

# Why go underground

Print



For hundreds of thousands of years, our natural domain has been a principally two-dimensional space : the surface of the ground.

Urged by necessity, curiosity, and even by temerity, we have always tried to escape from this space, either by widening it, which is only possible in a very restrictive sense, or by searching to utilize the third dimension, upwards or downwards. In these efforts, we have always encountered great difficulties that have been overcome thanks only to an astonishing tenacity.

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So it has been and so it still is in the conquest of the continents, the oceans, or outer space. So it is for the use of underground space.

In this field, as in the others, nature provides many challenges and we must doggedly gather our experiences, draw lessons from failures, improve techniques and use all our resources of inventiveness before succeeding. Underground works have always been difficult but this did not prevent their use at a very early stage of human development, as proved by the discovery of underground excavations that are among the first records of human activity.

Of course, nature, and not mankind, is at the origin of the first underground works. Grottos and caves are the result of the action of the rain, the rivers and the sea, and vital necessity drove early humans to settle in these natural cavities, no doubt to find protection from the weather and from attacks. On this point, it is tempting to think that humanity perhaps owes its survival largely to these natural habitats.

Cavemen's dwellings were an important landmark in the use of underground space by mankind ; with them, the use of the underground became intentional and active.

In every age, considerable use has been made of underground structures for mining and defensive purposes.

However, the most rapid increase in the use of underground works only appeared in the 19th and particularly the 20th centuries, thanks to the impetus of economic development.

During these periods, there was a dramatic increase in underground space use, in mining, in the field of transportation with the development of roads, waterways, and railways , and in the field of hydroelectric facilities.

So, since the dawn of human endeavor - more intensively during the recent centuries, and above all during the last decades - numerous reasons have encouraged mankind to use and develop underground space.

For a good understanding of these reasons, it is necessary to keep in mind certain fundamental characteristics of underground space.

- First, the underground medium is a space that can provide the setting for activities or infrastructures

- that are difficult, impossible, environmentally undesirable or less profitable to install above ground.
- Another fundamental characteristic of underground space lies in the natural protection it offers to whatever is placed underground. This protection is simultaneously mechanical, thermal, and acoustic.
- On the other hand, the containment created by underground structures has the advantage of protecting the surface environment from the risks and/or disturbances inherent in certain types of activities.
- Lastly, another important feature of underground space is its opacity. Thanks to the natural visual screen created by the geological medium, an underground structure is only visible at the point(s) where it connects to the surface.

But what are the main reasons today which justify a more intensive and a better-planned use of the underground space?

## To Know more

### ITA endorsed Publications

- Guidelines presented by the ITA WG 4 on Subsurface planning : To go underground Right or Wrong. ATTSU 1978
- Roundtable session on the subsurface use in developing countries. ATTSU 1982

### Other Publications

- "Development of Urban Underground Infrastructures in the world", Lecture presented by Andre Assis ITA Past-President in 18th National TAC Conference, Edmonton Canada, 2004
- Download the presentation "why go underground"
- Download the booklet "why go underground"

## Social reasons

Cities that are capable of functioning both in social and hygienic terms form the prerequisite for a decent life in built-up areas. Underground space has an important role to play in this respect, i.e. in the achievement of environmentally-friendly development, whether it be in the reduction of pollution or noise nuisance, the efficient use of space, economic development, the preservation of the living environment, public health or safety. In these fields, it offers numerous advantages.

- Tunnels play a vital environmental role by conveying clean water to and by conveying wastewater out from urban areas.
- Tunnels provide safe, environmentally sound, fast, and unobtrusive urban mass transit systems.
- City traffic tunnels clear vehicles from surface streets, traffic noise is reduced, air becomes less polluted and the surface street areas may partially be used for other purposes.
- Underground car parks and shopping malls in city centres leave room for recreation areas and playgrounds above ground.
- Multipurpose utility tunnels are less vulnerable to external conditions than surface installations and will cause only insignificant disturbance above ground when installed equipments are repaired or maintained.

### Indirect benefits

The assessment of underground structures is strongly related to the community valuation of drawbacks of surface or aerial structures in terms of environmental degradation.

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## **Social balance**

More and more, in a sustainable development approach, the PIB is no longer the only value to take into account.

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## **Environmental reasons**

### **Land Use & location**

That means mainly lack of surface place which is now the case not only in mega cities but in nearly all town and cities around the world.

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### **Isolation considerations**

The ground is massive and opaque and provides a variety of advantages in terms of isolation, such as climate, natural disasters and earthquake, protection, containment. Isolation is an important reason for placing facilities underground.

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### **Environmental preservation**

The ground also provides a variety of advantages in terms of protection of the environment, such as aesthetics or ecology. These are notably important aspects in designing facilities with a low environment impact.

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### **Topographic reasons**

In hilly or mountainous areas, the use of tunnels improves or make feasible various tranport options uch as roads, railways, canals, etc.

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## **Economical reasons**

Economical aspects wrongly remain a major barrier to the development of the use of the underground space. Since the initial construction cost of underground structures is generally higher than those of building in the open air, underground structures are in a sense « penalized » when compared to open air construction on this restricted basis. Thus, the economical benefits of an underground facility should be calculated by estimating the life-cost impacts of the benefits provided by such a facility. Moreover, the assessment of the underground structures should take into account the various indirect advantages they offer, notably with regard to the environment.

## **Costs**

## **Financing**

## **Risks**