham, instead of the one train in each direction available before the completion of electrification work, and journey times have been reduced by approximately one hour.

These new trains include one in each direction from Bristol via Birmingham giving an additional service between the West Country and Glasgow and Edinburgh.

Services between Manchester, Liverpool, and Scotland have also been improved in terms of speed and frequency of trains. The previous service of two trains each way has been increased to five including direct early morning and evening trains between Liverpool and Edinburgh, and Manchester and Glasgow, with interchange facilities at Preston.

Separate Liverpool and Manchester portions, combining at Preston. make up the remainder, two of which run to Glasgow and one to Edinburgh. About an hour has been cut from the previous travelling time, reducing the average journey to four hours and 20 minutes.

New Pattern

The new pattern of services between London and Glasgow introduced on May 6 1974, provides passengers travelling to and from stations between Carlisle and Warrington on the newly electrified portion of the Anglo-Scottish route with more high-speed trains. Preston–Glasgow services have more than doubled, from seven to 15 daily, with an average reduction in journey time of almost one hour. Preston–London trains have been increased from 12 to 19.

Faster journey times and improved connections at Oxenholme for Windermere make the Lake District more easily accessible from all centres on the electrified route.

The Conductor/guard uses the Public Address equipment to make announcements en route.

Travellers Fare

Full catering facilities are available on most services, and in addition drinks and light meals are on sale on the majority of trains.

The introduction of electric services coincided with the mid-point of a new approach to railway catering.

Travellers Fare, has taken over all services and establishments providing food and drink to rail passengers on stations and trains. More than £5m is being spent in a five year plan to modernise buffet and restaurant facilities.

On the Inter-City electric network, Travellers Fare prepared for the introduction of the faster and more frequent Anglo-Scottish services by opening a new bar at Birmingham New Street, and modernising the buffet at Preston station. Additional facilities planned include the opening of the new 'bistro' at Euston, and further improvements at Preston to the existing bar.

Travellers Fare provides food and drink to rail passengers who make 750 million journeys each year.

To find out the exact preferences of those millions of customers a major market research project has been completed. The results of this are already apparent. Changes in eating habits are reflected in some menus, and faster journey times combined with popular demand will probably lead to more 'a la carte' on train catering rather than the traditional three- to four-course meals.

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Electric all the way
London to Glasgow