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THE CONSTRUCTION OF THE HEATHROW EXTENSION

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After a preliminary planning period dating from 1946 an extension of the Piccadilly Line from Hounslow West to Heathrow was accepted as being not only cheaper than alternative proposals but also as being financially viable and Parliamentary powers were obtained in 1967. Detailed planning continued until 1971 when approval of the work was given by the GLC and the DoE later made a 25 per cent grant towards the cost. Civil engineering contracts were placed in 1971 and the current estimate of cost is about £25m.

The extension has been let in three contracts:-

1. Hounslow West to Hatton Cross covered ways and stations
Contractors - W & C French (Construction) Ltd.
Piling sub-contractor - A Waddington & Son Ltd.
2. Hatton Cross to Heathrow Central covered way and bored tunnels
Consultants - Sir William Halcrow & Partners
Contractors - John Mowlem & Co. Ltd.
3. Heathrow Central Station
Consultants - Sir William Halcrow & Partners
Contractors - Taylor Woodrow Construction Ltd.

The extension will transport air passengers between the airport and central London and provide a service for commuters who work in the airport area and for visitors.

The service will eventually be provided by 1973 tube stock which will replace the 1959 tube stock at present running on the Piccadilly Line. A 4½-minute peak hour service is proposed initially between the airport and central London.

The junction between the existing Piccadilly Line and the Heathrow Extension is immediately to the east of Hounslow West Station and the new station was constructed below ground level to the north of the former station. This has enabled the extension westwards to pass under the adjacent roads in cut and cover construction, but a week before the opening to Hatton Cross it was necessary to close the existing station at Hounslow West and to lower the formation at the point of junction east of the station by a maximum of 8 ft. in order to complete the tracks approaching the new station.

From the opening date the existing ticket hall at Hounslow West remained in use although a temporary surface access between the existing ticket hall and the new station was provided, pending the construction of a new ticket hall as part of a development over the new station.

The total length of the extension is about three and a half miles, of which the length from Hounslow West to Hatton Cross is two miles and basically of the cut-and-cover type of construction; the remainder, between Hatton Cross and Heathrow Central comprises a short length of cut-and-cover to gain depth and twin bored tunnels.

Between Hounslow West and Hatton Cross Station which is on the

perimeter of the airport, the tracks rise to the surface and cross over the River Crane and then descend to Hatton Cross Station which has been constructed in cut and cover with staircase connections to a surface ticket hall. Twin bored tunnels connect Hatton Cross to Heathrow Central Station and beyond Heathrow Central there are twin over-run and siding tunnels which have been aligned to suit future extension westwards.

Heathrow Central station is sited between the three passenger terminals. The ticket hall is below ground level and the platforms are at a depth of 50 ft. Between the ticket hall and each terminal the British Airports Authority is constructing a subway which will be equipped with travolators. There will be escalators and fixed stairs between the ticket hall and the bus station at ground level. Separate flights of escalators between the platform and the ticket hall and ticket barriers are being provided for arriving and departing passengers. Trolleys will be available for passengers to convey their luggage between the passenger terminals and the station, but suitcases will have to be carried by hand from the time passengers reach the ticket hall. A 'bureau-de-change' will enable passengers to change foreign money into pounds so that they can buy tickets.

Most of the covered way encloses two tracks and varies in width from 24 to 31 feet between walls according to location. The roof is between 2 ft 6 inches and 3 ft 6 inches below ground level, except for the section adjacent to the British Airways Overseas Division maintenance area where the railway passes under a sewer, here the roof is more than 17 feet below ground level. The headroom has generally been kept to 10 ft 6 inches to 11 ft from rail level except in the area adjacent to the Champions Sparking Plug Factory where it was decided to raise the roof level of the permanent structure, giving a headroom up to 21 ft to overcome difficulties with service diversions, ground water and temporary works.

In constructing the cut and cover portion of the Extension the first operation was to sink two lines of reinforced concrete bored piles to form the side walls. The piles which were 2 ft 11 in dia. were driven in groups of seven at 2 ft 7 in centres. As the piles were of circular section and intersected each other they were called 'secant' piles and when completed they formed a continuous reinforced concrete wall. Reinforced concrete capping beams were then cast along each line of piles to form seatings for the ends of the pre-cast pre-stressed concrete roof beams. After the roof beams had been placed the spaces between them were filled with concrete and a waterproofing membrane laid. This was protected by a thin concrete slab. At this stage it was possible to reinstate the original ground surface above the tunnel.

Excavation then proceeded under the tunnel roof and the concrete invert or floor slab and plinth walls on either side were cast.

When seeking Parliamentary powers an undertaking was given to adopt appropriate means for minimising the effects of noise and vibration from operating the railway. As a result of this undertaking, where the railway was close to residential property the next stage of construction was to install pre-cast reinforced concrete track trays, each 25 ft long and 10 ft wide which were

supported by rubber blocks on the tunnel floor. The trays were spaced transversely by rubber blocks, so that there was no concrete to concrete contact between the trays and the tunnel structure. The individual trays were joined by concrete cast in place to form a continuous trough.

Concrete panel walls were then erected on the plinth walls clear of the secant piles.

Conventional London Transport sleeper track was laid on limestone ballast in the trays.

Where the railway was well clear of houses the trays were omitted and the track ballast was laid directly on the concrete invert. It is intended to measure the effectiveness of the anti-noise and -vibration work now that the Extension has been opened to traffic.

Both the new Hounslow West and Hatton Cross stations were constructed with secant pile walls and reinforced concrete base slabs, island platforms, columns and roofs. At Hatton Cross an interlocking machine room was provided for the control of the double crossover east of the station which was required for reversing trains during Stage 1 and subsequently in emergencies. Other features of Hatton Cross are the 'kiss 'n' ride' facilities for cars, the bus station and the sound proofing precautions against aircraft noise which include the provision of double doors.

The twin tunnels under the Airport were driven in the London clay using two conventional shields of which the essential element was the fabricated steel cylindrical skin plate having an outside diameter corresponding closely to the external diameter of precast concrete flexible jointed tunnel linings which were to be erected in close contact with the clay. At the leading edge of the shields was a cutting edge the diameter of which slightly exceeded that of the main part of the shield. The skin of each shield was stiffened by fabricated steel annular rings around the periphery of which were mounted hydraulic rams. To these were attached shoes which pressed against the last ring of lining erected and thus propelled the shield forward a ring's width at a time. The 20 rams on each shield had a capacity of 40 tons each, but in normal conditions the shove only required up to 8 rams working at half the maximum pressure.

Whilst the traditional method of excavation of clay at the shield face has been to use hand held pneumatic spades, on the Victoria Line several full face rotary cutters were used. These gave high rates of progress, but being expensive were only economic for long drives, they suffered many breakdowns and gave only restricted access to the face for inspection or dealing with bad ground. On the Fleet Line and Heathrow Extension contractors have preferred simpler plant. Among the types used was the Anderson Mavor hydraulically driven boom mounted rotary cutter. The carriage on which the boom was mounted moved forward with the shield and the cutter was controlled by one operator.

Behind the shield the segments of the 3.85m precast concrete tunnel lining were erected and wedged into tight contact with clay with the aid of power winches and hydraulic rams.

East of Heathrow Central station a 9.5m dia. crossover tunnel has been constructed as an enlargement of the running tunnels. As

there is little clay cover to the crown of this tunnel and as the stratum above is sand and gravel the crossover was constructed in compressed air and was lined with bolted cast iron segments.

Heathrow Central station excavation was approximately 400 ft long x 80 ft wide x 60 ft deep. The faces of the excavation were supported by bored concrete piles which were in turn secured by temporary steel struts and walings. Foundation slab, platforms, outer walls, columns, floors and roof are being constructed of reinforced concrete cast in place.

Secant piles are formed with a Benoto piling rig. This machine forces a steel casing into the ground by means of hydraulic rams; a secondary transverse ram imparts a twisting motion to the casing at the same time. A grab removes material from inside the casing while sinking progresses, the casing always being kept a little in advance of the grab. When the excavation reaches the required depth, reinforcing steel is placed in the casing and concrete is then poured in to form a normal in situ pile.

As the concrete rises, the casing is gradually withdrawn, again with the twisting motion which, as can be seen in the tunnel, leaves a distinctive zig-zag finish on the concrete in the clay zone.

The Railway immediately West of Hatton Cross is not built by the same cut-and-cover methods as used elsewhere. The part of the railway between Hatton Cross station and the tunnel portals is being constructed in cut-and-cover principally to gain sufficient depth to enable the tunnel drives to start in good London clay. Because this section of the cut-and-cover goes down to a depth of 22 feet and is within the operational airfield there was no restriction to width of cut and a different method of construction was adopted. Firstly an over site excavation was made to ground water level, a depth of some 10 feet. From this level sheet piles were driven to seal into the clay and form a coffer dam around the site. Excavation then continued within the sheet piles down to the top of the clay level, a total depth of some 16 to 18 feet. From this level a series of king piles at 6 feet centres was driven immediately beside the permanent structure. The king piles varied in length from 18 to 30 feet and because of the height restriction on plant, the longer piles were placed in augered holes up to 10 feet deep and then driven for the remaining depth. Excavation within the king piles was then carried out, cast in situ panels being constructed between the king piles as the excavation proceeded to form the permanent ground support. According to the depth either one or two props between the piles were placed as excavation progressed. Within this excavation a normal reinforced concrete twin box section structure was cast. The king piles remain in position but the sheet piles were extracted as back-filling proceeded.

Between the end of the tube tunnel over-run and Hatton Cross the section will be ventilated by two fans for which shafts have been constructed, one at the end of the over-run tunnels, the other midway between Hatton Cross and Heathrow Central stations. The latter shaft is located in a grassed area within the airport's runway/taxiway complex and its construction is subject to close liaison with the British Airports Authority.



Hounslow West station undergoing reconstruction in 1926
(London Transport)

Hatton Cross station platform shortly after the opening
ceremony

(R J Greenaway)



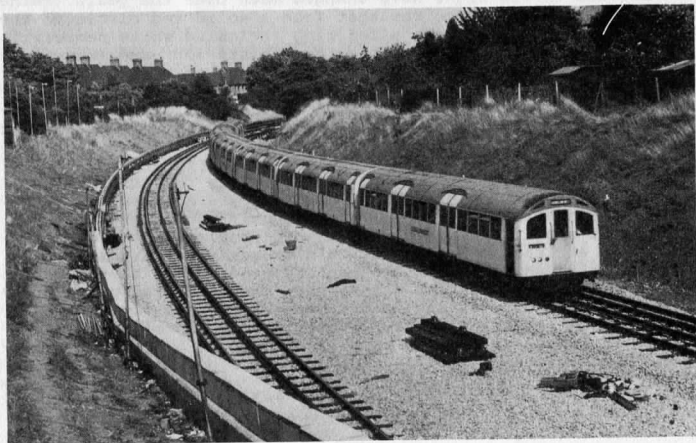


The tracks immediately east of Hounslow West station at the time of the changeover

Above. On Saturday 12 July 1975

Below. The same place on the following Wednesday, 3 days after the new station opened

(R J Greenaway)



The following Article is an updated version of one which appeared in several issues of Underground some years ago. It is reprinted partly so that all the information is together in one place but mainly as the first in a series of articles on allied subjects.

BAR-AND-CIRCLE

Dr H L Clarke

For nearly seventy years, users of the Underground have been accustomed to seeing station names displayed on one of the many versions of the bar-and-circle symbol used by the Underground Group and their successors as a totem. Other types of display have, of course, been employed (eg, large tiling letters in early LER days, friezes of tiling, paper or enamel, &c.,) but this article deals only with bar-and-circle signs. In passing, it should be noted that where the trains served stations belonging to other concerns, main-line type signs were (and are) used. Also, Metropolitan Railway signs were retained for many years after the formation of LPTB, although they have now all been replaced. They are a subject in themselves and will not be further considered here.

Bar-and-circle signs have changed much over the years. Perhaps the most striking change was that from a solid red circle to the Johnston type of sign with a red ring enclosing white semicircles above and below the blue bar bearing the station name (which was now in Johnston lettering). The introduction of this totem (for publicity, &c.,) is believed to date from about 1916, although I do not know of any ring signs which can be confidently dated to before 1923. In recent years the tendency has been to reduce, and ultimately to abolish, the detailed black and white lining of earlier signs of this type.

For descriptive purposes, it is necessary to classify the types of sign. Two main families of signs are apparent. In the first, the station name is an integral part of the sign, and changes of station name normally involve replacing the complete sign. (In at least one case, at Fulham Broadway, an additional blue bar with the new name has been screwed on top of the original Walham Green bar, while as a temporary measure, blue paper or plastic labels are usually used.) For this reason, I shall call these signs 'integral' signs. Except in the case of miniature signs, this type of sign is usually painted on a square or rectangular white enamel sheet (forming a white background), and is

made up of one or two sheets of steel.

The other family of signs has no white backing sheet, being screwed directly on to a wall, or standing in a metal frame. (In one or two instances, eg at North Weald and Debden, a separate white background has been provided). These signs are usually in three parts - two half-roundels and a separate blue bar. With this type of sign, which I shall call a "sectioned" sign, renaming can be carried out by replacing the blue bar only.

Dating Underground station signs is often not easy. Although new stations have new signs, these may not replace temporary signs provided for opening until some time has elapsed. Replacement of signs, unless associated with rebuilding or upgrading, is usually necessitated by the effects of weathering or vandalism. In little-used deep-level stations old signs may linger on for many years. At surface stations, the effects of weathering may sometimes be deduced from observations that the signs on open parts of platforms are of modern design, while much older signs may have been preserved under platform canopies.

Any discussion of station signs must include, as well as descriptions of the signs themselves, some consideration of their relationship to station architecture. On open stations, the choice of type of sign has been closely related to the design of platform lighting standards.

In this account, descriptions of types of sign currently in use are given an arbitrary reference number, and the appendix gives a list of the stations where each type of sign could be seen on 1.8.75. The provision of signs on tunnel hoardings (opposite the platform) and miniature signs generally, will be discussed in a separate section after considering the various types of standard size signs.

SOLID-CIRCLE SIGNS

According to Jackson & Croome ('Rails through the Clay', 1962) to which this article is indebted for details of dates, &c., the original bar-and-circle signs were introduced about 1908 on LER stations. As built, these stations displayed the station name in large tiling letters on the walls, and each station had distinctive colour schemes. Both of these excellent features were nullified by the need for revenue from advertising posters, and distinctive signs had to be provided. The original LER signs were of the sectioned type, with 4'6" diameter solid red roundels reaching to within a few inches of the end of the blue bar. The bar was enclosed in a red-painted ornamental wooden moulding, 5'0" X 1'0" overall.

Until a few years ago, these signs were to be seen at most of the original LER stations, to which their use was apparently confined. They are now to be found only on the eastern half of the original Piccadilly Line, the last solitary Northern Line example at Mornington Crescent having been removed about two years ago.. Only at Caledonian Road are the signs still in their original form (Ref: 1R), elsewhere the moulding round the bar having been repainted blue (Ref: 1B). It will be noted that at Arsenal the bar is lettered in Johnston style as a consequence of the station

being renamed in 1932. The renaming of Great Central to Marylebone in 1917 gave rise to a similar phenomenon.

The very large roundel gives a ponderous appearance to these signs, and this type was followed by a version (Ref: 2) in which the roundel was very much reduced in size. This sign was 'integral' in that it was made from a single sheet of steel, cut to shape rather than being left rectangular, and no moulding was provided round the bar. It was used on the District, where a few survive at Mansion House, and it, or a very similar design, was used to re-equip stations on the CLR in 1913.

The other common type of solid circle integral sign was in the form of a rectangle, with a white background to the bar and circle. A wooden moulding was provided round the bar, the moulding being originally painted red, but repainted blue on the only survivors at Ealing Broadway (Ref: 3). On this pattern, as on the original LER signs, the bar carried the maker's name ('Chromo Wolverhampton'). These signs were extensively used on the District, and were also employed on the Queens Park extension of the Bakerloo.

These signs were often incorporated into the general tiling arrangement of the stations by being given a border of ridged green tiles. Until the introduction in 1939 of eye-level tiling friezes bearing the station name, it was customary at deep-level stations for alternate signs to be provided at a height of about 7' from the platform. With the introduction in recent years of steel friezes at older stations, the tiling borders round the elevated signs were displaced down to the base of the station wall, and traces of this re-arrangement can be seen just above platform level at some stations.

FULLY LINED JOHNSTON SIGNS

The first type of Johnston sign with the roundel in the form of a red ring enclosing a white field was in use by 1923. It was an 'integral' sign, with the enamel plate usually in two parts, divided horizontally, the blue bar bearing the station name in white Johnston letters being at the upper edge of the lower sheet, and being surrounded by the same pattern of wooden moulding as used on the older signs. The red ring was bordered inside and out by a thin black line, with an additional white line and black line on the outside. The sign as a whole was either rectangular, or with a curved upper margin in the centre over the position of the roundel, and was enclosed in a wooden frame.

These signs were installed on the Morden and Edgware extensions and at most of the stations on the rebuilt CSLR. They were also used up to early LPTB days for replacing older signs (eg, Metropolitan signs at Hillingdon) and when stations were rebuilt or upgraded. Signs in original form, with a red moulding to the bar, are left at three stations (Ref: 4R), while at a number of other stations the moulding has been painted dark blue to match the bar (Ref: 4B). At Barons Court, repainting of the station in light blue included the mouldings on the signs (Ref: 4LB), while on two signs at Edgware the mouldings are unpainted and varnished (Ref: 4W). Early signs of this type are marked FRANCO SIGNS at bottom left, while most are marked REG NO 659,814 at bottom right.

From about 1938, this design was modified by surrounding the bar with a plain square section steel sheet framing instead of the wood moulding. In most cases, as in the last type described, the bar was at the upper edge of the lower sheet (Ref: 5L), but in some cases the bar was at the lower edge of the upper sheet (Ref: 5T). Some smaller signs of this general design at Finchley Road were painted on a single sheet (Ref: 5S), while single sheet signs at Burnt Oak had no framing to the bar, but had instead a broad red painted border (Ref: 5X). At Mansion House two similar signs (with detail differences in the lining) can be seen on glass instead of enamelled steel sheet (Ref: 5Y).

In recent years, as with the wooden mouldings on earlier signs, there has been a tendency for the metal framing round the bar to be repainted blue instead of red. This has so far only been seen on signs made up of two sheets, either with the bar on the lower sheet (Ref: 6L), or on the upper sheet (Ref: 6T). It would appear from notes I made in September 1973 that the signs at High Street Kensington and at Colindale may have been so repainted since that date.

During the 1939/45 blackout, there was an urgent need for additional signs at those unrebuilt Metropolitan stations used by Bakerloo trains. Under cover, this need could be met by the provision of paper temporary signs pasted on to buildings, &c., but this was not practicable in the open. Due to the wartime shortage of steel, standard signs could not be provided, and wooden signs were therefore constructed to the same general appearance as the last types described. The sign was constructed of vertical planks in a red-painted wooden frame, the blue bar being surrounded by a plain square section wooden framing painted red. Lining to the roundel was complete as described earlier. Among stations at which these signs were provided were Willesden Green, Neasden, Wembley Park and Kingsbury. They were all replaced by various types of permanent metal signs in 1950-51.

The final modification of the fully-lined-out integral sign appeared at Queensbury about 1951, similar to the earlier signs but with a blue bar of enamelled steel raised off the backing plate, with no framing to the bar. This may have been done as a means of re-using old signs from another station. (Ref: 7)

Interesting and unique signs were provided at Sudbury Town in 1932, where simplified bar-and-circle signs were incorporated into windows in the station buildings (Ref: 8).

The well-known standard bronze-framed sectioned sign made its appearance in 1932 on the Piccadilly extensions. They were used for most stations built, rebuilt or refurbished for the 1935/40 New Works Programme, and from about 1950 were extensively used elsewhere. As with most signs, there were variations in size to suit the site, and also variations in depth of bar to suit two-line station names, &c. In the commonest form, a bronze ring one inch wide enclosed the bar, 4'5" X 11", with semicircular bronze rings, radius 1'9", enclosing the red roundel, 6" wide. The roundel was bordered inside and out with a ½" black line, a white line on the outside separating it from the bronze framing. (Ref:9)

These signs were designed as part of the new standard of Underground architecture introduced at this time, in which the use

of bronze fittings was extensive. They were associated with extensive use of undisguised brickwork and concrete at surface stations, and with buff or yellow tiling underground. It was at this time the practice for these signs to be fastened by screws through the bronze frame to vertical surfaces of these materials. Where necessary, concrete platform walls were designed with this in mind (eg, at Alperton), and platform lighting fittings in ferro-concrete were designed to carry these signs. There were few exceptions before about 1950 to this practice; At Sudbury Hill they were incorporated into a pre-existing iron fence, at White City (1947) special tubular steel frames were provided on the platforms, and at some stations they were incorporated into platform seats. The best example, however, of the conventional application of these signs in the absence of the usual architecture may be seen at ex-GE Central Line stations such as Buckhurst Hill, where short lengths of brick wall have been erected to carry these signs..

After 1950, when this type of sign was used extensively on older stations in the open (eg, to replace most of the surviving Metropolitan Railway signs), it became established practice for them to be mounted in a mild steel angle frame bolted to the platform. By this time, the use of concrete lamp standards for new works was being discontinued in favour of the current type of plain tubular steel post. In some of the later examples (as at Farringdon and, as it then was, Aldersgate and Barbican) a light alloy frame was used instead of bronze, but all of these signs have now been altered (see later).

This type of sign was obviously derived from the superficially similar aluminium-framed signs on tubular steel stands used on the ex-CSLR island platform stations, which may date back to 1925. In these signs, however, the aluminium frame, although of the same general appearance as the later bronze-framed signs, is continuous round the sides of the sign with that of its back-to-back companion. Another difference is that the red ring has no black line on its outer side, being bordered by white. (Ref: 10).

An interesting indication of the relationship between architecture and station sign design is provided by the cases of Cockfosters and Uxbridge. In these two stations, built to similar designs, the architects, Adams, Holden & Pearson, specified signs differing from the standard bronze-framed design as used at other stations designed by them in that there was an additional semi-circular bronze ring inside the roundel, inside which the concrete of the station wall was visible. At Cockfosters (1933), the red ring is bordered inside and out by a white line (Ref: 11), but on the signs at Uxbridge, built five years later, the red ring retains the $\frac{1}{4}$ " black lining of the standard signs (Ref: 12).

SIGNS WITH REDUCED OR ABSENT LINING OUT

After nationalisation in 1948, signs were developed with simplified lining, although for some years there were extensive installations of the older, fully-lined-out types. Interesting temporary signs were provided at Wembley Park, for the 1948 Olympic Games, by painting out the diamonds on Metropolitan Railway signs and replacing them with plain, unlined red rings. At the

same time, platform 6 at this station, until this time without any signs at all, was provided with small square signs, the only lining provided being a thick black line outside the red ring. With the transfer of the Ealing & Shepherds Bush Line to LT in 1948, the GWR signs on this line were replaced by this pattern, some of which lasted until 1973. Although these signs were never widespread in enamel form, a miniature paper form was widely used on hoarding walls of deep-level stations for some years (see later). Another sign used on the E&SB, still to be seen, has single black outlining to both the roundel and the bar (Ref: 13).

The next development was the introduction of the current version of the bar-and-circle, on which there is no black lining at all. This is provided both as a vitreous enamelled sign, and as a glass sign. The best-known form of the latter is that introduced on the southern half of the Victoria Line from 1968, which are illuminated from the back (Ref: 14). It may not be generally realised, however, that non-illuminated signs of the same pattern were introduced as long ago as 1951 at Charing Cross for the Festival of Britain (Ref: 15).

Glass signs have limitations, particularly in an age of vandalism. (Even metal signs suffer from this - about 1970 the bronze frames were stolen from the signs at Shoreditch.) Since 1960, new signs have usually been of steel, of unlined design. As usual, there have been several variants.

Where completely new signs have been installed, the commonest form is an integral sign made up on a single sheet. In the open these are usually fitted to standard tubular lamp standards. These signs are, unlike most earlier integral signs, of greater width than height (Ref: 16). In many instances, however, it has been desirable to fit new signs into spaces previously occupied by older signs. For this purpose the new sign must, of course, be the same shape and size as the one it replaces, and signs for this purpose are made up of two sheets. Where these signs are used to replace early Johnston signs, the arrangement of sheets is usually for the blue bar to be at the upper edge of the lower sheet (Ref: 17L), but in some cases, especially when replacing Metropolitan or pre-Johnston Underground signs, the bar is on the upper sheet (Ref: 17T).

Although most of the current unlined signs are integral, of the types described above, there are also sectioned unlined signs. The first to appear (about 1960) was a replacement of lined-out roundels by unlined in standard bronze-framed signs. (The bronze frame suffers much less from weathering than the enamelled plates it encloses.) The red ring on the new half-roundels goes right out to the enclosing bronze ring. (Ref:18). At Ongar, signs of this pattern have had the bronze ring painted blue.

In a number of cases it would appear that only one lined half-roundel has been sufficiently corroded to require replacement, and as a result a number of mixed signs have appeared, with one old and one new half-roundel. At Acton Town there are now at least four mixed signs at the one station. (Ref: 19)

Currently, this process of replacing sections of bronze-framed signs is quite active. In the last year, some replacement appears to have occurred at at least twelve stations. The aluminium-framed

signs at Farringdon and Barbican have now been fully converted to the unlined pattern (Ref:18A). It is probable that non-standard bronze-framed signs are to be scrapped, rather than have special new sections provided for upgrading, as at Cockfosters there has been some replacement by standard integral signs.

The latest sign to appear is also section, but unframed as well as unlined, the edges of the three components (two half-roundels and the bar) being flanged so as to raise the sign about an inch from the wall, &c. (Ref: 20). It would seem that the crevices between the sections could act as traps for rain-water, &c., and render the sign liable to rapid corrosion. It is noteworthy that, so far, it has been used only in fairly sheltered locations when applied to surface stations.

TUNNEL HOARDING SIGNS & MINIATURE SIGNS

With the introduction of the standard bronze-framed sign in 1932 (Ref: 9), full size signs of this type were provided on tunnel hoarding walls (ie walls facing the platform) at new stations built at this time. Full-size signs proved, however, to be difficult to decipher from inside the train, and their use was not perpetuated. They may, however, still be seen at the stations concerned.

Much improved legibility was provided by the use of miniature paper signs with full lining (as on contemporary full-size signs). Similar signs, in enamelled form, survive on the hoarding walls of the Central Line platforms at Mile End, and on platform furniture at other stations (Ref: M4). From about 1949, the paper signs of this type were replaced by miniature paper versions of the now obsolete E&SB pattern sign described earlier.

For some of the new deep-level stations constructed for the 1935/40 New Works Programme, a miniature bronze-framed sign, similar to (Ref: 9), but with an outline frame only, was introduced for this purpose. (Ref: M9). This pattern was not, however, employed on the Central Line stations built as part of this scheme. A probable reason for this is the existence at these stations (and most other tube stations) of a high-tension cable run along the hoarding wall in the position where signs have to go to be visible from inside a train. These stations had, instead, paper-on-hard-board signs of the then current pattern. Miniature bronze-framed signs have been used, especially on pillars and stanchions, as part of the normal station signing. An early example was at Aldgate East in 1938. A modified version with full bronze framing has also been used (Ref: M9F), while unlined signs of this general type (with outline framing only) are to be seen in bronze (Ref: M18), and in aluminium (Ref: M18A) versions.

In the last ten years or so, the miniature paper signs on hoarding walls at nearly all the deep-level stations on the system have been replaced by miniature enamel signs of the unlined pattern, similar to (Ref: 16). They have also been used on station platforms, pillars, stanchions, &c. (Ref: M16). The signs of this type on the pillars at Mile End are on plates 16½" high X 21" wide, with 2" lettering on a 17½" X 3¼" blue bar. The unlined red roundel has an outside diameter of 13½" and a width of 2¼".

REFERENCE:

- (1R) PICCADILLY LINE: Caledonian Road
- (1B) PICCADILLY LINE: Covent Garden, Kings Cross (WB), Holloway Road, Arsenal, Finsbury Park (EB)
- (2) CIRCLE/DISTRICT LINES: Mansion House
- (3) DISTRICT LINE: Ealing Broadway
- (4R) DISTRICT LINE: Turnham Green (EB)
 NORTHERN LINE: Moorgate (City Branch SB) (last removed about 7/8/75)
- (4B) CIRCLE LINE: Mansion House, Blackfriars, Temple (IR), Westminster, St James Park
 DISTRICT LINE: Fulham Broadway, West Brompton, Earls Court, St James Park, Westminster, Temple (EB), Blackfriars, Mansion House
 METROPOLITAN LINE: Hillingdon
 NORTHERN LINE: Burnt Oak, Hendon Central, Charing Cross (SB), Kings Cross all stations London Bridge to Oval inclusive, all stations Clapham South to Morden incl.
 PICCADILLY LINE: Hillingdon, North Ealing
- (4LB) DISTRICT/PICC LINES: Barons Court
- (4W) NORTHERN LINE: Edgware
- (5L) BAKERLOO LINE: Kingsbury
 DISTRICT LINE: Turnham Green (WB)
 CENTRAL LINE: Wood Lane (EB)

REFERENCE:

- (5T) CIRCLE/DISTRICT LINES: Monument
- (5S) BAKERLOO/MET LINES: Finchley Road
CIRCLE/DISTRICT LINES: Westminster (WB)
- (5X) NORTHERN LINE: Burnt Oak
- (5Y) CIRCLE/DISTRICT LINES: Mansion House (Platforms 1 & 2)
- (6L) CIRCLE/DISTRICT LINES: High Street Kensington
METROPOLITAN LINE: Baker Street (main)
NORTHERN LINE: Colindale, Kings Cross (SB)
Morden
- (6T) CIRCLE/DISTRICT LINES: Paddington
- (7) BAKERLOO LINE: Queensbury
- (8) PICCADILLY LINE: Sudbury Town
- (9) BAKERLOO LINE: All stations Stanmore and Kilburn Pk to Regents Pk (except Queensbury) inc., Piccadilly Circus (NB), Trafalgar Square, Charing Cross, Lambeth North (NB), Elephant & Castle
- CENTRAL LINE: All stations West Ruislip to Hanger Lane inc., West Acton, White City, Shepherds Bush, Lancaster Gate, Marble Arch, Bond Street, Tott.Ct.Rd., Holborn, Chancery Lane, St Pauls (WB), all stations Bank to North Weald (except Stratford BR and Debden) inc., all stations Wanstead to Grange Hill (via Newbury Pk) inc., Chigwell (IR), Roding Valley
- CIRCLE LINE: Aldgate (OR), Charing Cross (IR), High Street Kensington, Kings Cross, Liverpool Street

REFERENCE:

- (9) DISTRICT LINE: Parsons Green, all stations
 (cont) Ealing Common to Turnham Green
 inclusive, Stamford Brook (EB)
 Hammersmith, West Kensington
 (WB), Earls Court, High Street
 Kensington, Charing X (EB),
 Aldgate East, Mile End
- EAST LONDON LINE: Shoreditch (one incomplete on
 disused plat), Whitechapel (SB)
- HAMMERSMITH & CITY: All stations Hammersmith to
 Westbourne Pk inclusive, Kings
 Cross, Liverpool Street,
 Aldgate East, Mile End
- METROPOLITAN LINE: Liverpool Street, Kings Cross,
 all stations Baker Street to
 Ruislip inc., North Harrow,
 Pinner (SB), all stations
 Rickmansworth to Amersham and
 Chesham inclusive
- NORTHERN LINE: Hendon Central, all stations
 High Barnet to Highgate inc.,
 Leicester Square, Moorgate
 (Highbury Branch)
- PICCADILLY LINE: All stations Ruislip to Sudbury
 Hill inc., Alperton, Ealing
 Common, Hounslow Central (EB),
 Osterley, South Ealing (EB),
 Acton Town, Hammersmith,
 Knightsbridge, Piccadilly
 Circus (EB), Leicester Square,
 Kings Cross, Caledonian Road
 (WB), all stations Manor House
 to Southgate inclusive
- (9W) CENTRAL LINE: White City
- (10) NORTHERN LINE: Angel, Clapham North, Clapham
 Common
- (11) PICCADILLY LINE: Cockfosters
- (12) MET/PICCADILLY LINES: Uxbridge
- (13) CENTRAL LINE: North Acton (WB), East Acton

REFERENCE:

- (14) NORTHERN LINE: Euston (City Branch NB), Old Street
- PICCADILLY LINE: Hatton Cross, Hounslow West
- VICTORIA LINE: All stations Kings Cross to Brixton inclusive
- (15) BAKERLOO LINE: Charing Cross
- CIRCLE/DISTRICT LINES: Mansion House (platform 2), Charing Cross
- PICCADILLY LINE: South Kensington
- (16) BAKERLOO LINE: Queensbury, Wembley Park, Neasden (plat.1), Finchley Rd, Warwick Ave (NB), Edgware Road, Marylebone, Baker Street (NB & SB Queens Pk Line), all stations Regents Pk to Elephant & Castle inclusive
- CENTRAL LINE: Ealing Broadway, all stations West Ruislip to Marble Arch (except White City) inclusive, Oxford Circus, Tott.Ct.Rd., all stations Chancery Lane to Liverpool St, inc., Debden, Chigwell
- CIRCLE LINE: Tower Hill, Cannon Street, Mansion House, Blackfriars, Temple, Charing X, Westminster, Victoria, Sloane Square, South Kensington, Gloucester Road, Notting Hill Gate, Paddington, Baker Street, Euston Square, Kings Cross, Barbican (IR), Moorgate, Liverpool Street
- CITY WIDENED LINES: Moorgate, Barbican, Kings Cross
- DISTRICT LINE: Putney Bridge, Parsons Green, Fulham Bdy, West Brompton (EB), Ealing Broadway, Turnham Green, Stamford Brook, Ravenscourt Pk, Barons Court, West Kensington, Notting Hall Gate, Paddington, Gloucester Road, South Kensington, Sloane Square, Victoria, all stations Westminster to Tower Hill inc., Whitechapel, Stepney Green, all stations Bromley-by-Bow to Upminster Br. (except Barking BR) inclusive

REFERENCE:
(16)
(cont)

EAST LONDON LINE:

Shoreditch, Whitechapel,
Shadwell, Wapping

HAMMERSMITH & CITY:

Royal Oak, Paddington, Baker
Street, Euston Square, Kings
Cross, Barbican (WB), Moorgate,
Liverpool Street, Whitechapel,
Stepney Green, all stations
Bromley-by-Bow to East Ham inc.

METROPOLITAN LINE:

Liverpool Street, Moorgate,
Barbican (WB), Kings Cross,
Euston Square, Finchley Road,
Wembley Park, Northwick Park,
West Harrow, Ickenham, Pinner,
Northwood Hills (NB), all
stations Northwood to Watford
inclusive, Chorleywood,
Amersham

NORTHERN LINE:

High Barnet, Mill Hill East,
all stations Archway and Edg-
ware to Mornington Cresc. inc.,
Euston (Charing X Line and City
Branch SB), Warren St, Godge
St, Tott.Ct.Rd., Strand(closed)
Charing X, Waterloo, Kennington
(plat.2), Oval (NB), Stockwell,
Clapham South, Balham, Tooting
Bec, Tooting Broadway (SB),
Colliers Wood (SB), South
Wimbledon, Morden, Old Street
(Highbury Branch), Essex Road,
Highbury (NB)

PICCADILLY LINE:

Ickenham, Sudbury Town, Park
Royal, Hounslow Central, Houn-
slow East, Boston Manor, North-
fields, South Ealing, all
stations Barons Court to
Arsenal (except Knightsbridge
and Leicester Square) inc.,
Finsbury Pk (WB), Arnos Grove,
Oakwood, Cockfosters, Aldwych

VICTORIA LINE:

All stations Walthamstow to
Highbury inclusive

(17L) BAKERLOO LINE:

Canons Park, Queensbury

CENTRAL LINE:

Bond Street

DISTRICT LINE:

West Brompton (WB)

METROPOLITAN LINE:

Hillingdon

REFERENCE:

(17L) **NORTHERN LINE:**
(cont)

Charing Cross (NB), Waterloo,
Bank, Elephant & Castle (NB),
Kennington (plat.2), Oval (SB)

PICCADILLY LINE:

Hillingdon, North Ealing

(17T) **BAKERLOO LINE:**

All stations Kilburn Park to
Paddington inc.

CIRCLE LINE:

South Kensington (disused IR
platform), Gloucester Road,
Notting Hill Gate, Baywater,
Great Portland Street

DISTRICT LINE:

Gloucester Road (WB) Sth Ken-
sington (disused platform),
Notting Hill Gate, Bayswater,

H & C/MET LINES:

Great Portland Street

(18) **BAKERLOO LINE:**

Wembley Park, Willesden Green
(NB Met.), West Hampstead (NB),
Baker Street (NB & SB Queens Pk
Line), Piccadilly Circus (NB),
Charing X, Waterloo, Lambeth
North (NB)

CENTRAL LINE:

West Acton, White City, Tott.Ct.
Rd., St Pauls, Bank (EB),
Liverpool Street, Leytonstone,
Buckhurst Hill (EB), Woodford,
Blake Hall, Ongar, Redbridge,
Fairlop, Grange Hill

CIRCLE LINE:

Aldgate, Mansion House (plat.2)
Sth Kensington, Notting Hill
Gate, Bayswater, Paddington (OR)
Edgware Rd, Baker Street,
Liverpool Street

DISTRICT LINE:

Parsons Green, Ealing Common,
Acton Town, Chiswick Park,
Hammersmith, Notting Hill Gate,
Bayswater, Paddington (EB),
Edgware Road, Gloucester Road
(WB), South Kensington, Mansion
House (platform 2)

EAST LONDON LINE:

Rotherhithe, Surrey Docks (SB)

HAMMERSMITH & CITY:

Goldhawk Rd, Westbourne Pk (WB)
Edgware Road, Baker Street,
Liverpool Street

REFERENCE:

(18)
(cont)

METROPOLITAN LINE:

Aldgate, Liverpool Street,
Baker Street, Wembley Park,
Preston Road, Ruislip Manor,
Northwood Hills (SB), Chorley-
wood, Chalfont, Amersham,
Chesham

NORTHERN LINE:

Totteridge, Woodside Park,
West Finchley, Archway, Goodge
Street (SB), Tott.Ct.Rd., Balham

PICCADILLY LINE:

Ruislip Manor, South Harrow,
Sudbury Hill, Alperton, Ealing
Common, Osterley, Northfields,
Acton Town, Hammersmith, Picc
Circus (EB), Leicester Sq (EB),
Holborn, all stations Manor
House to Oakwood inclusive,
Aldwych

(18A) CIRCLE, CITY WIDENED,
H & C and MET LINES:)

Farringdon, Barbican

(18W) CENTRAL LINE:

White City

(19) BAKERLOO LINE:

Dollis Hill (SB), West
Hampstead (SB)

DISTRICT/PICC LINES:

Acton Town

NORTHERN LINE:

Totteridge, West Finchley

(19W) CENTRAL LINE:

White City

(20) CENTRAL LINE:

West Acton, Shepherds Bush (WB)

CIRCLE LINE:

Monument

DISTRICT LINE:

Putney Bridge, Turnham Green,
Stamford Brook (WB), Monument,
Bow Road

EAST LONDON LINE:

Wapping, Rotherhithe, Surrey
Docks

HAMMERSMITH & CITY:

Bow Road

METROPOLITAN LINE:

Croxley, Watford

NORTHERN LINE:

Brent

PICCADILLY LINE:

Boston Manor, Hammersmith (EB)

REFERENCE:		
(M4)	DISTRICT LINE:	Turnham Green, Hammersmith (WB)
	PICCADILLY LINE:	Hammersmith (WB)
(M9)	CENTRAL LINE:	White City, Mile End, Leyton, Wanstead, Gants Hill
	CIRCLE LINE:	Mansion House
	DISTRICT LINE:	West Kensington (EB), Mansion House, Aldgate East, Mile End
	HAMMERSMITH & CITY:	Aldgate East, Mile End
(M9F)	DISTRICT/PICC LINES:	Hammersmith
(M16)	BAKERLOO LINE:	Stanmore
	CENTRAL LINE:	All stations West Ruislip to Hanger Lane inc., Mile End, Leyton (EB), Gants Hill
	CIRCLE LINE:	Charing Cross (OR)
	DISTRICT LINE:	Hammersmith (EB), Charing X (WB) Mile End
	HAMMERSMITH & CITY:	Mile End
	METROPOLITAN LINE:	Baker Street (Main)
	PICCADILLY LINE:	Hammersmith (EB), Hyde Park Corner
(M18)	CENTRAL LINE:	Gants Hill
	CIRCLE LINE:	St James Park (IR), Liverpool Street
	DISTRICT LINE:	St James Park (EB)
	HAMMERSMITH & CITY:	Liverpool Street
	METROPOLITAN LINE:	Liverpool Street, Northwood Hills, Amersham (platform 3)
(M18A)	CIRCLE LINE:	Charing Cross, Euston Square
	DISTRICT LINE:	Charing Cross
	H & C/MET LINES:	Euston Square

N.B. Cannon Street station has all-red roundels bearing the station name at the street-level entrance (though normal red and blue signs at platform level), similar in style to those experimentally installed at Sloane Square (platform level) in 1972.

PERMANENT WAY

Mr C E Lee has kindly supplied the following note to amplify the reference to the origin of the term "permanent way" in Vol XIV No 1.

(Extract from 'The Railway Gazette', October 15, 1937)

As we have previously pointed out, there is little doubt that the use of the term permanent way (comprising rails, chairs, sleepers, and ballast) arose through the necessity of differentiating between the temporary contractor's line and the road as finished for permanent use. The introduction of the name was one of many interesting points regarding track terminology that were dealt with on Tuesday by Mr Charles E Lee in an address to the Brighton section of the Permanent Way Institution. His earliest reference to such differentiation was the first (1825) edition of Thomas Tredgold's 'Practical Treatise on Railroads and Carriages' which contrasted the forming of 'temporary ways' with the fixing of 'permanent roads.' The oldest use of the precise term permanent way which Mr Lee had so far been able to trace was in the report of the London & Birmingham Railway dated February 3, 1837, which referred to the additional cost arising from the increased prices it had 'been found necessary to give for all the materials composing the permanent way, such as Rails, Blocks, etc....' Exactly a year earlier the report had spoken of 'the Rails, Chairs, Stone Blocks, and Wooden Sleepers, required for the permanent Railway..'. In a report which Charles Vignoles made on November 25, 1836, to the directors of the Midland Counties Railway he consistently used the term 'upper works of railways,' as did Francis Wishaw in his 'Analysis of Railways' in 1837. The latter, however, gave the definition in his 'Railways of Great Britain and Ireland' (1840) that 'the rails, chairs, pins, keys, felt-blocks, sleepers, and ballasting, constitute the permanent way, or upper works of railways.'

ELECTRICS IN ECLIPSE

David R Webb

It was quite obvious that my chances of catching my usual morning train, the 7.45 to Baker Street, were almost nil. My feet went from under and I sat down half a dozen times before I had gone fifty yards. Everywhere the ground was covered by a paper-thin sheet of ice and the icy drizzle which was falling merely froze as it fell. It was a phenomenon known as a 'silver thaw', caused by a thaw followed by a rapid drop in temperature accompanied by a light, freezing rain.

It was 8th December, 1936. At that time the conductor rails terminated at Rickmansworth and Metropolitan Railway trains to

Aylesbury changed from electricity to steam there. North of Harrow-on-the-Hill there were only two tracks. During the two rush-hour periods trains on the Aylesbury line ran non-stop between Moor Park and Baker Street or Marylebone. Rickmansworth and all stations north thereof were manually signalled with lower quadrant semaphores, although it may be mentioned in passing that the down line Rickmansworth 'distant' was a two-position colour light signal which, when the line was clear, showed green for LNER trains and yellow for Metropolitan trains, which had the starter 'on' when they reached the platform as they had to change engines.

My schedule between home and station was tight and had no recovery margin. The Amersham up home signal was in my view all the way and as I struggled along I glanced at it whenever I could to see if it had been pulled off. But it did not move. Nor did any trains and I began to wonder if the unusual conditions were affecting more than just myself.

Most Amersham residents had much longer journeys from their homes to the station than I had, so I was not very surprised to find the station very quiet. Luckily I had only a few moments to wait for a train, which was a Metropolitan one hauled by 4-4-4 tank No 106. In my innocence I imagined that it was the 7.45 am running somewhat late, but it turned out to be the second train before, running very late indeed.

Unusually, the sidings at Rickmansworth in which were parked the Metropolitan locomotives waiting to take over from the electrics, were empty. I was travelling in the first carriage of the train and noticed that the normal sounds which accompanied the uncoupling of the steam locomotive were absent. Obviously something was going on and I risked unpopularity from my fellow-travellers by stepping on to the platform to find out. (The Met's Aylesbury line sets of that time had bars across the windows to prevent heads being stuck out of the windows, which could have been fatal in the tunnels south of Finchley Road.) No 106 was still on the train and was taking water preparatory to taking her train on as no electric locomotives had arrived to perform their normal task.

Not far outside Moor Park we stopped, crawled forward, stopped again with a slight bump and then moved forward. The roar from No 106's exhaust was something to be remembered. We were pushing a stranded e.m.u. from Watford and the beats from No 106's chimney were punctuated by the bangs and splutters from the shoes of the e.m.u. as they vainly tried to pick up current from the iced-up conductor rails. As we drew cautiously into Moor Park station, another e.m.u. passed on the down line assisted in rear by another 4-4-4 tank, probably on its way from Neasden shed to Rickmansworth. After a double stop to enable both trains to draw up at Moor Park platform, we set off up the gradient towards Northwood and it was quite obvious that No 106 was doing the lion's share of the work. As we progressed at a majestic 15 mph, there passed on the down line a Metropolitan six-coach Aylesbury line set headed by a B-B electric locomotive, assisted in rear by a LNER stopping train in charge of one of the Bl7 4-6-0s which were then much in use on the old Great Central line.

We stopped at Northwood with our lame duck e.m.u. in the plat-

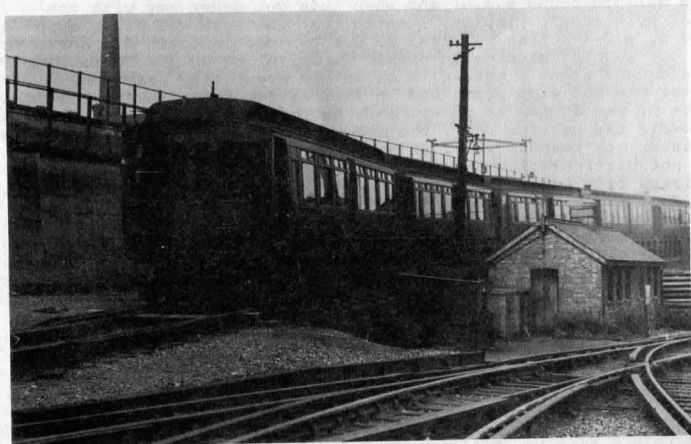
form and our own train outside it. The down platform was occupied by a Watford-bound e.m.u. and when this got under way with the usual pyrotechnic display, I noted that the push was being supplied by a 0-4-4 tank of Class E. Our own double train did not move off for several minutes to enable the driver of No 106 to restore an adequate steam pressure. When we did eventually start the driver did not stop again and in fact as far as Harrow-on-the-Hill, where he was forced to do so, made obvious and successful efforts to avoid the pulling up of the Aylesbury line set in any platform. Whatever his reasons were, we passengers were grateful to him. We did not particularly desire our privacy to be invaded by hordes of denizens from inner suburbia.

Just after we crossed the bridge which spans the main road between Northwood and Northwood Hills, there rolled by on the down line an immense triple train. It was led by an e.m.u. bound for Watford, assisted from behind by a Metropolitan train for Aylesbury in charge of a 4-4-4 tank - steam hauled Metropolitan passenger trains had been a rarity on this section of line for 10 years or more - and behind that a second train for Aylesbury, this time a LNER one headed by a Robinson A5 4-6-2 tank. This was certainly more than enough power for an ailing e.m.u., but no doubt the running of the two Aylesbury trains as one was due to the need to ease the problem of line occupation, which must have become pressing by then.

By now various impromptu de-icing efforts and a slight rise in temperature were beginning to have their effects and the e.m.u. which had been our companion for so long, in time if not in distance, was now able to proceed under its own power. While we waited for it to clear the section - standing aloofly away from the platform, of course - yet another steam-cum-electric combination passed on the other line. It was the fourth e.m.u. for Watford which I had seen that morning - there must have been quite a congestion on the platforms at Watford - and this had a LNER train as helper, the motive power being another A5 4-6-2 tank.

It was the last which I saw. We ran gently as far as Harrow-on-the-Hill, doubtless to avoid over-running the e.m.u. in front of us, which stopped at every station. It is quite likely also that the driver of No 106 was conserving his coal and water as he would have to run back to Rickmansworth before he could take on any more. At any rate he handed over to a B-B electric locomotive at Harrow - which had been normal practice until the electrification had been extended to Rickmansworth in 1925 - and we proceeded to Baker Street without further incident. I have often wondered how late was the train on schedule, but I only know that it was quite 45 minutes behind time when it reached Amersham, assuming that it was the train I was told it was (and there was not little confusion that December morning) and that it lost some 80 minutes on the normal timing between Amersham and Baker Street.

(This article is reprinted, by permission, from Vol 50 No 582 (January 1974) SLS Journal.)

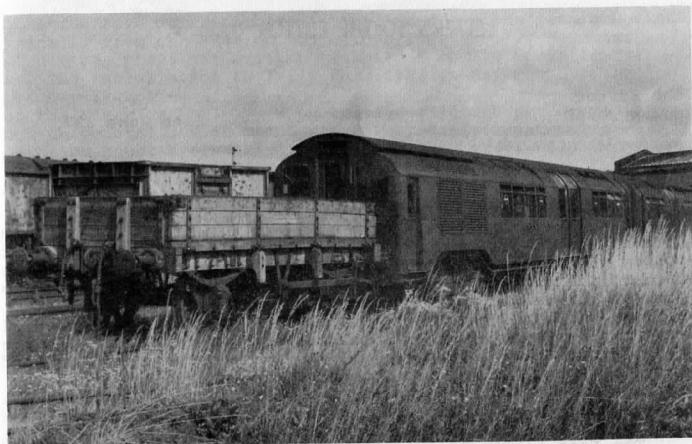


Drayton Park with GN&C stock in use; the train is standing on the original access incline to the GNR which joined the GN & CR at the back of the depot



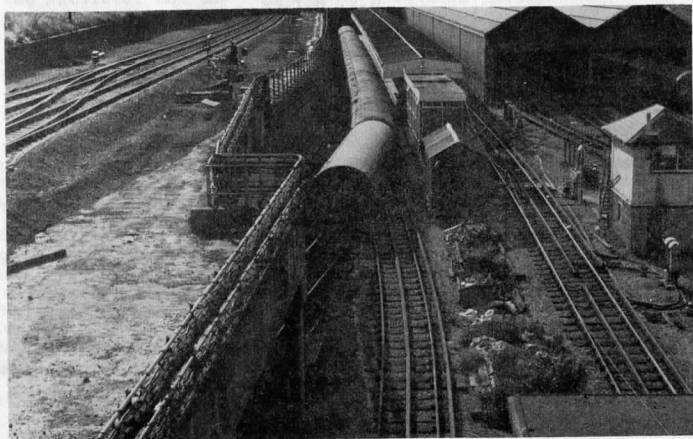
Drayton Park station on 27 March 1954 showing a Metropolitan Railway nameboard and the access ramp and track built under the uncompleted 1935-40 new works programme and subsequently connected to Highbury Vale sidings (LNER)

(A A Jackson)



LT tube-gauge match wagons and Northern City Line pre-1938 stock in Highbury Vale sidings in connection with transfer trips to and from the Northern Line 9 September 1962

(TLURS Collection)



Drayton Park station on the day following the closure of the line (5 October 1975) with a six car train about to be hauled up the access ramp whilst being removed to Neasdon depot

LETTERS TO THE EDITOR

The Editor
Underground

11th June 1975

Sir,

The Underground Guide

I refer to page 37 of The Journal, April 1975.

The District Railway ceased to issue time table books at the time of electrification. It is not however generally known that pocket sized pamphlets were issued to the public free, but were rather difficult to obtain. Usually there were separate pamphlets for (a) Wimbledon, (b) Richmond, (c) Ealing, Hounslow, South Harrow (d) Uxbridge including connections to Harrow-on-the-Hill via Rayners Lane. All trains were given in detail, and with the exception of the Uxbridge sheet, the stations were enumerated from and to Barking. It was not too easy to ascertain the complete service from Barking to Central London from these pamphlets but fortunately the LT&S time book gave the complete service of District trains from and to the LT&S line.

The East London Railway issued a folded sheet time table, price one halfpenny. When the District trains were withdrawn in 1905 and until electrification in 1913 the East London time table carried the heading 'Provisional service of trains'. Both the District and the East London pamphlets ceased to be issued about 1915 and none appear to have survived.

Yours faithfully,

H.V. Borley

The Editor
Underground

11th June 1975

Sir,

Spagnoletti on the Underground

May I add a few notes to the interesting articles by Mr Bett and Mr Benest.

A minor error occurs on page 34, the name of the signal box between Amersham and Great Missenden should read Mantles Wood.

There was a box on the GCR named Willesden; it was at the north end of Willesden Green station. This may have been a Great Central box and replaced Mapesbury. There was also one called Brent South, at the south end of Neasden sidings; this was probably a Metropolitan box, and was I think provided a little later than Brent North. Brent South was replaced by a GC box, Neasden Junction South when the High Wycombe line was opened.

During construction of the GCR there were small temporary Met boxes at West Hampstead and St Johns Wood Road.

Quinton Road Junction box was abolished and the points worked electrically from the Station box with effect from 27 November 1921. This was the first British example of remote operation of points. The installation is fully described in Railway Gazette 8 September 1922.

On the District Railway, Sion College although not dismantled was not in general use in more recent years. After extension east from Mansion House trains cleared quicker than previously.

As regards the working conditions in the signal boxes I believe the men worked 10 hours a day in some boxes and eight hours in others. The atmospheric conditions were not too bad, the worst was probably the Midland Railway box on the curve towards Camden Road. The access to this box was by a spiral staircase at the west side of St Pancras station.

Yours faithfully,

H.V. Borley

THE UNDERGROUND'S FIRST ESCALATOR INSTALLATION

The following account of the installation of the first escalator on the London Underground system is taken from Ministry of Transport File MT/6/3185 at the Public Record Office.

The earliest documents on the file are blue-prints of the Otis Elevator Co. design. One dated 12th January 1911 shows the Drive for the Escalator and the other shows a section through the Incline and is dated 28th March 1911. A letter from the LER dated 25th September 1911 states that the works will be completed in a few days and invites the Inspecting Officer to make arrangements to come and see the installation. There are drawings dated the following day which show the two escalators located between the Eastbound and Westbound platforms of the District Railway at Earls Court.

On 30th September Col von Donop announced his intention of arranging inspection as soon as convenient and rather surprisingly added that he saw no objection to the use of the escalator in the meantime.

Col H A Yorke actually carried out the inspection on 5th October 1911 in his capacity as an Inspecting Officer from the Board of Trade Railway Department and a copy of the report was issued on 10th October 1911. He stated that these escalators were the first for railway service in this country although similar appliances had been in use in New York for some years and also in Paris for ascending only. The present installation was regarded as an experiment for purposes of interchange between the District Railway and the Great Northern, Brompton and Piccadilly Railway. The two escalators were situated parallel to each other about 3'6" apart in a tunnel inclined at 1 in 2.015 lined with cast-iron

segments. The internal diameter was 16'4". One escalator was arranged for ascending only and the other was reversible. The width of each stairway was 4' and consisted of 57 steps each with 18" tread and 8" rise. The total vertical distance between the landings was 38'. The machines were described as consisting of sloping endless chains on which steps were fixed, the treads of which were horizontal on the upper side when in use. The hand-rail on each side of the stairway travelled at the same speed as the stairs. The Lower landing was situated in a tunnel which connected the two platforms of the Piccadilly tube while the Upper landing was contained in a rectangular chamber under the District Railway. A fixed staircase led from the chamber to the East and Westbound platforms. The balustrading of the escalator was made of teak while the treads and risers were of fireproofed American Oak. No other inflammable material was used.

The escalator was driven at a rate of 90 ft per minute by a 50 hp motor through a reduction gear which gave a speed of 60 steps per minute. Allowing a notional three people standing on each step the capacity of the escalator was calculated as 10,800 per hour. The motors for each machine were in duplicate located in a basement under the upper landing. Each stairway was fitted with safety devices consisting of an emergency push button at the top and bottom of each stairway. After this had been operated the machinery could only be restarted from the control room. A further switch was provided at the bottom of each stairway which it was stated entirely prevented the machine from being started up again. (One is led to imagine a kind of scuttling device!) The current was supplied from the live rails of the District Railway with throw-over switches to either the up main or the up local line. In the opinion of Col Yorke the moving parts were so accurately fitted together that it was in the highest degree improbable for a finger or clothing to become engaged in the machine. He charged the Company with keeping a record of the number using the escalator and to report back at the end of one month.

The covering letter dated 10th October 1911 stated that subject to the stairs and lifts being kept open to passengers as at present, it would be in order to operate the escalator for one month.

The second report dated 4th November 1911 gave an account of the mishaps all of which appear to have occurred in the first week. They were 9 torn dresses, one pinched finger (improbable though it must have seemed to Col Yorke) and (not surprisingly) one lame passenger using crutches who fell. Dress guards were promptly provided on each side of the descending stairway and at the top and bottom only of the ascending stairway. A total of 550,000 passengers had been carried since the opening day with a daily average of 18,000 and a maximum in one day of 24,500.

The addition of these guards was alleged to have caused injury to a boy's hand in 1913 and the solicitor acting for the boy's parents drew attention to the fact that the 'skirting boards' could not be seen in the drawing of the escalators which was published in the Illustrated London News of 14th October 1911. The account ends here but the file also contains details of the first straight type escalator.

Bar-and-Circle (appendix) (contd from page 64)

Location of types of sign on Tunnel Hoarding Walls

These signs are provided at all deep-level stations and on the Central Line platforms at Mile End and the Circle/H&C/Metropolitan Line platforms at Kings Cross. All signs are of the type (Ref: M16) except at the stations shown below where other types of sign are in use.

REFERENCE

(9)	CENTRAL LINE:	Holborn
	PICCADILLY LINE:	all stations Manor House to Bounds Green inclusive, Southgate
(M4)	CENTRAL LINE:	Mile End
(M9)	BAKERLOO LINE:	Swiss Cottage, St Johns Wood, Baker Street (Stanmore line s.b.)
	NORTHERN LINE:	Highgate

Apology

We regret that owing to an Editorial aberration the article on Computer-controlled Signalling that appeared in the last issue was not acknowledged. The information contained in the article was based on a Paper given by Mr E O Goddard to the Institution of Railway Signal Engineers on 17 December 1974 and was used with the kind permission of the Institution.

Cover Photograph Captions

Page .ix. (front)	The thyristor-controlled 1960 tube-stock train at Hainault during the evening of 30 September 1975 after completing its first round trip in passenger service since its conversion from PCM control.
Page.xii. (back)	The new battery locomotives for use by the Eastern Region on the 'tube' section of the Great Northern Electrification Scheme seen near Drayton Park. The locomotives are ex Euston-Watford type passenger stock reconstructed.

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