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The Features of Creation of an Urban Building Environment with Completion of Underground Infrastructure Areas of the City of Yerevan



Abstract: - Underground areas are those parts of the city that can become the best way to overcome the expansion of the surrounding areas of the city, thanks to which new ideas can be created and developed, achieving eco-economic success, creating new opportunities to ensure people's livelihood and security. Underground areas can include transportation structures, passageways, industrial buildings, and public service infrastructure. Basically, the underground areas, developing vertically on several levels, extend under the crowded zones of the city center, in the areas adjacent to the transport hubs. The unloading of above-ground urban areas can lead to the positive process that freed areas will be used to create green zones, improving the sanitary and hygienic condition of the city. It will allow maintaining the existing urban environment, creating favorable conditions for improving people's living activities.

Keywords: urban development environment, underground areas, maintenance of built areas, infrastructures, c. Yerevan:

INTRODUCTION

There's a huge interest in the process of appropriation of underground spaces in modern large cities. It's explained both by the rapid growth of urbanization and by the severe saturation of urban surface areas, especially in the central parts. The solution of these problems, such as the scarcity of urban areas, the daily increase of the population, the increase in the number of cars, the insufficient maintenance of infrastructures, the deterioration of the ecological condition, require the structural replenishment of underground areas and more intensive use [1]. As it is known, although sufficient funds are required for the implementation of the construction of underground areas, it is the most optimal solution for the elimination of many problems. The involvement of underground areas in the urban environment is an inevitable condition in the context of the development of modern urban planning [2]. It predetermines the key to the preservation of urban areas and the solution of everyday socio-economic issues.

MATERIALS AND METHODS

The involvement of underground areas in the urban environment helps to overcome the expansion of the city limits in the vertical direction rather than horizontally. In addition to the construction of residential houses, all other structures of both commercial and industrial nature can be planned in the underground areas such as security buildings, warehouses, transport stations, halls, sports structures of various purposes and many other functionally important infrastructural elements. It should be noted that the complex appropriation of underground areas can lead to a more rational use of freed above-ground areas, such as increasing the construction of residential buildings, increasing and improving green areas, reducing ground vehicles, and reducing engineering communications. Such examples can be found in the underground part of the central streets in many cities: in the underground part of Kreschatnik Street in Kyiv, in the section of Kinza Street in Tokyo, in the underground parts of the streets of "Down Town" in Montreal and in many other cities [3].

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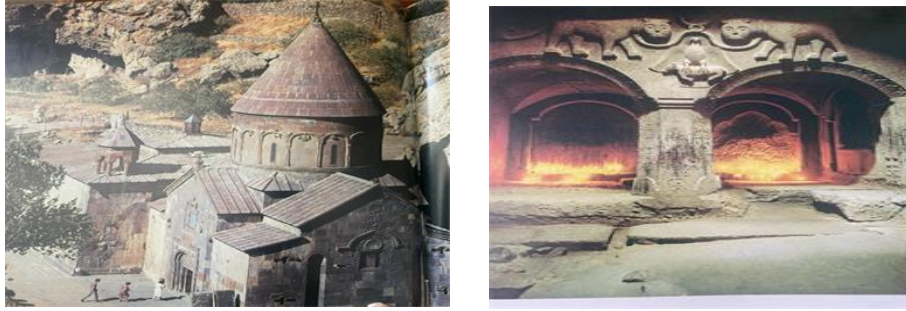


Fig. 1. a, b - Geghard church complex and Vimapor bell tower built in 1177 Armenia²

Among the underground infrastructural structures, the most important role take the means of transport, the first of which is the urban transport, the subway, which was originally an underground means in the urban environment. It is important to note that the underground areas can have multi-functional, multi-service facilities, shops, stations, parking lots, which will be connected to the above-ground structures by elevators, escalators and moving walkways. The use of such systems exists in Paris, London, New York and other cities. The complex use of underground and above-ground areas allows to jointly solve problems such as city-building, transport, engineering, social problems, improving the architectural layout system of cities, freeing above-ground areas from public and industrial infrastructures. Rational use of freed areas can be a stimulus for residential construction, improving and restoring green areas. At the same time, carefully preserving the historical monuments and unique structures of value in the above-ground area.

RESULTS AND DISCUSSION

Exploitation of underground areas started long ago in human history. The prototype can be considered the natural excavation niches in the rocks, which were a means of living and protection, already in the first millennium BC in Armenia as well as in other countries.

As mentioned by historians, Armenian architects, the cities of Teyshebani, Argishtikhinil and other cities were built on impregnable rock formations, which had various migration routes and dugout settlements, which were designed for protection and security [4]. It is also worth mentioning the 5th century church complex, Geghard (Fig. 1 a, b), which was built instead of the quarry church of Ayrvank in the 9th-10th centuries. In 1177, the bell tower of St. by Grigor the “Lusavorich”, which is entirely in the rock. In the modern city of Yerevan, there are also several examples of the use of underground spaces: "Metronome" on Abovyan Street, which is an underground two-story structure with many trade and service sector facilities, with an amphitheater part for certain performances and exhibitions (Fig. 2).

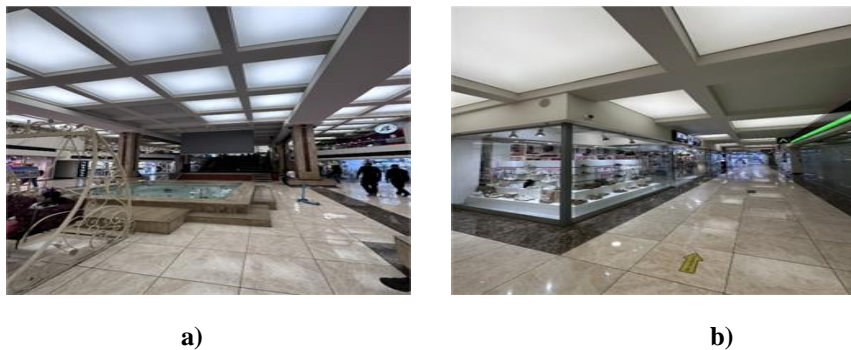


Fig. 2. a, b, "Metronome" public service center built in the underground area of Abovyan street in Yerevan³

² <https://whc.unesco.org/en/list/960/>

³ <https://metronome.am/>

The service zone named "No. 1" built in the underground area at the intersection of Mashtots and Aram street is no less remarkable, where shops, cafes and other service facilities are included (Fig. 3 a, b).



Fig. 3. a, b - "No. 1" underground area built at the intersection of Mashtots and Aram streets in Yerevan⁴

"Tashir Street" is also interesting, it is located in the underground area along Northern Avenue (Fig. 4 a,b), where many shops and cafes are included and it extends along the entire street. It is serviced by elevators and escalators.

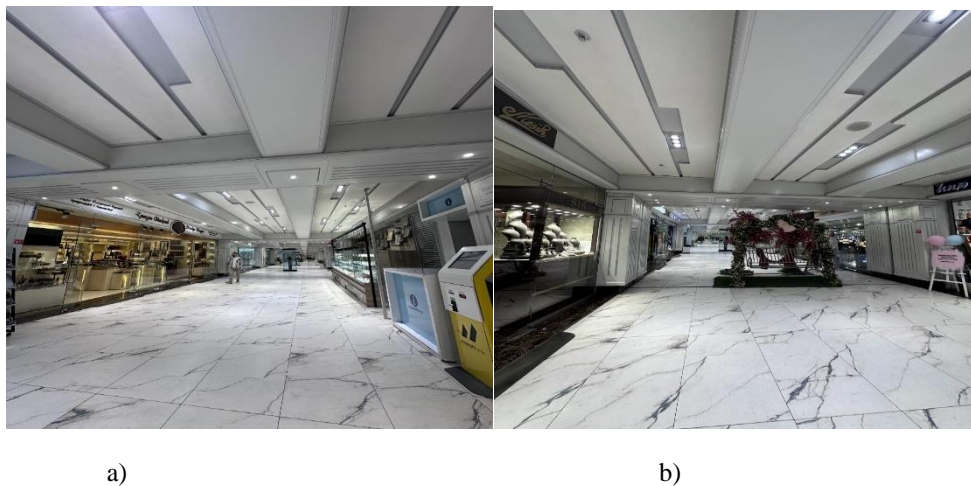


Fig. 4 a,b: Yerevan, Northern Avenue <<Tashir Street>> underground infrastructure complex⁵

Modern architectural and constructive solutions are one of the important circumstances for mastering the underground spaces. The design of interior spaces - the design where human activity is planned for the long term rather than the moment. Lack of daylight, the very fact of being underground (especially if it's long-term) increases fatigue and has a bad effect on the human body. For this reason, the underground spaces work to be more than comfortable, illuminated by many artificial lights and colors. This can be achieved by the sequence of competently designed areas and also the provision of special fans, the presence of which does not allow people to suffer from agoraphobia and the negative feeling of claustrophobia. The acoustics of the area also have an important effect, which can contribute to the well-being of people. Modern communication links also facilitate the connection of people in the underground area with the external surface areas and also the fact of ensuring security issues in the underground areas is considered extremely important. Operation of underground areas not only ensures the

⁴https://www.reddit.com/r/armenia/comments/ma05ae/new_underground_street_pass_under_mashtots_street/?rdt=63562

⁵ <https://visityerevan.am/places/details/330/en/>

maintenance of vehicles, but also ensures the solution of a number of problems together, providing for the implementation of underground multi-functional complexes for various purposes: trade, service, sports, events and other purposes [6].

Such examples are already being used in many cities around the world and are having a positive impact on the city's infrastructure. For example, the shopping center La Rochelle (on 44 ha) has a railway and bus station, a parking lot for 5000 cars, a theater, and a hotel. Commercial halls make up 72 thousand square meters (Fig. 5 a, b) [7].

For transport service in the public center, several levels of underground spaces are provided by law, which are used for different types of transport. It is customary to use the lowest level as subway stations, the others for railways, and the top level for cars and people. The best example can also be the Paris La Défense complex, where many public and administrative structures are located in the underground areas (Fig. 6). It is placed on several levels taking into account the functional type of service, vehicles are located in the underground section.



Fig. 5. a,b La Rochelle shopping center⁶

By studying many examples of the experience of the existing cities of the world, it can be concluded that the inclusion of underground areas to the built-up above-ground areas of the existing cities gives an opportunity and an advantage in the economy of the area, since the planned underground structures can be expanded by increasing the surface of the city without taking into account the complexity of the terrain.



Fig. 6. " La Défense " complex in Paris⁷

The best example of this can be the ingenious connection of above-ground and underground structures on the banks of the Rhine River in Germany, which includes both the railway station (fig. 7 a,b) and the green mass of the famous park leading to the Rhine River, two museums, a concert hall and five levels underground. the parking

⁶ <https://en.tripmydream.com/france/la-rochelle/shopping>

⁷ <https://urbanplanet.info/urbanism/la-defense-a-unique-business-district-france/>

lot, which is located on the relief along the river and is an additional protective measure for the underground museum and concert hall.

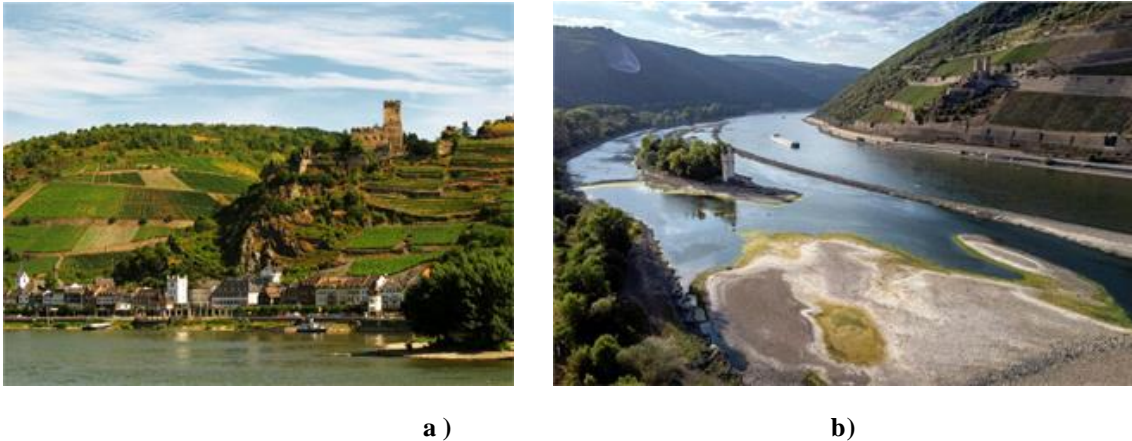


Fig .7 (a, b) . The Rhine River, two museums, a concert hall and five levels underground, the parking lot

Conclusion

Exploitation of the underground areas began long ago and is now under development. Over the centuries, it has been refined to become a hub for multi-functional applications, solving a variety of transportation, engineering and social problems. The inclusion of underground areas with city areas creates opportunities for complex operation, which will allow the development of the city in the vertical direction while limiting its development in the horizontal direction. No less important is also the replacement of the freed areas due to the relocation of a number of public structures in above-ground urban areas with green zones and residential districts, which can significantly improve the lifestyle of the population by getting rid of traffic and other noises.

The presented concept can be the basis for the present and future of the city of Yerevan, and it will provide a reliable and safe environment for the population, making the city more prosperous and comfortable.

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