EXCAVATION OF THE HOMOLE TUNNEL FROM THE DESIGNER'S AND CONTRACTOR'S PERSPECTIVE

J. Rožek
AMBERG Engineering Brno, a.s., Brno, Czech Republic
A. Korba
Marti a.s., Žilina, Slovak Republic

ABSTRACT: The Homole Tunnel is part of the D35 Ostrov – Vysoké Mýto project. It consists of two unidirectional tunnel tubes of category T-8.0, with lengths of 526 m and 570 m. The two tubes are connected by a single cross passage. The tunnel is designed with a double-shell lining system, including an intermediate umbrella waterproofing and invert side drains. The overburden height ranges from 8 to 24 m. Both tunnels pass beneath the busy I/17 road, with an overburden of approximately 13.5 m. Excavation in complicated geotechnical conditions was carried out following the contractor's design from December 2024 to December 2025 under the FIDIC Emerald Book regime. The paper describes the tunnelling technology and design of the primary and secondary lining and summarizes the experience of both the designer and the contractor during construction. Completion of the project is scheduled for the end of 2026.

1. INTRODUCTION

The D35 motorway is part of the Czech Republic's national motorway and road network. Within this network, the D35 serves as the "second northern link" between Bohemia and Moravia, running parallel to the D1 motorway. It enables traffic redistribution and helps reduce traffic loads on the D1 between Olomouc and Hradec Králové. The D35 is also important for regional connections across northern Bohemia and Moravia and for linking motorways D1 Lipník nad Bečvou – Ostrava – CZ/PL border and D11 Prague – Hradec Králové – CZ/PL border as an internationally significant corridor. The construction of the Homole Tunnel is part of a future 7-km section "Ostrov – Vysoké Mýto"of the D35 motorway. Due to its technical complexity, the tunnel project was separated into an independent construction contract. The tunnel ensures the connection of both motorway subsections into a single functional unit.

The tunnel is located northeast of the village of Vraclav, where the D35 passes beneath the Vraclav Ridge and the Homole Hill. The motorway is designed in category R 25.5/120 with a widened median strip from 3.0 to 3.5 m.

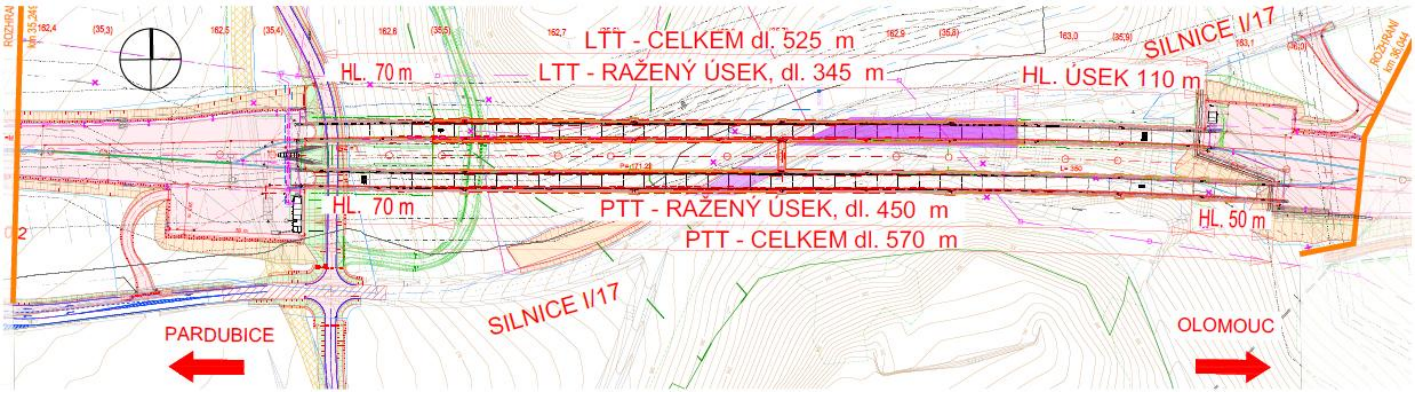

Figure 1: Layout of the Homole tunnel

The project client is the Road and Motorway Directorate of the Czech Republic (ŘSD). The contractor is the joint venture "Consortium for the Construction of D35 Ostrov – Vysoké Mýto, Homole Tunnel":

EUROVIA CZ a.s.; Marti a.s.; EUROVIA SK, a.s. The tunnel designer is Amberg Engineering Slovakia, s.r.o., and the designer of the mined section is AMBERG Engineering Brno, a.s. Tunnel excavation is carried out by Marti a.s.

The tunnel consists of two unidirectional tubes. The left tube is 525 m long, including 180 m of cut-and-cover and 345 m of mined section. The right tube is 569 m long (120 m cut-and-cover, 449 m mined). The total construction length is 795 m, including portal areas. The tunnels are connected by a pedestrian cross passage 17.5 m long. Overburden height ranges from 8.5 to 24 m above the left tube (LTT) and 7 to 19 m above the right tube (PTT). Excavation follows the New Austrian Tunneling Method (NATM) with mechanical excavation. The mined section design follows FIDIC Yellow Book conditions with several elements from the FIDIC Emerald Book.

2. GEOLOGICAL AND HYDROLOGICAL CONDITIONS

The Homole Tunnel lies within the eastern margin of the Czech Cretaceous Basin, in the so called Orlicko Žďár Facies of the Cretaceous.

According to the planned horizontal and vertical alignment, the tunnel cuts through the Vraclav Ridge and passes through diverse Quaternary soils and pre-Quaternary bedrock consisting of variable sandy marlstones and siltstones with occasional grey clayey limestones. The groundwater table lies above the tunnel axis along the entire route, but it is not aggressive on concrete.

The tunnel was divided into quasi homogeneous geotechnical units. The mined section of the left tube (LTT) consists mainly of two such units; the right tube (PTT) consists mainly of three units.

Before excavation, the contractor performed additional geotechnical investigation in the right tube area, including four 30 m boreholes. These verified the rock mass conditions in areas previously inaccessible due to high voltage lines. The investigation confirmed unfavourable geological conditions in units II PTT and III PTT and somewhat better conditions in unit IV PTT near the eastern portal.

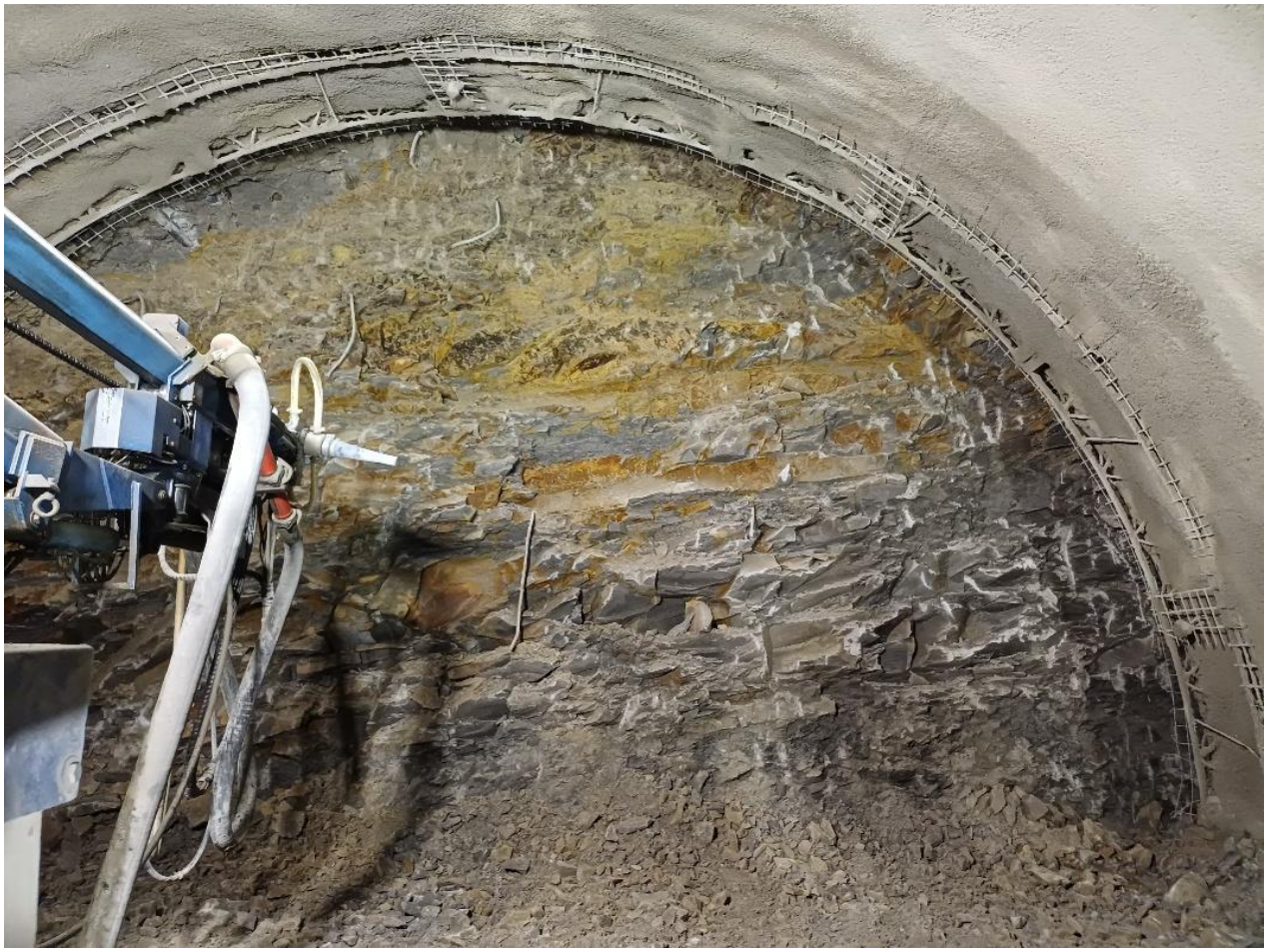

Figure 2: An example of the tunnel face in excavation class TT4

Hydrogeological conditions were expected to be unfavourable, with predicted inflows of 20–22 l/s. Inflows reached only up to 4 l/s and did not significantly hinder excavation. A groundwater drawdown of 4–8 m was recorded around the tunnel, nearly down to the tunnel invert.

3. GEOTECHNICAL MONITORING BEFORE AND DURING EXCAVATION

Part of the geotechnical monitoring (GTM) is provided by the client (measurements affecting key GBR criteria and tunnel durability), while the contractor performs all remaining monitoring.

Due to complex geological conditions, monitoring was divided into pre-excavation and excavation phases. Pre excavation monitoring included: inclinometer measurements, trigonometric monitoring of the HV pylon, geodetic monitoring of borehole collars, portal monitoring points, and anchor force monitoring in the western portal excavation pit. Four surface settlement monitoring profiles and three extensometer profiles were installed. For monitoring settlement of the I/17 road, six trigonometric points were installed.

Inside the tunnels, five – and seven-point convergence profiles were designed, along with three stress monitoring (strain gauge) profiles in primary lining. Groundwater monitoring was carried out at hydro wells from the beginning of construction.

The greatest concern involved tunneling under the heavily trafficked I/17 road, where traffic restrictions were not permitted. Surface points were monitored continuously. Maximum recorded settlement of the road was 41 mm, within allowable limits. No visible pavement damage occurred, so no traffic restriction was necessary beyond a temporary speed reduction to 50 km/h above the active excavation area.

4. EXCAVATION DESIGN

Excavation was planned from the western portal. The left tube (525 m) consists of a 70 m cut and cover section, two mined units (190 m and 155 m), and a 110 m cut and cover section at the eastern portal.

The right tube (570 m) includes a 70 m cut and cover section, three mined units (145 m, 190 m, 115 m), and a 50 m cut and cover section.

NATM excavation is divided into top heading and bench along the entire tunnel. In TT5 sections, an invert was planned. Excavation/support classes used were TT3, TT4, TT5a, TT5b, and TT5b TI.

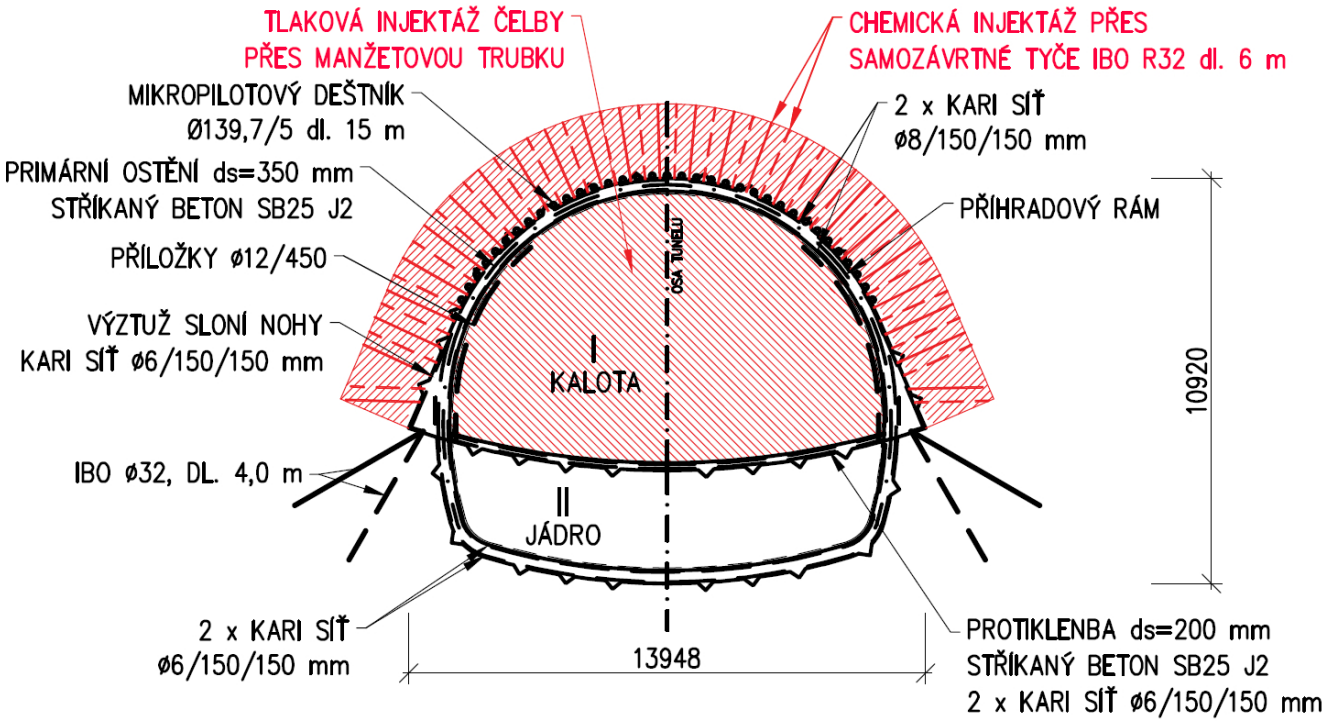

Figure 3: Cross section in support class TT5b-TI

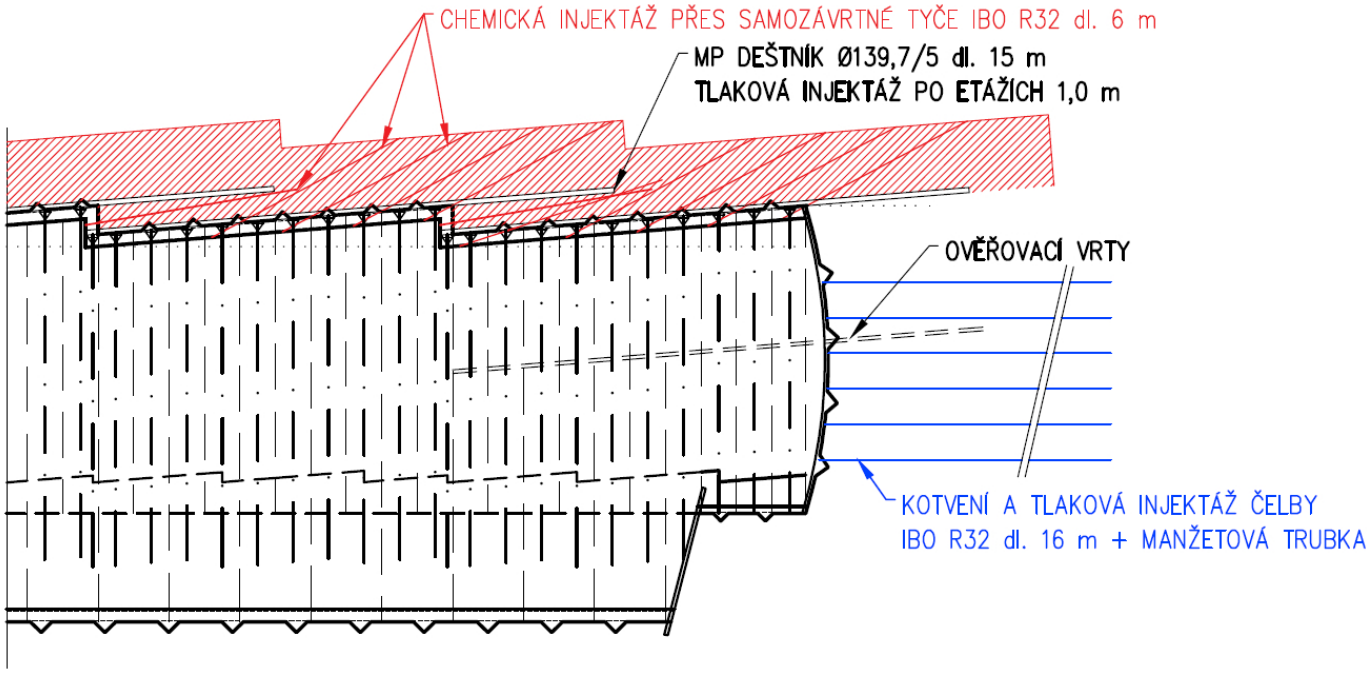

Figure 4: Longitudinal section in support class TT5b-TI

The contractor introduced three major changes vs. the reference documentation:

1. Only one cross passage was designed (Fig. 1), located beneath I/17, still meeting ČSN 737507 requirements. With appropriate tunnelling methods, it was excavated without exceeding convergence or settlement limits.
2. In the most difficult TT5b-TI support class zones, instead of planned jet grouting from the surface, the contractor used underground stabilisation measures: systematic micropile umbrella (MPD), pressure grouting of the face, chemical grouting above the MPD, and 16 m IBO 32 face anchors.
3. At the eastern portal (LTT), the cut and cover section was designed with excavation and lining cast beneath a vaulted support structure constructed at the bottom of the construction pit ("turtle structure").

5. FINAL LINING DESIGN

The tunnel features a double shell lining with umbrella waterproofing and side invert drainages. The final lining is typically founded on reinforced concrete footings. In a 25 m section near the eastern LTT portal with less competent ground, a plain concrete arched invert was added.

For the lining arch monolithic reinforced concrete C30/37 XC3, XD1, XF2 with PP fibres is used; for footings the C25/30 XA1, XC2 concrete is used. Crown thickness is 400 mm, widening to maximum 652 mm at the sides. Footings are 600 mm thick and 1450 mm wide. The cross-section geometry was slightly modified to match contractor technology. The lining is cast in 12.5 m blocks; there are 28 blocks in LTT and 38 in PTT. Expansion joints follow the VL5 guideline (2023) with spacing every 50 m, other joints are construction joints without continuous reinforcement.

6. EXCAVATION PROGRESS

Both tunnel tubes were excavated from the western portal. Excavation in LTT began on 22 November 2024. PTT excavation followed three weeks later with a 60 m face offset. Breakthrough in PTT occurred on 15 December 2025; LTT excavation including the "turtle" section finished in January 2026.

Excavation encountered better than expected rock in some areas (geotypes K4 and K5, R3–R2), requiring blasting. Thus, class TT2—originally not planned in the GBR—was added. Conversely, marlstones and siltstones were highly blocky, requiring reduced advance length and increased forepoling and face anchoring. In transitional zones between geotypes K2 (R5) and K4, the crown was unstable despite strong shale at the bench level.

Figure: Preparation for concreting the cross passage block

Classes TT5a, TT5b, and TT5b TI involved excavation in marlstones, claystones, and partly Quaternary soils. Pipe umbrella was installed using the Soilmec ST120 double boom drilling rig with a 24 m drill mast, suitable for long micropiles. Air flushing was used to avoid weakening the ground. LTT received 13 pipe umbrella stages (TM 201.85 to TM 348.05), and PTT received 16 stages (TM 151.75 to TM 335.25).

Expected groundwater inflows did not occur — smaller inflows up to 2.5 l/s shifted from crown to invert in geological unit 2.

Maximum recorded deformations:

- Surface settlement: 94 mm (outside the road)
- Convergence of primary lining: 71 mm (mainly vertical settlement)

Figure 6: Soilmec ST 120 drilling rig installing pipe umbrella

7. LESSONS LEARNED

From the designer's perspective, the Homole Tunnel is an example of how a carefully tailored excavation concept for class TT5b in poor overburden materials can eliminate the need for surface-based ground improvement and replace it with face-based grouting and micropile umbrellas. The contractor's selection of suitable equipment and focus on rapid closure of the excavation profile, minimization of downtime, and safety under shallow cover beneath a live road were essential. The monitoring program provided sufficient data to adjust the excavation method for both more favourable and less favourable conditions than predicted.

8. CONCLUSION

Excavation works were completed in January 2026. The secondary lining is currently being constructed. Commissioning of the entire project is planned for December 2026. The Homole Tunnel, together with the full D35 Ostrov – Vysoké Mýto section, will improve regional traffic and contribute to the completion of the D35 motorway.

Construction under FIDIC Emerald Book conditions was carried out for the first time in the Czech Republic, and the practical experience gained will be valuable for future road and railway tunnel projects in both the Czech Republic and Slovakia.

LITERATURE

KORBA, A..; ČILLIK, B. Tunel Homole. Tunel 2025, 34 (4), 15-20.

Ing. Jan Rožek
AMBERG Engineering Brno, a.s., Česká republika
jrozek@amberg.cz

Ing. Andrej Korba
Marti a.s., Slovenská republika
andrej.korba@martias.sk