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Development for urban underground space in Helsinki

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Abstract

Underground space is a resource for those functions that do not need to be on the surface. From the point of sustainability there are several benefits of locating technical networks in bedrock such as expenses are shared by several users, land is released for other construction purposes, the city's appearance and image are improved as the number of overhead lines can be reduced. The Underground Master Plan of Helsinki shows both existing and future underground spaces and tunnels, as well as existing vital access links to the underground. It has been claimed by some non-Finnish experts that the favourable characteristics of the bedrock and the very severe winter climate conditions have been the main drivers for the underground development. While rock material is one of them, there are other main drivers heading the list over winter, such as the Finnish need to have open spaces even in the city centre. Real estate owners may restrict the use of underground space under their lot or get compensation only if the space to be used is harmful or it causes some loss to the owners. The capital areas of Helsinki and Tallinn have grown enormously during the last 20 years. The 80 kilometre-wide Gulf of Finland separates the cities and restricts the movement of people and goods. A tunnel between Tallinn and Helsinki would be an extension of the Rail Baltica rail link, a project to improve north–south connections between EU Member States. The most up-to-date results for developing coastal areas are about the sea level scenarios. This new data has a lot to do for example with the safe and adequate levels of accesses to underground spaces.

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1. Introduction

The roots of this paper lie in a lecture in 2009 at the World Tunnel Congress in Budapest, Hungary. Following this, the theme has been a major subject of interest around the world, mostly in the Far East. Using the City of Helsinki, a forerunner in the field, as a prime example, several papers have been written, numerous interviews given, many questionnaires completed and a number of site visits arranged in order to give inspiration and encouragement to other cities and decision makers on the possibilities of underground space Use [1,2].

The most up-to-date results for developing coastal areas are about the sea level scenarios. As a result of ‘Safe levels for construction at coastal areas of Helsinki in 2020, 2050 and 2100’ project we got the maximum levels of wave crest elevation during a storm surge in the year 2020, 2050 and 2100. The short-term variation in the sea level data was calculated from the per-minute mareograph observations. The rise in the mean sea level due to climate change was taken into account by making use of the mean sea level scenarios. Besides estimating the largest wave field, this report also estimates the combined effect of the water level and the wave field on the coastline. Directly adding together the maximum values of water level and wave height gives too restrictive an estimate, producing values that are impractically large. This new data has a lot to do for example with the safe and adequate levels of accesses to underground spaces [3].

Finnish Tunnelling Association MTR-FTA has also been active in promoting the use of underground space to planners, decision makers and politicians. The Fourth Wave of Rock Construction [4] gives several examples of environmentally responsible underground design and execution.

2. Key considerations for the use of underground space

There are 10,000,000 m³ underground spaces in Helsinki (parking, sports, oil and coal storages, the metro, etc.), more than 400 premises, 220 km of technical tunnels, 24 km of raw water tunnels and 60 km of ‘all-in-one’ utility tunnels (district heating and cooling, electrical and telecommunications cables, and water). Some unique examples of the use of underground spaces are shown in Fig. 1 and 2.

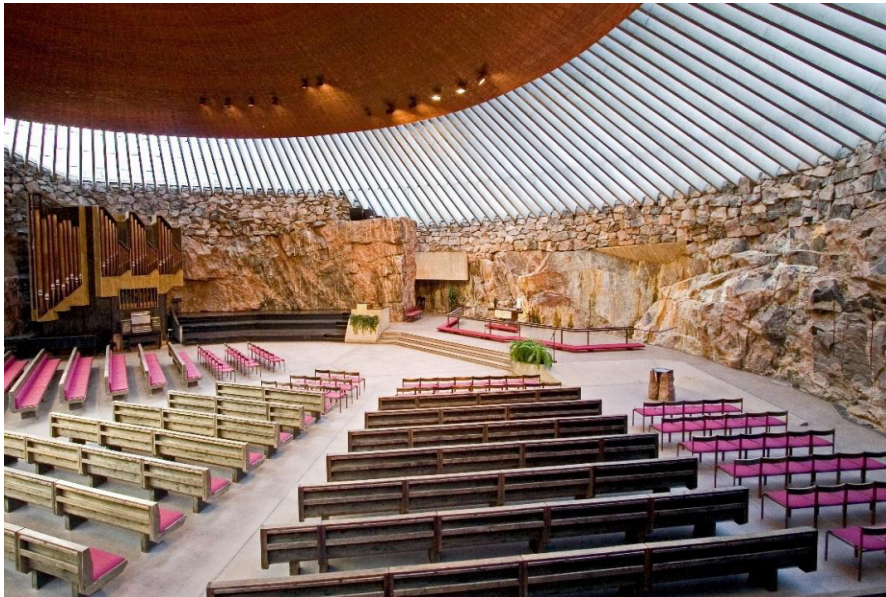


Fig. 1. Interior of the Tempeliaukio Church, which was designed by architects and brothers Timo and Tuomo Suomalainen and opened in 1969. It is also known as the Rock Church. (Photo: Juha-Pekka Järvenpää)

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