

Tunnel Construction in a Widened Section

— The Kamiyagisawa Tunnel, Chubu Transversal Expressway —

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1. Introduction

Kamiyagisawa Tunnel is on the Chubu Transversal Expressway (a national expressway that is 132km long). It is a two-lane, 678km-long tunnel that was planned for expansion in five phases for 130.5m from the exit side of the portal. The largest expansion profile of this tunnel (226m²) is approximately 2.2 times of the standard profile (103m²), and has one of the largest tunnel profiles in Japan (Photo-1). The profile of the expansion area had small overburden, and the base mudstone was weathered. Along with the thin layer of crush and intrusive rock, the area was weak in geological conditions. This report will detail on the countermeasures taken during the construction to stabilize the tunnel face and crown, as well as measures taken to increase safety during excavation.



Photo 1 Largest Excavation Section with size 226m²

2. Stabilizing the Face

Long steel face bolts (ϕ 76.3mm, L=12.8m, wrap length 3.5m, 12 bolts/section, 6 shifts, silica resin 70kg/bolt) were implemented to stabilize the face of the expanded area. The long steel face bolts helped increase the shearing resistance of the face and restrain preceding displacement and dropout rock.

3. Three-Division Excavation and Excavation of Advancing Drift

Among the five phases of expansion, excavation of the top half of the expanded section of the third to fifth phases (L=76.5m) becomes higher than the boom type cutting machine. Advanced multiple bench cut method (Three-division) was adopted. This method breaks up the excavation section, allowing the stress release to be smaller and the tunnel face stabilized.

The expansion section area from the fourth phase (L=46.5m) onwards needed the natural ground of the portal to be fortified in advance, since the overburden was small and the geological conditions weak. So, a pilot drift was penetrated in advance for the following purposes:

Preceding fortifications of the upper half of the natural ground of the expansion section using the pilot drift's GFRP rock bolts (L=4m, ϕ 27mm, bearing 343kN, 6bolts/space) Ensure the stability of the natural ground around the portal using long steel bolt fore piling from the portal after the drift had been penetrated. After taking the above measures, the multiple bench cut method was used to excavate the largest expansion section area (Fig.1).

With combining the pilot drift with multiple bench cut method, the loosening of natural the ground around the expansion area was repressed, and stable excavation was possible.

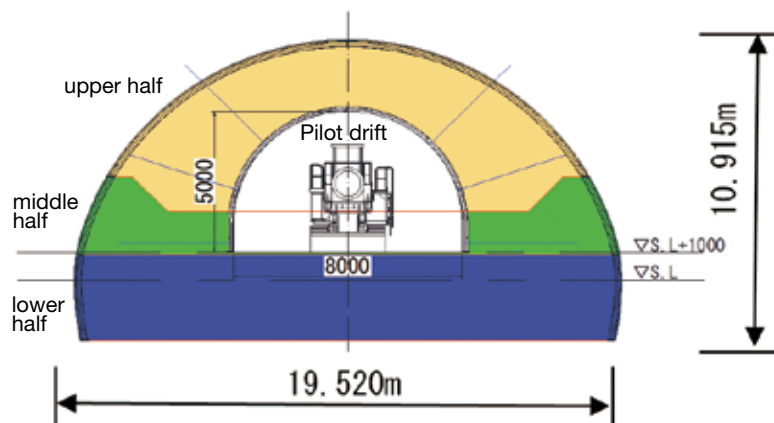


Fig. 1 Pilot Drift and Three division excavation