Lessons learned.

Rotermann Quarter, Tallinn (2004-2006)

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Introduction

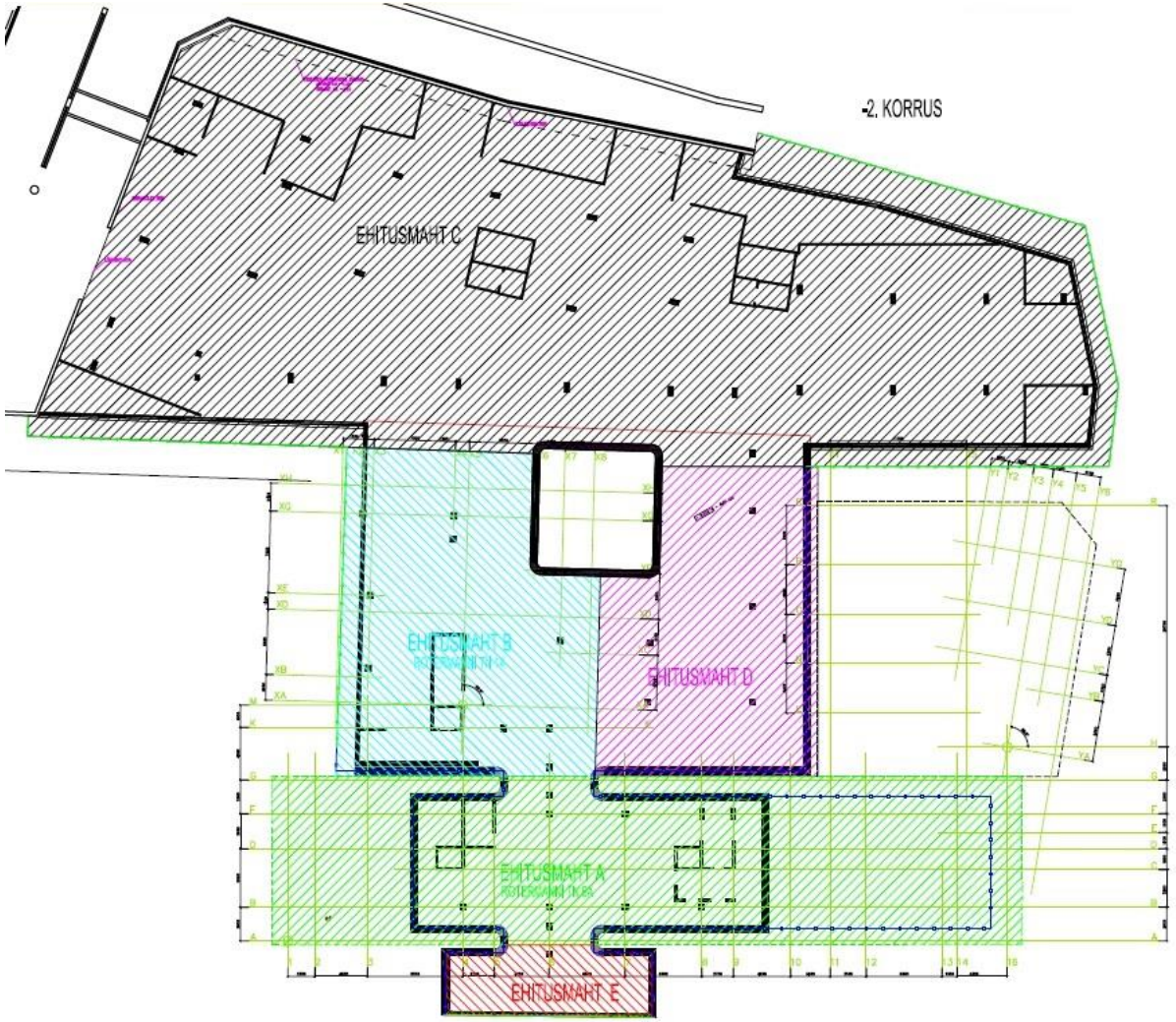
The Rotermann Quarter is a former industrial area in the heart of Tallinn, Estonia that has been given a new life as a modern shopping, entertainment, business and residential zone.

New intended purpose has been given to:

- Old flour warehouse
- Bread factory
- Wheat mill
- Elevator building
- Cattle house chimney etc.

Work scope

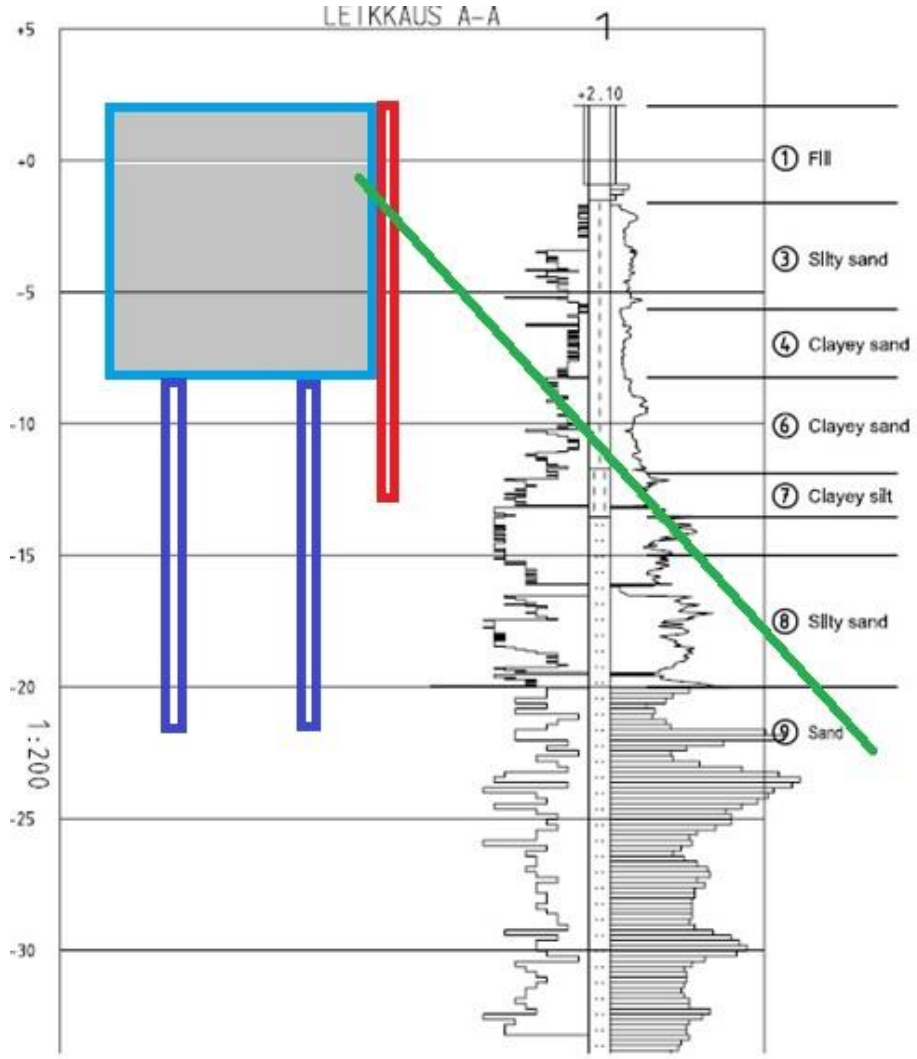
Our engineers' special skills were needed when creating a two-level underground parking garage underneath the valuable heritage site with weak soil and fragile historic structures overhead. The parking garage was built the same time as three new shop, office and apartment structures were being built directly overhead, one of them within the old façade of a salvaged building.



Main tasks and challenges

- To support and preserve existing historical building facades to survive demolishing of all floors, ceilings, walls and foundations;
- To construct new foundation for 54m high cattle house chimney;
- To build 5000m^2 -2 floor underground parking house inside fully saturated silty-clayey sand layers;

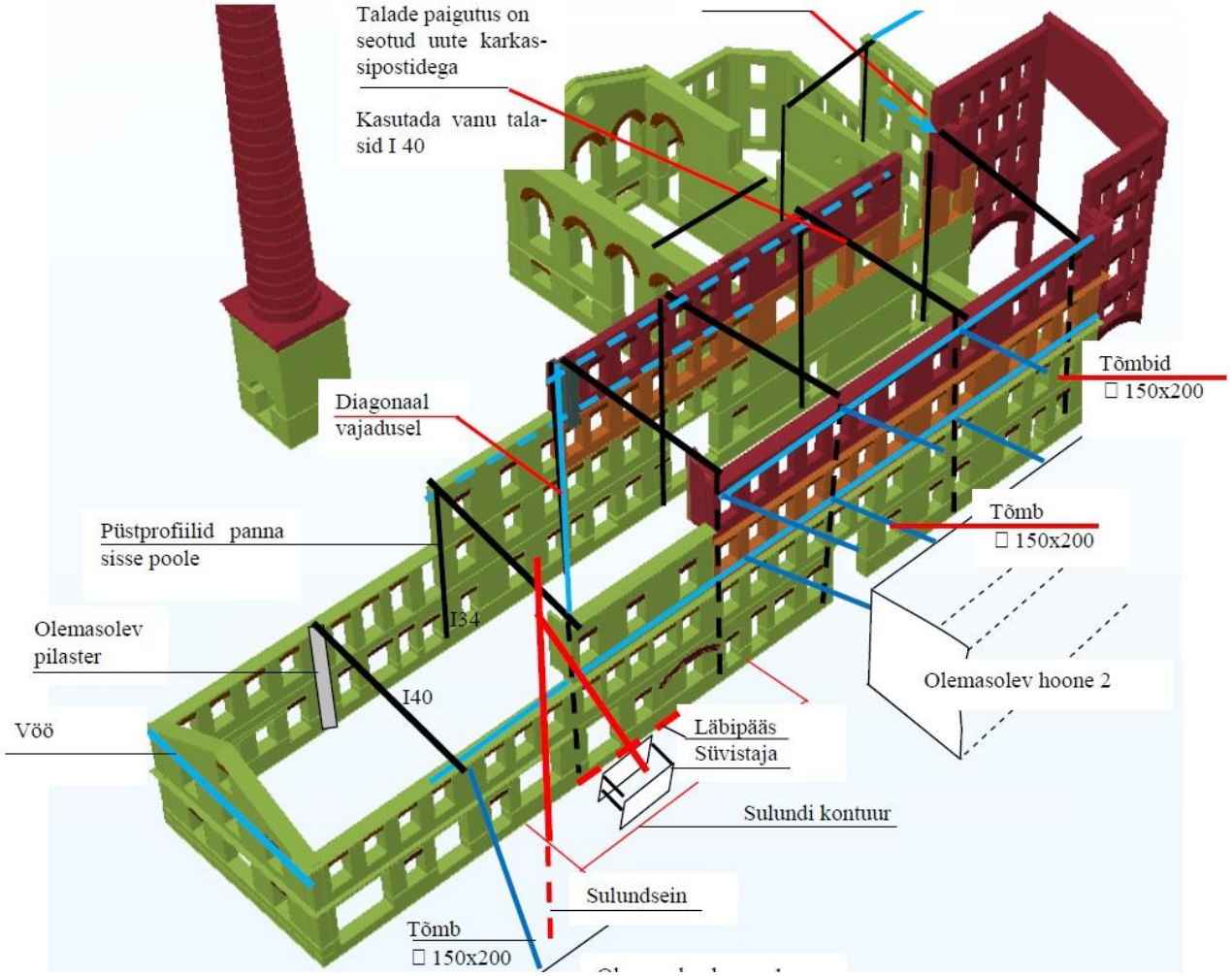
Additional soil investigations



Supporting of historical facades

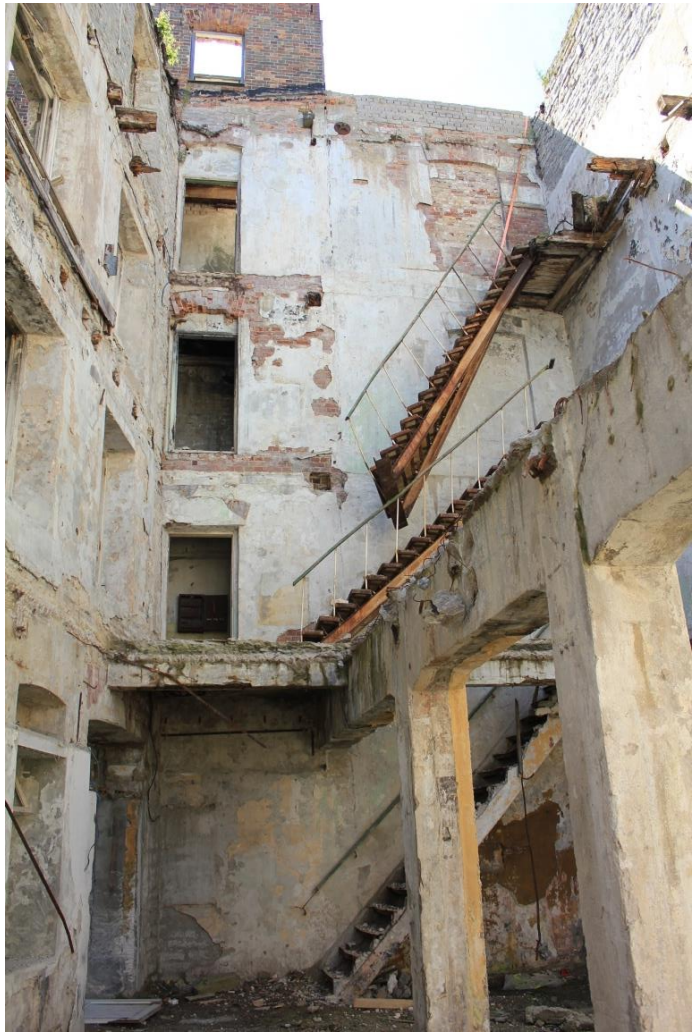
According to Estonian Heritage Protection Agency instructions, old historical facades had to be preserved and new functionality buildings had to be built inside old walls.

To demolish existing floors and walls, additional supports had to be installed.



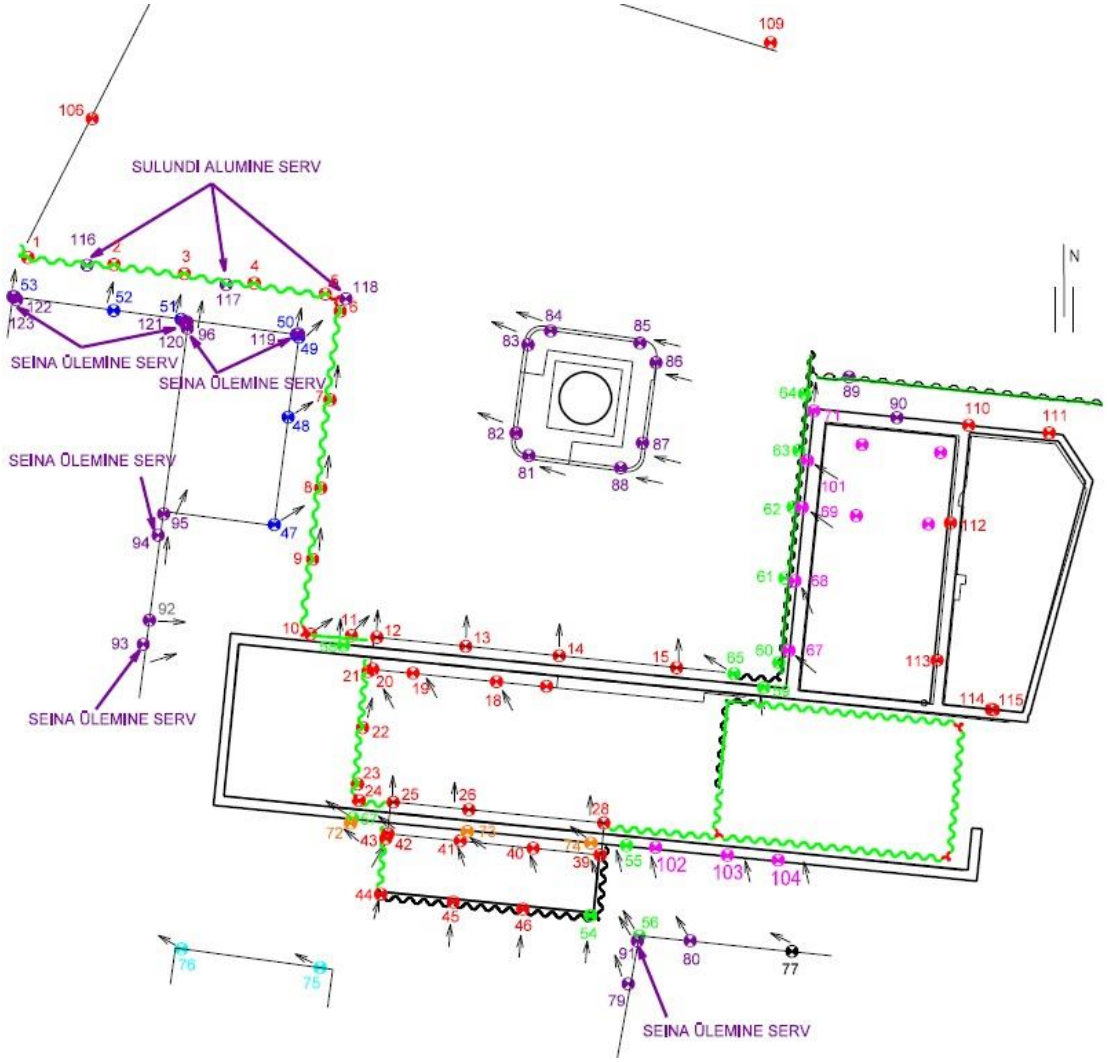
Supporting of historical facades

Demolishing of walls and ceilings



Setting up measuring points

- To monitor all movements of historical walls, surrounding buildings, excavation pit walls and chimney, system with more than 130 measuring points was created;
- All measurements were taken with 24H interval;
- Horizontal and vertical movements were measured;



Underpinning

All facade walls and also some of surrounding building foundations were underpinned with micropiles

Sheetpiling

- Excavation pit was surrounded with metal sheetpiles and jet-grouted columns;
- To avoid vibrations and possible cracks inside historical walls, half of sheetpile elements were pressed inside ground;

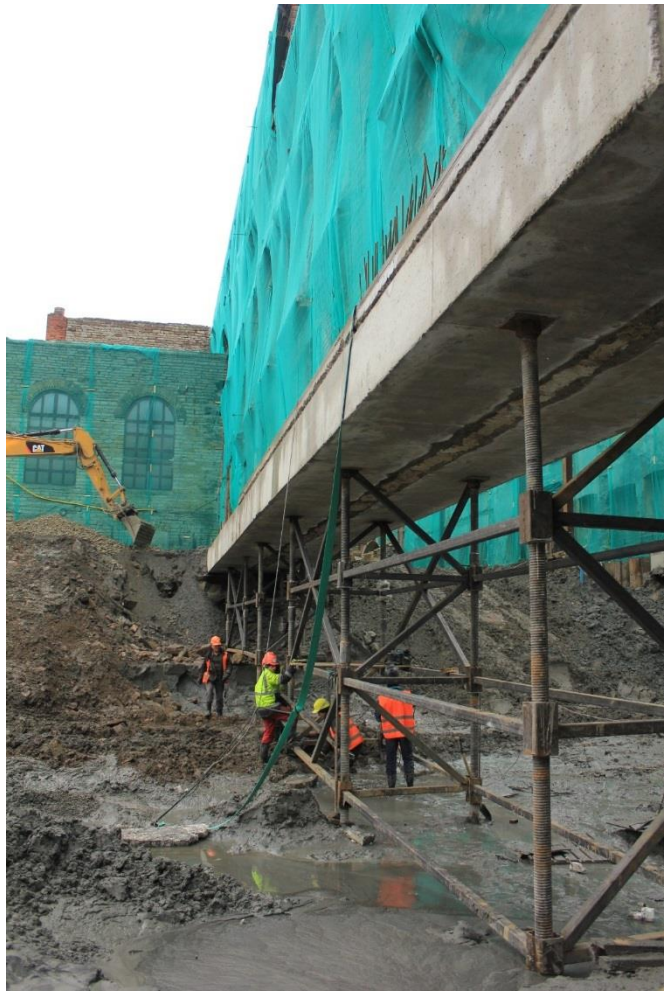
Excavation works

- All existing foundations were sitting on wooden rafts;
- More than 33 000m^3 of silty soil was excavated from the work area.
- Excavation pit bottom was 7…8m deeper than sea level horizon;

Digging from below the old walls

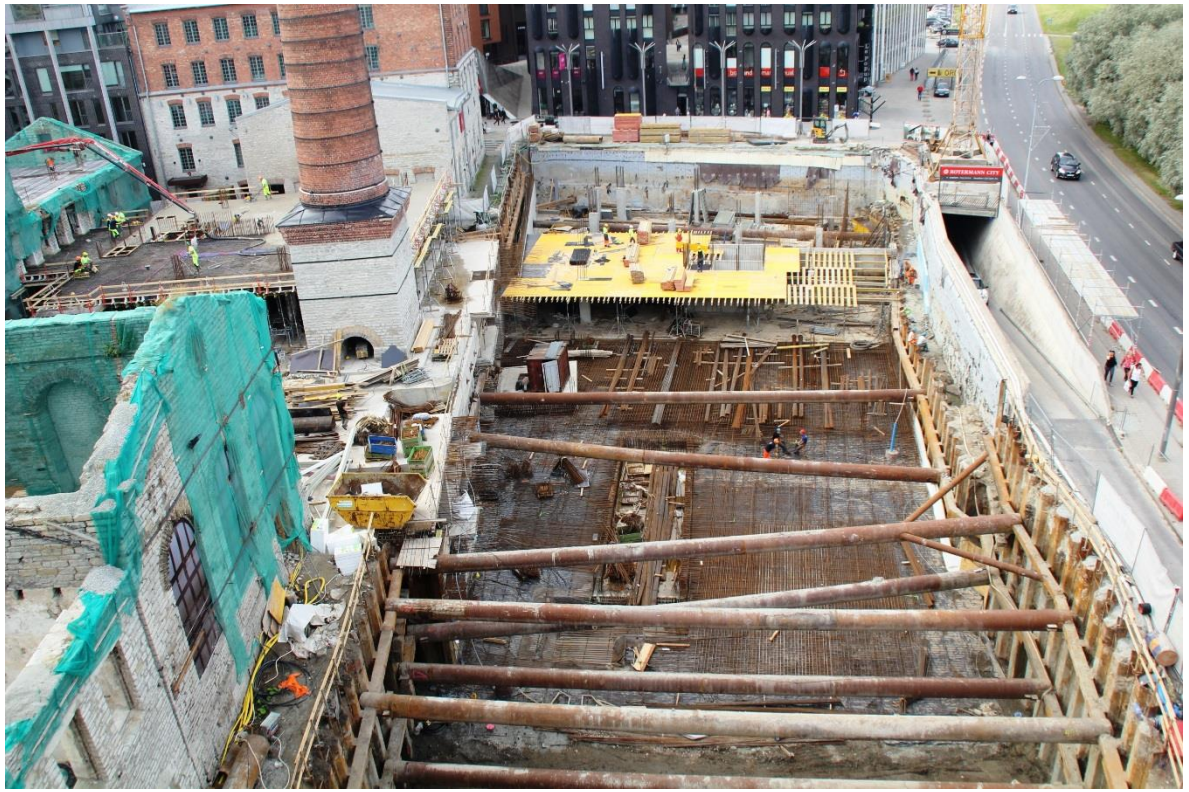
- Load from existing walls was transferred to micropiles;
- To avoid buckling effect, additional diagonals were installed between micropiles;

Digging from below the old walls



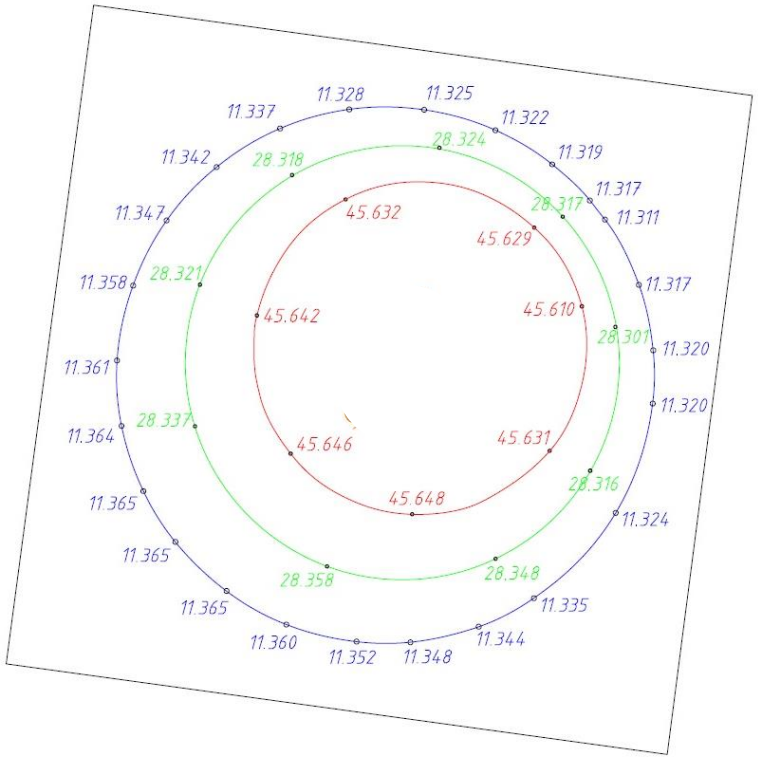
Finalizing excavation

Excavation pit was supported with pre-tensioned struts and ground anchors:

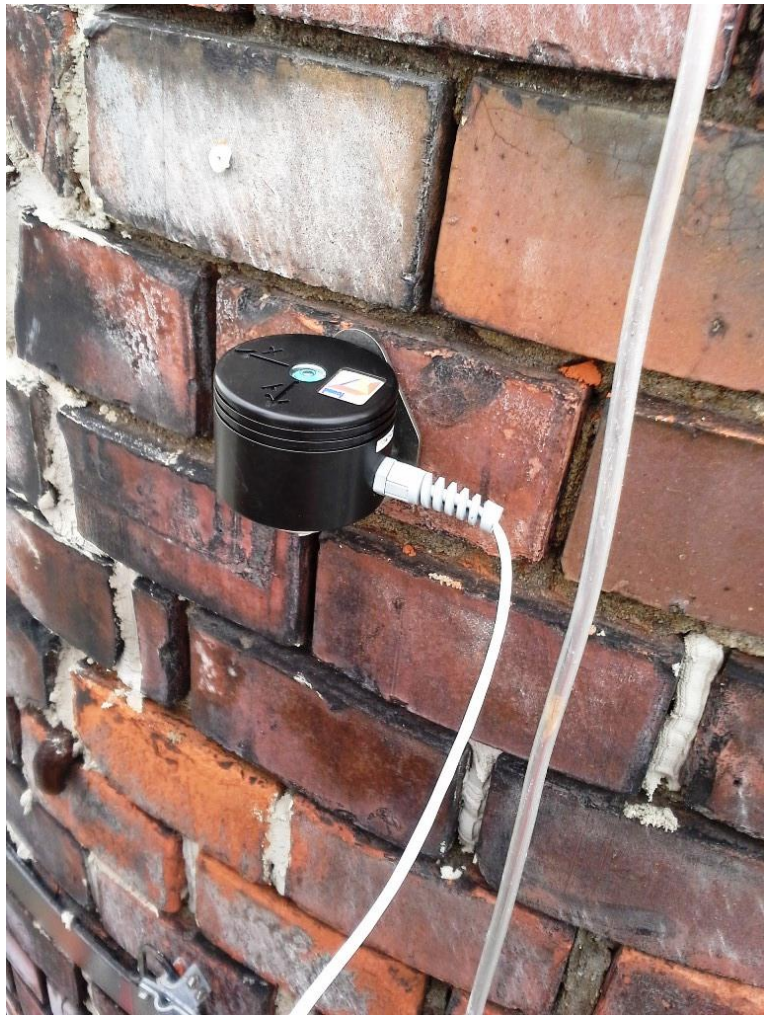


New foundation for chimney

- Height of the chimney 54m;
- Weight 18500kN;
- Built in 1910 on a wooden raft;
- Before construction works chimney's top was inclined 57cm to northeast = stated as building in emergency situation;



New foundation for chimney



New foundation for chimney

As new parking house bottom was 5m deeper than chimneys old limestone foundation, proper load transfer was needed:

- Secant pile wall
- Micropiles
- Massive concrete beam with tension bars

New foundation for chimney

New foundation for chimney

According to last measure-ments chimney sanked from original position 102mm deeper during excavation and water lowering process.

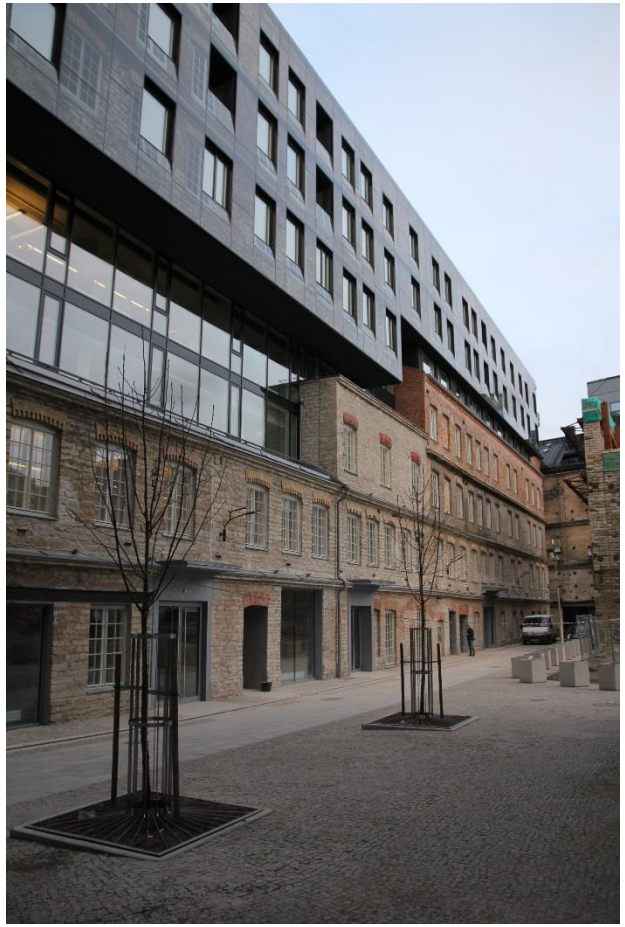
Chimneys inclination was decreased from 54cm to 32cm during foundation process .

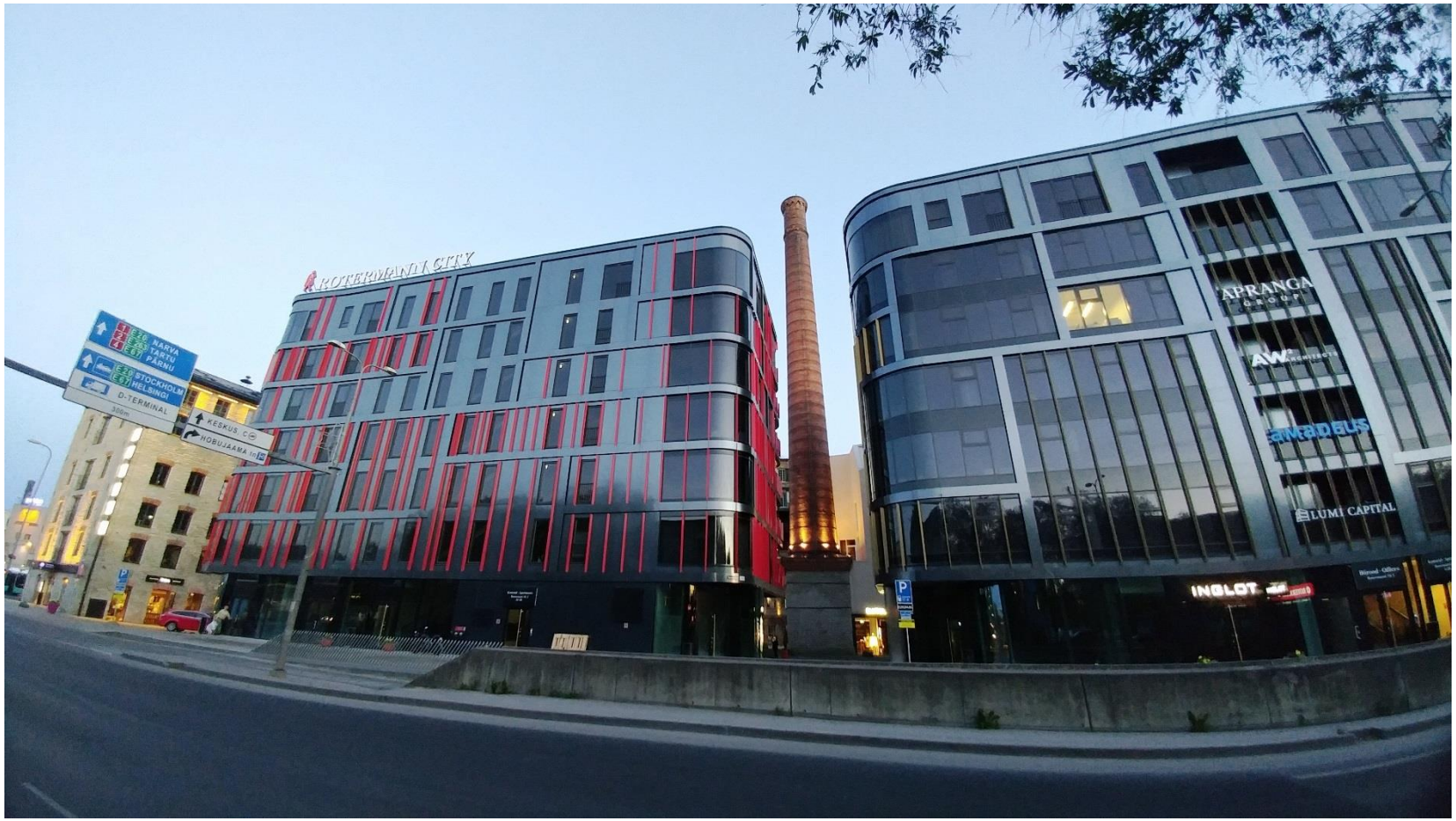
New foundation for chimney

Chimneys foundation and highly tensioned bars are now observable from both parking house floors:

New Rotermann Quarter

Rotermann Quarter has got totally new outlook:





Lessons learned

1) Minimum subsidences of a building can be allowed…until they are even;

2) Piles, anchors and sheetpiles will get their movements/ settlements before achieving their full work load;

3) Never underestimate the force of ground water;

Thank you for Your attention!

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