

Research on the Multidimensionality of the Renovation of the Architectural and Urban Environment in the "Post-carbon" City*

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Abstract—From the middle of the 20th century, a firm position has been formed about the value of each stage of historical development of populated areas and preservation of their uniqueness. Historical science, as a rule, investigates architectural objects, established urban ensembles or historical cities. Applied research and practical urban planning should focus on functional zones, structure, and infrastructure of populated areas. Urban areas of different scale as objects of cultural history that function actively in all their problematic complexity mostly remain subjects of scholarly debate. Thus, there forms a strong contradiction in the understanding of approaches to the renovation of a modern city. In the early 21st century, the urban theory forms definitions such as “post-industrial”, “post-carbon” and other city types, due to technological alterations and dynamically changing lifestyle of a modern person. Such trends lead not only to radical shifts in the structure of a town, but also to the reassessment of values in relation to the environment of a modern city, and therefore to a different mechanism of the renovation of human environment.

Keywords—*renovation of the urban and architectural environment; post-carbon city; post-industrial city; multidimensionality; city structure; urban context*

I. INTRODUCTION

The concept of the “post-carbon city” contains a collective image of the modern city. Its main features are the reinterpretation of modern technologies that use natural resources without limit in order to learn to live in harmony with nature. The new formula of the city leads to a modification of its morphology. In this regard, understanding of the continuity of the urban decisions and preservation of the heritage of early eras become important. The problem is how to renovate existing city taking into account the tasks of restructuring on all levels, including global consumption

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process with the combination of heritage preservation and objectively determine what is heritage at that point. From the middle of the 20th century, a firm position has been formed about the value of each stage of historical development of populated areas and preservation of their uniqueness. Historical science, as a rule, investigates architectural objects, established urban ensembles or historical cities. Applied research and practical urban design and planning focus on functional zones, structure, and infrastructure of populated areas. Urban areas of different scale as objects of cultural history that function actively in all their problematic complexity mostly remain subjects of scholarly debate. Thus, there forms a strong contradiction in the understanding of approaches to the renovation of a modern city. In the early 21st century, the urban theory forms definitions such as “post-industrial”, “post-carbon” and other city types, due to technological alterations and dynamically changing lifestyle of a modern person. Such trends lead not only to radical shifts in the structure of a town, but also to the reassessment of values in relation to the environment of a modern city, and therefore to a different mechanism of the renovation of human environment.

II. CONTEXTUAL CHANGES IN THE CITY

The structure of the city is topic for research among intellectuals from different epochs that retains its relevance. Similarly, significant is the problem of introducing regulations, special use regimes for territories to uphold the dynamic equilibrium in the city structure. From the mid-19th century to the present, humankind has four times changed their perception of environment under the pressure of changes in technological epochs. A city witnesses the medieval (agricultural), industrial, post-industrial, as defined by a number of researchers, stages of development and descends into the “post-carbon” one.

The industrial city of the 20th century was previously considered from the standpoint of technocratic engineering and sociological utopias. Within those frameworks, any settlement system was not viewed as an organism that has internal laws of development, but a machine that can be planned, assembled, and engineered down to the smallest

details of production and life. The technocratic methodology, which continues to live today, at least in standards and regulations, is based on the notion that the natural processes of development of urban systems, including social life, its material and spatial embodiment in the city environment, are entirely determined by the planning and construction industry. What excluded are the internal dynamics, transformations, and functional mix, the ambiguity of interpretations of certain objects, spaces of a city, the multi-layer and polysemy of historical and other areas. At a time when urban life was treated as a conveyor belt, while life and culture being the derived functions of industrial processes, the idea of social and spatial self-organization was denied. It was not anticipated that technologies can not only become obsolete, but lead to the loss of industrial flagships of economy and in this connection contribute to radical changes in the spatial structure of a city, filling it with marginal lacunae. [7], [8]

Indeed, none of the authors of that time could appreciate to a sufficient degree the essence of the global conversion of the late 20th and early 21st century. Kisho Kurokawa had the closest understanding of the present situation. In 1959, he predicted that the world would make the transition from the “era of Machine Principle to the era of Life Principle. While former is a century of homogenization, the latter - a century of pluralism or diversity. Thus, the architecture of Life Epoch of is an expression of the diversity era. There comes a century of intercultural interaction, when the value system and life style come into a relationship of coexistence and symbiosis. The doctrine of humanism, which forged humans into rational beings, secondary only to God, and also gave them control over the entire living and natural world, is coming to a crisis.” Kurokawa argues that the question of the survival of humanity, even if viewed solely from an environmental perspective, depends only on the ability to coexist with other life forms and ecosystems on our planet. [6]

These arguments contain at least three ideas about the development of populated areas, confirmed by a number of interdisciplinary research and new large-scale projects of the late 20th - early 21st century. This issue refers to striving to ensure conflict-free coexistence in a single urbanized space of phenomena and systems that were considered incompatible, and, in a certain sense, parallel.

III. STRUCTURAL PROBLEMS

As transpired, natural transformations that were not widely considered in the epoch of technocracy led to the fact that large areas of cities are occupied by so-called “urban fabric ruptures” - heterogeneous territories with different interpretations, having a common contradictory quality of connecting and disconnecting various territories of urban structures. Probably, this quality can be used in modern strategies of urban regeneration, since, as a rule, “unidentified” lacunae are located on the outskirts of existing, often self-sufficient structures, such as elementary residential planning units, thereby strengthening the integrity of the latter or, through their scale, disconnecting residential and other functional areas. These territories are termed

differently by various authors. The first international discussion of these problematic areas can be considered the International Union of Architects Congress of 1996 in Barcelona, where they are combined into one typological group of related objects. (See “Fig. 1”)



Fig. 1. Conversion areas in Leipzig.

A number of strategic urban development projects testify to the recognition of the fact that spatial and social segregation are not the only dissonances characteristic of a modern city. They also imbue a functional interlacing of “inter-territorialism”, ecologically “sensitive” areas of swamps, valleys of small rivers, and ravines. City territories are populated not only by communities of people but also by other species — the law of life, which was not taken into account by planners in past eras. A particular notion gains strength that in inhabited places there should occur not only the unification of people within a certain territory, but also non-destructive coexistence with other biological species. [4]

At present, a person as a biotype is compared in its rights with other forms of life. Here, we state a fundamentally different approach — non-exhaustion of biological resources of the planet in connection with the functioning of cities. The latter concept radically changes methods in planning and strategic development of ecosystem conservation in a city and not necessarily within the green planting systems. The natural basis of a city was a priori dependent on urban development. Therefore, in the development strategies for most metropolises of the late 20th- early 21st centuries, planners define “eco-sensitive” objects and elaborate for them special rules of development, use, and protection from excessive anthropogenic influence. As a rule, special natural landscapes within a city are protected by buffer zones. [8]

In a number of publications exploring the morphology of a city, there appears a term “internal landscapes”, seemingly understandable at first glance: some objectively existing natural substance, which is characterized by an internal unity of all forms of its manifestation, self-development, dynamics, and directionality. Concurrently, there is a popular, topical idealistic desire of planners to create unified continuous green systems, ranging from the intuitive projects of the Olmsted brothers, who re-planned almost all major cities of North America in the middle of the 19th century, to present eco-frame projects, green paths, and so forth. At the same time, researchers include “internal landscapes” into artificial hierarchies of higher order. Here emerges a number of

dissonances. The contrast between the artificial and the natural principles turns this comprehensibility upside down due to the irreversibility of the natural laws of landscape development and, conversely, the variability of regulations for the formation of artificial environment created by humans in accordance with the level of development of technology and machinery. At the same time, the urbanization process is seen as a force capable of breaking the landscape. At the same time, each period of technological progress is accompanied by its own legislative regulatory basis for architectural and urban planning creativity, while natural laws remain unchanged. What changes is the depth and time period of their feedback to anthropogenic processes, directly dependent on the scale of the latter. "Internal landscapes" are used in the strategies of restoration or renovation of town-planning objects, and numerous other actions with a "re-" prefix precisely because they are seen as a different world, parallel reality, specific territories where nature gives away its cause and effect status to will and success of social life.

Nonetheless, there emerges and matures the ethics of understanding the value of survival of every life form on the planet. [5] Thus, for instance, the wayward Brisbane river poses a certain threat to the city with the same name in Australia by frequent flooding, not only because of the proximity of the "big water" of the ocean, but also because of the extremely tortuous riverbed and special regime - the river changes its water flow direction twice a day. The root system of coastal thickets and floodplain meadows keep coastal areas from excessive caving during flooding and, at the same time, are home to some unique species of fish, and amphibians. The life cycle of the latter is to clean the waters of the river. Therefore, in the city, open access to the water surface is extremely limited despite the luxurious green embankments. The coastline areas are represented by usually small, well-equipped parks, provided with a flood protection system. Highways are "cut off" from the coastline and transformed into pillar bridges, which makes car access to the coast virtually impossible. (See "Fig. 2" and "Fig. 3")

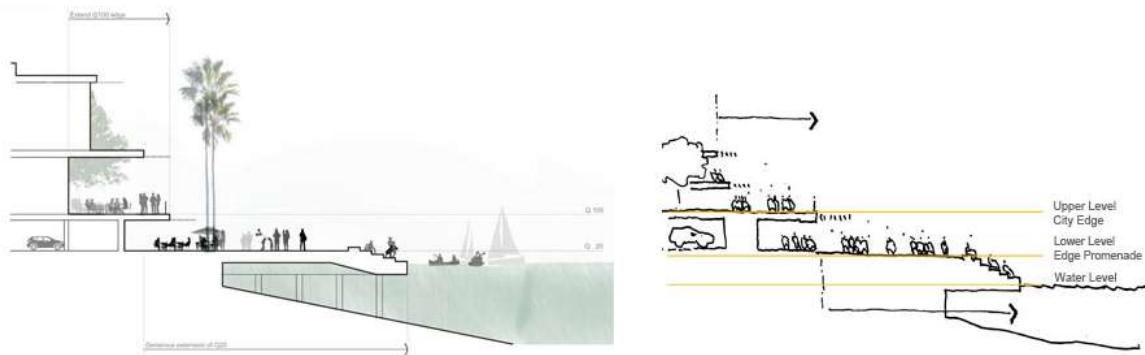


Fig. 2. Project of the waterfront of river Brisbane in the city of Brisbane: upper level is the "city edge", lower is the river bed.



Fig. 3. Brisbane "cut off" from the river.

IV. THE DEVELOPMENT OF THE "POST-CARBON" CITY CONCEPT

The fourth industrial revolution, tied to new energy sources and digital technologies, radically changes the world and the ideas about the human environment, where environmental problems gain relevance. From the standpoint of economy, the formula for "sustainable development" accelerates to an incredible scale the processing of

hydrocarbons, advancement of the latest technologies, and equipment for working in the most difficult geographical conditions. Simultaneously, from an environmental point of view, it is trying to ban global consumption of non-renewable natural resources including those necessary for world's energy industry. Therefore, analysts in different areas of human activity pose a rightful question – is it possible to defeat oil and how will this affect the cultural landscape?

The scientific concept of "petroleumscape" is built on the interdisciplinary research. It relates to the analytical work of Michael Watts using materials from early research by Timothy Mitchell, Andrew Barry, and others, and the term introduced by the author of the study, "oil assemblage" is a literally untranslatable phrase, but it apparently means the ability of oil to create ensembles or the "ensembleability" of oil (if such is possible). Watts focuses on the features of territorial aspects of the oil industry, but very poorly covers a discussion about the architecture and typology in this regard. The idea of "petroleumscape" is also related to the work of Arun Appadurai. He suggested that the suffix "scape" in the term gives an insight into the complexity of interweaving in modern culture and economics, which can no longer be viewed as simple and linear "periphery-center" dependencies, but only as a unity of unique layers tied together by a common development process. Thus, the concept of

"petroleumscape" connects the flow of goods and energy with a variety of spaces and commutes them over national borders, urban-rural relations, and architectural typology. There are many humanitarian works on energy that emphasize the importance of studies as "representative" objects, primarily the oil industry, for a better comprehension of modern society and study of problems that are associated with overcoming dependence on oil. [1]

The spatial components of "petroleumscape" include: production, objects of product sales, administrative and associated facilities, infrastructure, philanthropic and enterprises responsible for the prosperity of the state or company. The representative components of the "petroleumscape" include: popular media corporations, architectural and artistic objects, as well as works of pop culture. "Various constellations of oil actors — including corporations and nations — have shaped seemingly disconnected and geographically distant landscapes, cities, and buildings around the world over the last 150 years. Corporate, public, and popular media have publicized these cycles of spatializing oil. Together, construction and representation have created what is here collectively identified as a global palimpsestic petroleumscape." — namely, as a multi-layered physical and social landscape, which reproduces itself in increasing volumes and specific forms over a long time. [1]

The flows of goods, united on local, national, and global scale, ensure the mobility of capital, people, technology, and cultures – that is understood as globalization. Flows of oil, consumer goods produced with the use of oil can be collectively called the most striking example of globalization processes of the 20th century. Oil is undoubtedly a global market product, a key component of energy industry, and a driving force that transforms human environment in different areas and at different levels, tying together multifunctional objects, territories, regions, agglomerations, and countries. Moreover, the all-pervasiveness of oil in the modern world is manifested everywhere, regardless of the availability of deposits, infrastructures, populated places, political regimes, economic structures in places of extraction, processing or transportation, as well as specific geographical, social and cultural traditions and their localization. The omnipresence of oil extends also to local conditions and does not always adapt to their needs. The result is a very bizarre hybrid of a cultural landscape, such as cities that produce oil, or port cities that transport and sell oil and oil products. [3]

Oil flows stimulate the construction of new cities and provoke increased demands for quality and comfort of the environment, development of the service system and especially recreational structures. It intensifies not only the creative efforts of architects aimed for invention all known architectural types of buildings and structures, but also religious activities, and construction of religious buildings. Usually, with no regard for the degree of state regulation of oil industry, corporations cooperate with governments in building infrastructures. The most fascinating example of this kind is the construction of roads, where the main building material is asphalt which is an oil product. In such case it does not matter whether oil corporations invest in the

financing of roads. The second ambiguous moment is the spatial arrangement of holdings, which overnight can expand the economies of many countries, but remain a sustainable development factor for the locality (region) where they are situated. Oil processing plants, as a rule, attract the organization of related industries in the region, their location in conjunction with the ports initiate active urban planning processes. Partnerships with oil corporations are built on sustainable feedback, which leads to an increase in the consumption of petroleum products at the local level in all senses. For example, it fosters the development of various areas ranging from chemical and IT to the architectural, construction, advertising, and other businesses. In the last decades of the 20th century, mining companies initiated a number of design competitions for populated areas, individual districts, and architectural sites. While the subject of architectural and town planning projects was often a special, memorable architectural compositions, for the territorially large-scale competitions, prognostic tasks were formulated. One of the largest projects was the Cities+ competition held by Gas Union Company which involved the developmental plan for agglomerations in the 100-year perspective. The winner project called "Livable Region Strategic Plan" of Great Vancouver becomes a kind of benchmark for creating a "livable" region. Within this framework there develop several fundamental formulas of modern urban planning: populated areas, the activity of which has a minimal ecological footprint; quality of life concept; the driving forces of sustainable regional development. The unusual design goal, limited to hundred years, was explained by the desire to trace the dynamics of the development of populated areas while maintaining the current level of consumption of natural resources and to find an alternative to this consumption so that the next generations will not be left with the depleted Earth. In the projects of metropolitan districts (Atlanta, and the South group, until 2025), regional cities (Stockholm until 2030), statistical districts, and other regional facilities use the planning concepts tested in the Livable Region Strategic Plan of Great Vancouver. [2]

Mankind accelerates its spiral movement to a new round of technologies at the end of which there should come a phase of withdrawal from hydrocarbons and their influence on the human environment. It should be noted that there is some interest in the prognostic planning of the future cultural landscape, in which pictures of enormous lenses and fields of solar panels and wind generators appear increasingly frequent. Yet, these sprouts of alternative energy can only claim to replace a small fraction of what is currently produced by oil and hydrocarbons. Nevertheless, the next question, which is still relevant due to the recent and ongoing urban renovation in connection with the conversion processes - what should be considered the heritage of a city that needs to be subject to conservation in the near future?

V. FEW TERRITORIAL METHODS AND TECHNIQUES OF RENOVATION

Urban theory proves the tendency of development of polycentric "connected and discrete" cities, which allows to

relate consciously to the harmonious co-development of different-quality, diverse, but unique territorial entities.

Overcoming spatial segregation associated with the formation of marginal lacunae in the process of replacing industrial, energy, and information technologies leads to the restructuring of a city. It becomes possible to connect and divide the areas of different historical eras, functional and technological content with the introduction of a structural system of buffer zones. In accordance with the academic dictionary, a structural system is a general scientific definition of all types of frameworks supporting and providing ground for a certain structure of an object. This system can be considered as an environmental protection tool for urban historical areas, landscape, architectural objects, and natural reserves of large cities, as well as a method for overcoming spatial segregation. [8]

VI. CONCLUSION

There emerges an inevitable trend for the blending of the global and regional elements of a modern city, with a parallel preservation of its culturological identification.

Through their activities, mining and processing corporations permeate all levels of the human environment, including the mental sphere. Dynamic development occurs not only in the territories where corporations and related industries are physically active but also, indirectly, in the fields of architecture, architectural typology, and in such areas of the human environment, which architectural science cannot assess — the degree of state and individual freedom. Mining and processing corporations stimulate competitive and prognostic scientific activities aimed at planning the future world without hydrocarbons.

The latter requires the elaboration of a fundamentally new perspective on the regulations of ecologically oriented urban reconstruction based not on the principle of an economical approach to the engineering and construction complex, but on the certain healthy excessiveness, ensuring the viability of biological species especially in the case of anthropogenic crises. The main goal of urban renovation strategies becomes the restoration of indigenous ecosystems through functioning of a city and non-exhaustion of natural resources and merging of cultural and biotypical territories.

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