

Helsinki experience and best practices on Underground civil defence shelters

January 24, 2024

Ilkka Vähäaho



ALEF GEO-CONSULTING

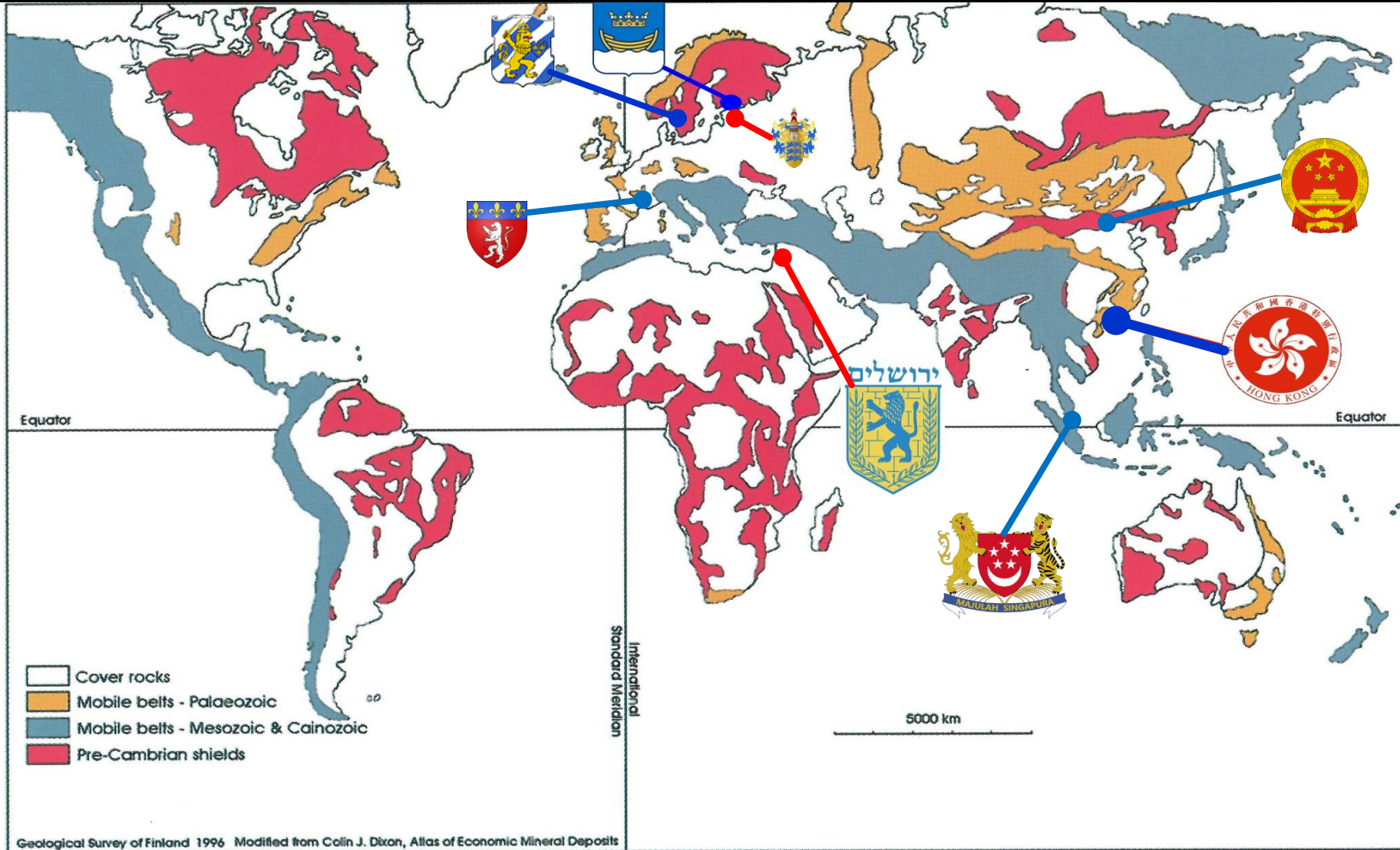


Contents

1. Author's experiences of underground sites around the world
2. About the geology of Northern Europe, Israel, and Ukraine
3. On the effects of earthquakes on tunnels
4. Statistics on rock-roofed underground spaces in Helsinki
5. Underground Master Plan of Helsinki
6. Legislation on the construction of civil defence shelters 1934–2022
7. Civil defence shelters in Helsinki
8. Conclusions

1. Author's experiences of underground sites around the world

Geological map of the globe where **white area means soft rock** and coloured areas mean **hard rock**

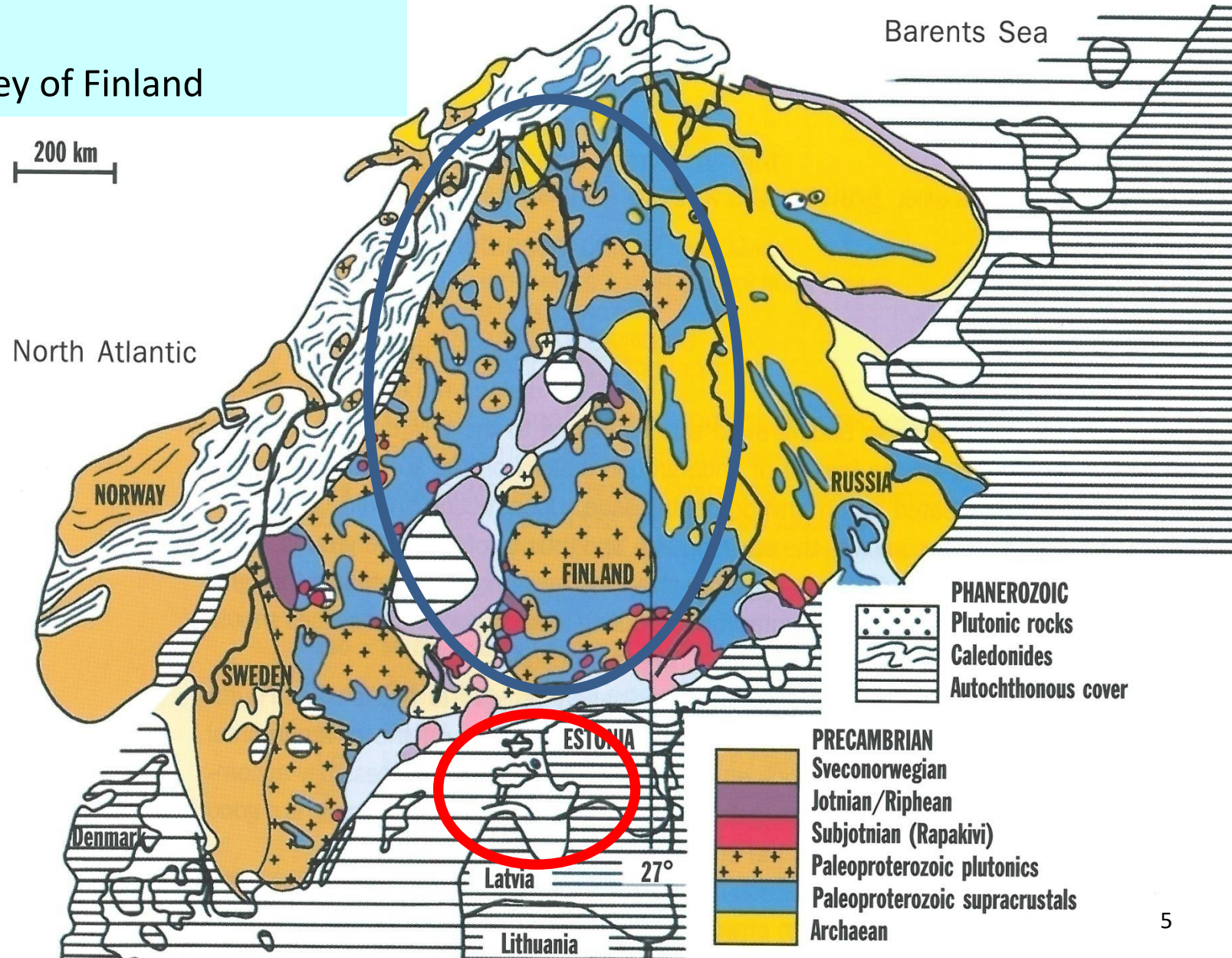




2. About the geology of Northern Europe, Israel, and Ukraine

Geological map of Fennoscandia

Courtesy Geological Survey of Finland



Examples of bedrock outcrops

Finland



Photo: O. Ikävalko

Estonia

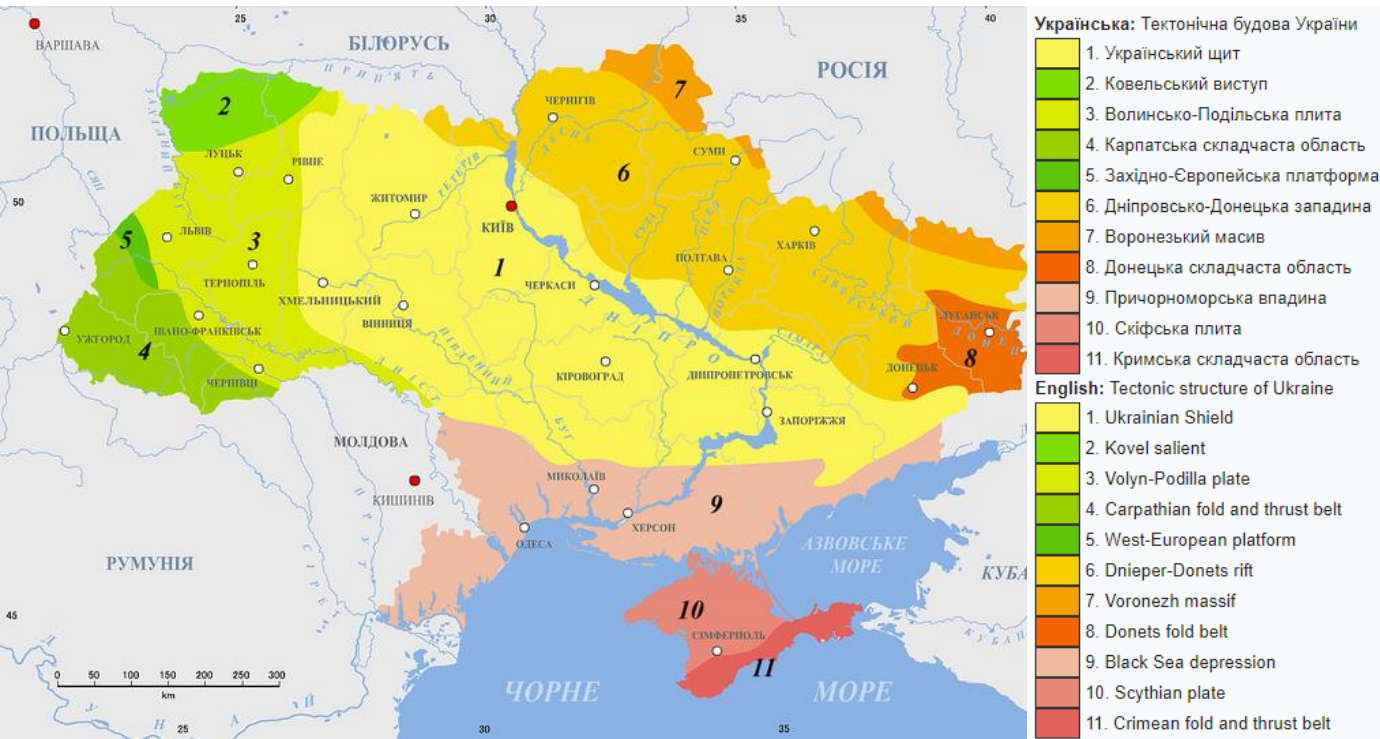


Israel



<https://en.wikipedia.org/wiki/Qumran>

Geology of Kiev and Ukraine



[Engineering-geological conditions of the Kiev region](#)

[File:Ukraine geology.png – Wikimedia Commons](#)

3. On the effects of earthquakes on tunnels

From the Open Session in World Tunnel Congress 2011, Helsinki

By: Tetsuya Hanamura, Dr. Eng.

Tunnels and UG Spaces are
Strong!

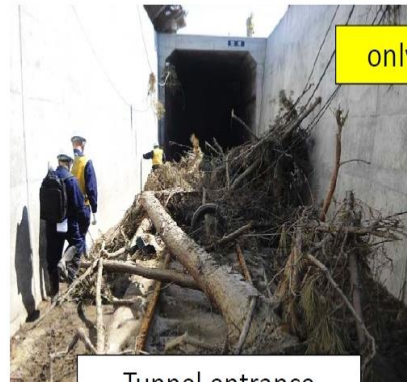
=> The earthquake in Japan (March 2011) caused little if any structural damage to the metro tunnels

=> The tsunami swept off almost everything on ground - but caused only minor damage in tunnels



Before the strike of 2011 earthquake

Tunnel underneath
the Sendai Airport
in Sendai Airport
Access Line



Tunnel entrance

only inundated



In the tunnel

Though the tunnel was inundated by tsunami,
no structural damage was observed.

4. Statistics on rock-roofed underground spaces in Helsinki

City Survey Unit, November 9, 2022

- Area 2 149 050 m² = 2,15 km²
- Volume 13 117 220 m³ = 120 x
 - ✓ UG spaces more than 400 pieces
 - ✓ Helsinki's surface area 215,12 km²
 - ✓ Average 1 m² UG space for each 100 m² surface area i.e. 1 %
 - ✓ [VALIO EMMENTAL BLUE LABEL CHEESE E700G](#) has on average c. 20 % holes (hole cheese)
- Tunnels altogether 295 km
 - ✓ 194 km of technical tunnels
 - ✓ 34 km of traffic tunnels
 - ✓ **30 km of tunnels with secondary purpose as civil defence shelters**
 - ✓ 14 km of parking caverns
 - ✓ 23 km of tunnels for other purposes



5. Underground Master Plan of Helsinki

- Since the 1980s, the City has maintained an underground space allocation plan
- In the early 2000s, a need arose to draw up an underground master plan
- In December 2004, the City Planning Committee approved a set of planning principles
- In April 2005, a participation and assessment plan was presented
- In 2005, an open discussion event was arranged
- In January 2006, discussions were held with the relevant public authorities
- In 2007, representatives from the official authorities were consulted on whether a thematic map showing technical services could be published
- In May 2007, the draft Underground Master Plan of Helsinki was distributed
- In December 2008, the City Planning Committee decided that a revised draft should be resubmitted
- In December 2009, the City Planning Committee proposed the Underground Master Plan for the City Council
- In December 2010, the City Council approved the Plan
- More information on [Publication 2018 \(pp. 11-14\): https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-11-18.pdf](https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-11-18.pdf)
- ***Everything changes, also underground planning***
- In 2021, a New Underground Master plan was approved

Underground Master Plan 2021

Urban Environment Material 2021:2, Page 41

https://www.hel.fi/hel2/ksv/liitteet/2021_kaava/mayk12704_SELOSTUS_Helsingin_maanalainen_yleiskaava_2021.pdf

- Over the decades, the City of Helsinki has built public and shared rock shelters, building-specific civil defence shelters and equipment shelters.
- Especially rock spaces built in the city centre area, such as metro stations and the parking caverns are equipped as civil defence shelters in addition to normal time use.
- Located in other regions Rock shelters are used, for example, as warehouses and archives, parking facilities or sports and hobby facilities.
- The use of standard time ensures the maintenance of civil defence shelters and enables the financing of shelters.

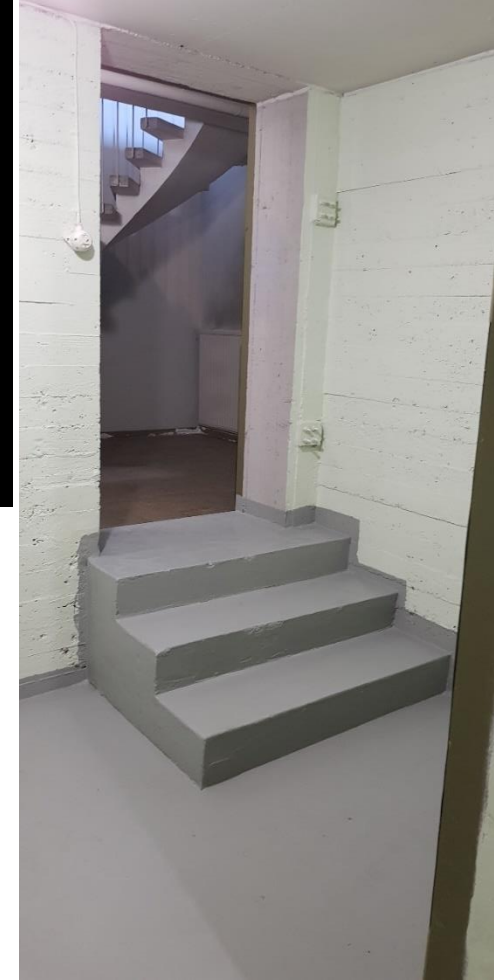


6. Legislation on the construction of civil defence shelters 1934–2022

Unofficial translation of Pekka Rajajärvi's blog "Väestönsuojien rakentamisen lainsäädäntö 1934-2022"

November 10, 2022

https://alefgeo.com/wp-content/uploads/2024/01/Legislation_construction_civil_defence_shelters_Finland.pdf



Stages of regulations on the construction of civil defence shelters 1934–2022

On 12.2.1934, six Members of Parliament submitted a wish motion to Parliament demanding that the Government submit a proposal for a municipal gas protection act. The initiator, Member of Parliament, Captain Y. Schildt (IKL), justified the parliamentary initiative as follows:

"The development of the gas weapon, which has made further progress since the World War, has forced all nations to pay attention to the danger of gas warfare. What is particularly noteworthy here is that this method of fighting is not only directed at the fighting forces but is under threat to the whole country and the civilian population."

The first bill in 1939 was drafted based on a proposal from the committee. According to the committee, the proposed civil defence would be very expensive and burden municipalities quite unevenly. On these grounds, in a letter dated 11.5.1939, the Defence Committee proposed that the bill be rejected. The Legal Affairs and Finance Committee did not have time to consider the proposal before the end of the parliamentary term. Parliament was dissolved and unfinished business during the parliamentary term lapsed. The committee examined various options for organising a central civil defence administration and unanimously proposed the Ministry of the Interior as a central agency. The new Parliament, which met after the 1939 parliamentary elections, received the bill for consideration on 22.9.1939, i.e., three weeks after the outbreak of World War II.

The second bill of 1939 was ratified by President of the Republic Kyösti Kallio at a government session on 30.10.1939, and it entered into force on 15.11.1939, just two weeks before the outbreak of war. The Implementing Decree required by the Civil Defence Act was issued on 8.12.1939 and the Decree on the establishment of posts in the Civil Defence Department and County Administrative Offices of the Ministry of the Interior on 14.12.1939.

Section 49 of the General Plan was amended 871/1945 on 6.9.1945 to halt the construction of civil defence shelters without amending the Act.

The work of the Committee on the Civil Defence Act appointed by the Government on 27.11.1951 was completed on 4.5.1954, and based on its recommendations, the Government decided on 26.8.1954 to amend section 49 of the General Plan so that the construction of civil defence shelters began again.

The Civil Defence Act 375/1939 was still in force, although it had been on hiatus for political reasons from 1945 to 1954. By Government Decision 342/54 of 26.8.1954 amending section 49 of the general plan, the reconstruction of civil defence shelters began on 1.11.1955. According to Law 375/39, a civil defence shelter must be built in a stone house of at least two storeys with at least twenty residential or commercial rooms and a volume of at least 2 500 m³. With these requirements, 50,000 shelters were built.

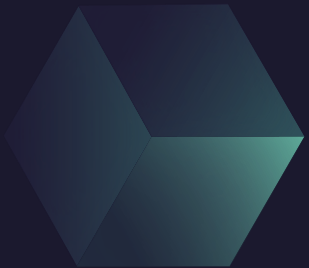
The Government submitted **the third bill on the Civil Defence Act in 1958** to Parliament on 5.11.1957. The proposal followed the Advisory Board's proposal very closely, both in the explanatory statement and in the details. A more deficient part of the bill was the distribution of the costs of civil protection. This law can be considered the basis of the current law.

At the consultation stage of **the fourth bill in 1990**, the limit for the obligation was 300 m². The Government proposed that the limit for the obligation to build a civil defence shelter be 400 m². The Committee on Defence in its report of 3/23.11.1989 proposed a limit of 500 m². In its report 1/14.2.1990, the Grand Committee amended the Government's bill so that the limit for the obligation to build a civil defence shelter is 600 m². The limit of the construction obligation changed all the time according to the global political situation.

The fifth bill of 1999 did not introduce any significant reforms to the provisions on civil protection. In combining the Civil Defence Act and the Act on Fire and Rescue Services, the chapter on civil defence brings together the rules concerning preparedness for emergency conditions, the obligation to build civil defence shelters and operations in emergency conditions. Clarifications have been made to the provisions concerning the obligation to build a civil defence shelter, which have proved necessary due to problems in the application of the current provisions.

In the sixth bill of 2003, the Rescue Services Act was reformed into the Rescue Act. In the reform, only minor repairs were made to the construction of civil defence shelters.

The key changes made in **the seventh bill in 2011** were big. Raising the limit of the construction obligation, the general limit for the construction obligation is 1,200 m² (the number of civil defence shelters decreased by 40%) and the limit for industrial, production, warehouse and assembly buildings is 1,500 m².



7. Civil defence shelters in Helsinki

Then and now

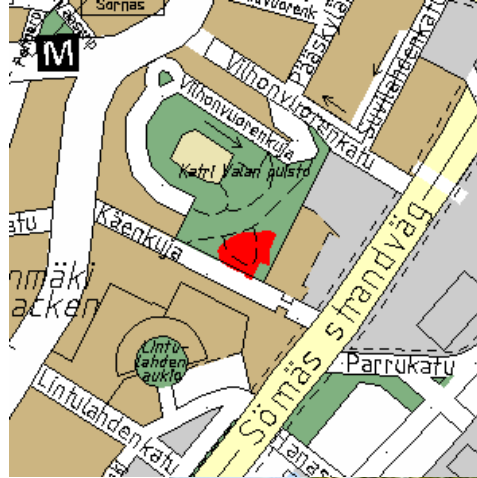


Old civil defence shelter

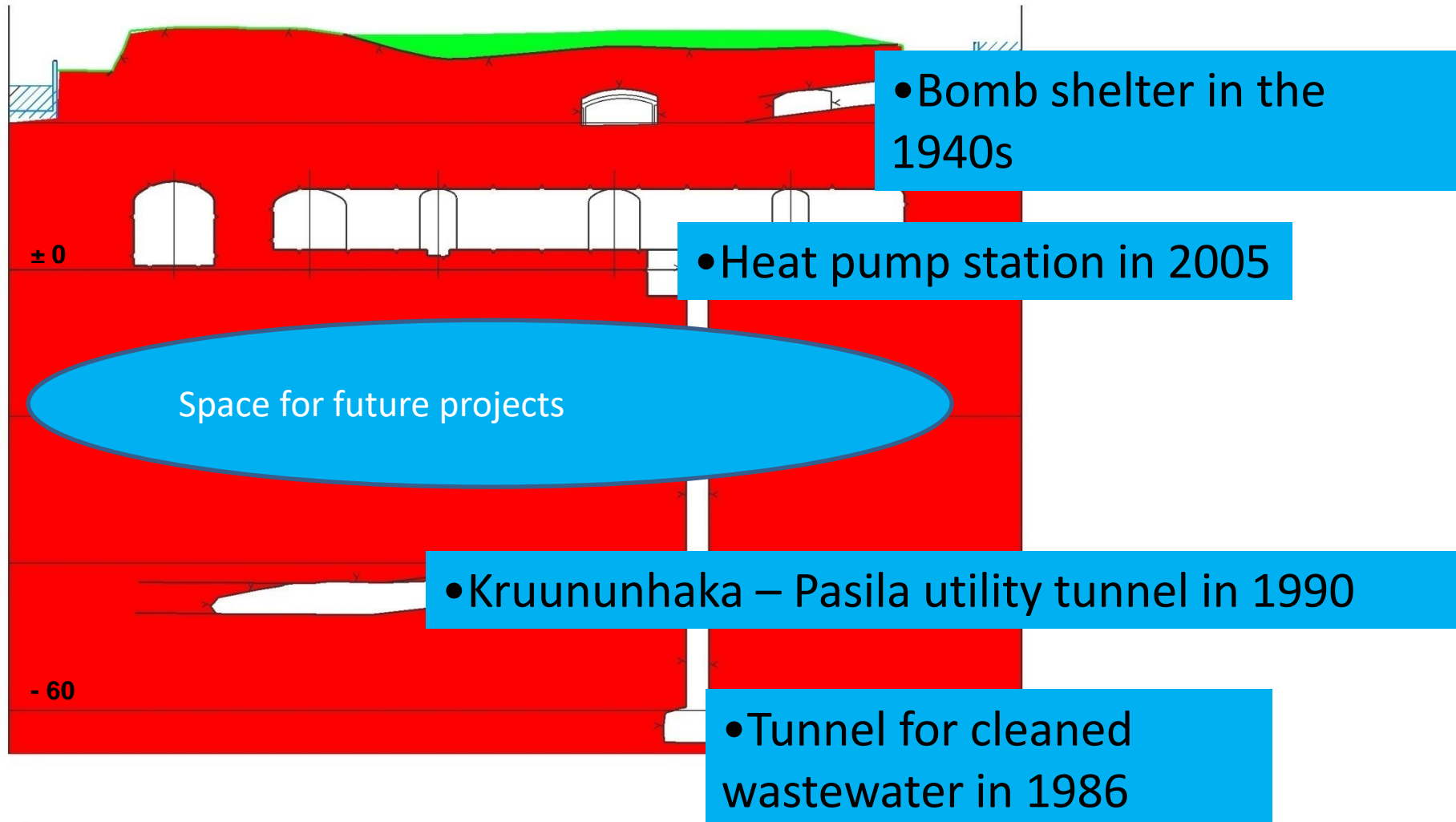


and a new one

Old civil defence shelter under Katri Vala park



Old civil defence shelter and other spaces under Katri Vala park





VÄESTÖNSUOJA
SKYDDSRUM

CIVIL
DEFENCE
SHELTER

The civil defence shelters are marked with the international emblem for civil protection, which is a blue triangle on orange background (Photo Ilkka Vähäaho).

Underground swimming pool in Itäkeskus, which can accommodate 1,000 customers at a time and can be converted into a Shared civil defence shelter for 3,800 people if necessary. (Photo: City of Helsinki Media Bank)



More attention is being paid to the attractiveness of underground spaces these days

P-Finlandia and a Property-specific civil defence shelter were designed as a multi-purpose facility



Public and shared civil defence shelters can be found with their address information on Service map (hel.fi) <https://palvelukartta.hel.fi/en/services>

Suomeksi In English På svenska Contrast Accessibility

Service Map Front page Services in your area Services list Traffic and movement

Search for services, locations or addresses
shelters Search

Write your home address Lisää

Close map settings

Select your sensory processing issues

Select your mobility issue

Select your city setting

Valitse palveluntarjoaja
City of Helsinki

Sort search results
Alphabetical order

SERVICE POINTS (57) SERVICES (3)

- Agrokseenmäki civil defence shelter** 10.5 km
Municipal service, The Social Services, Health Care and Rescue Services Division, City of Helsinki
- Allmänna befolkningskyddsrummet på Koivusaaris metrostation** 4.7 km
Municipal service, The Social Services, Health Care and Rescue Services Division, City of Helsinki
- Common civil defence shelter at Itäkeskus Swimming Hall** 16.4 km
Municipal service, The Social Services, Health Care and Rescue Services Division, City of Helsinki

Public safety (167)

- National defence (8)
- Sea rescue (13)
- Other safety services (6)
- Rescue services (45)
- Police (5)
- Border guard (1)
- Radiation and nuclear safety (1)
- Customs (8)
- Public alarm systems (49)
- Public shelters (55)**
 - Shared ground shelters (32)
 - General public shelters (33)
- Employment and public authorities (1155)

The civil defence shelter protects against radiation, gases, collapses, and conventional weapons

Civil defence shelters are divided into K, S1, S3 and S6 categories

1. Class K
 - protection can be constructed in either steel or reinforced concrete
2. Class S1
 - shall be made of reinforced concrete
3. Class S3
 - is either a lightweight rock shelter or a heavy reinforced concrete shelter
4. Class S6
 - is a large rock shelters that can withstand an explosion load of 6 bar

Bedrock shelters

- The bedrock shelters in Helsinki are public civil defence shelters, shared civil defence shelters or a combination thereof. The public civil defence shelters are bedrock shelters built by the city, and they are intended for people living, working, or staying in Helsinki and people on the move. Shared civil defence shelters are bedrock shelters built for several properties and intended for use by people working or living in these properties.
- Under normal conditions, bedrock shelters are in use, for example, as sports and recreation premises and as parking facilities. Metro stations from Sörnäinen to Ruoholahti are also equipped with civil defence equipment, meaning that they can be used as public civil defence shelters if necessary.
- The Rescue Department cooperates with several third sector actors, and hundreds of trained volunteers work in civil defence duties.



Property-specific civil defence shelters

- Property-specific civil defence shelters built for those living, working or staying in the building are the foundation of Helsinki's civil defence. Their use is based on the duty to build civil defence shelters defined in the Rescue Act.
- You can find out the location of the property-specific shelter from the property owner, property manager or rescue plan. The shelter is often located in the basement of the building and used during normal times as a storage space, for example.
- The condition and readiness for use of the civil defence shelter in the building are the responsibility of the owner or holder of the building. The owner of the shelter ensures that the shelter and its equipment remain in good condition, and it has the tools and equipment necessary for maintenance and sheltering situations. The civil defence shelter must be inspected annually. A sufficient number of trained personnel must also be reserved for civil defence duties in the shelters.

About the Finnish civil defence legislation and Civil defence shelters in Helsinki

- ❑ A civil defence shelter must be built when the size of the building is at least 1,200 m². For industrial, production, warehouse and assembly buildings, the limit is 1,500 m².
- ❑ Shelters places can also be purchased from a nearby shared defence shelter, but the shelter may be located no more than 500 metres from the building for which it is built.
- ❑ Helsinki has approximately 5,500 civil defence shelters with approximately 900,000 shelter places. According to population data, there were 664,028 people living in Helsinki at the end of 2022.
- ❑ The number of civil defence shelters in the city is sufficient to cover not only the permanent residents, but also the population visiting the city and moving outdoors.
- ❑ If a civil defence shelter is used for other purposes under normal circumstances, it must be possible to renovate it for civil defence use within 72 hours. It must be possible to deploy civil defence equipment within the same period.
- ❑ More information on
 - <https://pelastustoimi.fi/en/helsinki/services/civil-defence-in-helsinki/civil-defence-shelters-in-helsinki>

8. Conclusions

1. **Civil defence shelters should always have primary purpose during normal conditions** and secondary purpose as civil defence shelter during abnormal conditions
2. Underground space is a resource for those functions that do not need to be on the surface
3. Land is released for other purposes
4. City's appearance improves
5. Real estate owners may not restrict the use of underground space under their lot
6. Long term underground planning boosts overall safety and economy efficiency
7. More attention should be paid to the attractiveness of underground spaces

Contact details

Ilkka Vähäaho

Alef Geo-Consulting Ltd

MEng, CEO

ilkka@alefgeo.com

+358 500 464 132  

www.alefgeo.com