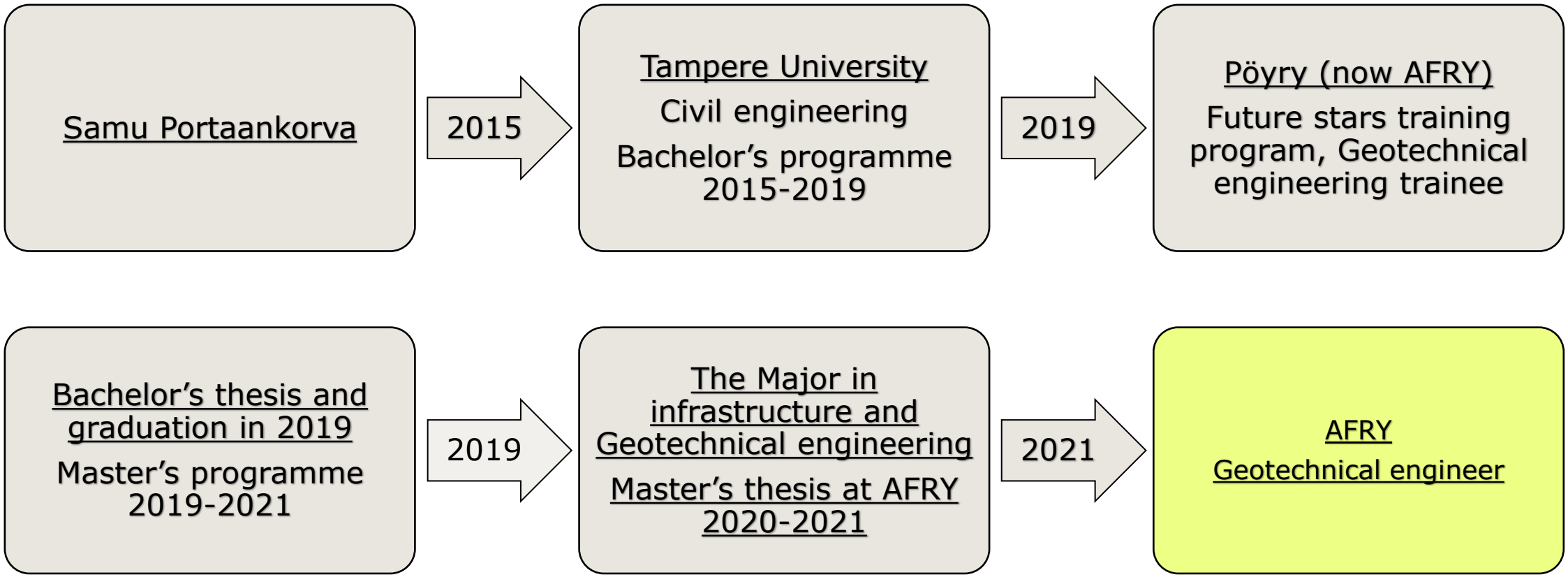
AFRY-
Making Future

GEOENGINEERING MASTER'S PROGRAM ORIENTATION DAY
AALTO UNIVERSITY 28.8.2024
SAMU PORTAANKORVA

1. About me
2. About AFRY
3. Rock engineering and underground spaces
4. Track engineering
5. Street, road and area engineering
6. Geotechnical engineering
7. Finite element method (FEM)

My path to AFRY



AFRY helps clients all around Finland

About

3,000

employees

Offices in

~30

locations

From Hanko to Kittilä

AFRY
ÅF PÖYRY

AFRY is an international engineering, design and advisory company

We are	We speak more than	Offices in more than	Projects in	Annual revenue
19,000	50	40	100	~2.4
employees	languages	countries	countries	billion EUR

Our services in 5 divisions





- Infrastructure
  - Water management and networks
  - Environmental and sustainable solutions
  - Transport infrastructure
  - Buildings
- Industrial & Digital Solutions
- Process Industries
- Energy
- Management Consulting

AFRY
ÅF PÖYRY

TRANSPORTATION FINLAND

— We are a unit of 320 experts in Finland representing AFRY's largest business area

— Turnover 2022: 31 M€

— Offices in: Vantaa, Turku, Tampere, Lappeenranta, Jyväskylä, Kouvola, Kuopio, Oulu, Seinäjoki

— Four market areas

ROAD & RAIL ENGINEERING

— Roads and highways

— Streets, areas, municipal engineering

— Railways, metros, tramways

— Geotechnics and earth works

— Asset management

BRIDGES AND SPECIAL CONSTRUCTIONS

— Bridges

— Pile slabs and embankment slabs

— Noise and retaining walls

— Park and environmental structures

— Inspections and studies

— Bridge renovations

— Construction management

ROCK ENGINEERING & UNDERGROUND SPACES

— Underground facilities

— Tunnels

— Rock cuttings and open pits

— Mines

— Geology

INFRASTRUCTURE SERVICES

— Mining infrastructure, special constructions, port and waterway structures, dams

— Environmental services

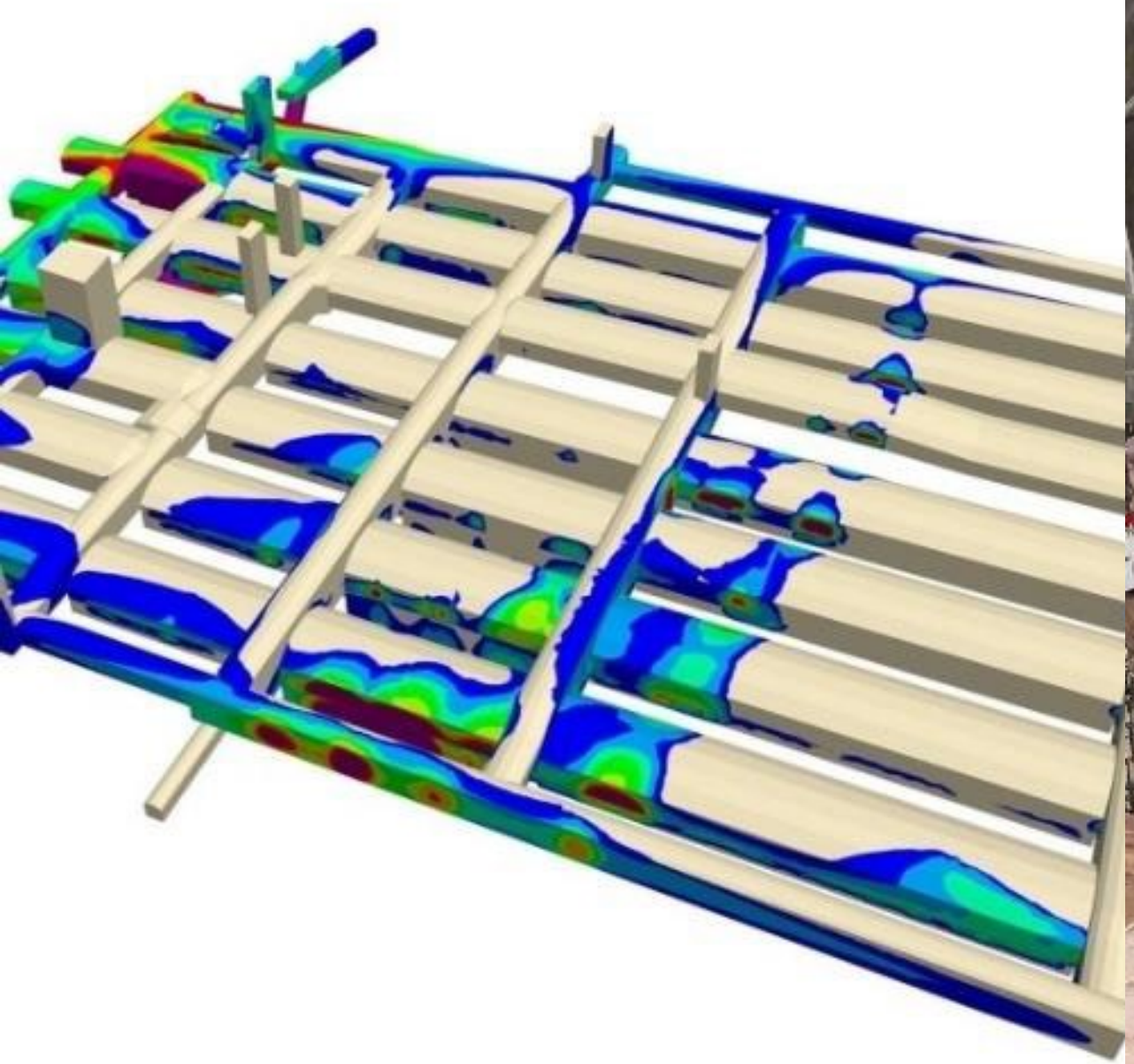
— Waste management and treatment areas

— Field investigations and geotechnics

Rock Engineering and Underground Spaces

- Rock and Structural engineering of underground spaces and tunnels
  - Wastewater treatment plants
  - Heat storage facilities
  - Road, rail and subway tunnels
- Mining Engineering
- Specialist services in Geology and Rock Mechanics
- Inspection of underground spaces, repair construction designing
- ~40 rock design engineers at AFRY

Blominmäki wastewater treatment plant

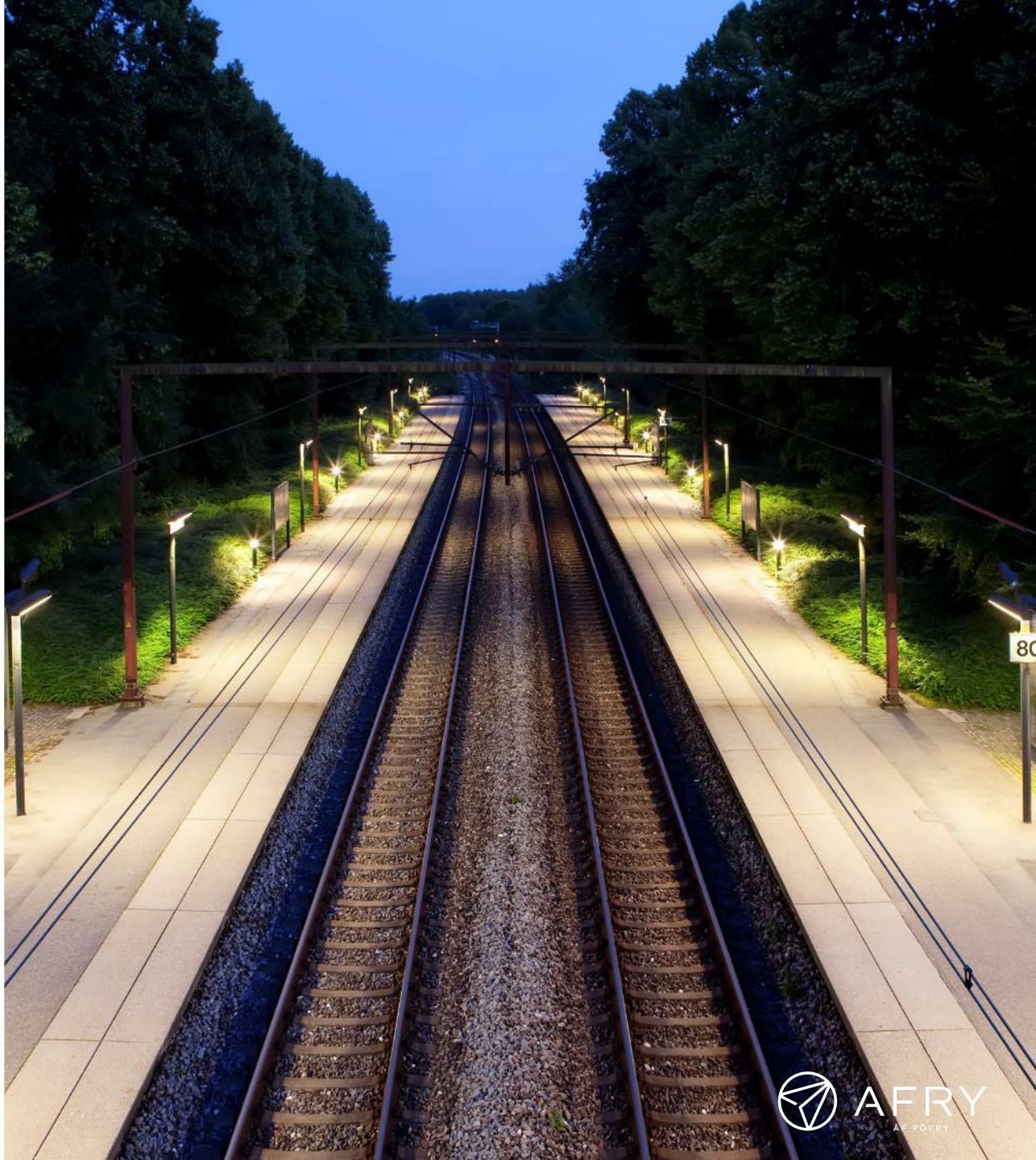


Länsimetro

Track engineering

- Heavy rails
  - Conventional Railways (Länsirata)
  - High speed rail (HSR)
- Rapid transit
  - Metro / Subway (Länsimetro)
- Urban rail transit
  - Tramways (Tampereen raitiotie, Kalasatama-Pasila)

- preliminary design and feasibility studies
- general design (Yleissuunnitelma)
- basic design (Ratasuunnitelma)
- construction design (Rakennussuunnitelma)
- maintenance investments
- ~20 track engineers at AFRY



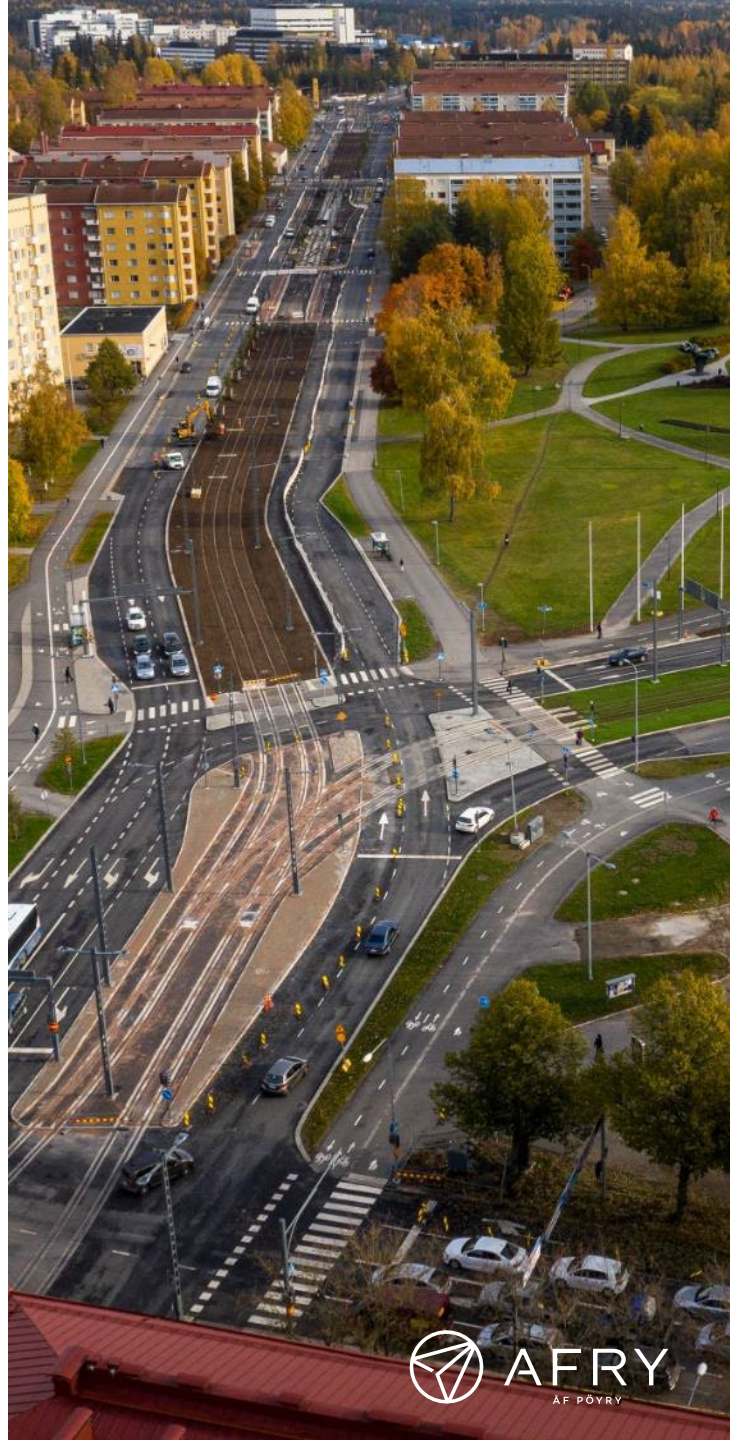
Tampere-Jyväskylä railway

Kalasatama-Pasila tramway

Pirkkala-Linnainmaa tramway

Street, road and area engineering

- Consists of design in different levels of detail
  - preliminary design and feasibility studies
  - general design (Yleissuunnitelma)
  - basic design (Tie- ja/tai katusuunnitelma)
  - construction design (Rakennussuunnitelma)
  - maintenance investments
- Road, street and area planning projects can be of varying scales
  - huge alliance projects such as Tampere tramway or Kalasatama-Pasila Project
  - planning a new main road / highway
  - remodeling an existing street or a road
- Grading work of industrial areas
- ~100 Street, road or area engineers at AFRY



Kyrön AKS

Pulp Mill, Paso De Los Toros, Uruguay

image source: UPM

Geotechnical engineering

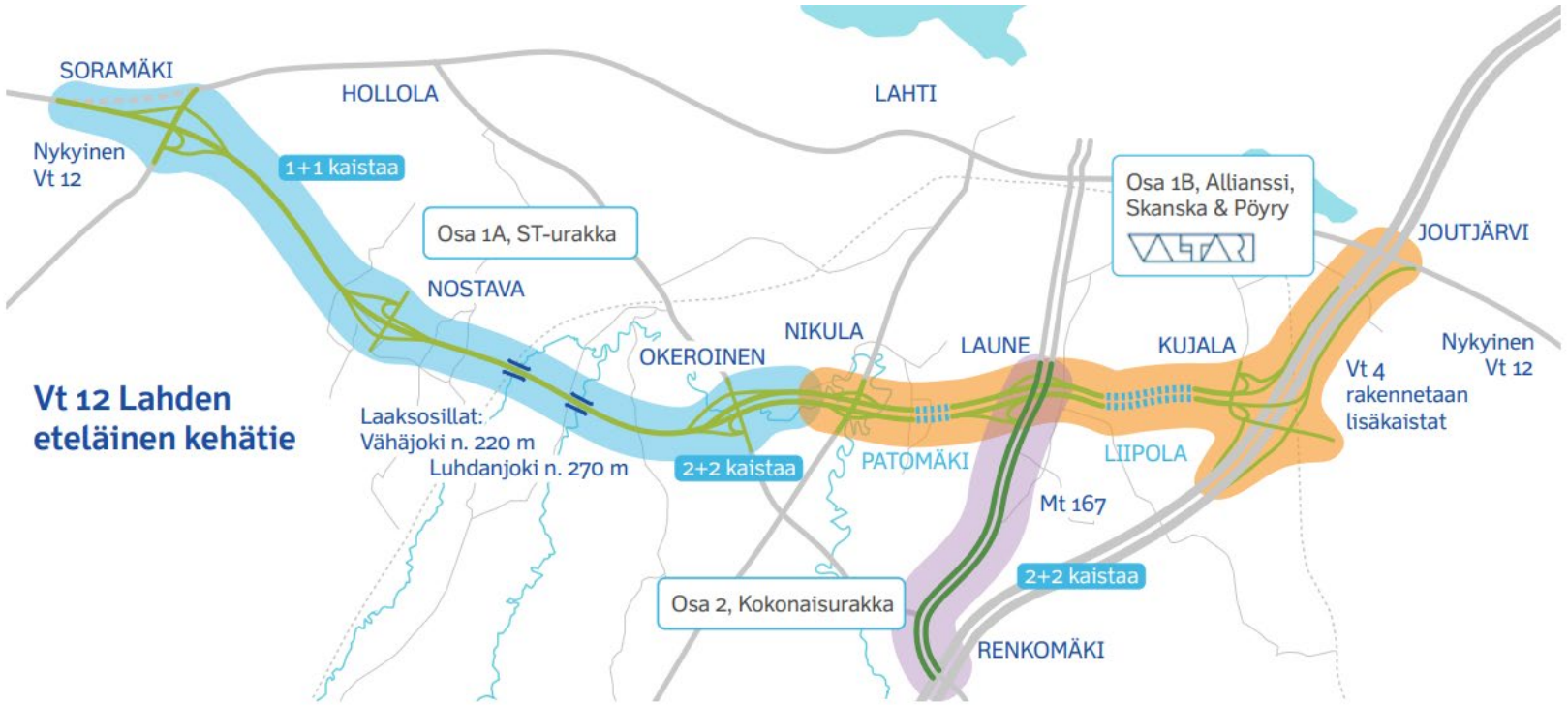
- Road and rail engineering
  - Road and railway base structures
  - Foundations, excavations
  - Bridges
- Buildings
  - Industrial and housing construction
- Water engineering
  - Piers, harbours
  - Underwater embankments
  - Tailings and embankment dams, cofferdams
- Other projects
  - Excavations for water networks
  - Groundwater protection and management
  - FEM calculations
- ~40 Geotechnical engineers at AFRY

CASE Vt12 Lahti southern ring road - alliance

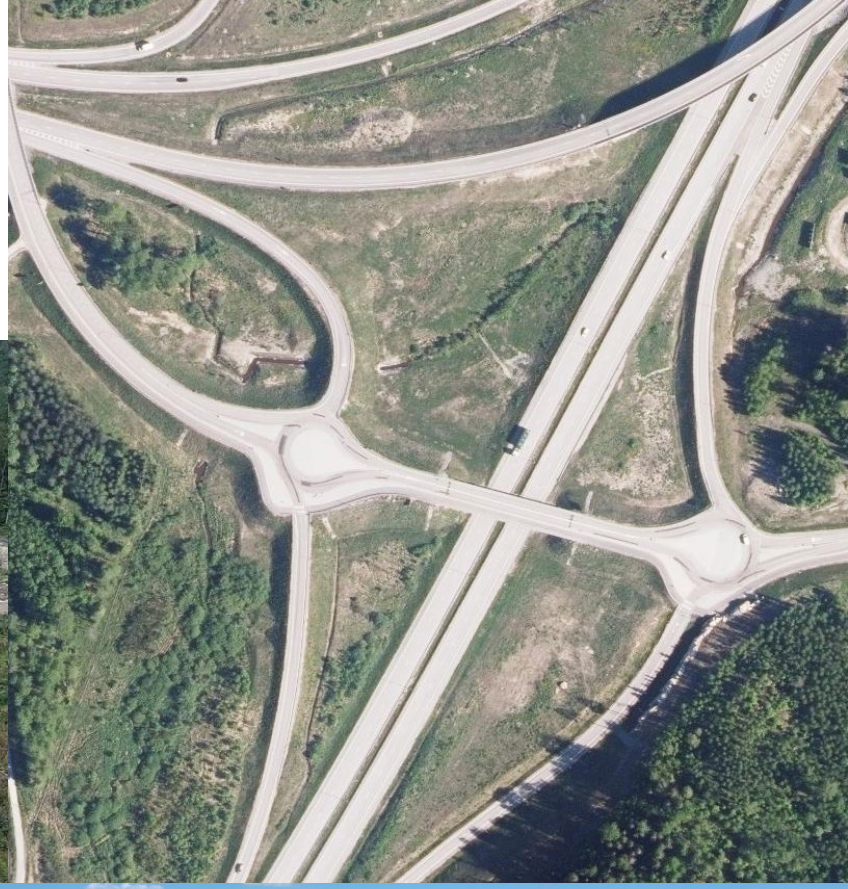
— 4,5 km new 2+2 road, 3 interchanges, 5 km new ramps, 4 km new streets, 12 new bridges, concrete tunnel etc.

— Geotechnical engineering of piled slabs, pre-loading embankments, lightweight materials, deep excavations

— Kujala test embankments, in co-operation with Aalto University

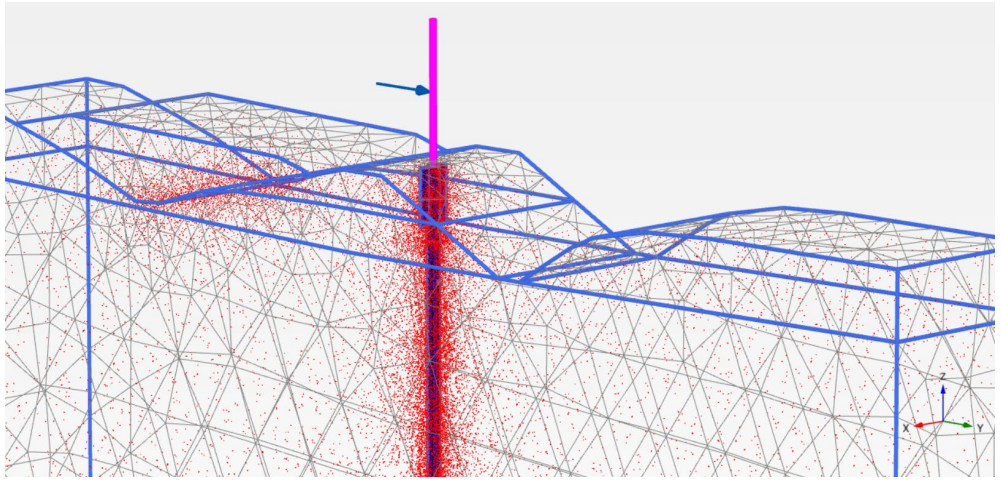


Kujala interchange piling

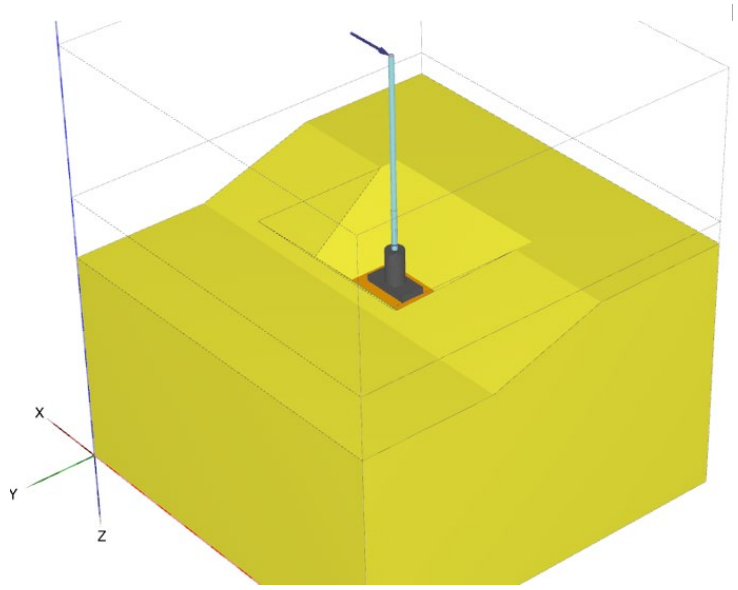


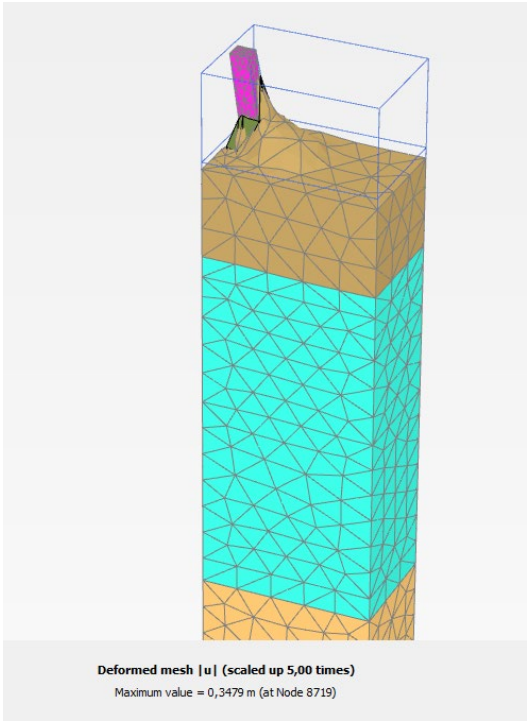
Finite element method: Projects and studies

FINITE ELEMENT ANALYSIS



- Versatile 2D and 3D Plaxis analyses covering all the geotechnical aspects.
- In some cases, the difference between parallel 2D and 3D analysis may be significant. Notice that the real failure surface will always be 3-dimensional.
- Significant benefits also for example local excavations and difficult loading conditions.

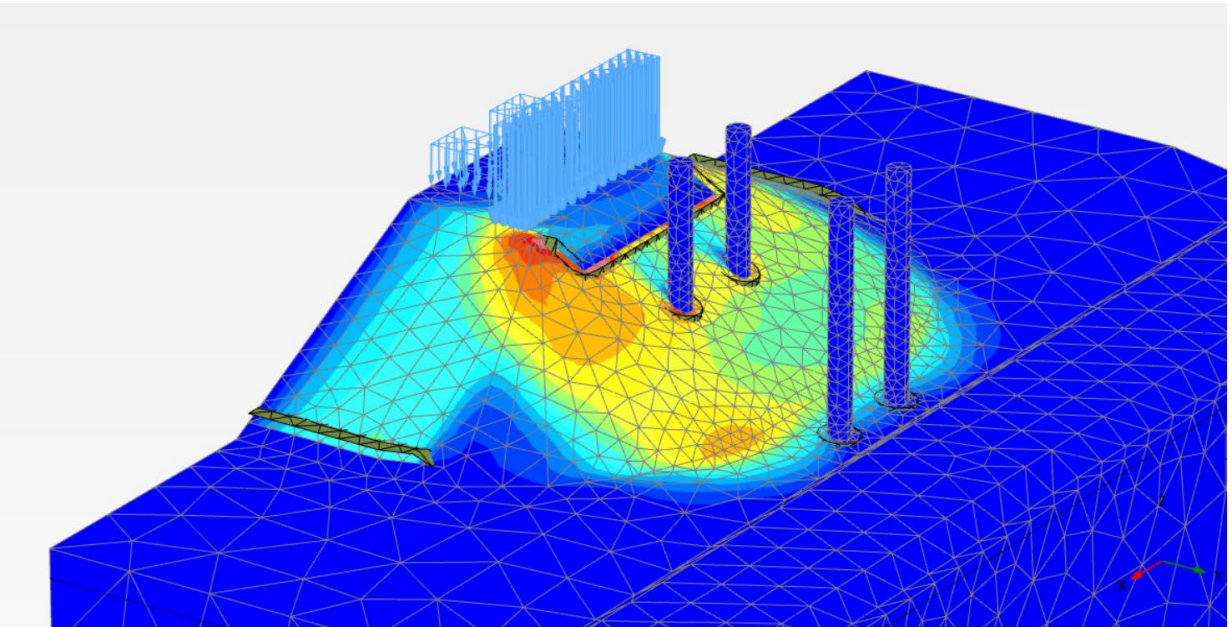


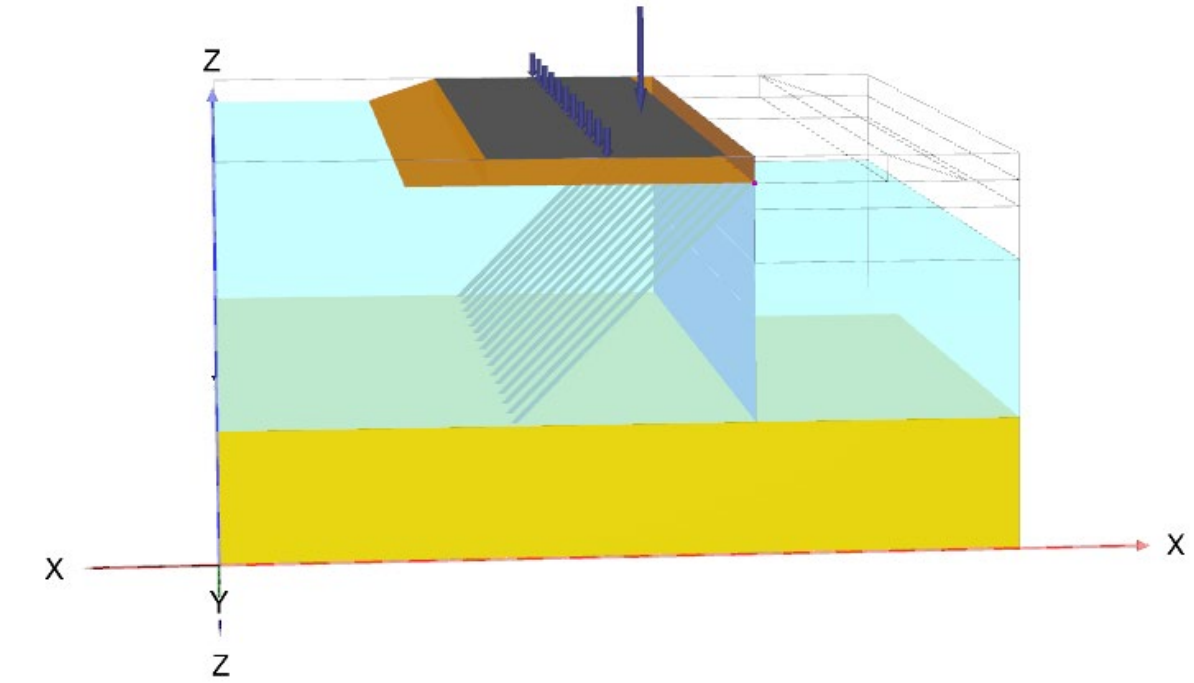


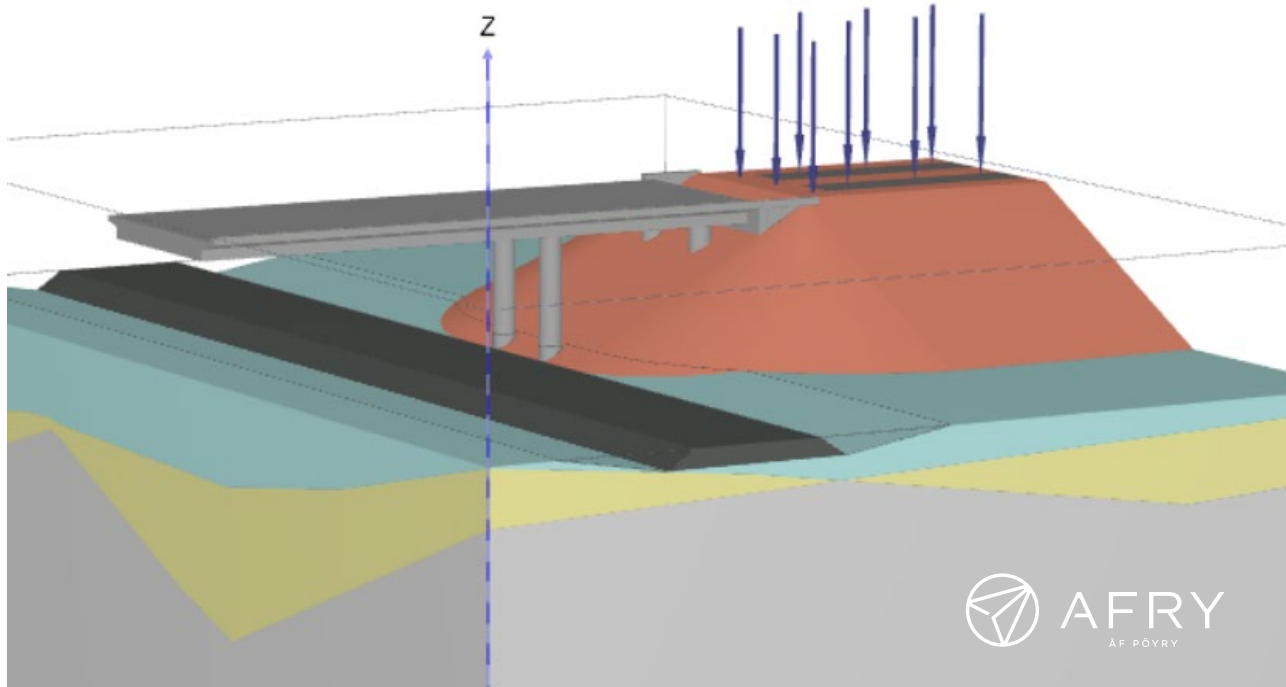
FINITE ELEMENT ANALYSIS

— Old FTA (Väylävirasto) guidelines for NCCI7 had only 3D traffic load model, almost all calculations were in 2D

— From 2023, FTA guidelines for NCCI7 emphasizes 3D stability analyses for bridge embankments.





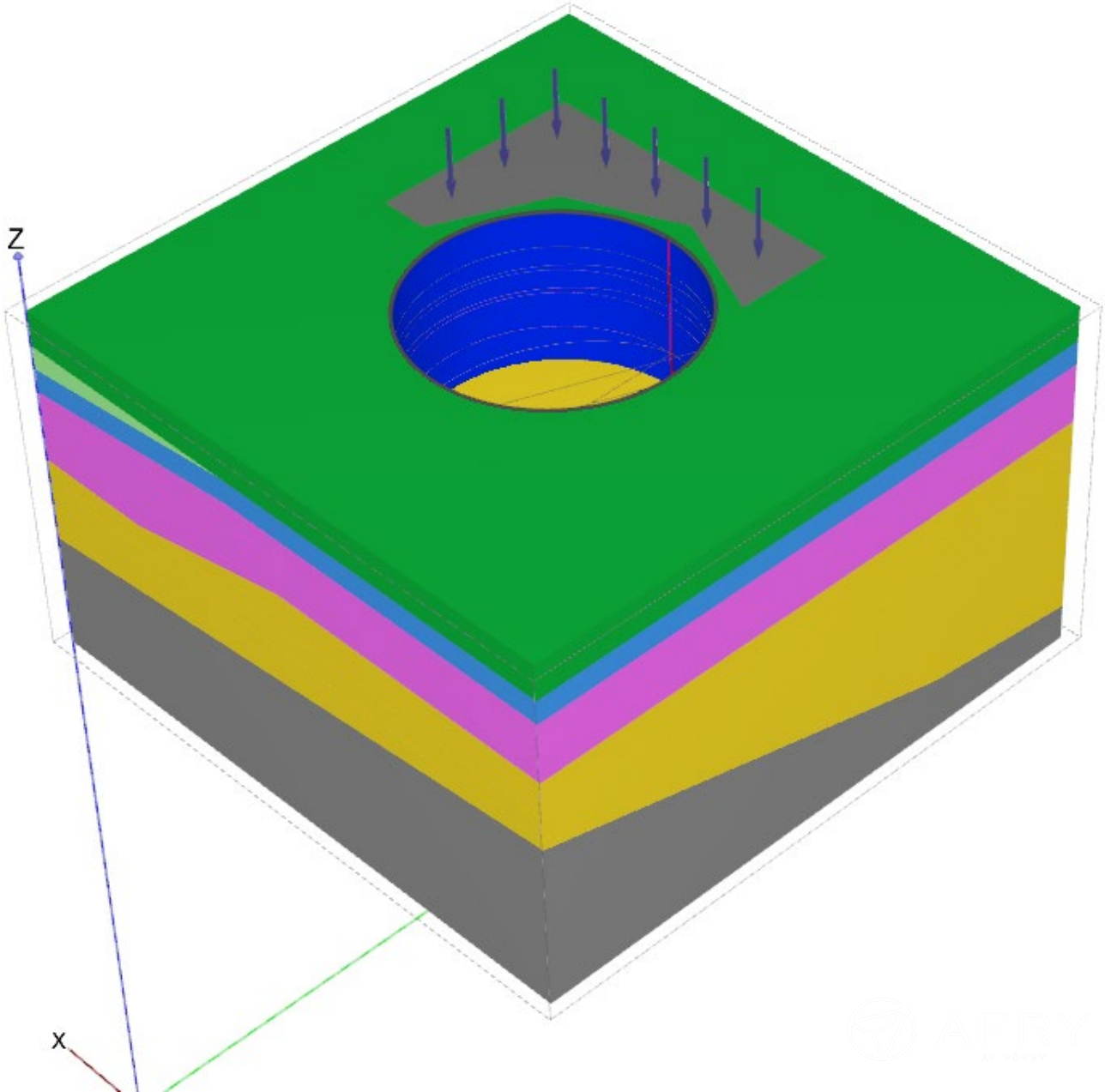


Viinikanlahti wastewater pumping station

- Circular bored pile wall, diameter 22 m
- 10 m deep excavation, 7 m below groundwater surface
- Geotechnical calculations and analysis in Plaxis 3D, structural analysis in Robot
- 0 anchors because of circular shape
- Soil was jet grouted around the discontinuity
- Project schedule: 2020-2024, boring and excavation 2022-2023
- Cost of the project: > 10 M€

KUVA: SAMU PORTAANKORVA AFRY


KUVA: SKARTA OY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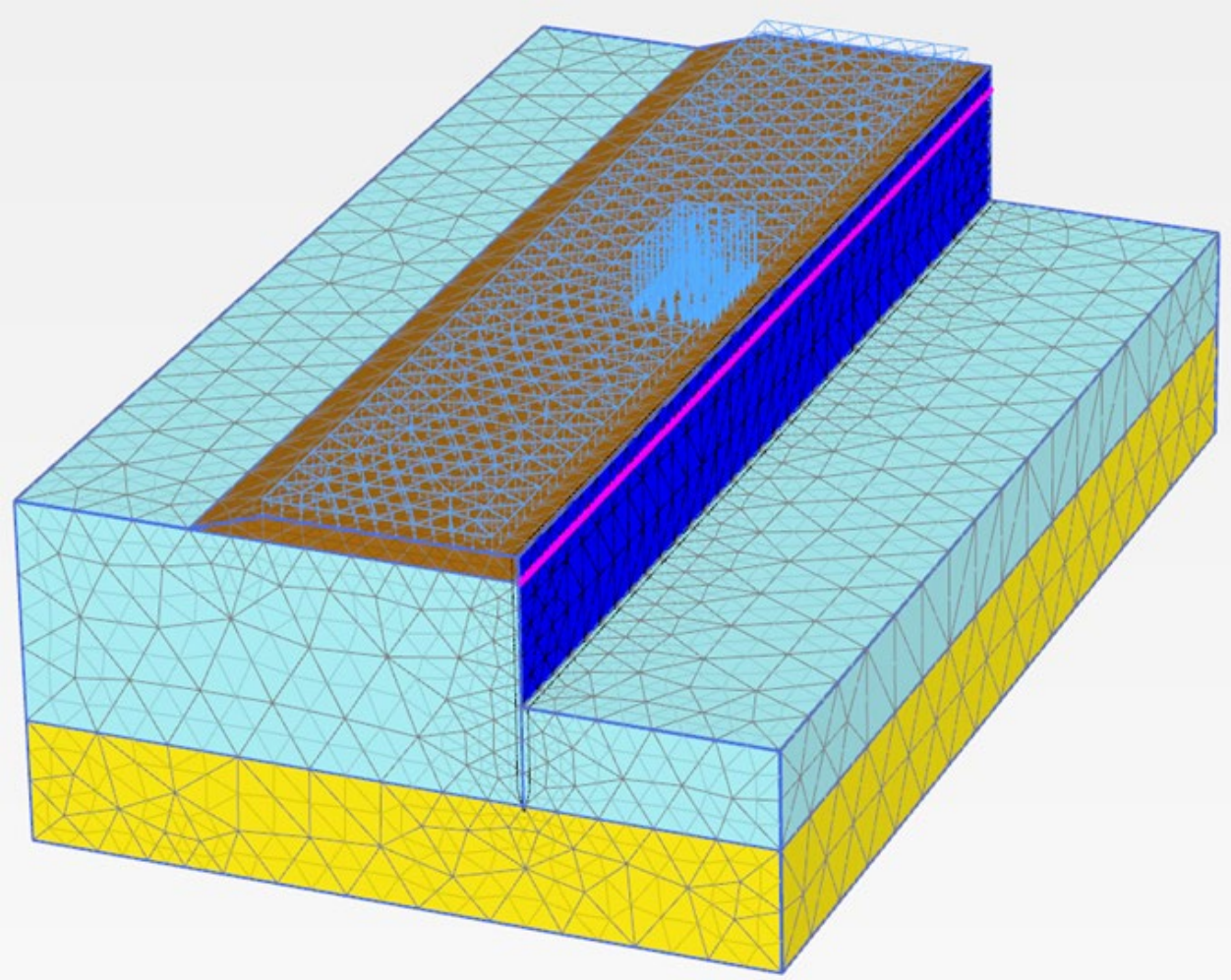
Studies that provide value for geotechnics

- Soil mechanics (the foundation for geotechnical engineering)
- Microsoft office, AutoCAD
- Knowledge in geotechnical design programs
  - Geocalc, Plaxis, Slide
- Basic knowledge of roads, streets, railways, structural engineering
- Anything that you are interested in



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