

CONSTRUCTION OF 2-LANE TUNNEL NEAR DATKI DEVI IN KM 33 & 34 ON NH 72A IN STATE OF UTTARAKHAND

INTRODUCTION:

The work was awarded to Genstru Consultants Pvt. Ltd., to provide consultancy services for design of tunnel section between Ch. km. 33 and 34.

The length of proposed underground road tunnel shall be of 330.0 m in silty to clayey strata. The tunnel shall be of Circular horseshoe shape tunnel having approximate width of 13.70m and height of 10.0m. The tentative alignment of the proposed tunnel is shown in **Fig.1**

The objective was to provide the detail design and to illustrate methodology concept for designing of support system for the tunnel. Further based on analysis, recommendation of support system has been provided.

SITE TOPOGRAPHY:

The tunnel is passing through a hillock. The ground level along the alignment of the tunnel rises from approximate 120.0m at the road level (NH 72A) Dehradun side to approximate 150.0m in middle of tunnel, and then descends to approximately 115.0m near Ganeshpur side. The hillock is having steep slope on either side of the proposed tunnel.

DESIGN APPROACH:

The numerical modelling has been carried out using small strain hardening soil model, with PLAXIS software based on FEM/FDM in 2D-plane strain analysis. For a plane strain analysis, it is assumed that, one of the in-situ principal stress axes is aligned with the out-of-plane direction (i.e., parallel to excavation axis).



Fig.1 tentative alignment

Therefore the other two principal stress directions lie in the plane of the analysis (i.e. perpendicular to excavation axes). The model for analysis is presented in **Fig.2** This analysis tool has been used for investigating the influence of geometry and in-situ stress variability on the stress changes in soil due to excavations.

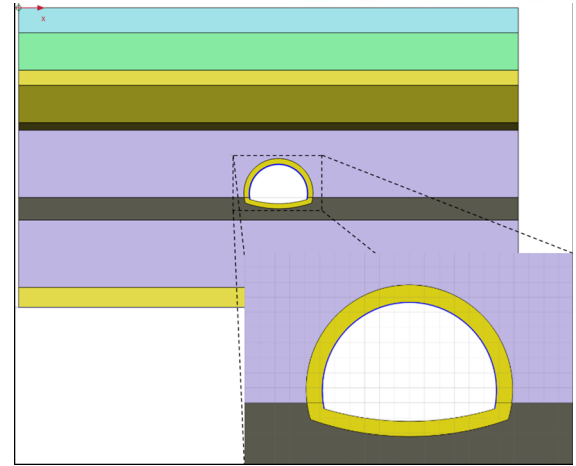


Fig.2 2D Numerical Model in Plaxis 2D

PLAXIS 2D INPUT:

Tunnel design is carried out using Plaxis 2D software following the construction stages as below. Two sections have been analyzed at locations having maximum (Section A) and minimum (Section B) overburden. The overburden height and stratification considered for the section A and B has been presented in **Fig.3** and **Fig. 4**.

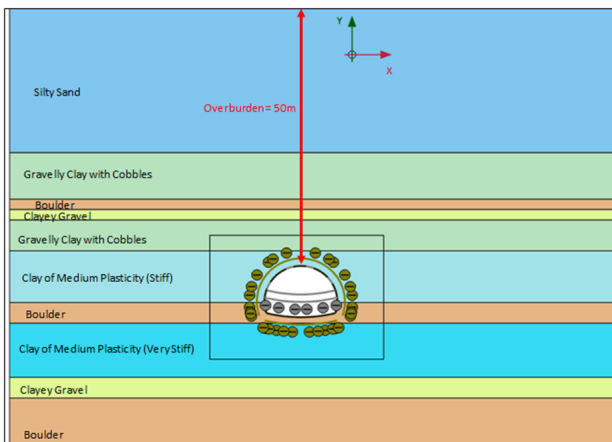


Fig.3 Plaxis 2D Input-Section A

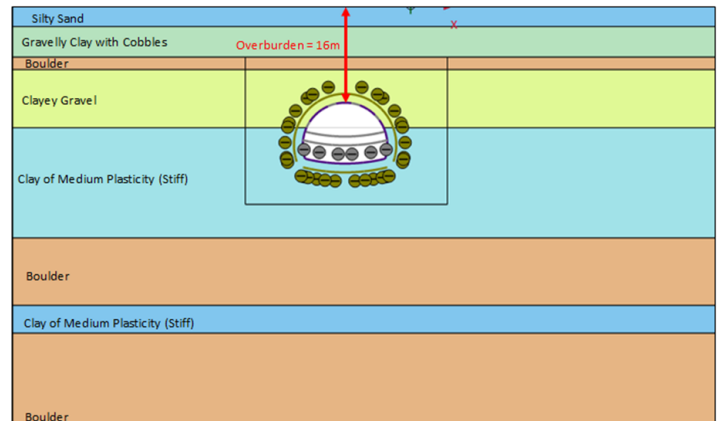


Fig.4 Plaxis 2D Input-Section B

CONSTRUCTION STAGE FOR ANALYSIS

Heading and benching excavation methodology is used in the analysis (Refer Figure 5). The construction phases considered for analysis is shown in Fig. 6 to Fig.10

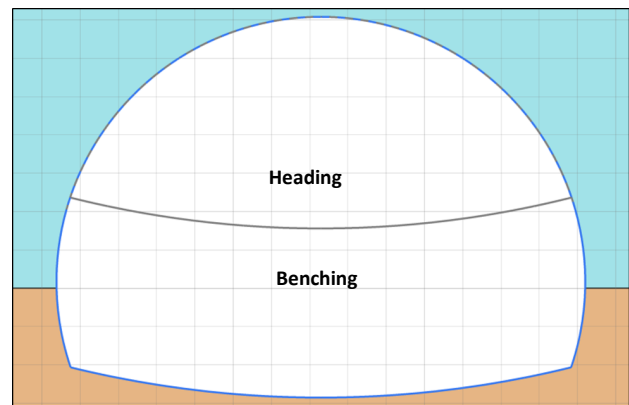


Fig.5 Heading and benching excavation

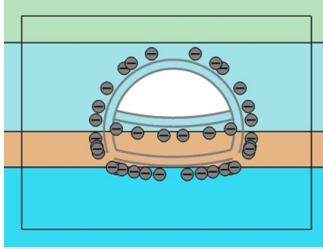


Fig.6 Phase 1- Excavate heading

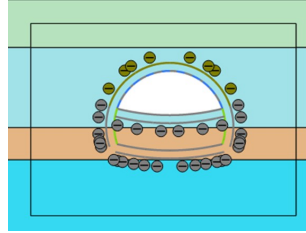


Fig.7 Phase 2- Install ISMB200, Backfill of any gap between ribs and excavation & Apply primary lining

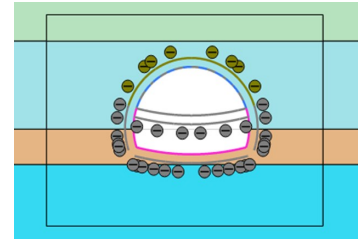


Fig.8 Phase 3- Excavate bench of tunnel

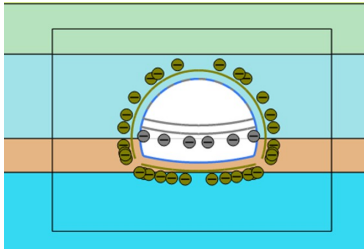


Fig.9 Phase 4 -Install ISMB200, Backfill of any gap between ribs and excavation & Apply primary lining

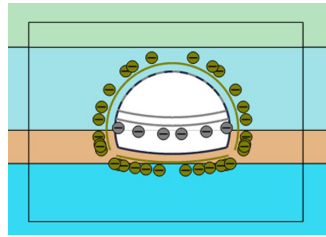
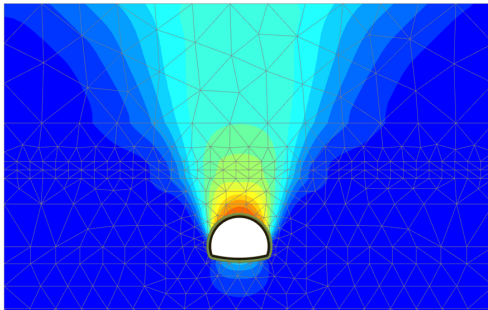
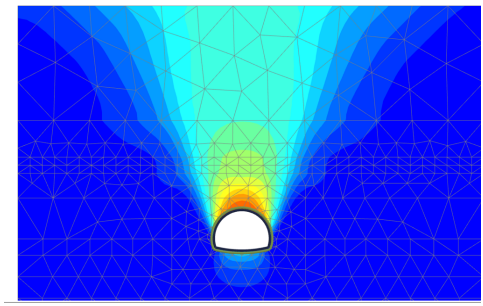


Fig.10 Phase 5- INSTALL SECONDARY LINING

PLAXIS 2D OUTPUT SECTION A:

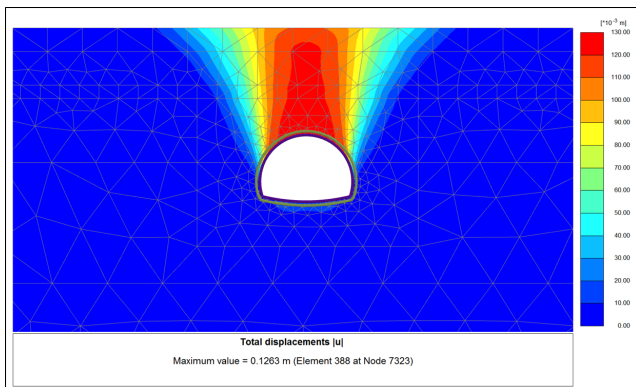


Stage 1 – Install ISMB+200mm concrete lining throughout the tunnel

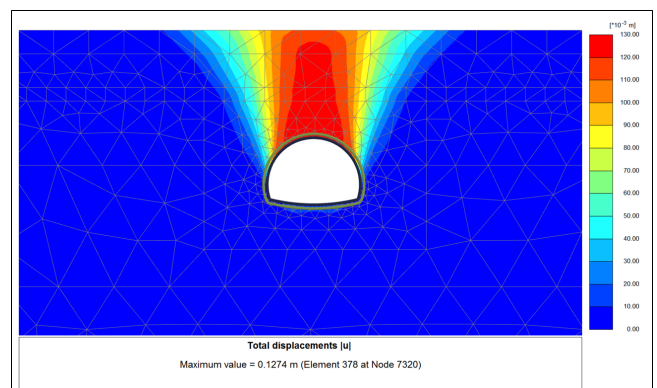


Stage 1 – Install Secondary Lining

PLAXIS 2D OUTPUT SECTION B:



Stage– Install ISMB and 200mm concrete lining throughout the tunnel



Stage– Install Secondary Lining

SUMMARY AND CONCLUSION:

Circular horse shoe tunnel with an overall width of 13.7 m and height of about 10m, extending over length of 330m has an overburden varying from 15 m to 50m. The tunnel passes through silty to clayey strata. Numerical analysis has been carried out using FEM based software Plaxis to evaluate deformations, stress changes in soil due to excavation and forces on the support system proposed for the tunnel.



Before Construction

Other Details:

- ◇ **Client:** National Highway PWD, Uttarakhand
- ◇ **Contractor:** Bharat Construction
- ◇ **Time Period:** March, 2016-May, 2018
- ◇ **Estimated Cost of Project:** INR. 40 Crore



After Construction