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**Autor:** Durmisevic, Sanja / Sariyildiz, Sevil  
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## A Step towards Sustainability through Underground Space Utilisation

**Sanja DURMISEVIC**  
Research Associate  
TU Delft  
Delft, The Netherlands

**Sevil SARIYILDIZ**  
Professor  
TU Delft  
Delft, The Netherlands

Received her master degree in  
architecture from TU Delft in  
1996

Received her degree's from  
Istanbul Yildiz University  
(architect) and master +  
PhD from TU Delft

### Summary

Building underground is becoming an important territory of a modern city. It has a potential to improve our urban environment by relieving pressure from the surface, developing better public-transport network, reducing noise and improving air quality, leaving more green areas in city centre intact and reducing distances by better concentration of functions. All of these aspects seem to be a characteristic of a sustainable city. On one hand, the sustainability of these structures is essential due to high construction costs. On the other hand, these spaces should provide enough flexibility for our ever-changing society and be able to satisfy the needs of the future generations. Therefore, these spaces deserve more attention from urban planners, architects and engineers due to specific requirements regarding both planning and design in order to improve the quality of underground spaces.

**Keywords:** sustainability; flexibility; planning; design; building underground.

### Abstract

It is not possible to discuss sustainability without explaining the meaning of the word. In this context, that will say related to the built environment, a following definition of sustainable development can be given:

*Sustainable development is such development that through its planning provides such design solutions that will assure a continuous exploitation in the future with respect to the existing ecosystem.*

The four apparent keywords in this definition are planning, design, exploitation and ecological responsibility. The hidden words of this definition are lifestyle change and technological development.

On the example of underground designs it will be explained how at the same time different issues related to the sustainability can be addressed. Like for example:

- Problem with infrastructure and mobility in the cities
- Planning and design of underground spaces for the future

## **1. The Indoor City Of Montreal (Canada)**

City of Montreal is an example where the underground transport system was successfully combined with other public functions. On one side, the realisation of Montreal's underground was made possible through well-defined financing scheme, where both the government and the private investors contributed financially to the realisation of the indoor city. On the other hand, such underground was only possible due to parallel and integrated planning and realisation of above ground buildings and underground spaces, since this significantly reduced the investment costs.

It is possible to plan and realise underground spaces and yet provide such design that would make it possible to realise above ground buildings later on. Such planning is very flexible and open for future needs and requirements and at the same time intensifies land exploitation in urban areas.

## **2. Building Today and Planning for the Future – Rijswijk (The Netherlands)**

The existing railway was a barrier in every sense: a visual, physical and psychological barrier. Once, this railway was designed on the edge of the city, but due to extensive development after II WW the city expanded on the other side of the tracks as well, and since then the tracks formed an obstacle for continuous city development. When the Dutch Railway Company decided to increase the capacity and double number of tracks, the municipality of Rijswijk favoured the underground solution. This intervention not only improved the quality of life in the surrounding area and connected the two city parts, but it also gave the possibility for new developments and intensification of the land use above the underground tunnel. It also shows the possibility of having very frequent traffic flow and an important, not only local, but regional infrastructure through the city, which still does not obstruct the daily activities in that area.

In such way, the present needs were met but also a step was made towards the future and possible new requirements. This was done in the following way. By placing railway underground a free space emerged, which planners saw as a chance to create extra green areas in combination with apartment and office building. A part of that area is used at the moment as a park and children's playground, with a possibility to realise buildings above the underground tunnel in the later stage. This was made possible with the realisation, since having in mind that in the future there may be a need to build above the tunnel some columns were reinforced to be able to take over the extra load. At the moment already two buildings are realised above the tunnel: one is an apartment and the other is an office building. In the future it is possible to realise more buildings above the tunnel.

## **3. Conclusion**

Building underground is not an answer for all problems, but it can be a very significant part of sustainable city. Two examples that were explained show that the underground spaces have a huge potential in cities where mobility is essential and land precious to be wasted. They also show the importance of integrated planning of above and underground spaces (Montreal) and the possibility to realise plan in time sequence, depending on requirements (Rijswijk). In other words, utilisation of underground spaces is an important step towards achieving more sustainable urban environment.