The New Post Office Railway Station at the New Western District Office

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Many of the postal-sorting offices in London are due for rebuilding, particularly as they are unsuitable for housing the equipment required for the modernization of the postal service. A description is given of some of the problems faced when seeking a site for the New Western District Office, and the complications surmounted in blending the Post Office Railway to the new building.

HISTORY OF THE POST OFFICE RAILWAY

THE Post Office (London) Railway Bill was put before Parliament in 1913, "to enable the Postmaster-General to construct for the purposes of the Post Office, certain underground railways and other works in London, and for purposes in connexion with such railways and works."

In presenting this Bill, it was stated that as long ago as 1853 Sir Rowland Hill had suggested that mails might be transmitted underground, and during the years 1873 and 1874 the Pneumatic Tube Company of London built a pneumatic tube to convey mails from the General Post Office to Euston Station. This scheme was in operation for only a short time, as it proved impossible to keep the tube air-tight. A Post Office Committee was appointed in 1909 to determine whether to recommend an improved type of pneumatic tube such as that being developed in New York, Chicago and Boston, or whether an underground railway should be favoured. It was decided that the mail-carrying capacity of the pneumatic system would be inadequate, even with the optimum size of tube. The only system which seemed to offer an improvement over the conveyance of mails by road van was an underground electric railway, and proposals were made for 6½ miles of tunnelling to run through the centre of London, from Eastern District Office to Liverpool Street Station, King Edward Building, Mount Pleasant, Western Central District Office, Western District Office, the Western Parcels Office and Paddington District Office and the main-line station.

The declared advantages expected of the railway were as follows:

(*a*) The conveyance of letters and parcels between the sorting offices on the route would be accelerated.

(*b*) The reduction of the large expenditure on road vans.

(*c*) Relief from congestion of the streets by the removal of a very large number of Post Office vans, both horse-drawn and motor.

In these respects the Post Office Railway, eventually completed in 1927,[1] has been successful, and if it were not for today's high cost of tunnelling the case for carrying out a number of the extensions envisaged by the 1909 Committee would be indisputable.

SELECTION OF A SITE FOR THE NEW WESTERN DISTRICT OFFICE

Many of the main sorting offices in London are housed in very old buildings, which are no longer suitable or adequate. Due to their importance in the postal structure, the old Western District Office, in Wimpole Street, and the Western Parcels Office, in Bird Street, were given some priority in the rebuilding program. Apart from the difficulties of out-housing such busy offices during rebuilding, the areas of the sites were considered to be far too small. The alternative was to develop a fresh site, and, naturally, one stipulation was that access to the Post Office Railway should be feasible.

The site acquired at Rathbone Place, London, W.1, in 1952 proved to meet all major requirements. It was well situated in the W.1 Postal District, and was large enough to accommodate both letter-sorting and parcel-sorting offices, and have space for further developments. Also, it was actually above the route of the Post Office Railway.

METHOD OF EXCAVATION

The problems associated with the formation of a station were delegated to consultant civil engineers, and Parliamentary powers for carrying out their proposals were obtained in 1956.

It was decided that the route of the railway should be diverted to provide a station with its axis running east–west, i.e. at right angles to Rathbone Place and Newman St. All other stations along the route are in the form of twin segmented cast-iron tunnels, of either 21 or 25 ft diameter, and this form of construction was the first considered. To avoid overloading the cast-iron segments, the columns supporting the building above would have been taken to footings below the tunnel level, but the tops of the tunnels would have been only 10 ft below the lowest basement level, and, therefore, the danger of distortion or overstressing was apparent. This scheme was, therefore, abandoned in favour of making a reinforced-concrete box excavation, 180 ft by 90 ft by 70 ft deep.

The box-excavation method provided for a much-improved station layout and for an additional floor immediately above the station for housing railway equipment. The walls and base could be designed to support the superimposed loads from the building above. One added complication was, of course, that it is not a simple matter to make such an excavation, with vertical sides, without the risk of movement of the adjacent ground and danger to the buildings thereon.

The main contract was awarded in April 1956, and the following description of the procedure adopted will be assisted by reference to Fig. 1 and 2.

First a shallow excavation with sloping sides was made over the area, and then the upper part of the area intended for deep excavation was enclosed in a coffer-dam of interlocking sheet-steel, driven far enough into the clay to effect a cut-off and prevent the intrusion of any surface water. At the corners of the enclosure, where interlocking sheets would not be effective, the gravel subsoil was chemically consolidated.

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[1]The Post Office (London) Railway. *P.O.E.E.J.*, Vol. 21, p. 147, July 1928.

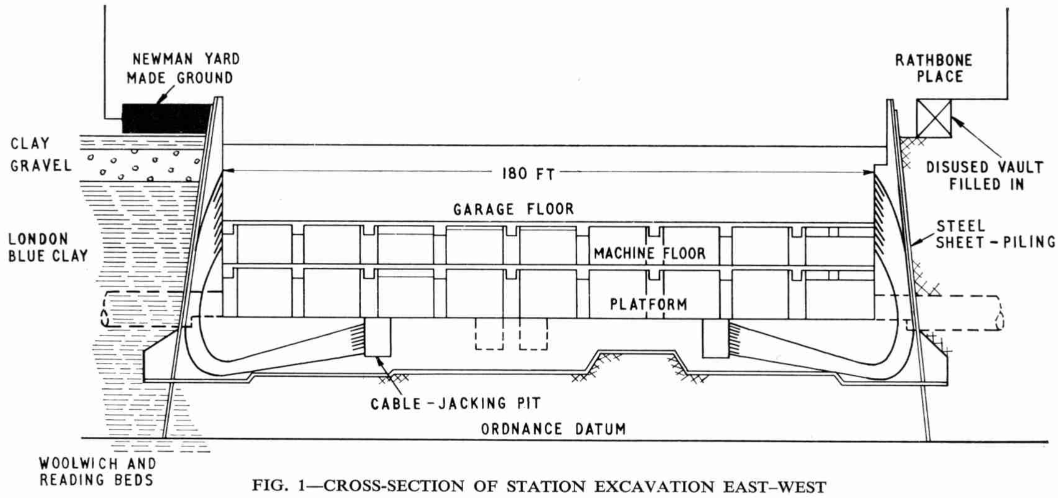

FIG. 1—CROSS-SECTION OF STATION EXCAVATION EAST–WEST

Steel "soldier" piles, 80 ft long, were driven at intervals of 5 ft around the periphery, penetrating to a depth below that of the intended excavation. Steel frames were assembled at between 10 and 11 ft vertical centres (determined by the intended floor spacing in the permanent structure) as the excavation developed, and needle joists were positioned between the steel soldier piles and the frames. Hydraulic jacks were used to apply predetermined stresses, calculated to prevent ground movement.

The frames were supported on steel "king" piles. Reinforced-concrete curtain walls, 9 in. thick, were cast in situ against the trimmed sides of the excavation and between the flanges of the steel soldier piles to ensure uniform distribution of pressures imposed by the jacks.

The presence of the existing 9 ft diameter segmented cast-iron tube, running across the south-west corner of the site and carrying the tracks of the Post Office Railway, added to the difficulties in carrying out the pile work, and made careful planning even more essential. Several of the piles were designed to pass within 12 in. of the tube, and this after being driven through 70 ft of London blue clay.

One of the largest excavations ever attempted in central London having been completed, work commenced on the construction of the railway station and the necessary diversion of the tunnels, together with the foundation work of the building that was later to be erected above. It had been decided that the east and west end walls should be built as cantilevers, with monolithic connexions to the side walls, and to post-tension them in order to minimize deflexions (see Fig. 3). One thousand two hundred cables, averaging 100 ft long, were incorporated in the walls and bases, each cable consisting of 12 steel wires of 0·276 in. diameter. A light rigid sheathing

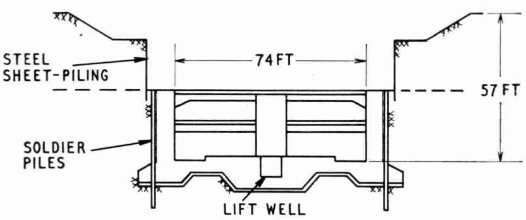

FIG. 2—CROSS-SECTION OF STATION EXCAVATION NORTH–SOUTH

was used to protect the cables, except at the 6 ft radius at the heel of the wall where steel tubing was required. The cable terminations were made in precast concrete blocks set in the walls and jacking pits, and, at the appropriate stages, tension was applied. As the structure progressed, and the needle joists were removed, the effect was observed by the use of 162 vibrating-wire strain gauges which had been embedded in the concrete.

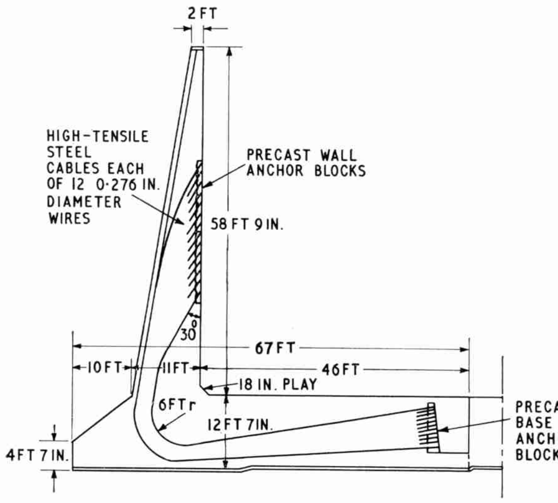

FIG. 3—ELEVATION OF END WALL, SHOWING METHOD OF POST-TENSIONING

DRIVING THE TUNNELS

With the excavation completed, headings were made on the east and west walls to commence the tunnel drives (see Fig. 4). Changes of tunnel section and the sharp curves limited the number of long drives and precluded the use of a tunnelling shield. Therefore, all the digging was carried out by compressed-air-driven hand tools. The clay was removed from the working face by a battery locomotive pulling tipper skips over a 2 ft gauge light track. Flat-top bogies were used to carry the cast-iron tunnel segments with which the tunnels were lined, and also the cement for grouting behind the newly erected segments.

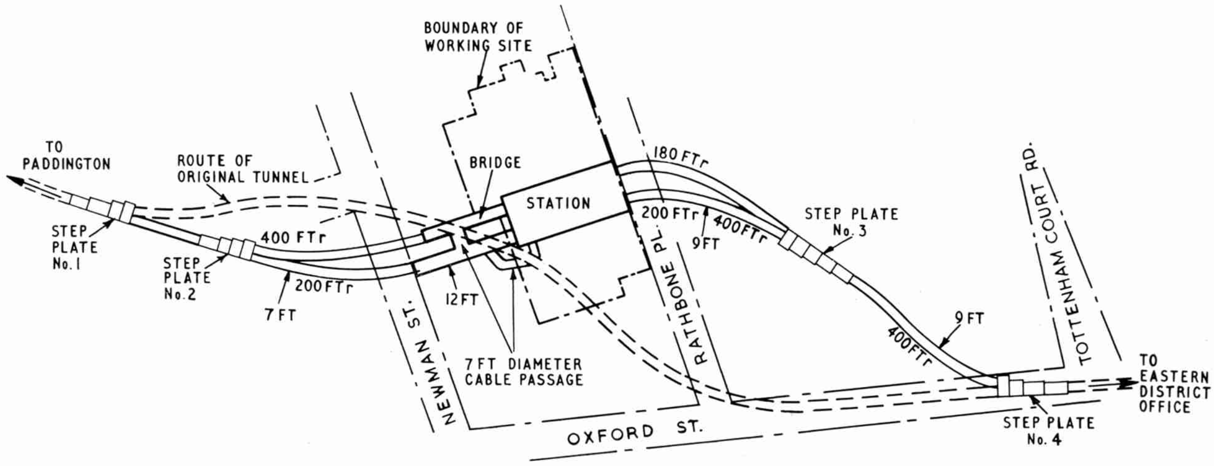

FIG. 4—NEW WESTERN DISTRICT OFFICE POST OFFICE RAILWAY TUNNEL LAYOUT

Step-plate junctions No. 2 and 3 were formed to provide the diversions from a single tunnel, containing east and west bound tracks, to separate tracks on either side of the station island-platform, as is the usual practice. Junctions No. 1 and 4 were required for the wedding of the old and new tunnels and subsequent diversion of tracks. It was considered vital that there should be no interruption of the normal Post Office Railway services, as there is now no alternative method of transport available. Junctions No. 1 and 4 were made large enough to encompass the old 9 ft diameter tunnel, which was temporarily supported by timber struts. The speed of the trains was considerably reduced from their normal 35 miles/hour during the whole of this operation.

When all the new tunnel and concrete work had progressed as far as possible, two tracks were laid via the northerly route, from step plate No. 1, through the station, and out to step plate No. 4. One track was intended as permanent, the sleepers being set in finished concrete, though provision was made for the insertion of rail switches (points) at a later date. Parts of the second track, between step plate No. 2 and the station, and between the station and step plate No. 3, were temporary and for use only until the other route through the station could be completed; they occupied space in the tunnel which would later be required for a "safe-walking" path, and the bed was, therefore, made of weak concrete set on a layer of paper to prevent bonding.

DIVERSION OF ROUTES

The vital point in the construction had now been reached when the trains would be diverted from the old tunnel, but, as the work could be carried out only during week-ends, the operation was spread over a period of six weeks.

During the first two week-ends the segments of the tunnel were removed down to track level. The concrete bed and segments below the track were demolished during the next two week-ends, the tracks being left supported on timber rafts. The fifth week-end was used for further preparation work: new tracks beds were formed, and prefabricated sections of track were suspended above their intended final positions.

Everything possible was done to reduce the amount of work to be carried out during the sixth and last week-end, as it was obvious that the 35 hours available would be barely sufficient to complete the program. As soon as the last train had passed through the old tunnel at 11.0 o'clock on the Saturday evening, the tracks at step plate junctions No. 1 and 4 were removed and concrete was laid to form the final levels and elevations for the new tracks, which were then lowered into position. Prepared shuttering was fixed between the sleepers and the inverts, and concrete was poured to secure the tracks in the bed. The final work of bonding and cabling and clearing all equipment from the tunnel was completed, and a battery locomotive was used to tow a train over the new sections to check clearances. At 10.0 o'clock on the Monday morning, the first train passed safely through the new station under its own power.

COMPLETION OF STATION

While the tunnel work was being carried out progress was being made on the formation of the station. A massive concrete base below the platform was designed to carry three rows of columns at 40 ft centres to support the building above. Tunnel portals had to be provided in the end walls, and openings were required to the upper floors for three lifts, two twin-band riser conveyors, and a twin spiral chute, in addition to stairways. Not until much of this work had been completed could the way be cleared for the diversion of the new tracks to their final positions on either side of the platform.

Completion of the station and machinery floors left the north and south walls retained by the internal permanent structure up to the level of the machinery-floor ceiling, while the east and west end walls were adequately stressed by virtue of the post-tensioning system, and they retained the surrounding earth up to ground level. The two upper stress frames, with their needle struts holding the sheet piling in position, were still in situ.

The area of the excavation was now extended both east and west to the limits of the foundations for the new building, and to the depth of the proposed sub-basement. The stressing frames were removed as the pressures were released. Extensive underpinning of the adjacent property was necessary, and the concrete beds formed for this purpose were also used as part of the foundations for the new District Office. Reinforced-concrete pillars were erected upon foundation blocks set in the blue clay, and from this point the building progressed in a more orthodox fashion. The project was completed in November 1958.

In all, 58,000 yd^3 of earth were removed from the excavations, requiring 11,600 journeys by 5 yd^3 lorries. 13,500 yd^3 of concrete, 1,150 tons of mild-steel re-inforcement, and 146 tons of high-tensile steel wire were used in the construction work below ground level.

While the new sorting office was being erected above the station, Post Office staff were engaged in installing equipment to make the station ready for operation. At no time, other than the normal maintenance periods, was interruption of the service permitted. Cabling was transferred from the old tunnel to the new route through the station, and the tracks were divided into sections with their separate feeders to give control over the movement of trains. A room on the machinery floor was equipped with all the necessary control apparatus to reduce the speed of trains as they approach the station and stop them at the appropriate loading berth.

TRAIN CONTROL AT THE NEW STATION

The process of train control at the new station is described briefly as follows. As a train passes from the normal automatic section it enters a dead section of track, de-energizing the motor and the brake solenoid to slow the train. The bridging by the train of the running rails of this section operates a 440-volt contactor via a time-delay device; thus, after an interval of slowing time, power at 440 volts is applied to the conductor rail and the train continues to move forward to a point where the voltage is dropped to 150 volts to give a reasonable speed of approach to the loading berth. The short duration of application of the 440-volt supply is necessary to guard against the consequences of a train actually coming to a standstill in the braking section, when the 150-volt supply might not provide sufficient torque to restart the train. As a further safeguard against the remote possibility of a train stalling and causing delay to service, a switch is provided in the head-wall of the station platform, to override the track circuit at the station approach and apply the full voltage to the conductor rail. The normal track circuit, which leaves a "dead" section of track behind each train, is used to prevent one train from running into the rear of another.

The operation of the train-despatch push-switch by the platform staff energizes the conductor rail via a 440-volt contactor, and, after a set time, there is a change-over to 150 volts, giving a low speed until the train reaches the first automatic section out of the station. Two stabling berths, with automatic shunting from the first to the second, are provided on each road.

The whole station area is controlled from a console equipped with two main switches, four sectional switches, receive and send switches for loading and stabling berths, and an illuminated route diagram. Occupation of sections is shown by a change of colour of the illuminating lamps.

LOCAL RAILWAY POWER SUPPLIES

Electric power supplies for the Post Office Railway, and for the building, are provided by the London Electricity Board: a 440-volt 3-phase supply for the building, and an 11 kV supply for the railway. The 11 kV supply is taken to transformer and mercury-arc rectifier units[2] on the machinery floor to produce the two voltages required for traction purposes. In the event of a failure of the 11 kV supply, facilities are available for a rapid change-over to the 6·6 kV supply from the sub-station at King Edward Building.

CONCLUSIONS

Several other sorting offices on the route of the Post Office Railway are scheduled for rebuilding in the near future, and it might prove desirable to lengthen some stations when circumstances are opportune. No deviation of the route can be envisaged, and the cost of such work as carried out at the New Western District Office would be prohibitive for the sole purpose of carrying out station improvements.

[2]Post Office Railway—Change to Mercury-Arc Rectifiers. *P.O.E.E.J.*, Vol. 52, p. 300, Jan. 1960.