

# Finland



**Name:** Finnish Tunnelling Association – MTR - FTA Space Association (AFTES)

**Type of Structure:** Non-profit, independent association

**Number of Members:** 202 Individual Associate Members, 23 Corporate Affiliate Members

**Incomes:** Annual fees and conferences as a main source of incomes

## ASSOCIATION ACTIVITIES DURING 2022

- Annual Meeting on 12th April 2022
- Nomination of Finnish Young Tunneller 2021-2022
- Seminar on underground solutions in green transition energy projects
- Four scholarships for students active in

studies, working life and position of trust

- Activities of the Young Member Group
- Participating in the FISE Qualification of Professionals in Building, HVAC and Real Estate Sector in Finland

## NEWLY COMPLETED PROJECTS

### Blominmäki Underground Wastewater

## Treatment Plant

- The project was completed at the end of 2022.
- The treatment plant processes the wastewater of 400,000 residents (2022).
- By 2040: 150,000m<sup>3</sup> of wastewater will flow through the new treatment plant daily.
- More info: <https://www.youtube.com/watch?v=D9PwTxA4rQ0>

## Helsinki Metro Western Extension to Espoo (testing phase)

- The Helsinki metro is extending to the west in two phases: 8 + 5 new stations.
- The first phase was completed in autumn 2017 and the second was opened December 3rd, 2022.
- The metro route is 21km underground through twin parallel tunnels.
- In addition to the stations, a total



Savilahti Underground Sport and Event Centre (Photo credit: Vicente Serra)

of 23 shafts were built for pressure equalization, ventilation and smoke extraction. The shafts are also used as emergency exits. An underground metro depot is located in Sammalvuori with a total excavation volume of 240,000m<sup>3</sup>.

- More info: <https://www.lansimetro.fi/en/home/>

#### Jokeri Light Rail

- The Jokeri Light Rail line will be built between Itäkeskus in Helsinki and Keilaniemi in Espoo and is one of the key projects for orbital cross-region public transport in the capital area.
- Construction works on the line started in 2019.
- The length of the line is approximately 25km and will have 33 stops.
- 400m of tunnel was excavated during 2021.
- More info: <https://raidejokeri.info/in-english/>

#### Cavern Heat Storage Facility

- The caverns located underground in Mustikkamaa were used for storing heavy fuel oil. The oil stores were emptied and decommissioned in 1999. Two of the connected caverns will now be converted into a heat storage facility.
- It will no longer be necessary to use and produce all of the heat at the same time. With the facility, it will be possible to avoid having to start up separate oil or gas fired heating plants in the winter.
- The volume of the heat storage facility is 260,000 cubic metres. The amount of energy stored is 11.6GWh. Its

charging and discharging capacity is 120 megawatts, which enables discharge or charge for about four days when the accumulator is full or empty.

- Budget €15M, with construction works from 2019-2021.
- More info: <https://www.helen.fi/en/news/2018/gigantic-cavern-heat-storage-facility-to-be-implemented-in-mustikkamaa>

#### CURRENT TUNNELLING ACTIVITIES

##### Tampere Region Central Wastewater Treatment Plant “Sulkavuori” (under construction)

- The underground treatment plant will process wastewater for up to 420,000 residents (2040).
- With a budget of €346M, it is the largest single environmental investment in the Tampere region.
- The project started in 2018 and it will be operational in 2025/2026.
- More info: <https://www.keskuspuhdistamo.fi/>

##### Final Disposal Facility ONKALO (under construction)

- The final disposal facility consists of two sections:
  - The above ground encapsulation plant where spent nuclear fuel is received, dried and packed into final disposal canisters.
  - The repository located deep inside the bedrock. Vital are the tunnels where the encapsulated spent nuclear fuel is disposed of.
- The volume of rock to be excavated for the repository, is approximately 1.5

million cubic metres.

- The number of final disposal tunnels required is 137. The total length of the tunnels is 50km, located within an area extending over two to three square kilometres.
- Final disposal starts in the mid 2020's.
- More info: Posiva - Front page

##### Art Cave Saimaa Retretti (under construction)

- Reconstruction and additional spaces.
- The new Centre of Art and Culture will be built from 2021-25.
- More info: <https://www.saimaantaideluola.fi/about-3-2>

##### Savilahti Underground Sport and Event Center, Kuopio (under construction)

- Re-use of an old underground military depot built 80 years ago.
- A new facility to serve as an event center for 2,500 people and also as an air-raid shelter for 7,000 people.
- Construction period 2021-2024.

##### Underground Parking Hall in Keilaniemi, Espoo (under construction)

- Excavation volume of 280,000m<sup>3</sup>.
- Underground parking for 1,600 cars.
- Construction 2022-2026.

##### Underground Parking Hall for Laakso hospital, Helsinki (under construction)

- Underground parking for 550 cars .
- Construction 2023.

##### Underground swimming pool in Lempäälä

- Construction 3/2023-07/2024.

### Eiranranta heat pump plant (Helen, Helsinki)

- The size of the heat pump plant is about 50,000m<sup>3</sup>.
- For the production of carbon-neutral district heating (93MW) and district cooling (60MW).
- Construction 1/2023-11/2025.

### FUTURE TUNNELLING ACTIVITIES

#### Seawater Heat Recovery Project, Helsinki

- The owner of the project is Helen Oy.
- The project is a Heat Pump Plant that uses seawater as a heat source.
  - Located in Salmisaari.
  - Underground space with a total volume of excavation of 300,000m<sup>3</sup>.
- The seawater system includes.
  - An intake tunnel, 17km long, excavated by TBM.
  - A discharge tunnel, 9km long, excavated by Drill & Blast.
  - Total volume of excavation 1,300,000m<sup>3</sup>

#### Seasonal Heat Storage, Vantaa

- VECTES (Vantaa Energy Cavern Thermal Energy Storage) is a seasonal energy storage project, which harnesses the warmth of summer for the cold winter days. The facility will be the world's largest cavern for thermal energy storage with a 1,000,000m<sup>3</sup> size. It will have a storage capacity of 90GWh of energy – the annual heat consumption of a medium-sized town.
- More info: <https://www.vantaanenergia.fi/en/fossil-free-2026/worlds-largest-cavern-thermal-energy-storage-to-be-built-in-vantaa/>

#### Toellisuuskatu Waste Water Tunnel, Helsinki

- To improve wastewater and storm water handling in Helsinki.
- Length 0.5km.
- Construction estimated 2023-2025.

#### Garden Helsinki

- An event arena providing sports and culture events, shopping facilities, apartments, underground parking etc.
- Private funding.
- Excavation volume of 800,000m<sup>3</sup>.
- Schedule open.
- More info: <http://www.gardenhelsinki.fi/en/>

#### Underground Parking Hall, Maria 01, Helsinki

- Excavation volume of 60,000m<sup>3</sup>.
- Underground parking for 350 cars.
- Construction schedule remains open.
- More info: <https://www.yit.fi/en/mariasarea>

### Traffic Tunnel in Sörnäinen, Helsinki (planning)

- Two parallel tunnels with length of 800m and an excavation volume of 270,000m<sup>3</sup>.
- Estimated cost of €160M.
- Construction estimated between 2028-2032.

### West Harbour Tunnel, Helsinki (planning)

- Estimated cost of €260M.
- The city council of Helsinki made a positive in-principle decision in Feb 2021.
- Currently in the general planning phase.
- Construction schedule remains open.

### Esplanadi Waste Water Tunnel, Helsinki (planning, waiting for decision of construction):

- Improve wastewater and storm water handling in the city centre of Helsinki.
- Length 1km.
- Estimated cost of €5M.
- Construction estimated from 2025-2027.

### Espoo – Salo -High-speed Railway (planning):

- 95km of new high-speed railway between Espoo and Salo
- Multiple tunnels with a total length of over 14km
- More info: <https://vayla.fi/kaikki-hankkeet/espoo-salo-oikorata>

### Salo – Hajala -High-speed Railway (planning):

- 55km of new high-speed railway between Salo and Hajala.
- Two new railway tunnels with a total length about 700m.
- More info: <https://vayla.fi/helsinki-turku-nopea-ratayhteys>

### Lahdenperä – Jämsä - railway (planning):

- 18km of new railway between Lahdenperä and Jämsä.
- 5km length of railway tunnel.
- More info: <https://vayla.fi/kaikki-hankkeet/tampere-jyvaskyla>

### Pyhäsalmi Mine Pumped Hydro Energy Storage

- Mine depth 1450m.
- Power 75MW, capacity 530MWh.

### Subsea Tunnel in Åland (feasibility study):

- Subsea road tunnel to link the island of Föglö and the Åland island where the city of Mariehamn is located.
- Tunnel length 10.5km.
- Requires further work for investigations, studies and design.

### City Rail Loop Pissararata, Helsinki (waiting for decision):

- The City Rail Loop is a planned urban railway line for commuter trains beneath Helsinki city centre.
- The city plan has been approved but the decision on the construction has yet to be verified.
- More info: <https://vayla.fi/pisara#WgrnfU32SM8>

### STATISTICS

#### Underground (UG) Spaces in Helsinki with Rock Surface:

- Area 2,145,081m<sup>2</sup> = 2,145km<sup>2</sup>
- Volume 13,100,000m<sup>3</sup>
  - UG spaces altogether 336
  - Helsinki's surface area 215,12km<sup>2</sup>
  - 1m<sup>2</sup> UG space for each 100m<sup>2</sup> surface area i.e. 1%
- Tunnels altogether 294km
  - 194km of technical tunnels
  - 34km of traffic tunnels
  - 30km of tunnels with secondary purpose as emergency shelters
  - 14km of parking caverns
  - 22km of tunnels for other purposes.

### EDUCATION ON TUNNELLING IN THE COUNTRY

#### Aalto University:

Engineering Geology; Rock Excavation; Rock Mechanics; Rock Construction; Seminar in Geoengineering; Project Course in Geoengineering

#### Tampere University:

Introduction to Rock Engineering; Design of Rock Engineering Structures; Construction of Rock Engineering Structures

#### University of Oulu:

Rock Mechanics; Mining Technology; Rock Blasting; Applied Rock Mechanics; Rock Dynamic and Applications

#### Lapland University of Applied Sciences + Kajaani University of Applied Sciences

Rock Excavation and Mining Technology; Rock Engineering

#### Metropolia University of Applied Sciences

Soil and Rock Construction

#### Saimaa University of Applied Sciences

Rock Excavation and Safety Regulations for Blasting Works; Underground Excavation and Rock Reinforcement Methods; Rock Mechanics

#### Turku University of Applied Sciences

Rock Engineering