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6. Underground Structures

In the construction of the Tohoku Shinkansen, Ueno underground station of 800 m in total length will be constructed at a distance of about 4 km from Tokyo Station and it will be followed by circular double track shield-driven tunnels of about 13 m in diameter and 1700 m in total length (see Fig. 2)

Ueno Underground Station

The station structure is as long as 800 m in total, 50 m wide at maximum and 30 m deep as shown in Fig. 3. It consists of four underground storeys, two platforms for four tracks of the Shinkansen being situated at the lowest storey.

The structure is planned to be constructed by the method of reverse construction sequence, in which the construction of the upper stories precedes that of the lower stories. It is mainly composed of side walls and slabs of reinforced concrete and columns of centrifugally cast steel pipes. The walls consist of inner and outer ones, the latter being cast in situ to serve as the retaining walls during excavation and to remain as permanent elements of the station structure.

Near the construction area there exist many kinds of structures such as railway tracks, a box-type subway station, the existing JNR station building, overhead pedestrian bridges and highway bridges. One of the most important and complicated tasks is therefore that of providing protection for the existing structures from damage due to the excavation works. Many structures in the area are to be underpinned before the excavation works for the new Ueno station begin (see Fig. 4 and Fig. 5).

Shield Tunnel

The tunnel with a maximum covering depth of 20 m is to be constructed by the circular shield-driving tunnel method, instead of the open-cutting method. Because it is very difficult to obtain the right-of-way on the surface of the ground, the shield-driving tunnel method is considered favorable, as it minimizes the area influenced by the excavation of the ground. Fig. 6 shows the cross-section of the circular shield tunnel.

As the shield is driven through water-bearing sand deposit, it will be necessary to stabilize it by means of chemical grouting, compressed air and so on.

Application of the shield-driving method of hand excavation is planned to facilitate the works concerning the cut and removal of many structural foundations.

The main tunnel lining consists of 60 cm thick precast segments of slab-type reinforced concrete, while the 30 cm thick concrete for the auxiliary lining, which prevents the ground water from entering the tunnel, is cast in place.

Eight buildings will have to be underpinned in the shield-driving lots and this will involve the cutting and removal of about 100 foundation piles.

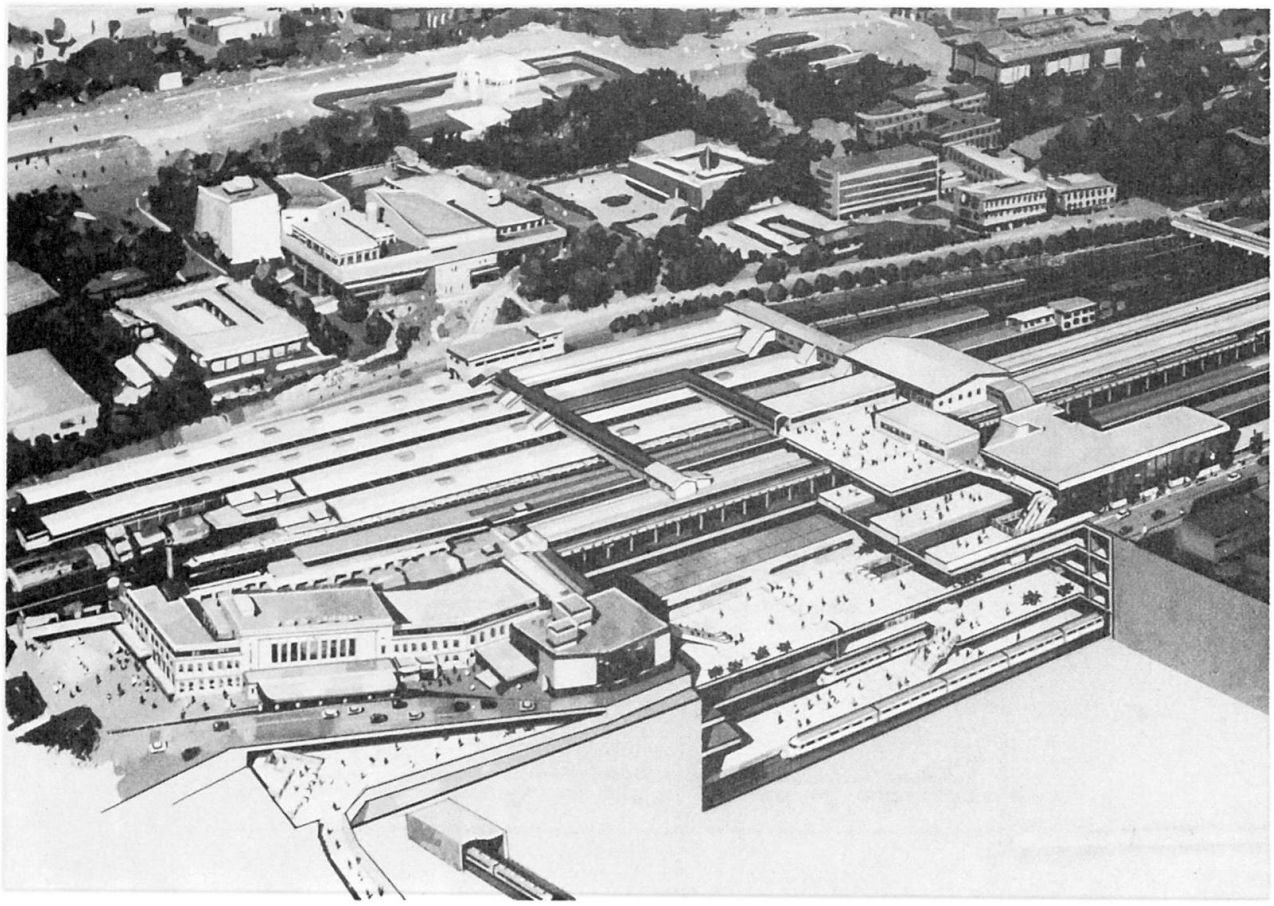

Fig. 1 General view of Ueno station

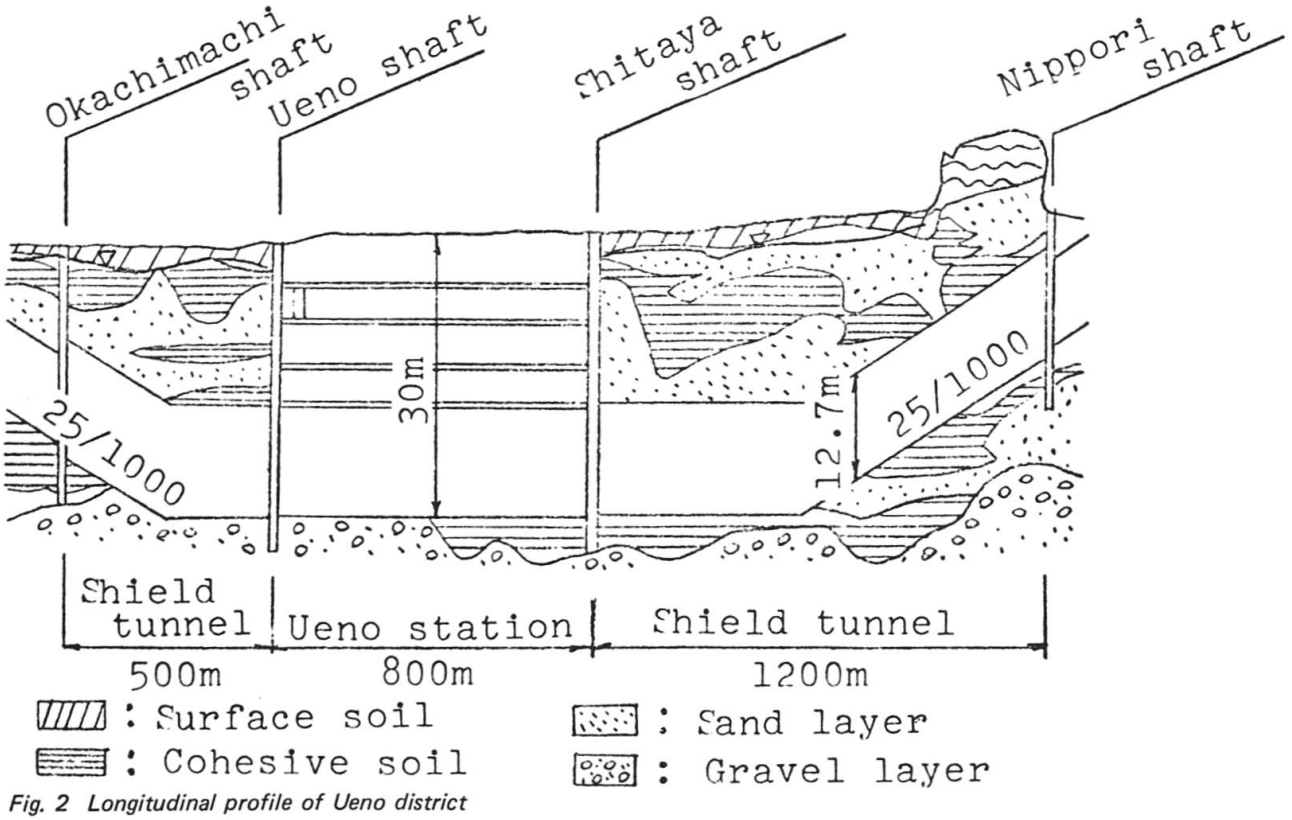

Fig. 2 Longitudinal profile of Ueno district

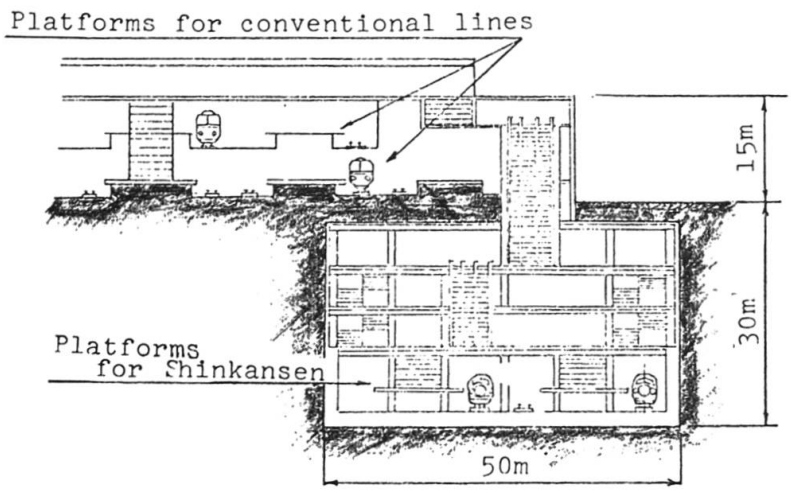

Fig. 3 Cross section of Ueno station

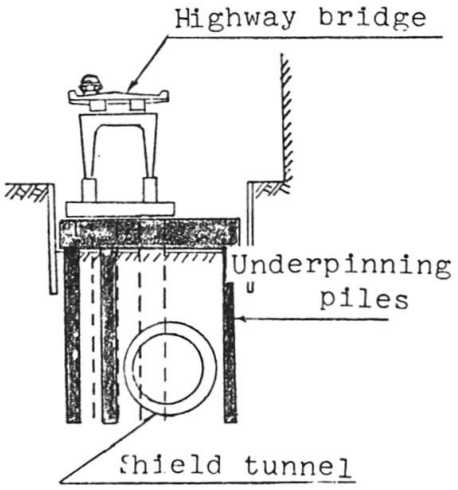

Fig. 4 Underpinning for highway bridge

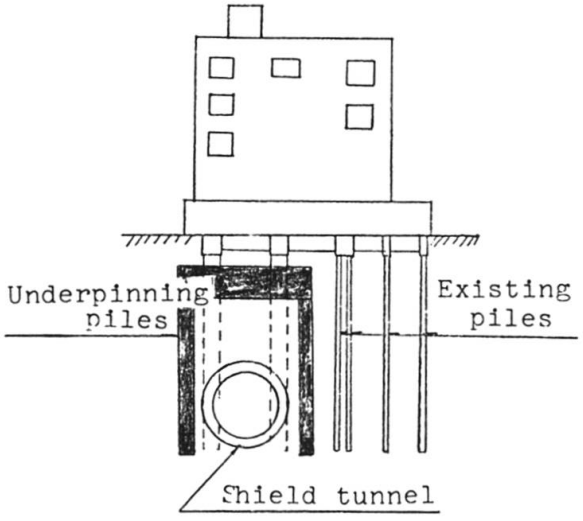

Fig. 5 Underpinning for building

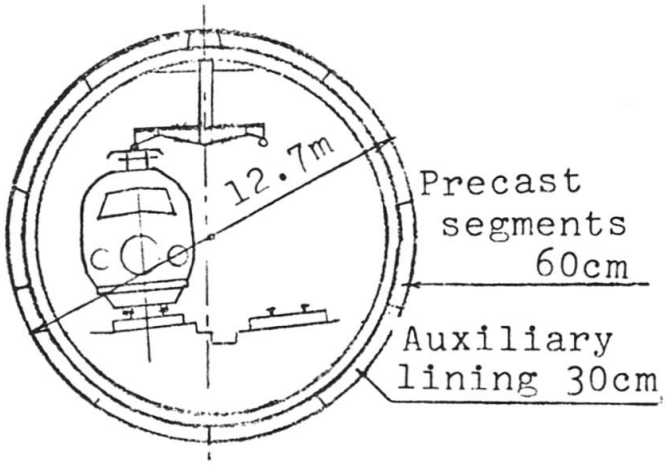

Fig. 6 Cross section of shield tunnel