Pasila Tripla, Helsinki

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Outline

- Pasila Tripla Description of the project
- Soil conditions & investigation program
- Design boundaries
- Alternative solutions for the retaining barrier wall
 - Selected solution
- Long term durability
- Installation
- Anchors
- Excavation
- Summary



Pasila Tripla – quick facts

- A massive construction project that will encompass three city blocks including a shopping centre, public transportation hub, housing, hotels and headquarterslevel offices
- Tripla-project was a result of a design competition PasilaONE, which was arranged by City of Helsinki (2013-2014):
 - YIT's winning proposal "Pasila Tripla"
- The total area will be 183,000 floor square metres
- ► Total value >1 mrd€
- Tripla will be constructed in stages during 2018–2021. Shopping mall part ready 2019, 1st apartments 2020





Pasila Tripla covers three city blocks



What is Tripla?



Under Station & Western blocks will be shopping mall & underground parking facility for 2500 cars -> utilize RD pile wall

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- 3000 citizens and 15000 jobs
- Permitted building volume 183,000 floor square m
- Execution during 10 next years
- Pasila Station block
 - 100 trains daily
 - Conference center
 - HQ offices & public transportation terminal
- Center block
 - Hotel, City Suites, etc.
- Western block
 - Apartments
 - Garden/resident park







1:1250

0 5 10 20

Soil conditions – A lot of variations

- Ground level +15.0...15,5
- PW & GW levels +14.0
 - Perch and groundwater flow from the Northern Pasila to South
- The whole area is covered with a layer of filling (typically 2...3 m)
 - Gravel, sand and in part of the areas also some blasted rock (up to 6 m)
 - Part of the fills are polluted (such as creosote)
- Under the fill there are thin layers of peat and clay including gyttja
- After that layers of clay and sand until the moraine layer which is very dense just above bedrock.
- Bed rock can be found at deepest at the level of -16.5 (i.e. 32 meters below the ground surface). The bedrock includes two major weathered zones



Extensive soil investigation program – 300 locations (10 m distance at wall line)





Some boundary conditions

Existing nearby structures:

- East: Pasila railway station (founded on Cast in-situ piles and on rock) and ground supported railway line embankments
- South: The Old and the new Pasila Bridges. The Old Bridge is founded on Cast in-situ piles and the new one on RD piles.
- West: Pasilankatu (street) on loose & mixed fill incl. large boulders which has normal traffic and also tram lines
- North: Nothing major
- To implement:
 - A barrier wall structure, which prevents perch (PW) and groundwater (GW) levels from dropping. Southside of Tripla, is an old railway engine hall, which is founded partly on wooden piles and partly ground supported on clay.
 - Separate PW and GW transfer systems that will collect and transfer PW and GW from the Northern part into South where they are absorbed into the ground again. This is because the barrier wall cuts the normal flow of PW and GW from North to South.
 - A barrier wall and foundations on the parking facility which have design age of 200 years
 - A barrier wall structure and the excavation itself which may leak only 60 l/min

Alternatives for the retaining barrier wall – Pros & Cons of RD pile wall

- RD pile wall
 - Selected solution after technical & economical comparison
- Cast-in-situ concrete secant pile wall
- Cast-in-situ concrete piles & Jet Grouting columns in between
 - Considered to include major risks already at the beginning of the evaluation
- Pros & Cons pf RD pile wall according to contractor:
 - Fast to install
 - Reliable water tightness during the excavation
 - Good positional tolerance after the installation
 - Can take large loads (steel grade, wall thickness, reinforcement and concreting)
 - Doubts on long-term (200 years) water tightness at interlock location
 - Corrosion (some organic and contaminated soil layers exist)
 - Disturbance of the soil layers during the installation (air)
 - Large amount drilling mud



Piling solution for Central-Pasila Tripla underground parking facility

Mainly RD700/14.2 S440J2H pile wall

- 746 pcs of piles (16.6 km / 4050 t) ranging from 5.5 m to 33.5 m installed in one pieces
- Design life 200 years (corrosion allowance 6.5 mm)
- RM/RF interlocks provided with bitumen
- Installed first by vibrating and finally by drilling into the bedrock
- Reinforced and concreted
- Small amount RD400/12.5 S440J2H pile wall
 - 60 pcs of piles (1.2 km / 150 t) ranging from 23 m to 26 m with element length of 4 m
 - RD400/12.5 piles will be reinforced by inner RD320/12.5 S550J2H pipes
- Altogether close to 4200 tons of piles / 13500 square m
- Over 130 on-time deliveries to site in less than six months
- Designer: Ramboll Finland Oy
- Main contractor: YIT Rakennus Oy
- Piling contractor: KSBR Oy and Fort Ehitus OU



13500 m² of RD pile wall, avg. depth 24 m and max 32 m – Width x length of excavation 220 x 110 m



Doubts on long-term (200 years) water tightness at interlock location



Corrosion (some organic and contaminated soil layers exist)

- Soil samples were taken from 2 locations from the layers below the fill layer.
 - pH, conductivity, amount of sulfate (SO4) ions and total amount of sulfur.
 - The report from Technical Research Centre of Finland (VTT) indicated that the corrosion margin in the clay layer should be in 12 mm/200 years and for mineral soil layers 2 mm/200 years.
- However when old Pasila Bridge was constructed, old railroad rails were used as a rack piling.
 - One such "pile" with a length of 23 m was found (produced in Britain at the end of the 19th century. The rail had been in ground for more than 30 years!
 - The rail was cut into pieces and the pieces were taken into laboratory for measurements. The measurements were taken every 10 cm from the foot, the stem and the top of the rail.



After thorough analysis the new info was simplified by using corrosion margin on 12 mm all the layers above level +9.0 and below that it was used a corrosion margin of 6 mm.



Installation phase I – Vibrating into moraine layer, no splice welding with RD700 piles



16

Installation phase II – Augering the pile pipe empty



Installation phase III – Drilling into the bedrock



Robit Steel Fist Wing Pilot



Use of template clearly improves the tolerance of the wall



Drilling mud

- The amount of replaced soil by RD pile wall in the job site is 7000 m³
- Amount of drilling mud is increased by the existing weathered rocks below ground water table
- Drilling muds were collected into reservoirs where they were mixed with dry soils in order to facilitate the transportation away





Drilling of RD400/12.5 pile wall under railway platform



Splice welding of RD400/12.5 pile wall



Concreting of the piles & space between pile pipe and bedrock



Anchors

- RD pile wall is supported by temporary rock anchors
 - Appr. 800 pcs (14.2 km of soil drilling and 6 km of rock drilling)
- Anchors are strands with 15.7 mm strand and nr of the strands vary fro 5 to 19 (design loads 450-2910 kN)
- Anchors are generally inclined 1:1 and grouted into the rock. The longest soil drilling are >40 m long
 - Casing tubes are SSAB threaded RDc140/5 & bevelled RD140/4.5 and RD170/4.5.
- All anchors will finally be deactivated (cut) and the supporting will be implemented with the floor slabs of the parking facility



Excavation ongoing – Appr. 640 000 m³



SUMMARY



RD[®] pile wall in Pasila Tripla, Finland

Reliable and watertight retaining wall in demanding soil conditions and busy urban environment with fast installation



RD® pile wall in Pasila Tripla, Finland Reliable and watertight retaining wall in demanding soil conditions and busy urban environment with fast installation

OUR SOLUTION

SSAB's RD pile wall solution enabled fast installation with tight tolerances. Accuracy and speed in addition to water tightness made RD pile wall best solution for the customer. Installation method was also least risky for the surroundings as removing the clay with auger creates little to no spatter. Piles were transported full-length sections. Exceptional length of the piles was up to 33,5 m (8,5 t).

CUSTOMER CASE

Pasila Tripla is three-block retail, office and housing complex to be built in Pasila district close to the city center of Helsinki. It will be completed in stages by the early 2020s.

Customer's challenge was to find a watertight retaining wall solution to surround the 640 000m3 excavation for the garage. Location is critical right by a bridge with foot traffic, railway track and busy Pasilankatu street. Delivery and installation speed were critical for the customer: it was important to have piles delivered in one piece to avoid additional welding at site. The retaining wall cuts through groundwater layers, which exerts an enormous pressure on the underground structures making water-proofing the retaining wall demanding.





Delivery (2015-2016) so far:

• SSAB RD pile walls

- 754 pcs RF/RM-interlocked drilled piles RD700/14,2, 16 700 m in total
- 60 pcs RF/RM-interlocked drilled piles RD400 /12,5, 1 300 m in total
- 60 pcs structural pipes RD323/12,5, 1300 m in total
- Anchor casing tubes: RDc140 /5,0 and RD170/5,0, 20 000 m in total

Co-operation partners:

- Client/Project owner: YIT Rakennus Oy
- Main contractor: Keski-Suomen Betonirakenne Oy
- Drilling contractor: Fort Ehitus OÜ and YIT Rakennus Oy
- Drilling consultant: Ilmi Solutions Oy
- Drill bit supplier: Robit Oyj
- Design: Ramboll Finland Oy



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QUESTIONS?

