7. Янковская Ю.С. Семиотические механизмы социально-психологической обусловленности архитектурного проектирования / Ю.С. Янковская – Архитектон: известия вузов. №1(6), 2004.

THE CONCEPT OF FRAME IN HISTORIC CONSTRUCTION CONTEXT

EUGENE SURZHAN, post-graduate student
O.M. Beketov National University of Urban Economy in Kharkiv

Space frame is one of the most widely used building designs. Recent developments illustrate great economical advantage of implementing constructions of that type in projects. However, little research in revealing adjustable design prescriptions for Ukrainian construction industry has been pursued. The paper examines the conceptual variety of f*rame* designations in construction domain. The aim has been to give a brief insight into evolutionary history of the concept of *frame* in construction space.

The first prototype of a frame is considered a truss. *Truss* first was mentioned in ancient Egypt and according to Online Etymology Dictionary, meaning "framework for supporting a roof or bridge" [1] was first recorded in 1650.

A diversity of definitions of this facility in construction terminology proposes a wide range of its designations. For instance, according to Costanzo & Francesco, «In engineering, a truss is a structure that consists of two-force members only, where the members are organized so that the assemblage as a whole behaves as a single object» [2].

The Columbia Electronic Encyclopedia gives the following definition of the notion in question: «Truss in architecture and engineering, a supporting structure or framework composed of beams, girders, or rods commonly of steel or wood lying in a single plane. (...) Trusses are used for large spans and heavy loads, especially, in bridges and roofs» [3].

In current meaning *truss* is a geometry sustainable system of bars to convert bending loads to a compression and tension. It can be plane and three-dimensional.

The further development of the facility was necessitated by the demand to build covers with a longer span. Thus, timber beams, connected in five or more triangles, were used by builders. Using mentioned above designs was spread in Greece, Rome Empire and Middle East.

New horizons were opened when engineers started to implement cast iron as a building material in trusses and in a construction in general (in the seventeenth century – England, France, Germany and Russia). It is necessary to emphasize the fact that cast iron possessed a number of poor qualities, in particular low tensile strength. Thus, it confined possibility to cover spans over 30m long.

In the eighteenth century technological discoveries fostered using iron for building needs. At the same time a new mechanical theory, describing the behavior of trusses under impact of external load appeared. Polonso was the author of this theory.

It permitted to combine compressed cast iron and tensile iron elements in one design, with significant increase of span length and price decrease.

In the 30s of the twentieth century metallurgists made their contribution to strengthening riveted joint. It facilitated implementation of the theory of Ritter & Culman for space frames and trusses. It's novelty was in latticework application.

In 1896 the Eiffel Tower was built. It was erected due to advance in science and technology. The Eiffel Tower height is 324 meters. It is noteworthy to mention that it had been the highest man-made structure in the world up to 1936. The Eiffel Tower was further development of truss systems and represented space framework.

In 1896 V.G. Shukhov invented the first double curvature steel space framework [4]. Practical calculations of stresses and deformations of beams, involved in space framework, were first carried out by V.G. Shukhov. Moreover, he was the first who describe by mathematical model the behavior of shells and membranes on elastic foundation. The legacy of Shukhov predetermined modern engineering and architecture advance.

Fuller Buckminster (1947) investigated approximation of spheres. He showed that using triangulation can be applied for round surfaces.

In 2014 Heydar Aliev Center won Design of the Year Award [5]. It was designed by Iraqi-British architect Zaha Hadid and was "noted for its distinctive architecture and flowing, curved style that eschews sharp angles" [6]. It is obvious that 'fluid" shape appeared mainly owing to steel space framework.

Werner Sobek solved one of the biggest challenges of the project, having proposed methodology of geometrical approximation for double-curved surfaces of different types. Actually the approximation is the key for engineers as it allows building *the space frameworks.*

However, proposed methodology has a disadvantage "due to double-curved geometry, all nodes and members of which are different and individually produced» [7]. That feature requires individual treatment at the stage of development and production. Thus, it cannot be applied for industrial design.

At the present stage the erection of reticulated structures and trusses on free-form surfaces is possible only when individual project has been pursued for each building. However, mentioned above circumstances lead to increasing expenditures. One of the solutions is to develop new technique for approximation of different Gaussian curvature surfaces to enable applying framework with pre-assembled elements.

References

1. Online Etymology Dictionary. (n.d.). Truss. Retrieved from http://www.etymonline.com

2. Costanzo, F. (2013). *Engineering Mechanics: Statics (2nd ed.).* New York: McGraw-Hill.

3. Columbia University Press (n.d.). Truss. Retrieved from http://www.cc.columbia.edu/cu/cup/

4. Structurae (n.d.). Hyperboloid water tower. In *Structures*. Retrieved from http://structurae.net/structures/hyperboloid-water-tower

5. Montgomery, A. (2014, July). Zaha Hadid building is 'best design of the year'. Retrieved from http://www.designweek.co.uk/issues/june-2014/zaha-hadid-building-is-best-design-of-the-year/

6. Wikipedia. (2015, January). Heydar Aliyev Center. Retrieved from https://en.wikipedia.org/wiki/Heydar_Aliyev_Center#cite_note-5
7. Bekiroglu, S., & Hadid, Z. (n.d.). Heydar Aliyev Center. In *Architettura.* Retrieved from http://www.archimagazine.com/aheydarali.htm

TRANSPORT INNOVATIONS

ANASTASIIA TOMAKH, student
YEKATERINA VAKULENKO, Associate Professor (Transport Technologies)
IEVGENIIA MOSHTAGH, Senior Teacher of English
O.M.Beketov National University of Urban Economy in Kharkiv

Transportation has been one of the essential components of the civil engineering profession since its early days. From time immemorial, the building of roads, bridges, pipelines, tunnels, canals, railroads, ports, and harbors has shaped the profession and defined much of its public image. As cities grew, civil engineers became involved in developing, building, and operating transit facilities, including street railways and elevated and underground systems. The role of civil engineers is providing transportation infrastructure to accommodate a growing population.

Transportation systems consist not only of the physical and organizational elements that interact with each other to produce transportation opportunities, but also of the demand that takes advantage of such opportunities to travel from one place to another, that is why development of transport infrastructure and introduction of innovative solutions in this field is considered as a substantial target in progression and reconstruction of modern cities.

The main objectives of the most important transport infrastructure projects in modern cities which are developing and being implemented at the moment are as follows:

- Radical improving transport accessibility.
- Reducing the pressure on the existing transport infrastructure by introducing new modes of transport and traffic management systems.
- Improving the environmental situation.
- Developing intelligent decision-making systems during the driving process.
- Ensuring the harmonious development of the city and the surrounding region as well as the creation "distributed" or "multi-pole" cities on the basis of existing ones.
- Introducing urban planning and technological solutions that can transform existing transport infrastructure to redundant.

However, it should be noted that the common solutions to these problems that are appropriate for all cities without exception does not exist. Moreover, a number of key areas has been identified, in which searching for new urban development and technological solutions has taken place.

French Rhône-Alpes region has introduced the concept of "multi-polar cities"