

"Structural Rationalism" as a Trend in Architecture of the Second Half of the XIX — Early XX Centuries In the Context of the Cities in the South of Russia

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ABSTRACT

The article describes the idea of "structural rationalism" as the most important trend in the architecture of the XIX - early XX centuries. The origin of the idea of "structural rationalism" belongs to the period of total classicism domination. This idea is related to the rational recognition of the structure of Gothic architecture. The basic principles of structural rationalism were formulated by the middle of the XIX century. In the 1890s rationalism produced great results in design practice when the period commercial exploitation of steel and reinforced concrete structures began together with the spread of a combined design structure. By the beginning of the XX century the conditions for the spread of structural rationalism trends were formed in the cities of the southern Russia. Structural rationalism was reflected in the architecture of large trading houses, commercial apartment buildings and public buildings.

Keywords: "structural rationalism", the South of Russia, theory of the architecture, architectural form, design structure

I. INTRODUCTION

The most important component of the architect's thinking and professional activity is rationalism – a multidimensional concept which undergoes transformation under the influence of cultural and historical conditions keeping its significance. One of the most important stages of "rationalism" formation in architectural theory and practice took place in the XIX century. During this period rationality moves from the category of philosophical and theoretical concepts to the sphere of architectural practice. At the same time, this period may be considered as the prehistory of rational architecture of the XX century.

One of the most significant phenomena in the architectural theory of the XIX century was the concept of "structural rationalism". At the same time, "structural rationalism" wasn't considered as a holistic concept that evolves over time and a clear definition of the phenomenon wasn't defined in the historical and architectural literature.

II. THE DEFINITION OF THE TERM

The term "structural rationalism" is initially devoid of uniqueness and is contingent. The semantic content of this concept has undergone significant transformations over several centuries (the late XVIII - early XXI centuries).

This term was defined by foreign and Russian theorists and architectural historians. In foreign, primarily English-language works, the concept of "structure" in relation to architecture is quite clearly associated with architectural design and as a result "structural rationalism" is also clearly associated with the structural basis of the building and its identification in architectural form [1], [2].

At the turn of the XX-XXI centuries in Russian works on the theory and history of architecture the concept of "structure" is considered not only in relation to the design, but also primarily as a part of architectural composition. In the collective Russian study of modernism "Composition in modern architecture" (1973) the term "structure" was analyzed as the first among the main principles of composition.

This semantic hierarchy was also used in the "Theory of composition in Soviet architecture(1986)" [3].

E. I. Kirichenko defines the "structural rationalism" of Art Nouveau as a creation of decorative forms, spatial planning and design features of the building, the desire to abandon the "actual decorative forms that only adorn the building and persistent attempts to make forms artistically expressive, constructive and utilitarian" [4]. "The structure of rationality in Art Nouveau excludes figurativeness in the mood of modern architecture, the expression of the useful by means of the beautiful... Although in Art Nouveau it is a dialectical unity of the useful and the beautiful expressed in artistic understanding of the utilitarian and constructive elements of buildings" [5].

However, the general idea of "structural rationalism" expressed by researchers at the turn of the XX — XXI centuries is the identification of the nature of the interaction between structural foundations of the building and architectural forms, as well as recognition of functional-structural elements influence on architecture and art.

III. THE FORMATION STAGES OF "STRUCTURAL RATIONALISM" – FROM THEORY TO DESIGN PRACTICE

The origin of structural rationalism in the depths of the rational theory of the classicism era ("Gothic" rationalism, classical rationalism) dates back to the second half of the XVIII century. It is primarily associated with the recognition of bold logic and truthfulness of the Gothic design structure, as well as attempts to return constructive logic to the classical forms of architecture.

Jacques-Germain Soufflot (1713-1780) described rationalism in architecture as "...limiting of aesthetic effects to those that logically follow from the nature of structural components and the construction of these components according to rational criteria" [2].

The architect used the features of "Gothic rationalism" common in Europe in the XVIII century, as well as the emerging structural rationalism. Rationalistic tendencies peculiar to that time were reflected in the most famous works of the architect: The Church of Saint-Genevieve (now Le Pantheon, Paris, France, 1755-90), The Hotel-Dieu Hospital in Lyon (1741-48).

The French rationalists were adherents of the idea that architectural form follows the design structure. They identify the architectural form and the design (structural) form and no matter how elegant and decorated these basic structural forms are. In 1864 Sazar Daily defines rational architecture as a decorated structure.

Among Russian architectural theorists of the XIX century A. K. Krasovsky most clearly defined principles of "structural rationalism" in his famous work "Civil architecture" (1851): "The architecture trend should not be an exclusive tendency for only useful or only elegant forms. Its main rule is the transformation of one into another, i.e. useful forms into elegant ones. ...Technique or construction is the main source of architectural forms" [6].

The following general principles of "structural rationalism" were formulated in the architectural theory by the middle of the XIX century:

- Limiting of the aesthetic effects to those that "logically follow from the nature of the structural components" (Jacques - Germain Soufflot);
- Identification of architectural and structural forms;
- Identification of the load-bearing frame of the building;
- "Truthfulness" of the architectural and artistic image of the building which expresses the features of the design structure;
- Influence of construction equipment development on the formation of architectural styles (A. Choisy).

At the same time, architectural practice primarily reflects the principles of aesthetic expression of the design structure of the building formulated in the theory of the first half of the XIX century and the "relief parts" of the building should be "vertical and horizontal belts" that make up a load-bearing frame of the building. In this case, the rest part of the building is considered as a filling of the load-bearing frame. This idea of design and architectural form is most clearly defined by Ya. A. Borgnis in "Elementary Treatise on Construction", 1823: "The relief parts must be horizontal and vertical belts that "make up a load-bearing frame of the building" and, therefore, must be made of carefully processed solid materials. Thus, the rest part of the building "which is only a filling" can be built of fragile materials and the strength of a building will not significantly suffer" [2]. On the basis of "structural rationalism" principle a special trend in the architecture of the XIX century appeared and was represented by the architect Eugene Train (1832-1903). The Lycée Voltaire (1885-1890), Collège Chaptal (France, until 1881) is characterized by the identification of the structural frame of the building by means of the decorative forms: a variety of horizontal and vertical rods, strongly protruding pilasters and cornices. A kind of "visual tectonics" was widely expressed in the mass architecture of the last quarter of the XIX century.

One of the important stages of spreading the principles of "structural rationalism" was the use of open structural elements made of metal. At the turn of the XIX - XX centuries many architects and theorists called it the "iron architecture".

In the Russian architectural theory and practice A. K. Krasovsky was the first who noticed metal as a building material that can stimulate new architectural forms and compositional solutions. In 1851 he predicted the iron "to make a revolution in architectural forms and produce new, original forms which will probably constitute a new style" [6].

The use of metal structures became noticeable only by the 1850s-60s within the framework of the eclectic architecture. In practice, during this period, metal structures became a part of the architectural and artistic image in its original form only in works of utilitarian architecture (warehouse and industrial buildings, markets, transport infrastructure buildings) and were revealed in the interior of buildings. Generally, metal structural elements were artistically shaped (exhibition and park pavilions, small architectural forms). Structurally necessary elements had plastic forms and reflected the motives of the historical architecture.

"Structural rationalism" did not give the intended effect until the beginning of the commercial exploitation of steel and reinforced concrete structures and the widespread use of a combined design structure divided into frame-wall, metal-brick, and brick-reinforced concrete varieties in the early 1890s.

The ideas of structural rationalism in the theoretical works of Eugène Emmanuel Viollet-le-Duc (1814-1879) are accompanied by the recognition of the rationality of the combined design structure. Thus, in the second volume of "Discourses on architecture" (1863-72) he recognizes the reasonable simultaneous use of metal and stone structures as the most important goal of architectural practice: "Nowhere has anyone tried to use metal and stone structures simultaneously. Meanwhile, architects in many cases should work towards that goal" [7]. It is obvious that many of the innovative constructive ideas of Viollet-Le-Duc came from the study of historical, mainly medieval, experience. However, the main conclusion that Viollet-Le-Duc made is the necessity to identify patterns of design and construction and to formulate general principles based on the study of the previous experience. "The study of the previous experience is useful and necessary, but only if principles rather than forms are derived from it" [7].

Auguste Perret was the first architect who made reinforced concrete the main material in the history of architecture. He was influenced by his teacher Julien Guadet the last great theorist of classical rationalism, the works of Viollet-Le-Duc on Gothic rationalism and

had a practical experience in his father's building company. A. Perret was the first to use reinforced concrete as the means of architectural expression. The reinforced concrete frame in the residential building at 25 Franklin Street (1903) is exposed and is the part of the facade architecture. The load-bearing frame of the building was independent from the internal floor plan resulting in a free layout of all floors. This house symbolizes a historical event-the differentiation of load-bearing and enclosing structures using a reinforced concrete frame.

Thus, throughout the XIX century "structural rationalism" in architectural theory and practice evolved over several periods:

- Study and recognition of the tectonic logic value of Gothic and classical architecture ("Gothic" and "classical" rationalism, the work of the French national school of roads and bridges-*École nationale des ponts et chaussées*);
- Recognition of the necessity to identify the design structure in the architectural form, limiting of the aesthetic effects to those that are due to the logic of the design structure (Jacques-Germain Soufflot, A. K. Krasovsky);
- Expression of the ideas of "structural rationalism" in the design practice of the XIX century. "Visual tectonics" (Eugene Train);
- Artistic interpretation of new building materials and structural systems of the early XX century ("iron architecture", the work of Auguste Perret, the use of a combined structural system).

IV. PREREQUISITES AND CONDITIONS FOR SPREADING THE PRINCIPLES OF STRUCTURAL RATIONALISM IN THE CITIES OF THE SOUTHERN RUSSIA IN THE SECOND HALF OF THE XIX-EARLY XX CENTURIES

By the beginning of the XX century, structural rationalism trends were spread in big cities in the South of Russia. Some of the external prerequisites may be noted:

- the growth of the population in cities;
- expansion of building construction;
- urban densification;
- increasing number of storeys in a building of the central part of the city;
- the availability of technical possibilities for the production of progressive construction materials and structures;

- the customer's readiness to perceive a new artistic image of the building.

"The economic prerequisites for the spread of rationalist tendencies in the architecture of the region are: the development of trade, crafts and manufacturing industries, railroad construction, the growth of population in cities, expansion of building construction, urban densification, increasing number of storeys in a building of the central part of the city and expansion of the architectural typology" [8].

The spread of rational trends in architectural practice was influenced by intra-professional phenomena:

- active practice of graduates of St. Petersburg educational institutions – the Institute of Civil Engineers and the Academy of Arts;
- organization of architectural competitions in which the leading architects of the country participated;
- professional interaction of the regional architects with leading local and foreign representatives of the rational trend of architecture;
- distribution of specialized literature on architecture and building, participation of regional architects in congresses of Russian architects (N. N. Durbach, E. M. Gulin).

"At the end of the XIX - beginning of the XX century famous Moscow architects designed buildings in the southern cities: V. O. Sherwood and A. N. Pomerantsev in Rostov-on-Don, F. O. Shekhtel in Taganrog and Ekaterinodar, and the graduates of the Moscow Architectural School: L. F. Eberg (in Rostov-on-Don and Ekaterinodar), V. A. Vlastov (in Novochoerkassk), and others. Examples of design creativity of these architects demonstrate a wide range of the capital's architectural fashion influence" [9].

V. "STRUCTURAL RATIONALISM" IN THE ARCHITECTURE OF THE SOUTHERN RUSSIA

The trends of "structural rationalism" are prevalent in the architectural practice of the southern region during the last quarter of the XIX century and are associated with "visual tectonics" of eclecticism. Quiet often the desire to identify the structural basis by decorative means is reflected in buildings of the "brick style" and is harmonized with forms of stylized medieval architecture (Romanesque architecture, Gothic architecture and Old Russian architecture). Thus, in utilitarian buildings stylized in the forms of Gothic and Romanesque architecture (Paramonov's Mill (1880s) and State Wine Warehouses (early 1900s) in Rostov-on-Don, the brewery building in Maikop) the load-bearing framework of the wall is revealed by

means of strongly protruding pilasters above the final cornice of the building like medieval towers. A similar technique is used in later buildings constructed in the style of the Romantic Art Nouveau: the Stepanov men's gymnasium in Rostov-on-Don (P. Ya. Lyubimov, 1915) and the city power station in Stavropol (G. P. Kuskov, V. E. Lobanovsky, 1909). The architecture of these buildings is marked by geometrization and simplification of forms.

The need to solve practical problems (fire prevention discipline, increasing the number of storeys of buildings, hall rooms and wide picture window planning) promoted the spread of new construction materials (structural elements made of metal and concrete) and a combined design structure in the architecture of the cities in the South of Russia. In the second half of the XIX century iron and cast iron were widely used in design structure and artistic design of buildings. Thus, the design solution of the indoor market building of the Old market in Rostov-on-Don (N. M. Sokolov, 1893) is based on the widespread use of metal structures (roof trusses, overhead lights, cast-iron supports). The building is constructed in the "brick style". Its architectural and artistic image is based on the use of open brickwork which is durable and profitable in the climatic conditions of the region. The functional purpose corresponds to the laconic forms of simplified classical decor. Iron floor structures are identified in the interior of the market trading hall. "The use of cast-iron small cross-section diameter columns in the interior of the building allowed clearing additional space, creating spacious rooms with a minimum number of supports. Thus, cast-iron columns are used in the interior of the Rostov Club of Clerks (1899) to overlap the vast premises of the club lobby" [10]. The architectural and artistic image in recreational buildings such as the Lermontov gallery in Pyatigorsk (S. Schiller, 1901), the Pushkin gallery in Zheleznovodsk (Z.E. Khrzhanovsky, 1902), the Gusakov coffee house in Pyatigorsk (S. Gushchin, 1908-1909) is based on the identification of openwork metal structures (thin support pillars, metal frame elements, floor trusses). At the same time, the design elements are aestheticized and stylized in the forms of early modernism.

The principles of structural rationalism were reflected primarily in the architecture of large commercial apartment buildings, as well as a number of public buildings built on the basis of a combined metal-brick, frame-wall, brick-reinforced concrete design structure in the regional architecture of the first decade of the 1900s and 1910s.

Progressive variants of the combined design structure became a means of achieving maximum compliance of the architectural form with functional requirements in commercial buildings of the early XX century. The use of a combined design structure in the

construction of a department store building "Provodnik" (E. M. Gulin, 1910) made it possible to replace the load-bearing walls in the interior of the building with pillars organizing a complete space, creating favorable lighting conditions for retail premises and their visual connection with the external space. The artistic language of "structural rationalism" is used to create a modern image of a public building in Art Nouveau style. The composite structure of facades is dominated by vertical divisions supported by the risalites, narrow piers corresponding to the frame posts with high wide picture window. The same method is used in the architecture of Art Nouveau style - the commercial apartment building of P. Khokhlacheva (S. V. Popilin, 1905), Nikitin's trading house (1900s, lost) in Rostov-on-Don.

VI. CONCLUSION

"Structural rationalism" is one of the leading trends in architectural theory and practice and has evolved throughout the XIX century from the recognition of the constructive value and the rationality of Gothic architecture to the artistic understanding of new building materials and structural systems of the early XX century in design practice. The principles of "structural rationalism" have become widespread in the architectural practice of the South of Russia under the influence of several internal professional and external conditions. The "visual tectonics" of eclecticism in buildings of the last quarter of the XIX - early XX centuries makes way for the spread of new building materials and combined design structure in the architecture of the cities in the south of Russia which contributed to a new compositional and figurative design of buildings corresponding to the principles of "structural rationalism".

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