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Urban utility tunnels as a long-term solution for the sustainable revitalization of historic centres: The case study of Pamplona-Spain

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ABSTRACT

This paper exposes, through the case study of the city of Pamplona (Spain), the benefits of employ a system of urban utility tunnels (UUTs) for the smart and sustainable regeneration of historic centres. Governors and technicians of the city of Pamplona faced the challenge and responsibility to protect the historical and cultural heritage of the city and, in turn, to of adapt it to the needs of an ever changing society taking into account the new social and functional needs. This situation motivated the election of a system of UUTs as an optimal solution thinking about the future because it facilitates the maintenance, renewal or expansion of utility networks, while reduces inconvenience to residents and visitors by minimizing works in public space and visual pollution caused by aerial and fixed on facades wiring. This action allows the inhabitants of the historic city centre to have the same opportunities as citizens of new urban developments to enjoy the same quality, or more, of urban basic services and infrastructures. Likewise, in this paper will be presented the main difficulties encountered for the development of the project and the constructive solution finally executed.

1. Introduction

The historic centres are spaces full of cultural, historical, social, symbolic and urban values, which represent the collective memory of their cities. Not in vain, they were cities in the past and for that reason they are usually strongly marked by an urban fabric that responds to the origin and evolution of the primitive city. In this city the headquarters of the political, religious and economic powers were concentrated so they used to have a high amount of buildings of historical and artistic value.

Throughout history, the defensive need of the cities demanded that they be protected by ramparts, situation that resulted in a slow urban development that only allowed them to grow in height, adding new floors to the existing buildings. The consequence was a high density of buildings with poor hygienic conditions and the absence of public spaces and infrastructures.

The loss of the defensive function of the city walls together with the increase of population and the search for new amenities changed, in the late nineteenth and early twentieth centuries, the growth model of cities. It was allowed the construction outside the city walls and even the demolition of some of the ramparts, which propitiated a new model of creation of neighborhoods or urban enlargements that is still used nowadays.

Over the years, this model of city growth, based on an expansion of the existing urban fabric and the creation of new neighborhoods, has led to the emergence of numerous environmental, social and economic problems. On the one hand, the search for better living conditions displaced most of the population, industries and even public organizations to the new neighborhoods causing the abandonment and deterioration of the old city. The main problems resulting from this situation are: buildings deterioration, precarious living conditions, loss of functional vitality, demographic emptying, aging, residential underuse, mobility and parking difficulty, and precarious level of facilities and services. On the other hand, as a consequence of the above, and taking into account that soil is a limited resource, the transformation of rural to urban land implies a series of detrimental effects on the environment, which multiply with the disproportionate increase of urbanized areas (Troitiño, 2003).

It makes no sense to continue with the cities growth by emptying and letting existing urban areas deteriorate. Faced with the need to constantly adapt the physical support of the city to increasing and changing demands for activities and urban uses, the European Union itself pointed out the need to promote settlement model that make an efficient use of the natural resources, limiting land use and the urban expansion precisely among its objectives for the improvement of urban environments (European Commission, 1998).

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With an increasingly population inclined to live in cities, it is necessary to change the paradigm of urbanism in cities and to promote a new model based on principles of sustainability, which favors the urban regeneration (environmental, functional and socioeconomic) of degraded areas instead of the expansion of the city. It seems evident that the rehabilitation of historic city centres is one of the opportunities that allows to achieve a sustainable development, since it provides the use of existing structures, avoiding the increase of built areas and providing the reduction of material consumption and production of waste. It also makes it possible to preserve the identity of the place and foster social and cultural sustainability, turning these sites into powerful focus of tourist attraction and whose heritage safeguard is necessary. Therefore, there must be a balance in its functional reuse, maintaining and making compatible residential, tourist, cultural, commercial and public uses.

Among the actions required in these urban environments in the functional area are actions on urban basic services, infrastructure, mobility and accessibility, housing, facilities, parking and public spaces. Urban basic services are those that promote and guarantee the quality of life of a population, are indispensable for citizenship, and therefore, it is necessary that they have continuity, regularity, uniformity, quality and efficiency. The functioning of the city is directly linked to the quality of these services. However, as a result of the complexity and configuration of these services, whenever there have been significant economic and technological changes in history, the functionality of historic centres has been questioned.

Traditionally, urban service networks have been built underground, such as sewerage or water supply pipes, whose origins go back to Roman times. With the increase in population in the cities and the technological advance, some new urban service typologies appeared at the end of the 19th century coinciding with the Second Industrial Revolution, such as electricity, gas or telephony. Most of these networks, based on extensive cabling, went on to indiscriminately occupy part of the facades of buildings regardless of their patrimonial value.

At the end of the 20th century, the authorities realized that these infrastructures capable of generating quality of life for society and whose absence would be difficult to imagine in our daily lives, were becoming security risks and a threat to the historical heritage and urban space, which the municipal leaders wanted to conserve and rehabilitate, because of the visual pollution that they were generating. This situation led to a special reference to the prohibition of the execution of new overhead wiring in urban development plans and laws for the protection of historical heritage, and even to urge the burial of existing ones in protected areas of cities.

However, far from achieving this objective, the problem of visual pollution of historical centres has recently worsened with the advent of the telecommunications and digital revolution. The liberalization of operators and the incorporation of new technologies (mobile telephony, internet, digital televisions,…) lead many companies, which do not want to assume great costs, continue indiscriminately occupying the facades and roofs of buildings with their fibre optic cables and antennas.

This same situation occurred in the historic city centre of Pamplona at the end of 20th century. The main characteristics of the urban basic service networks were the following:

- Sewerage and water networks run through the subsoil. Sewer networks are unitary (they do not separate wastewater from rainwater) and, due to their construction systems and obsolescence, have a large number of leaks. Sewerage leaks generates problems of soil contamination and leaks and bad odors in the basements of nearby homes. It can also cause alterations in the soil with the consequent problems of differential settlements of the foundations of nearby buildings. In the case of water supply networks, the leakages of water suitable for human consumption generate significant economic losses and also problems in the subsoil and foundations.
- Electricity, gas and telephone networks run in the majority of cases indiscriminately through the facades of buildings. In many cases new networks overlap with others that are no longer in use.
- Narrow section of the streets (distance between facades) that makes impossible to comply the safety regulations in terms of minimum distance between utilities. Any work on the street to make a repair or modification prevents the access of vehicles and/or people.
- Existence of a great number of pipes, ducts and cables of different companies that cross in the subsoil without any coordination and many of them out of service. At the time they were built, the exact point by which they run is not documented, so it is often difficult to locate them in order to act on them.
- Continued disturbance by the problems generated by the opening of trenches for the repair and renovation of networks, or the need to make new connections to buildings that are rehabilitated.
- Functional and visual impact caused by the multiplication of waste containers as a result of the waste selective collection to facilitate their recycling.
- Prohibition of the city councils to carry out new overhead wires on facades and to install elements such antennas or air conditioning units in order to eliminate visual pollution and improve the aesthetics and environmental quality of cities. On many occasions this situation gets to generate conflicts with the operators, preventing some citizens from accessing the services they offer.
- New forms of life, the advancement of technologies and competition between utility companies require the deployment of new telecommunications networks.
- Archaeological potential in the subsoil of historic centres, whose need for protection and safeguard may prevent the creation of new trenches for utilities.

In view of this situation, it seems obvious that if citizens want to enjoy in the historic centres with the same quality of life and endowments as in a newly developed area, through a modern and complete infrastructure network, it is necessary that the protection and recovery policies must have effective tools and solutions to regulate and resolve the tension between static physical realities and changing socio-economic realities. Achieving a balance between the two sides and arriving at consensus solutions becomes the challenge of government and utility providers. Achieving sustainable development between history and present, technology and heritage must be the challenge of intervention policies in historic centres.

Unfortunately, when urban redevelopment works are carried out in historic centres, the solution that is still being used, in the 21st century, in most cities is the burial of utilities networks using the traditional opening of trenches in the subsoil. A situation that in many cases is due to the ignorance of its municipal leaders and practitioners and in other cases to the scarcity of resources or the obsession to reduce the initial costs of the investment without thinking about the long term, that is, the complete life-cycle of the solution.

This paper will try to explain, following the pioneering case study of the city of Pamplona (Spain), how to solve these problems through the use of urban utility tunnels in the regeneration of the historical city centres. Nowadays, there are many experiences of building urban utility tunnels in the development of new urbanizations (Canto-Perelló and Curiel-Esparza, 2001; Canto-Perelló and Curiel-Esparza, 2013; Glerum, 1995; Goel, 2001; He et al., 2012; Hulme and Burchell, 1999; Hunt and Rogers, 2005; Phienwej, 1998; Rogers and Hunt, 2006; Yang and Peng, 2016), but there are almost no cases in which they have been used in historic city centres.

2. Approach to the concept of urban utility tunnel and its advantages

An urban utility tunnel (UUT), also called multi-utility tunnel, common utility tunnel, utility corridor or utilidor, can be defined as any system of underground structure containing one or more utility service