IBES Baugrundinstitut GmbH

Beratende Ingenieure und Geologen für Bauwesen

The IBES Baugrundinstitut GmbH is a modern service industry with a broad and impressive performance profile. It was founded in 1977 by Mr. H.-J. Rauch in Neustadt an der Weinstraße, Germany, and is still a family-run business.

The service spectrum we offer includes the fields of geotechnique, specialized civil engineering, environmental engineering, hydrogeology, and consultation in the planning and implementation as well as the execution of numerical computations. These numerical computations are used mainly to solve difficult and demanding tasks. We place a lot of emphasis on working closely with our customers in all phases of these computations.

Current efforts are being made to introduce Hypoplasticity with intergranular strains as well as Visco-Hypoplasticity and the related laboratory experiments in order to determine the parameters. The goal of intrucing these high-quality constitutive equations for cohesive and non-cohesive soil, is a continuous improvement in the quality of predictions. Possible areas of application for these procedures are for example: the simulation of ground liquefaction as a result of an earthquake, the cyclic stress as well as the prediction of creep deformation and creep breakage with clay soil. There is a strict separation into material parameters and state variables. Material parameters can be determined independently from the state variables in simple laborary tests.

In some cases however, with the help of simple elastic-plastic constitutive equations, realistic results ca be achieved.

Railway Crossover

Due to an increase in traffic-volume in the inner-city, an additional traffic link between two city-districts is needed. During the process of construction, the existing construction frame must be exposed on one side. It is necessary to compile data on the intensity and distribution of the horizontal load behind the non-exposed frame wall, to verify the inner load-carrying capacity of the existing steel-reinforced concrete frame.

Due to the possible placement of trains at the construction site (5 tracks) as well as the geometry of the excavation site, it is necessary to make calculations by using a three-dimensional model. The construction of the new bridge abutment is based on the beginning status of the project and simulated by creating models for numerous different construction steps. The foundation for the new abutment is based on bored piles.

For the calculations, we used the Hardening-Soil-Model for the soil, as well as the elasticity of the construction elements (frames, piles and struts). Contact springs were installed between the frame wall and the soil, and between the frame wall and the new abutment respectively, as well as between the base slab and soil.

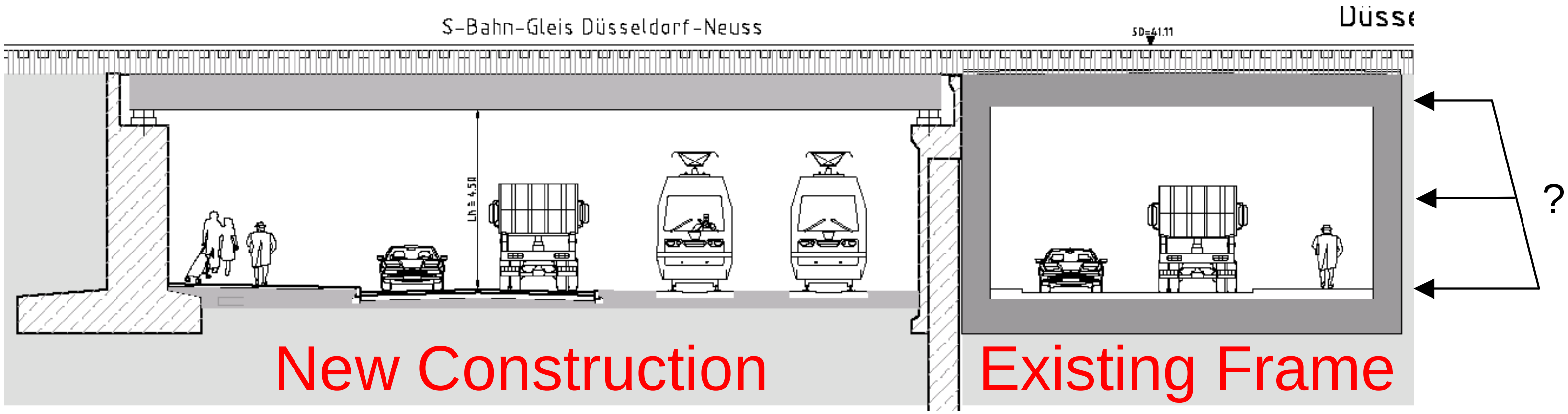
Based on the initial earth pressure, the horizontal eart pressure behind the frame wall is reduced only to 75% earth pressure at rest and 25% active earth pressure.

Railway Crossover

- Project

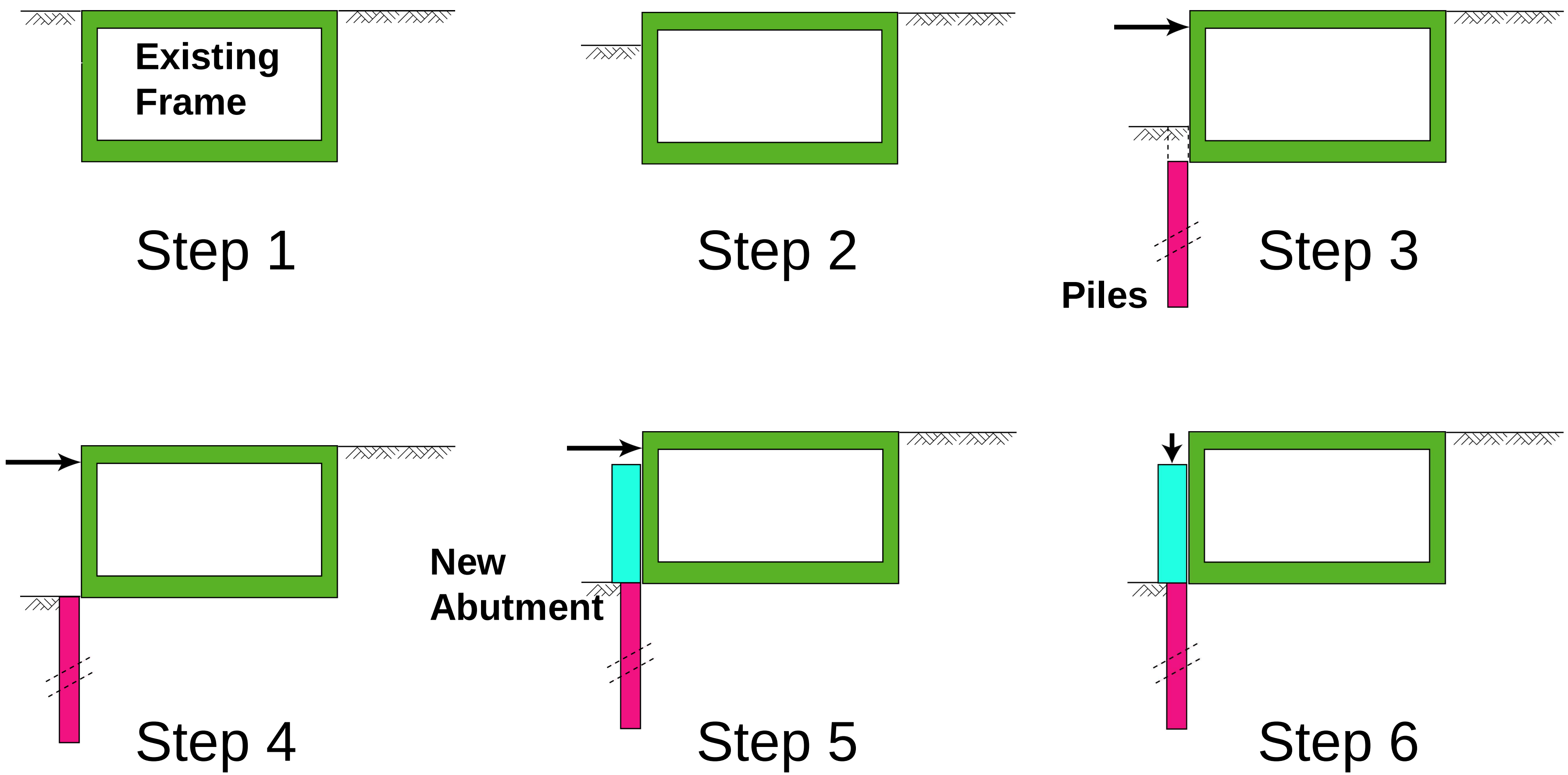
One-sided excavation of railway crossover (frame)

Prediction of horizontal stress behind the concrete frame



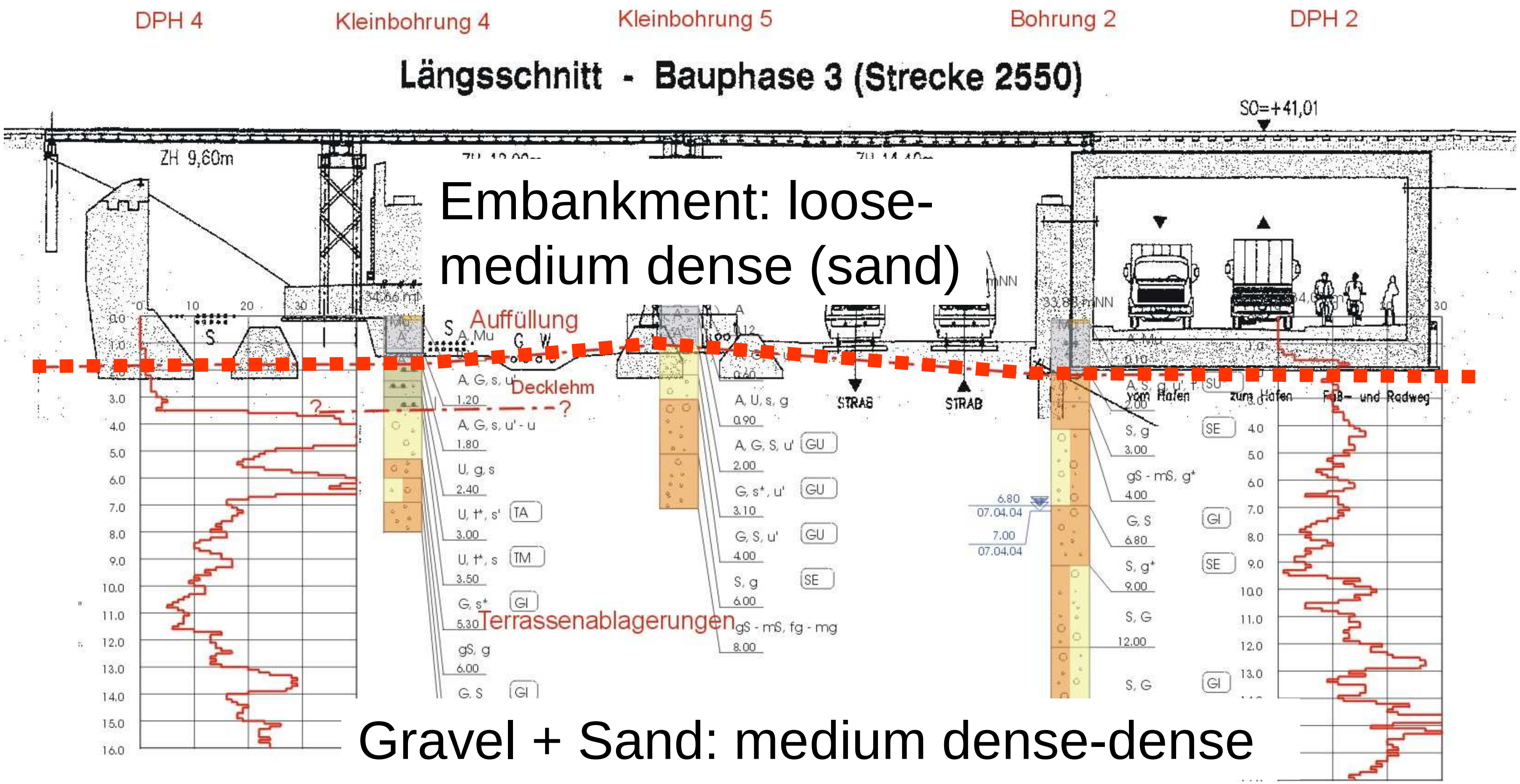
Railway Crossover

- Construction Stages (simplified)



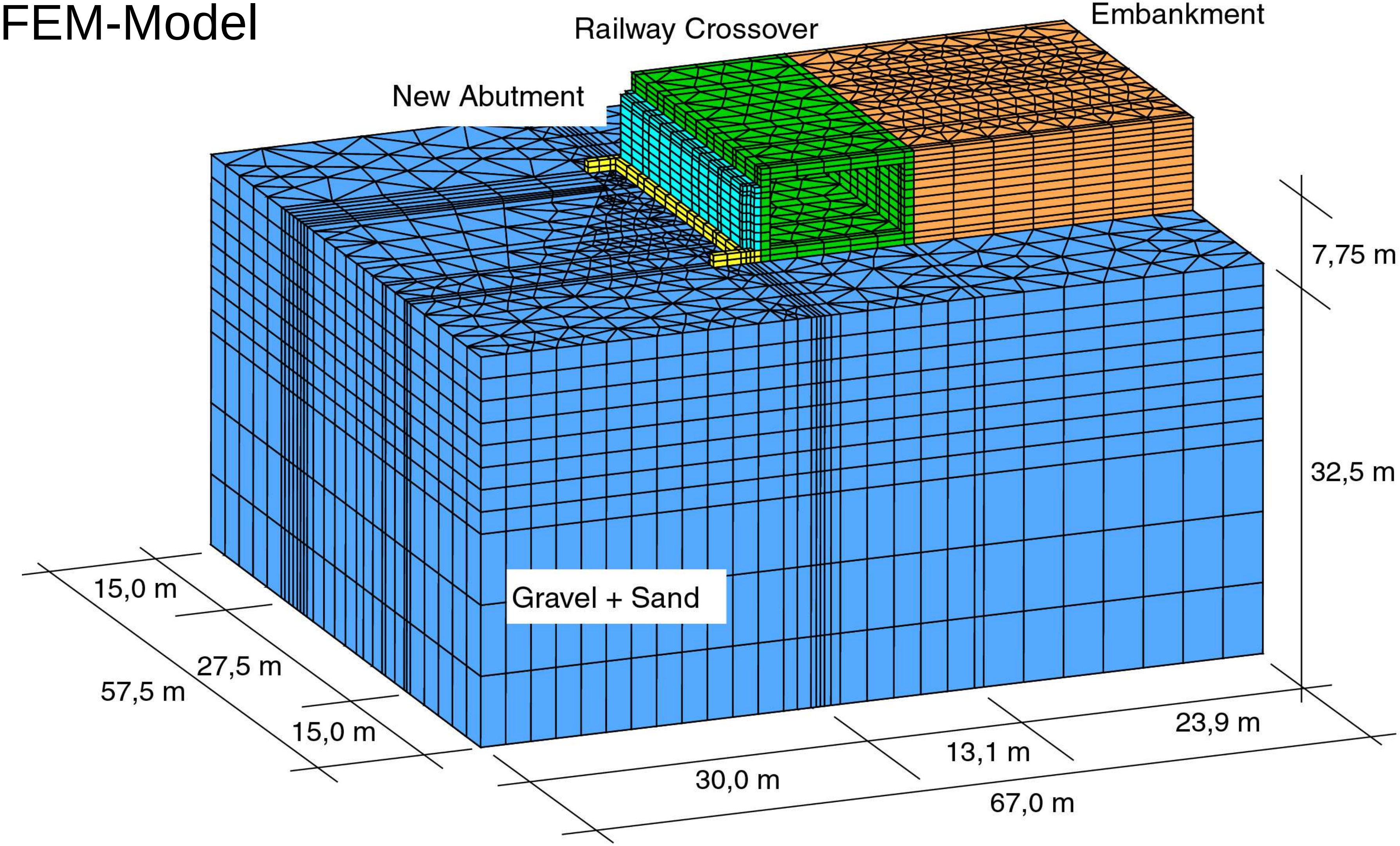
Railway Crossover

- Stratigraphy



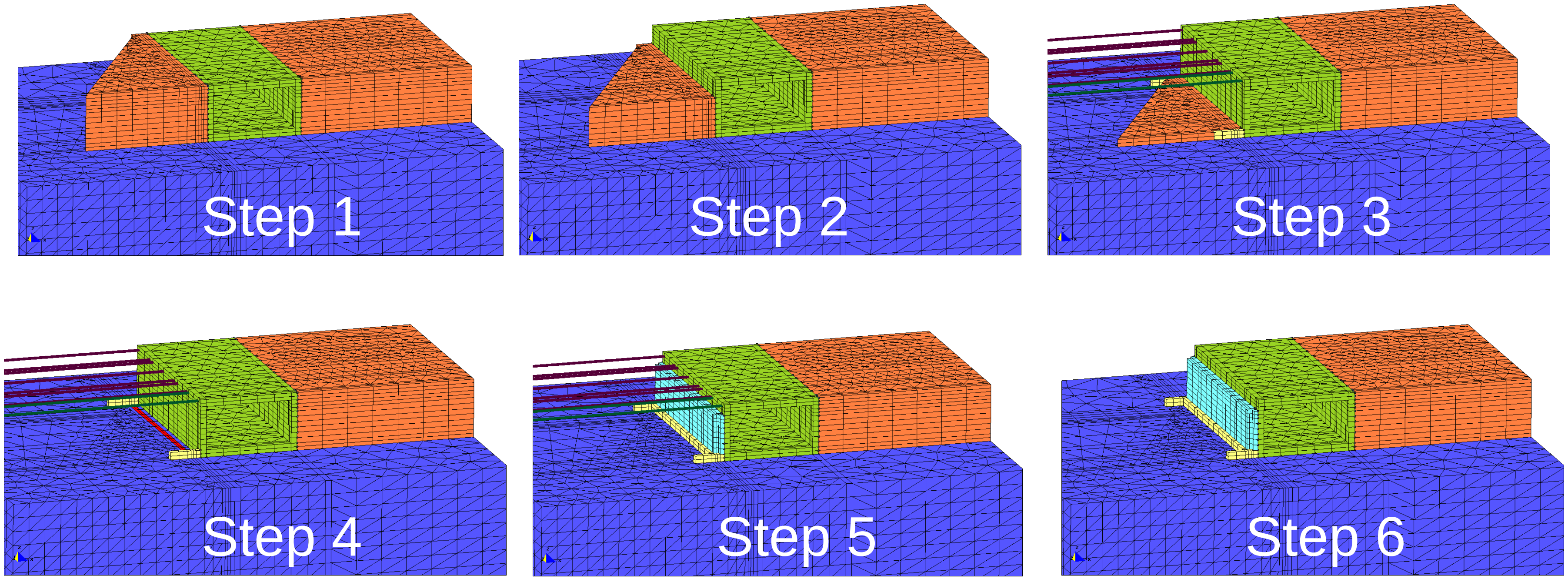
Railway Crossover

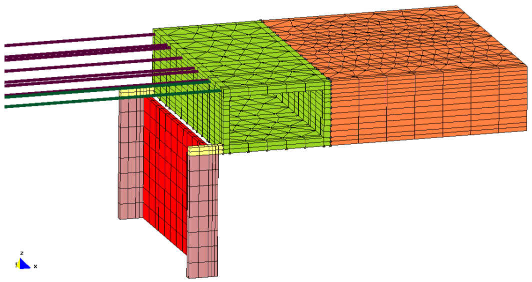
FEM-Model



Railway Crossover

Simulated Construction Phases





Deactivated gravel/sand layer with bored piles in the underground (installed in Step 2 and 4)

Railway Crossover

- Mechanical Properties

Material	γ	γ'	φ	c	ψ
	[kN/m³]	[kN/m³]	[°]	[kN/m²]	[°]
Embankment	17,5	-	30,0	0	0,0
Gravel+Sand	-	11,0	37,5	0	7,5

Strength

(Tension-cut-off)

Material	E_{50}^{ref}	E_{oed}^{ref}	E_{UR}^{ref}	m
	[MN/m²]	[MN/m²]	[MN/m²]	[-]
Dam	15/40	15/40	45/120	0,5
Gravel+Sand	100	100	300	0,5

Stiffness

Initial Horizontal Stress $\boldsymbol{\sigma_h} = \boldsymbol{\sigma_v}$ x K_0; $K_0 = 1 - \sin \varphi$

Railway Crossover

- Construtional Elements

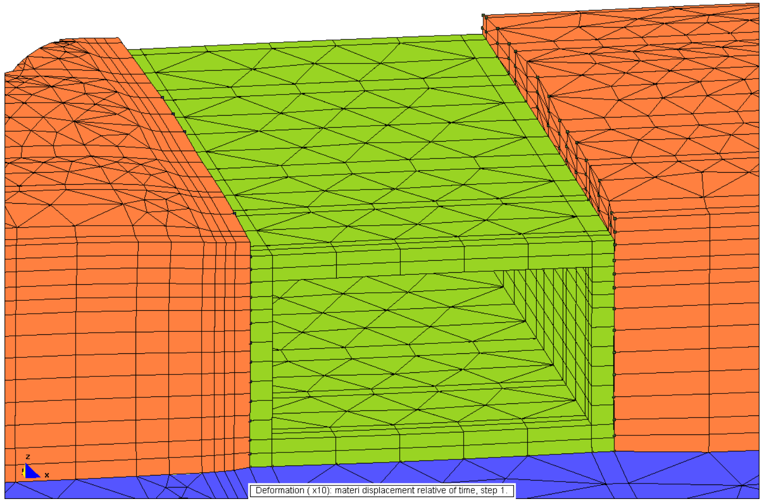
* Pile, existing frame, new abutment

Material	E	A	ν	γ
	[MN/m²]	[cm²]	[-]	[kN/m³]
Concrete*	30.000 / 34.000	-	0,2	25,0
Strut	210.000	303/ 326	0,2	-

<u>Contact Springs:</u>

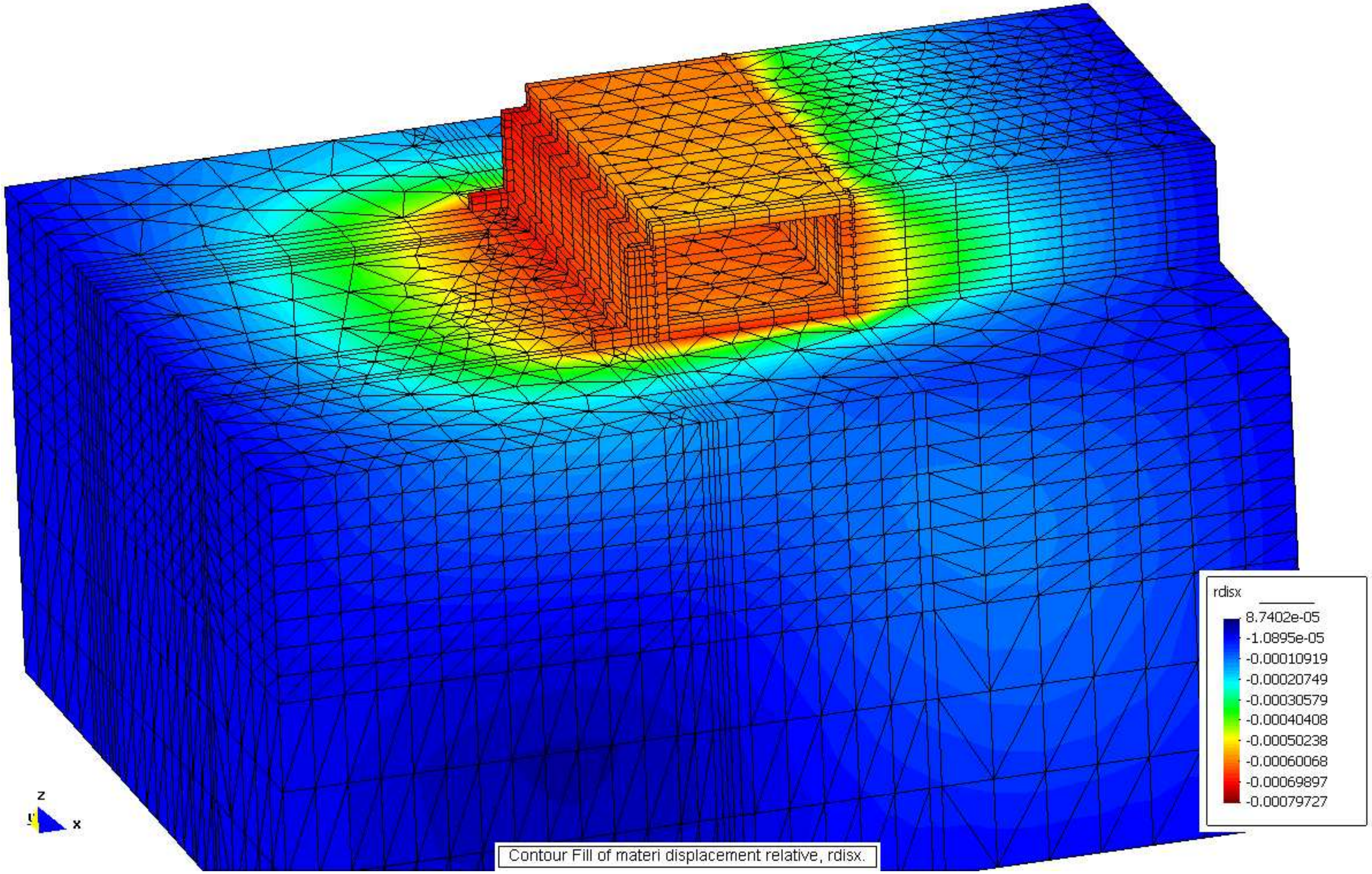
between frame and soil: $\mu = 0{,}0$

between base slab and soil: $\mu = 0{,}2$



Railway Crossover

Results



Contour plot of horizontal relative displacements [m]
due to removal of struts

Railway Crossover

Results: Horizontal stress behind the frame