

NORTH-WEST ROAD BYPASS OF MERANO - SOUTH TYROL - ITALY

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GENERAL OVERVIEW

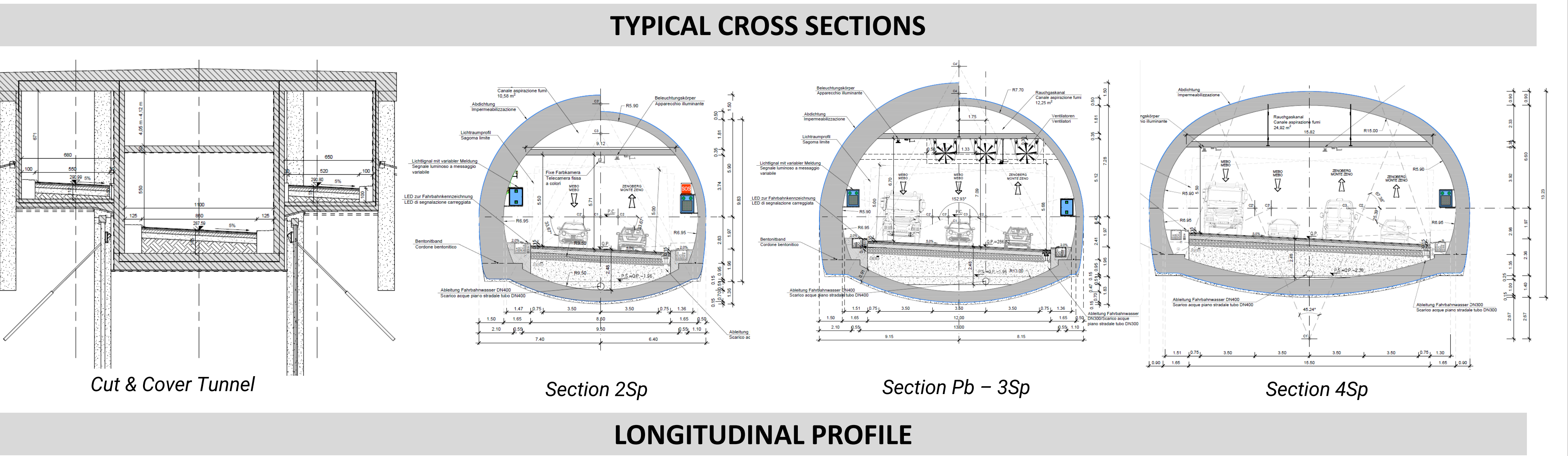
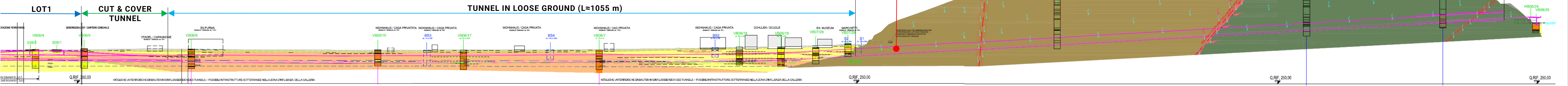
The road layout of Lot 2 starts in the North-West part of Merano, in continuity with Lot 1, which has already been completed and is currently in operation, runs eastwards under the city and then connects to the existing road system of Passiria Valley.

Except for the open-air sections to the East, Lot 2 mainly consists of a **single tunnel** with a total length of about 2200 m, which can be divided into two parts: an initial section of **Cut&Cover tunnel (L=136 m)**, connected to Lot 1 and the surface roads, and a subsequent section of **conventional underground excavation (L=2064 m)**.

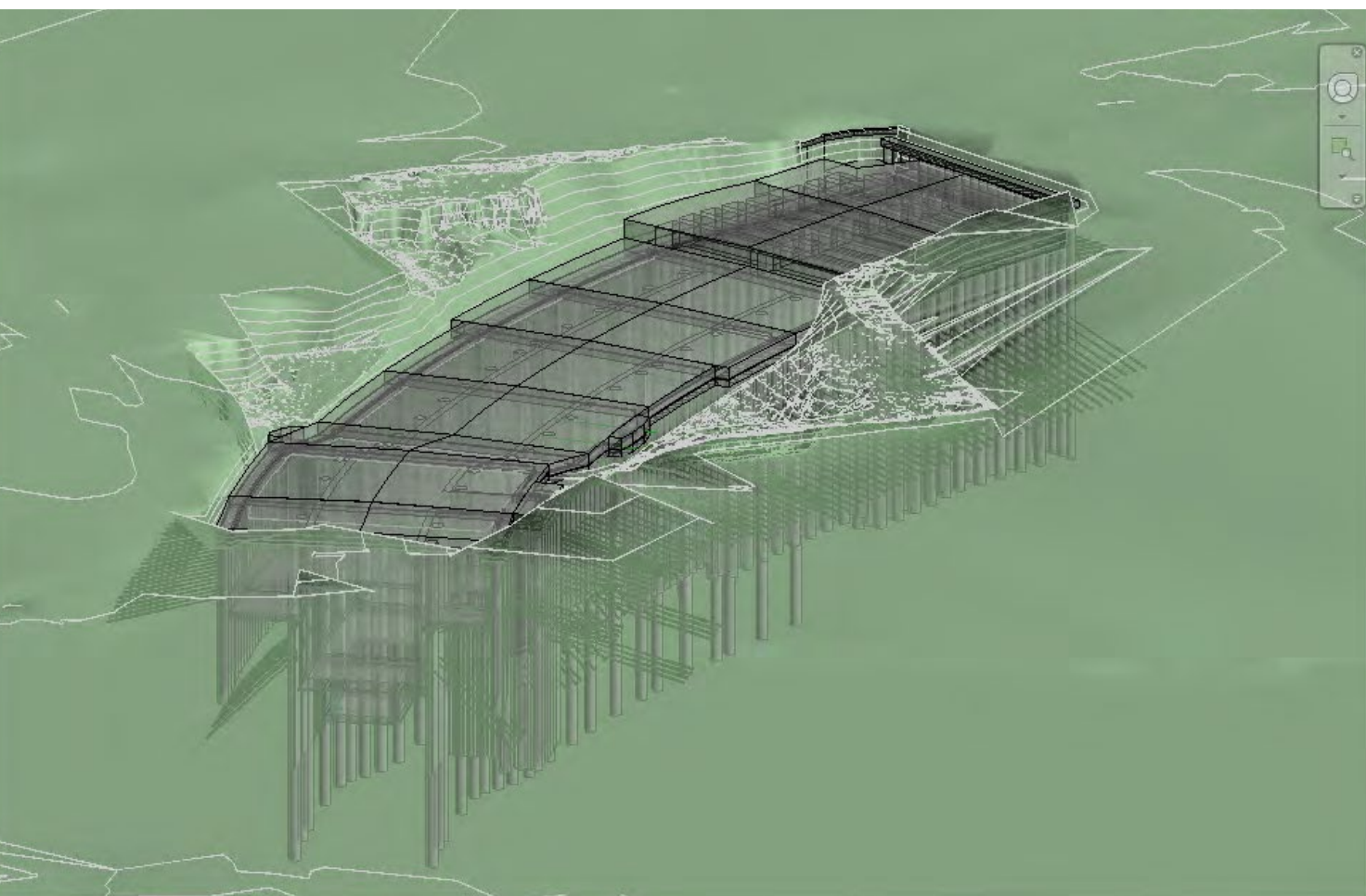
The latter, approximately for the first km, crosses the city of Merano and is characterized by the presence of **loose ground and shallow overburdens**; moving eastward, the tunnel crosses the **metamorphic rock formations** of Mount San Benedetto, with overburdens up to about 100 m. In this stretch, an underground roundabout with an overall diameter of 42 m, consisting of a toroidal tunnel with a central rock pillar of 8 m of diameter, for the connection with the future underground parking of Monte San Benedetto, is foreseen.

The tunnel standard section has a two-way carriageway, characterized by 2 lanes of 3.5 m, two 0.75 m side platforms and two footpaths with variable width for an overall **platform width of 9.5 m (Section 2Sp)**.

The road platform widens in correspondence to the **4 lay-bays (Section Pb)** provided along the route (2 in the rocky section and 2 in the loose ground stretch) and in the sections accommodating the entrance and exit lanes: approaching the East portal (Section 3Sp+, platform width = 15.1 m) and in the first West section of the natural tunnel (Section 4Sp, platform width = 15.5 m).

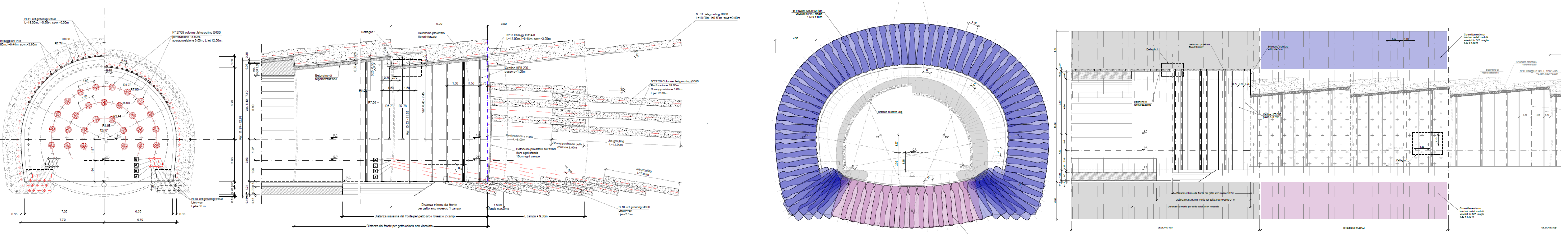


CUT AND COVER TUNNEL



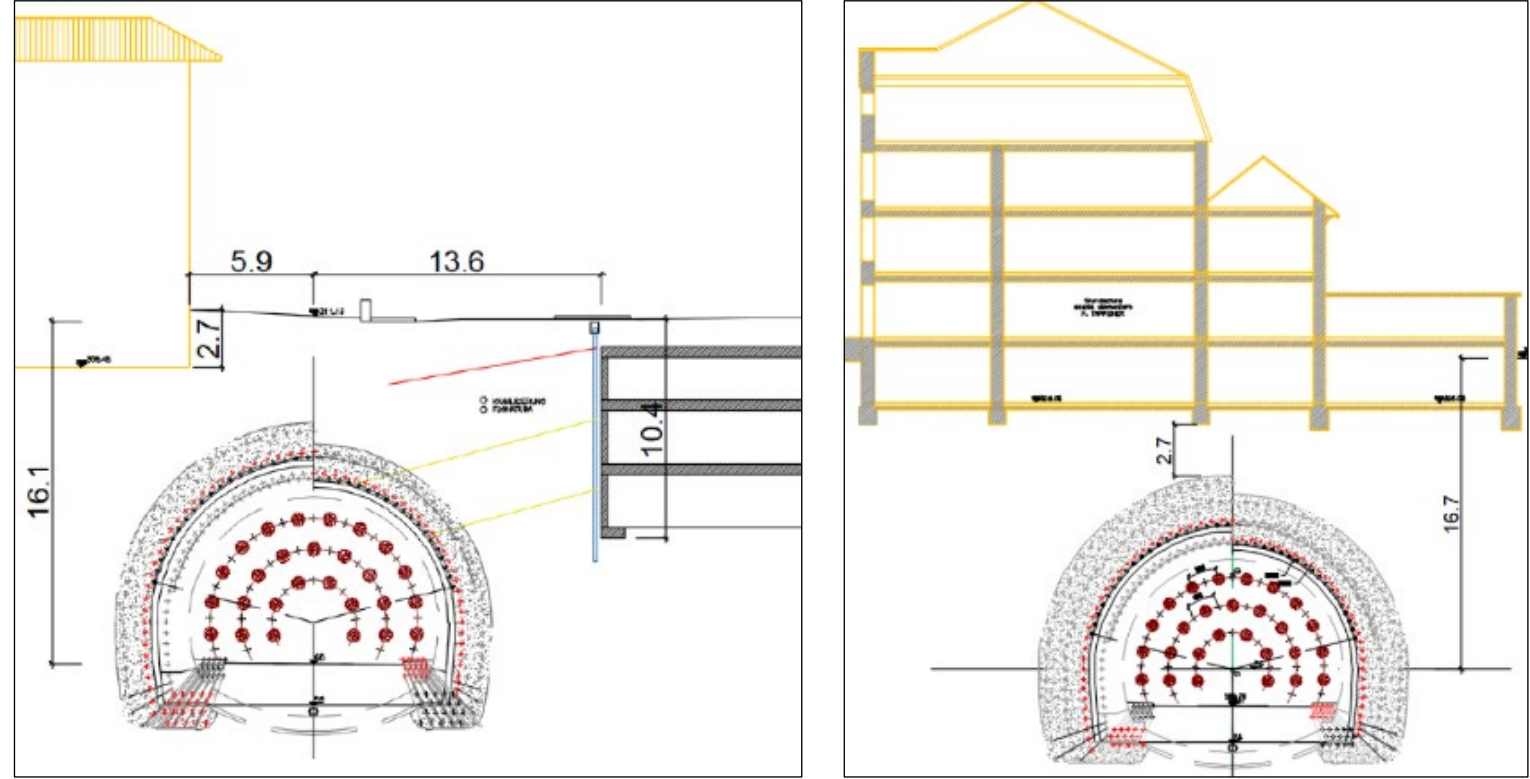
Cut & Cover tunnel – Top down construction: BIM model and photos

NATURAL TUNNEL IN LOOSE GROUND

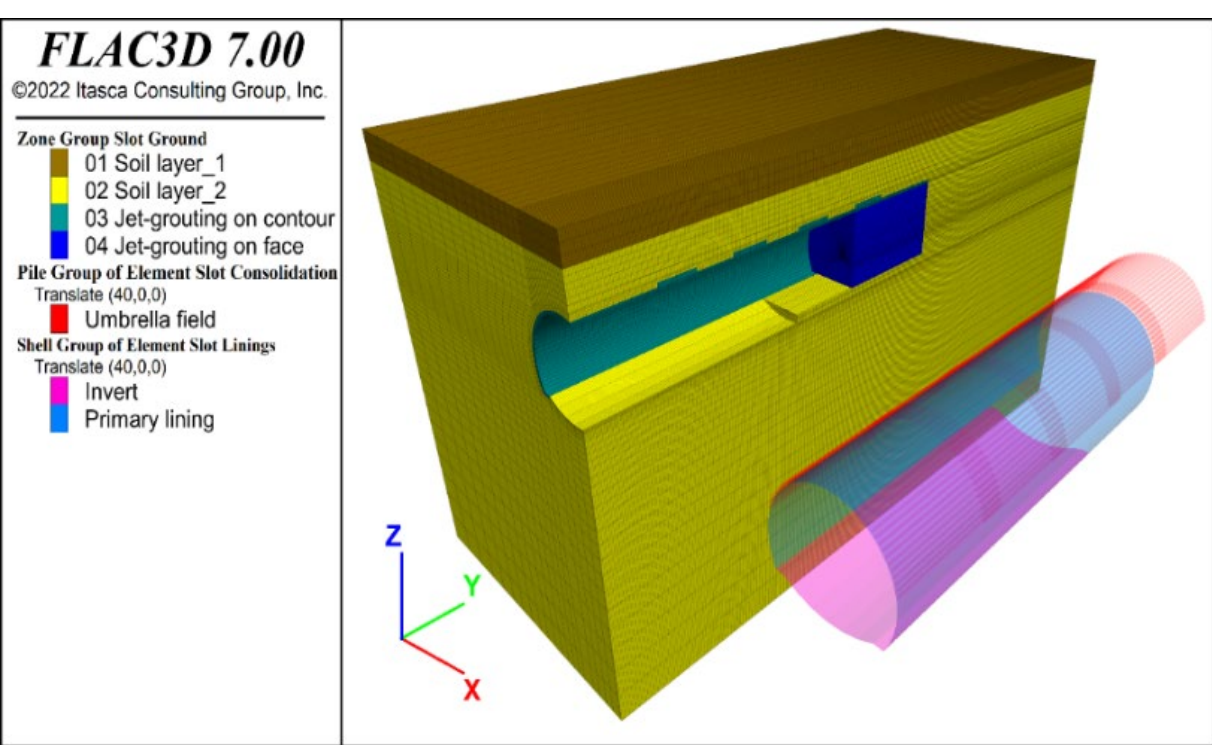


Excavation support for Section 2Sp – Jet grouting injections

Excavation support for Section 4Sp – Radial cement-bentonite mix injections from pilot tunnel



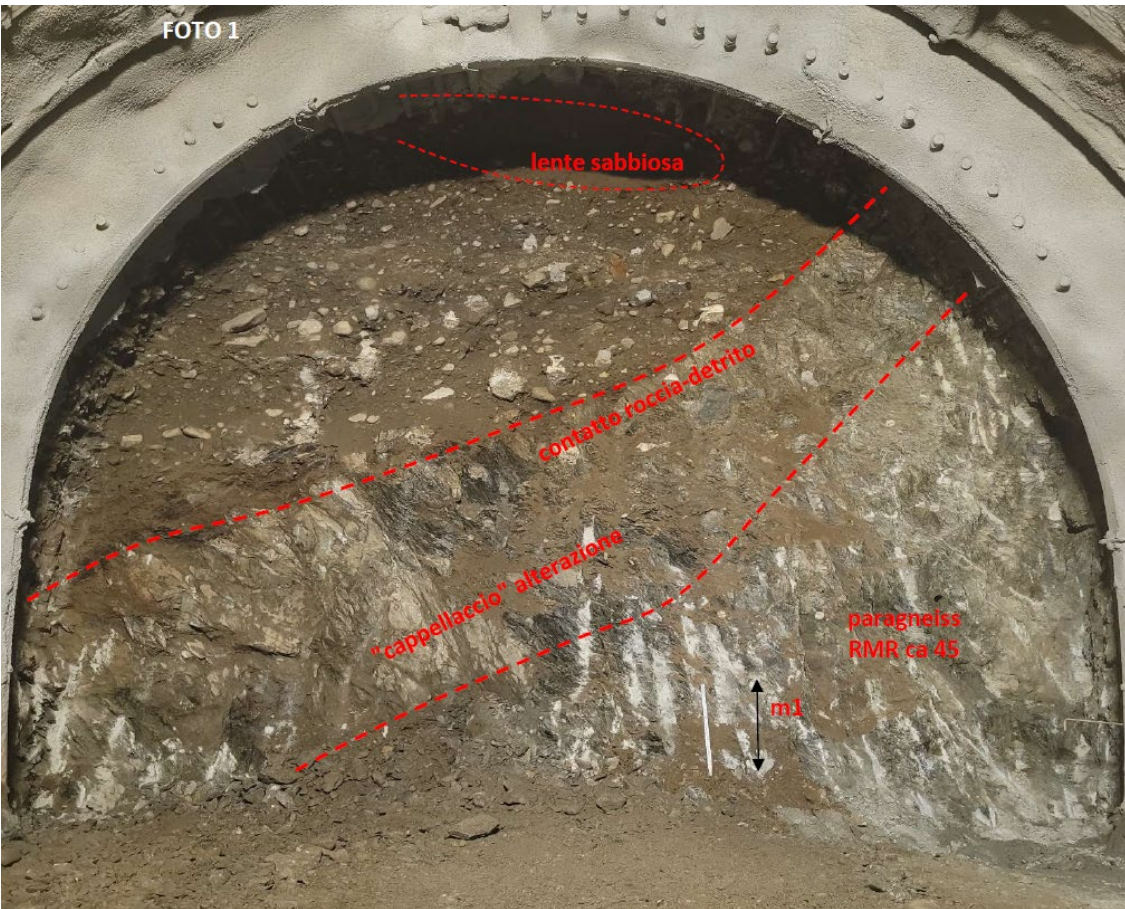
Boundary conditions: Section 2Sp\_9 near the building (on the left) and Section 2Sp\_6 under the buildings (on the right)



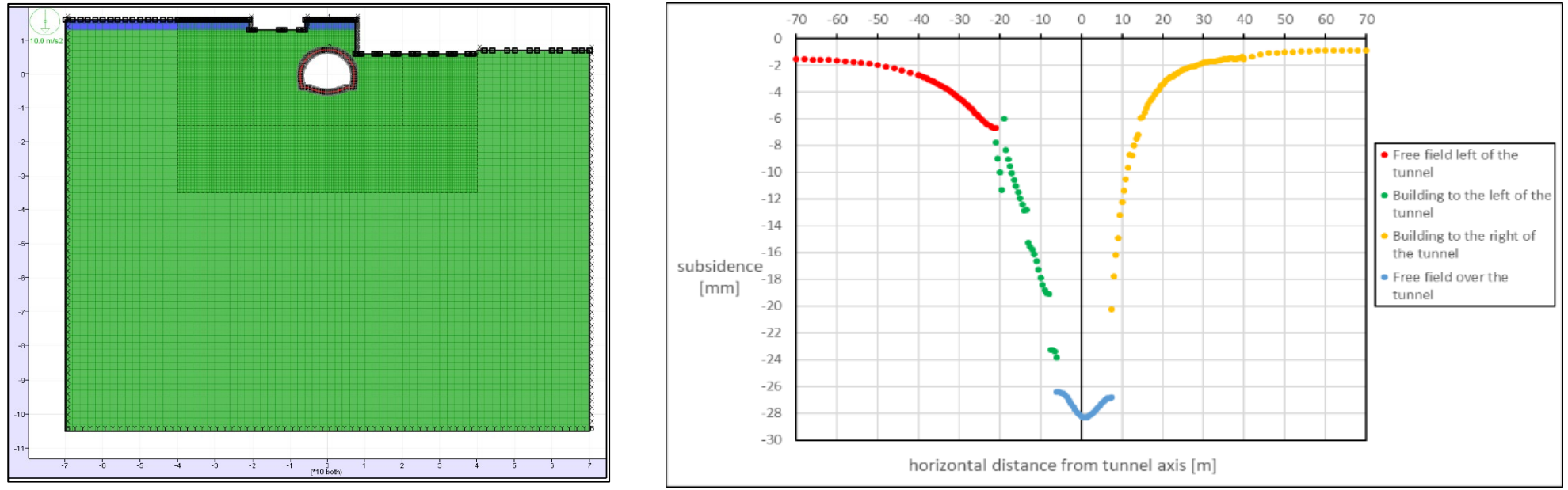
Step by Step 3D analysis for assessing a reliable de-confinement law – Section 2Sp\_12 – Soil group and structural elements



Excavation under the buildings

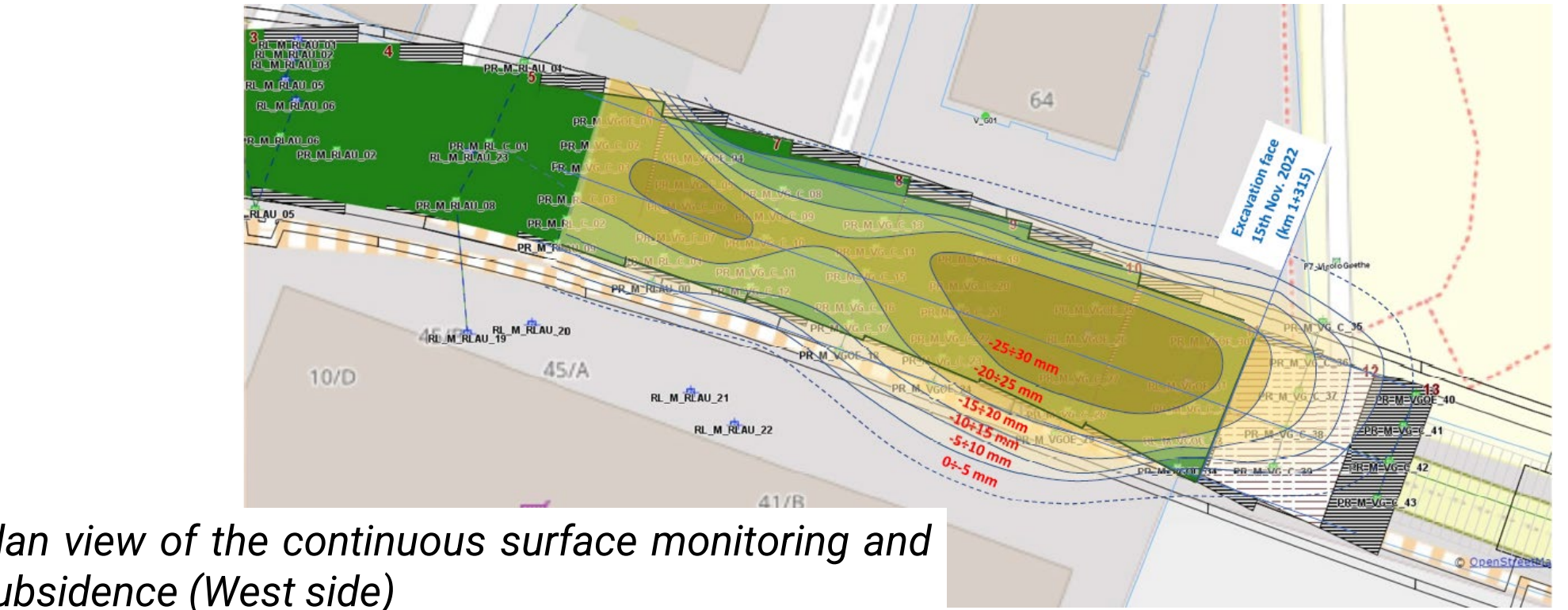


Transition zone between rocky part and loose ground



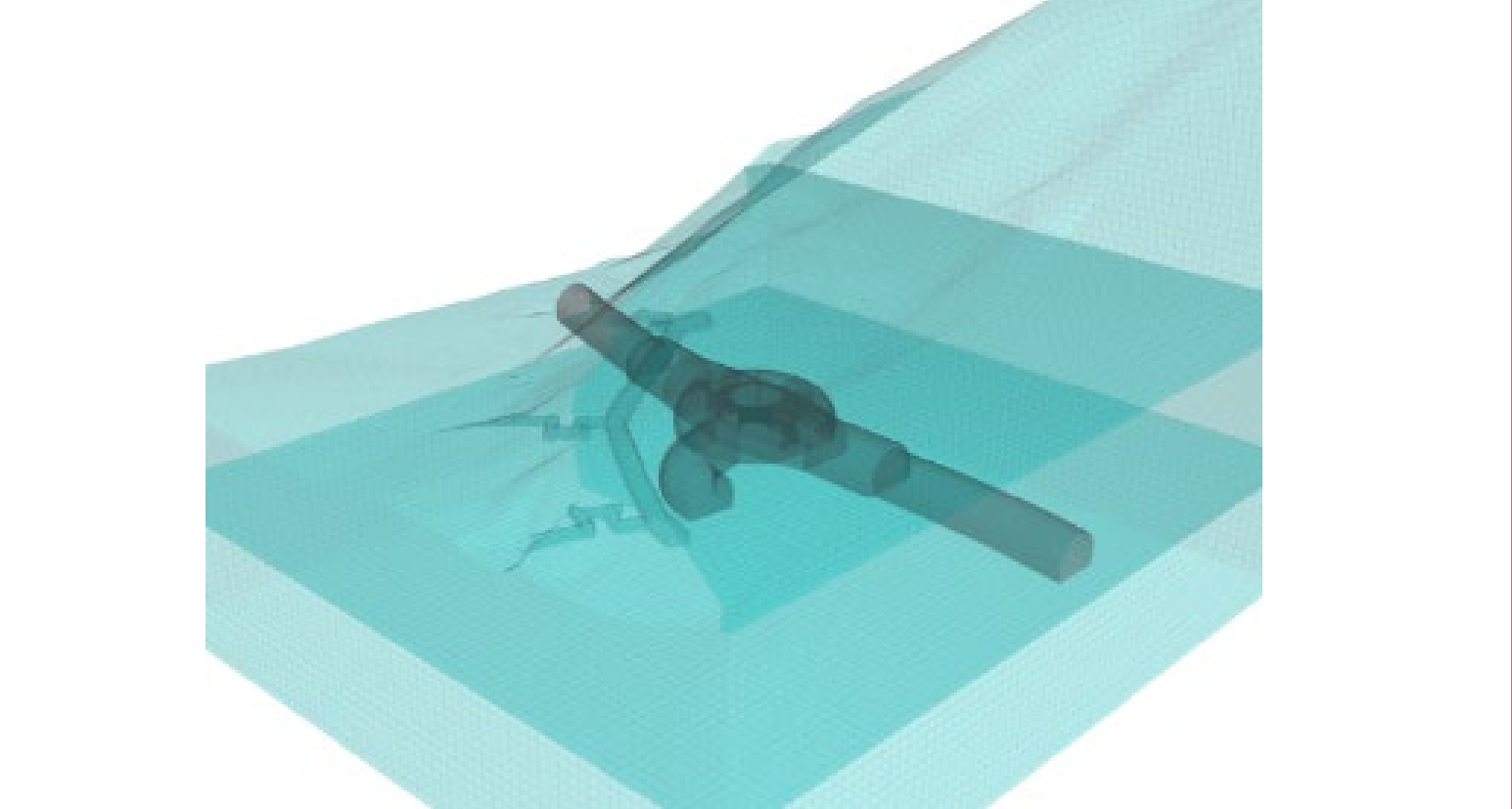
2D analysis for the evaluation of the subsidence on surface and below the buildings (on the left); Development of the subsidence (on the right)

Attention and alarm thresholds values - Maximum subsidence (Smax) and distortion (Dmax) Monitoring section on surface NOT yet undercut by the tunnel excavation (30% of the respective values far behind the excavation face)					
Reference Section	Smax free field [mm]		Smax under buildings [mm]		Dmax under buildings [-]
	Attention	Alarm	Attention	Alarm	
2Sp; Pb; 2Sp*	15	25	10	15	1/1000
4Sp	65	95			1/600



Plan view of the continuous surface monitoring and subsidence (West side)

NATURAL TUNNEL IN ROCK - UNDERGROUND ROUNDABOUT



- Phase 1) Excavation of two side tunnels, 8 m wide, tangent to the central rock pillar.
- Phase 2) Excavation of two by-pass between the two side tunnels around the central pillar; circling the central rock pillar; widening from the side tunnel to the final section of the roundabout;
- Phase 3) Excavation of the connection to the future underground parking; casting of the final lining.



Underground roundabout: FLAC 3D model, macrophases and photo (Phase 1 – side tunnels)

