Cities Think Underground – Underground Space (also) for People

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Abstract

The ACUUS, the Associated research Centers for the Urban Underground Space, was established in Montreal in 1997 to promote partnership amongst all actors involved in the planning, design, construction, management and research on urban underground space. To explain how ACUUS has become an international organization over the years, and recognized by UN-Habitat, the evolution of global attention on underground space since the 19th century, with the gradual arrival of national and international organizations dedicated to the underground. Based on personal experience as a municipal planner, ways in which urban underground space should be planned and managed are described. The underground should be a place for people as much as for tunnels and public utilities. Montreal Underground City, one of the largest of its kind in the world, is used to demonstrate how, since 1962, underground use can evolve and the sub-surface can be “humanized”. Some global trends are described, and challenges that need to be overcome in order to “populate” the underground, are also highlighted.

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1. Introduction

ACUUS, the Associated research Centers for the Urban Underground Space, is a non-governmental organization incorporated in Canada in 1996. However, it started its activities long before, in 1983 in Australia, with a first international conference dedicated to earth shelters. The organization which is independent and funded by its members, rather than industry, is an international ‘Think Tank’ for the world community of planners, architects, geo-engineers,

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lawyers, builders and investors, as well as scholars and researchers, decision makers, cities and private agencies involved in the urban underground space. ACUUS aims at sharing the questions and answers of “Why to”, “Where to”, “When to” as well as the “what is the impact of”, instead of only focusing on the “How to” when it is time to develop in the underground space [1].

2. The Initial Awareness of the Underground Space

Today the most visited places of the world are not the well-known landmarks, such as the Eiffel Tower or the imposing St-Peter’s in Rome. Rather, they are rather train or subway stations whose pedestrian traffic is often ten times higher than those of many of the major jewels of world heritage. It is for this reason that countries and cities grant today as much importance to their underground stations as they do to their tourist icons [8].

To find the first milestones in the awareness of this fact, we must return at the end of the 19th century, when the first subways were built. They were seen as a way to fight unhealthy living conditions in cities. The earliest metro, the London Underground, opened in 1863, to solve the huge horse-drawn traffic problem in London at the time. Several cities decided after London to build subways, as in New York, Chicago, Glasgow, Budapest, Paris, and elsewhere. Despite technical difficulties and comfort problems for their users, the metros enjoyed great success.

Another key milestone in response to poor living conditions in London, was made by the planner Ebenezer Howard who in 1902 developed the visionary and utopian plan called the Garden City, in which he envisaged a series of new towns in the countryside. He basically believed that big cities had no future. On the other side of the English Channel, the French architect Eugène Hénard denounced for the first time, the anarchic use and congestion of the urban underground beneath streets and instead, suggested a more organized approach to use the sub-surface by burying urban traffic, the fluids, waste and goods in a gallery with multiple floors. Decades later, in 1930, Frank Lloyd Wright, the American father of suburbia, dreamt of replacing traditional cities with low-density housing, linked by highways. He assumed that each family would own a car [4].

3. Toward an Underground Urbanism

Underground urbanism also took shape in the 1930s. Inspired by Hénard, the French architect Edouard Utudjian set up in 1933 the GECUS (Groupe d'études et de coordination de l'urbanisme souterrain). That Study and Coordination Group for Underground Urbanism had the objective of promoting better use of underground space in cities [9,10]. Unfortunately, this underground option was firmly rejected by other architects and thinkers as a solution to relieve traffic congestion in cities. Like the Swiss architect Le Corbusier and Frank Lloyd Wright, they preferred to put car ownership at the center of their plans, with high-rise geometric blocks set in open parkland traversed by great highways. Hénard and Utudjian wanted instead a vertical segregation of urban functions, an idea that would remain eccentric in Europe [4].

The situation was quite different in North America. In San Francisco, in 1941, the world’s first underground parking structure was built under Union Square. This was possible thanks to a land lease under a public space awarded to a private corporation. Two years before, the Rockefeller Center in New York opened its door. Developed and financed solely by the billionaire John D Rockefeller, the 19-building complex was the largest private building project ever undertaken in modern times. The complex was built over an extensive concourse with shops and restaurants; access was provided via lobby stairways and elevators in six of the nineteen landmark buildings, surrounding a skating rink. Importantly, a connection to the Subway was provided.

The urban planner Vincent Ponte was another prominent figure in underground urbanism. Ponte was working for the architect, I.M. Pei, when he became involved, in 1957, in the design of Place Ville Marie in Montreal. Ponte envisioned a new concept for that city, which he called "the multi-level, interconnected city". He said: “here we will concentrate the core functions into a tight, totally interrelated unit, doubling and tripling the use of the same parcels of precious downtown land by inserting several levels above and below ground”. Ponte is the one who initiated and planned the Montreal Underground City. Time Magazine, in 1970, would later call him the Multilevel Man [3].

In the mid-sixties, La Défense in Paris started to become a huge transportation hub and a mixed neighborhood with housing and commercial centers. In 2009, La Défense had seventy-one buildings. The organization of the space is based on a strict segregation of land uses with at the surface, a large slab for the pedestrian traffic, while mass transit,
cords, deliveries and parking lots are located under the slab. The so-called “urbanisme de dalle” in French, or Podium planning, was characterized by a total separation of pedestrian paths and vehicular traffic by an "artificial" soil. In the 70s, this kind of urbanism was criticized by contemporary planners [2].

Many other landmark structures were built around the world in the 1960s. Tokyo had in the 1950s many small underground arcades located in basements, but it was the Yaesu shopping mall, opened in 1969 on the east side of Tokyo Station, which would pave the way to similar malls in major cities across Japan. With numerous restaurants, cafes, and shops, the Yaesu mall remains today as one of the largest underground shopping gallerias in the country. All are privately owned, lined with shops and located directly underneath streets, with, as a consequence, the absence of light from the surface and long linear corridors [5].

4. Professionals are Mobilized for the Underground

The 70s saw the gradual creation of national and international bodies, regrouping underground experts, mainly tunnellers and engineers [1,6]:

- 1970: “Association Française des Travaux en Souterrain” (AFTS)
- 1974: International Tunneling Association (ITA) established in 19 countries
- 1975: "Espace souterrain" (France) with architects and planners
- 1976: American Underground Space Association (USA)
- 1983: Birth of the Associated research Centers for the Urban Underground Space (ACUUS) - first conference
- 1987: Underground Space Centre of Japan (USJ)
- 1996: ACUUS is incorporated as an NGO in Canada
- 2005: "Espace souterrain" is absorbed by AFTS and becomes “Association Française des Tunnels et de l’Espace Souterrain” (AFTES)
- 2008: ITA put in place its Committee on Underground Space (ITACUS)

Today, many countries have their own associations or are members of the above.

At a global scale, the underground space took time to find an interest amongst the international agencies. After the Rio Earth Summit in 1992, Habitat II in 1996 reaffirmed the need for improvements in living conditions, using mixed use and services at the local level. The notion of ‘compact cities’ also emerged as a way for more creative reuse of existing buildings and for mixed-use projects. The environmental benefits of compact cities were clear. If you can walk inside your city, supplemented by efficient and clean underground public transport like a subway, the compact city is a premise behind greater usage of the underground space. Based on those concepts, ACUUS conferences have considered sustainable development of underground as a resource for cities - but a non-renewable one.

However, it wasn’t until 2014 that UN-Habitat signed an agreement with ACUUS to raise awareness of the sustainable development of the urban underground space. ACUUS also joined the World Urban Campaign such that underground space could be included as a “Driver of changes” in the document The City We Need 2 prepared for Habitat III last year [11]. Even if those good moves with United Nations, the work of persuasion is not finished yet and we must continue to increase the critical mass of experts and local leaders concerned and truly involved in the underground, not only for tubes and tunnels, but also for a pleasant and safe environment for people. In this regard, the COST Sub-Urban Action, with its key interaction between geoscientists, and especially those from European Geological Survey Organizations, researchers and city decision-makers (planners and others), is a positive contribution toward extending the critical mass, and one which can be built further on.

5. Planning the Underground Space

There are two ways to plan the underground space for a city. The first is to adopt a dedicated master plan, solely for the underground, such as for the pedestrian network of Toronto (PATH) in Canada. In 2000, the City Planning
Department initiated a master plan to improve the PATH network and manage its growth and enhancement over the next 25-30 years. The study was completed in 2012, but the City Council never adopted it, as it was considered to be too long-term a commitment for them [6]. Another good example of dedicated planning of the underground is the City of Helsinki, that adopted in 2010, a master plan for its underground, aiming at reserving and using over the long term some designated publicly owned subsoil for transport, civil defense, sports, public installations, water and energy supply, parking, storage, waste management and similar. However, Helsinki was developing a system of planning for its sub-surface as early as the 1970s, and continued to do so up to 2010². The second way is to develop a master plan of the underground, which is also built into a City or a District Master Plan (i.e. for the surface and above ground). This is the case for the City of Montreal with its indoor pedestrian city, also called Underground City.

Both formulas are valid, but the second approach, at least for Montreal, was preferable because an indoor pedestrian network is part of the city above ground. Because a City Master Plan is usually revised each 5-7 year, and because the orientations in a City Master Plan are usually translated into by-laws and various regulations, which can and should also be used for the underground to orientate its development [4,6].

In both cases, however, some problems can be encountered if the master plan of underground space is too detailed, this is because, in a privately driven real estate market, a city cannot oblige a developer to invest on a particular site, and even less so below ground. Also, a too-detailed master plan takes away the flexibility needed to adapt a development to the local real estate market over time and so to the needs and wants of the City.

6. Underground Space (also) for People

The urban underground space has great potential to contribute significantly to the quality of life of citizens. The underground should also be a place to meet people, exchange ideas, do business or shopping, study or simply to relax. Creating well organized indoor spaces in the underground and providing attractive experiences for users are as easy as they are for buildings above ground. Care should be taken in the planning and design, not only the envelope of a building, but also of the spaces inside the buildings. The needs of pedestrians should be better recognized and catered for - what they like and don’t like inside, and safety should be the number one priority⁷. Without a safety feeling, people won’t be attracted by underground spaces and corridors, even if all of the other design features are provided. Unfortunately, too many architects are not sensitive enough to the question of safety and some not at all, saying that it could damage the aesthetic of their projects or increase their cost. Also, to improve safety, some developers prefer not to be directly connected to a subway station or to an already connected building, pleading that it will be easier to control/manage crowds. This is a major mistake, as they restrict the number of pedestrians who will come inside their basements and ultimately reduce their commercial attractiveness [5].

There are two basic planning principles that should be considered for underground spaces when considering the welcoming of people. The first is to place the pedestrian, the downtown employees, students, the elderly & handicapped persons at the center of the planning effort. Secondly, a good balance should be maintained between the three key functions inside underground spaces, namely: commercial; transportation; and social, including indoor public spaces and street furniture [3,4]. Planning alone is not enough however. Cities also need standards and regulation to guide design, and to implement the planning effort. Amongst the numerous by-laws that a city should adopt for its underground, there are rules and by-laws amongst many others for [4,5]:

- universal accessibility and changes of levels;
- fire protection and emergency exits, which are generally embedded in a building code;
- the opening and closing hours of corridors and tunnels; and
- a signage system to improve the spatial readability, and to prevent hyper-accumulation of signs, media, and displays disseminated amongst corridors and courts.

However, even with good design which fully respects standards and regulations, a successful indoor space also needs good management. The key objective here is to know who amongst the public & private stakeholders is responsible for what in the underground. The task of the city is also to collect consistent data, manage archives and provide free and easy access to the data. A city should favour open dialogue with developers, but on top of that, it should ensure coordination amongst its planners, engineers and architects, as well as with the police, fire departments, the subway operator, and public utilities companies. An often-forgotten task in the management of underground structures is the regular supervision of those structures whether public or private. It is not sufficient that the City
informs and supervises contractors during underground works to ensure the integrity of public infrastructure; it is equally, if not more important to do so after construction, and to continue to do so into the future [6].

Because underground constructing is not only an engineering challenge, a crucial step towards a better planning should be its integration with the local economy and environment, and including the annual budget of the city.

7. The Montreal Underground City

The Montreal underground city dealing with these planning principles, rules and management issues for 55 years, and has built a wealth of experience for others to draw on. The Underground City is a 32 km long indoor pedestrian network, with tunnels only since Montreal has never allowed overhead skyways. The Underground City was named RESO in 2004 (the French translation of network), and users can find maps of RESO everywhere underground, as well as those on posts in the street, and at each entrance). The morphology of the network is like a "net", with public corridors pass through the basements of privately-owned building, and crossing the streets below in a perpendicular way. Started in 1962, RESO was financed only by private developers, with the exception of the Metro, which was inaugurated in 1966. The network is open during the same hours as the subway and its users can walk in the corridors of private properties, even if the shops are closed. Citizens have access through RESO to sixty-five buildings, including hotels, shopping malls, universities, congress centers, public libraries, and a hospital. Most of the CBD office towers are accessible from below and 35% of all downtown shops are included in RESO. Half a million people use it each day [3].

There are three key reasons which have driven the successful development of RESO. Firstly, because Montreal has cold winters and hot summers, RESO provides a controlled climate throughout the year for its users; secondly, it is because of its underground metro system, that allowed easier links of basements to the transport infrastructure; and finally, it is also due to the fact that the city center of Montreal is very compact, facilitating the interconnection between buildings.

The idea behind the Underground City came from Vincent Ponte, just after the Place Ville-Marie opening. For developers around the real estate complex, he prepared the first master plan of the Underground City in 1964, in close collaboration with the Planning Department of the Montreal City. Later, Montreal had two other master plans of the indoor city prepared by the City Planning Department, after the opening of the Metro in 1966. The first was a dedicated development plan, prepared in 1984, which serves as a framework for the approval of underground projects by the City. The last, prepared in 2004, was integrated with the City Master Plan as a strategy to favour pedestrians instead of individual cars in downtown Montreal. The configuration of the indoor city has remained fairly constant over the years thanks to incentives, adapted zoning by-laws and development agreements negotiated with the City [4,7].

As mentioned before, successful underground spaces should be multifunctional, with well-planned and safe spaces for the public, but there is again a little bit more to it than that. Art and culture should also be included within underground spaces, as is the case in Montreal. It started with the distinctive architecture of the Metro. By awarding building contracts for each station to different architectural firms, diversity of style and ambiance was ensured. Instead of travelling into a system where all stations are alike, the users commute within a system where stations are unique, and are decorated with artworks, thanks to the national Act for artworks in public buildings, which requires that 1% of the construction budget of stations be allocated to artworks. With 1.1 million riders a day, the Montreal Metro is now one of the world’s largest underground art galleries [3]. Such examples have influenced developers, who have therefore been more likely to improve their indoor spaces with generous volumes, atriums letting sunlight into basements, and with street furniture, artworks, fountains, sculptures, etc..

8. Key Observations About Underground Space

Some key observations are worth highlighting amongst all of the challenges that cities must face if they want to develop the underground sustainably for coming generations. Obviously, the first is that with the growth of the world's population and worldwide urbanization, the urban future increasingly depends on harnessing the potential of the urban sub-surface. Unfortunately, for many reasons, underground space is not contributing its real value in sustainable development of many growing and dense metropolises [1].
The second observation is that underground space is not a renewable resource, and that it is a part of the next generation's inheritance. Unfortunately, many countries have complex ownership models for the sub-surface, with confusing local responsibilities in terms of providing guidelines, maintenance, repairs, budgets and liabilities. Also, aging urban infrastructure & deferred maintenance are all too common. What is not seen is often not a priority for politicians [1,4].

There is commonly also insufficient coordination and administrative support within cities because of the problem of administrative “silos”, but also because utility companies are not always subject to municipal rules and are handlers of their “underground” territory. There is also the public works market, which encourages new infrastructure development, almost always in ad hoc manner. The other most frequent management problems observed are the absence of dialogue between the city and developers, the lack of updated data and too traditional planning tools which do not include the use of the sub-soil [6].

A further observation is that underground spaces in cities, and essentially those dedicated to welcoming people, are not always seen as an asset that adds to the economic vitality of city centers. Indeed, in many cities, underground spaces are often: not connected to a subway station; unattractive; badly managed from the point of view of attracting citizens and keeping them inside; unsafe; and sometimes empty.

The last key observation is at a more global scale and concerns underground commercial facilities that are not in phase with new generation needs and with new technologies, such as online shopping and the internet of things. Cities are not particularly aware of these global trends which are impacting negatively on downtown commercial streets, as well as underground shopping centers & malls, even if they are connected to subway stations [5].

9. Challenges for an Underground Space for People

In conclusion, the challenges for cities hoping to use their underground space are obvious. They should subscribe to long-term policies and coordinated actions as regards the development of urban underground space, and invest in research programs to improve the performance and lifecycle of their infrastructure [1]. The dialogue between cities and developers should be improved, because cities can’t force investors to build their projects, especially in the underground. Also, apart from subways and public utilities, cities are not able to develop the underground on their own. City centers are also at risk from online commerce. To address this, developers and cities must facilitate the "customer experience" inside underground malls, as well as in subway and train stations, and especially so for younger people (15-34 years) who are major users of shopping centers and have grown up with tablets and smart phones. Finally, professionals should be better trained and aware of the challenges and opportunities the sub-surface presents if they are to adequately plan, build, manage and use it. They should draw on the experiences of international organizations such as ACUUS, ITACUS and SUB-URBAN for providing guidelines and expertise.

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References


See also various documents on the ACUUS and ITA websites (www.acuus.org and www.ita-aites.org).