

SCIENCE, INNOVATIONS AND EDUCATION: PROBLEMS AND PROSPECTS

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TYPES OF BRIDGES IN URBAN ENVIRONMENT

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Abstract: This scientific publication is devoted to bridges in the design of architectural environments. It reveals the previous work of scientists on the topic. Prerequisites for the use of bridges in urban space have been established. Their varieties are identified by different indicators. The classification of research objects by function, structural system, location in the environment, service life, purpose, spatial organization, length and materials used has been supplemented.

Key words: bridge, multifunctional bridge structure, urban environment, classification, modern varieties.

Introduction. The development of large cities and suburbs for recreation, leisure and tourism is often complicated by natural constraints. Among them are such as deep rivers, canyons, etc. Therefore, bridges are used to cross roads, pedestrians, waterways and other roads through such obstacles. Thus, bridges are architectural and engineering structures designed to cross the road over any obstacle (river, canal, ravine, gorge, other road, etc.). They can serve as communication in detached high-rise buildings. Thus, they give exquisite features to the architectural composition of urban development.

Today, bridges have lost many of their functions. Residential bridges are no longer popular, and the defensive function until recently was completely ineffective and unnecessary. But those of them that have survived to our time, as well as modern bridges, have found a new function. They have become an adornment of urban spaces, art objects, attractions for tourists, and often places for recreation with observation decks. Many bridges are outstanding monuments of architecture and

engineering because of their interesting design or successful location. Almost devoid of decor, they, however, due to their massiveness and expressive architecture create a feeling of strength and reliability. Or, conversely, successfully integrated into the environment, they dissolve and become one with the surrounding space. From the usual straightforward communication paths, bridges gradually acquired new functions, aesthetic qualities and complex spatial solutions [1, p. 132].

The purpose of this article is to highlight the types of bridges at the present stage of their development. Bridges and bridge structures are the subject of this study. Various research methods are involved in the work. The historical and theoretical method was used during the analysis of the scientific source base of the research. A comparative and historical method has been used to study the evolution of the formation of bridges in cities in domestic and foreign practice and to substantiate the peculiarities of environmental design with the inclusion of research objects. Structural-functional method has become key in the study of functional and spatial organization of bridges and bridge structures. The empirical method was useful during the visual analysis of modern urban spaces, the structure of which includes objects of study, their field survey.

Result of the research. First of all, encyclopedic sources are used in the work, which make it possible to understand the very concept of "bridge", its varieties and derivatives. It was found that the modern terminological apparatus in the study of these objects primarily represents the concept of "cities" – pedestrian, transport, parkway, junction, pontoon, etc. At the same time, it includes such concepts as "bridge structure" (viaduct), "engineering structure" (flyover, overpass, tunnel), "metro bridge", "eco-duck" ("Wildlife crossing"), "biotransition", "multifunctional bridge" building "(according to M. Makukhin, [2]).

Professional dictionaries [3], reference books [4], textbooks and manuals [5-7] became important assistants in the study of the object of research. They are devoted to such aspects in bridge construction as the design and operation of bridges of different materials, their types, design parameters and calculations, reconstruction of existing facilities.

Many scientists are interested in studying the bridges. The works of the above-mentioned scientist M. Makukhin are devoted to multifunctional bridge structures [8; 9]. The relevance of these objects in the scientific community is confirmed by separate collections of scientific papers on bridges: by T. Demchenko [10] and P. Koval [11], scientific monographs including by V. Kosyak [12], dissertations [13]. Significant importance among the materials belongs to the normative documents. – state standards of Ukraine [14]. Separate publications of scientists are devoted to the study of bridges in terms of their design and technical characteristics [15; 16; 17]. To this list should be added Internet resources that allow you to immerse yourself in the virtual world of urban spaces around the world with bridges in their structure. Previous author's research of bridges in the urban environment is also worth noting.

The preconditions for the use of bridges in urban space directly depend on the needs of the area where they are built, and the functions that the future structure should perform in this environment. The factors of formation of architectural-spatial and aesthetic solution of bridge constructions of M. Makukhin are used in the work. They are in natural conditions; parameters of the future building; location of the area with the bridge in the planning structure of the settlement; functional and planning organization of the environment and accessibility requirements for everyone.

It is impossible to determine when the world began to build bridges. However, we can be sure that their first incarnation was a very common fallen tree. It is overthrown so that both ends lie on opposite banks of the river. Of course, such a design was difficult to call an engineering creation. Its use was not safe or convenient. However, the idea itself certainly deserved to come to life. Later, it was reflected in both natural and stone structures.

The scientific work revealed that in the planning structure of the city bridges are located along the riverbed, in areas of historical fortifications of cities and in the relevant point locations. These facilities are accessible to all residents of the city, including those with limited mobility. They are objects of both landscape and urban environments at the present stage of existence (Fig. 1).

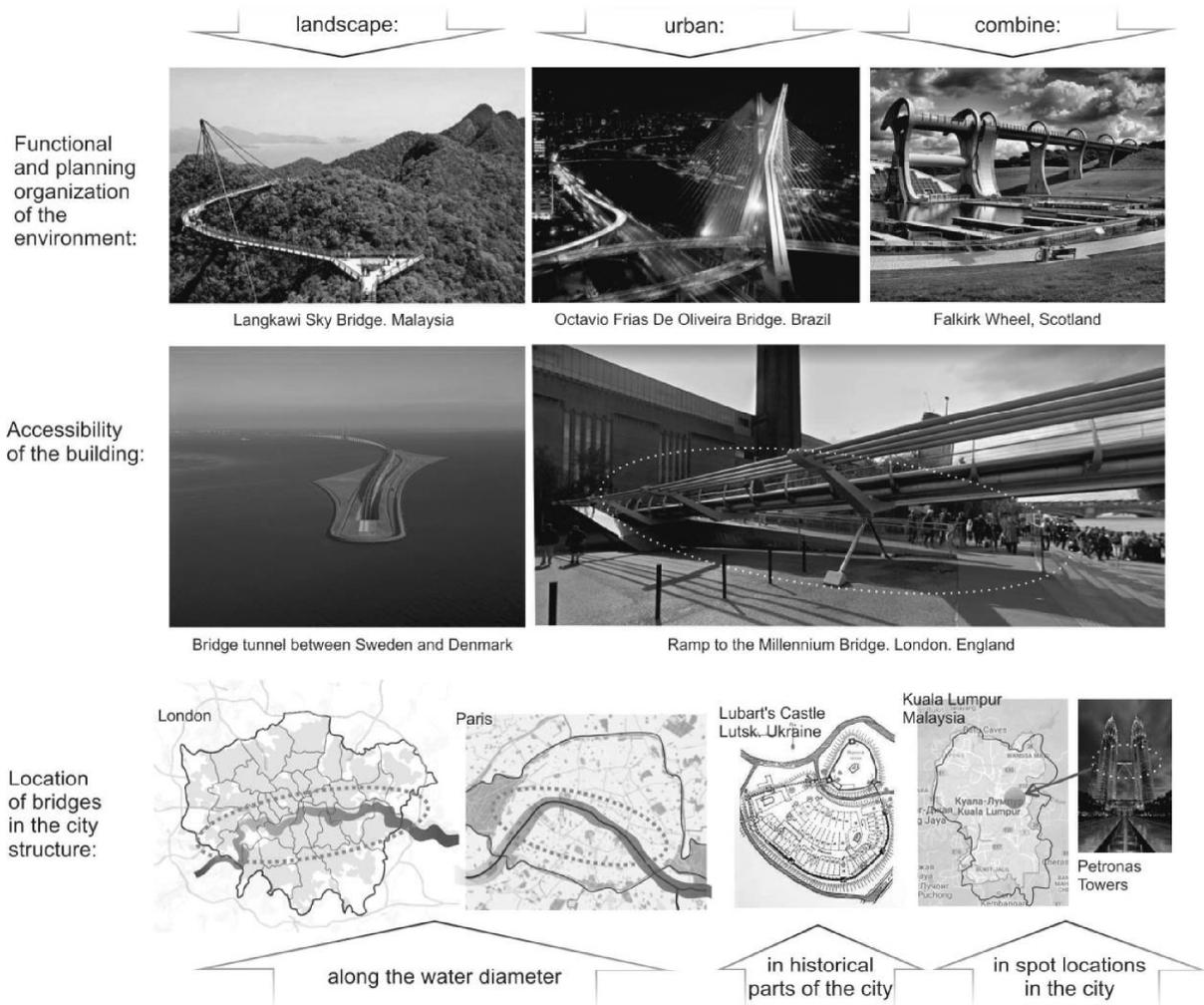


Fig. 1. Bridges in today's environment

As a result of careful analysis of a number of bridges in domestic and foreign cities, their classification has been improved. Taking into account modern experience, the existing classification was improved by function, design system, location in the environment, service life, purpose, spatial organization, length and materials used. Bridges perform the following functions in the urban environment:

- *communication* – for carrying cars, pedestrians through an obstacle;
- *tourist* – bridges, which are built as a lure for tourists;
- *public* – bridges with offices, recreation areas, libraries, parking lots, etc.;
- *historical* – bridges that have lost their primary purpose, and today have become a monument of history, construction and use of such constructive solutions (defensive bridges);

- *residential* – bridges with residential buildings located on them. Today, some residential bridges can be considered historic, but some of them still function as housing;

- *combined* – bridges that combine several functions.

Research has shown that bridges are intended for railways; automobile; metro bridge; pedestrian; water overpasses – bridges for boats, rafts, kayaks, etc.; combined – when combining several types; aqueducts. There are the following objects of study by spatial solution: bridges; overpasses – bridges with traffic in several levels; overpasses – multilevel crossings of transport routes; drawbridges; pontoon bridges – bridges with floating supports.

Stone, steel, reinforced concrete, and wood are mainly used for load-bearing supports in bridges. According to the constructive system, the objects of study can be:

- *with beam system* – is provided by overlapping of small runs between supports by means of beams; this is the simplest type of bridge. In this system, only vertical loads are transferred to the supports from the beams, and horizontal loads are absent. This is a characteristic feature of such a system;

- *with spacer system* – the system differs in the presence of not only vertical but also horizontal spacing forces;

- *with a combined system* – is formed using load-bearing elements of different systems in one building;

- *pontoon bridges* – temporary structures with floating supports;

- *temporary bridges*, their service life may not exceed 10 years. In addition, they are often seasonal, because in winter, when the water freezes - ice makes the structure unstable. Such bridges can be used as a road crossing, a pedestrian path to overcome a water obstacle or just for walking.

The length of the bridge is: small – up to 25 m; medium – 25-100 m long; large – more than 100 meters long. In terms of service life, bridges are divided into temporary (service life up to 10 years) and permanent.

Varieties of existing objects of research at the present stage of their functioning are found out. Among them are defensive bridges, historical, aqueducts, bridges-

buildings, transformed (folding, lifting, turning), subway bridges, tunnel bridges, air, "living", entertainment, kinetic. Most of them are actively used in modern functions, some - in the primary, the rest - in tourism (as objects of tourism and to demonstrate picturesque landscapes), as shown in Fig. 2. In the further practice of designing bridges and their implementation there are ecological bridges made of containers and natural plants, bicycle bridges in the city center, bridges-museums, bridges-galleries, heavenly bridges and bridge-loop. And this is not the whole list.

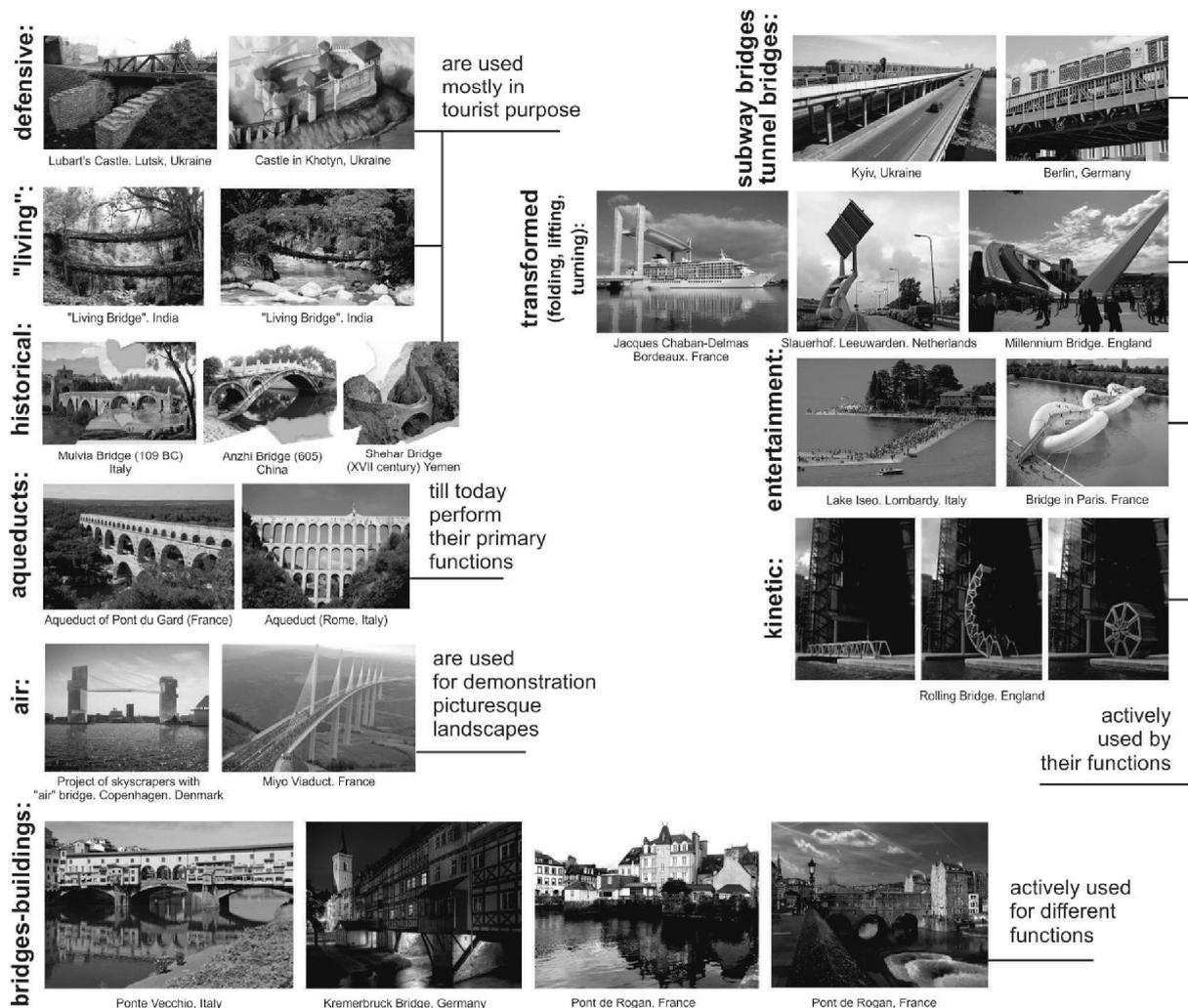


Fig. 2. Types of bridges at the present stage of their study

Conclusions. World theory and practice of the use of bridges has shown their significant evolutionary progress. From the usual straightforward communication paths, bridges gradually acquired new functions, aesthetic qualities and complex spatial solutions. Therefore, the modern terminological apparatus in the study of these objects together with the concept of "bridge" includes such as "bridge structure",

"engineering structure", "Metro bridge", "eco-duck", "biotransition", "multifunctional bridge structure". The types of existing research objects at the present stage of their functioning are clarified in this work. The classification of research objects is significantly supplemented by function, design system, location in the environment, service life, purpose, spatial organization, length and materials used. Variability in the use of materials and types of design solutions have contributed to the emergence of a number of interesting examples of urban design with the inclusion of bridges. This area is promising in the field of architecture and urban planning.

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