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MODERN TECHNOLOGIES AND URBAN PRINCIPLES FORMATION OF OPEN PUBLIC SPACES

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Abstract. The basic planning principles of urban rehabilitation are considered on the example of settlements in Denmark (Copenhagen). A comprehensive design program is aimed at overcoming social exclusion and creating a high-quality urban environment that meets the modern lifestyle using modern innovative technologies. Rational solutions for development planning, such as ecology, dense planning, climate conditions, pedestrian accessibility and social connectivity, and autonomous infrastructure systems. All these factors together contribute to the creation of a comfortable and environmentally friendly urban space for its residents. In Ukraine, the number of modernized low-rise housing in eco-towns located in Kyiv, Odesa, and Karpaty regions is growing. Promising cities are ecological settlements for urban residents, meaning they can be both primary and secondary homes, and their residents are accustomed to city services. Agriculture takes up a minimal share of their daily activities, and the level of communication is comparable to that of a city. The first small towns had a similar perspective. For example, the garden city was tied to a large city and was actually its satellite. Promising small towns can become a sustainable form of settlement in remote areas if they are united into local clusters. Creating conditions for the required level of social housing that will provide comfort not only on the periphery of large city agglomerations, but also in underdeveloped areas. The combination of a favorable environment, the psychological climate of a friendly neighborhood, the accessibility of the transportation system and the capabilities of autonomous infrastructure contributes to the creation of a comfortable, environmentally friendly urban space. The program for the formation of a promising living environment includes the following aspects: environmental, social, economic, and infrastructure. Urban planning should take into account the mechanisms for implementing architectural, urban planning, investment and construction projects, infrastructure management and monitoring technologies, security and protection against risks of various origins. The principles of the spatial organization of small towns include: compactness of the planning structure, functional diversity, human scale of development, connectivity and accessibility of public spaces, control and security, compliance of housing with the needs of citizens, development of natural potential, as well as flexibility and adaptability to future initiatives of the local community, and the use of modern innovative technologies in living space. Taking into account foreign experience is important for the formation of a conceptual model of the architectural and spatial organization of promising small towns as part of ecological settlements..

Keywords: architecture, urbanism, modernization, models of urban and residential environment, design of small towns, low-rise eco-housing**,** innovative technologies.

Introduction. The development of telecommunications and autonomous life support systems significantly increases the possibilities for an urban autonomous lifestyle without resorting to expensive “heavy” infrastructure. The limited circle of communication is partially compensated by the comfort of living, opportunities for a healthy lifestyle, and network services. It is necessary not only to compensate for social isolation, but also to ensure privacy. Excessive attention from neighbors is compensated by the ability to change the place of residence, and for permanent residents, by the large size of the private territory. In a small city, the required level of privacy is

most easily achieved by providing rental housing of different classes. Servicing and arrangement of temporary residents will contribute to the development of services and employment of the local population.

The sustainability and viability of a small town is primarily related to modern infrastructure and innovative design technology, as well as to the social and cultural life of people in a remote settlement.

Continuing the research, it can be noted that the technical capabilities and socio-cultural needs of a small community are only part of the direction for small towns, in addition to these two factors, it is important to add a strategy for interaction with the natural environment and the necessary inclusion in the global information space and economy.

"The architecture of eco-cities should be aimed at integrating eco-oriented architectural and planning solutions, environmental protection measures, efficient life support and communication systems" [2].

Analysis of the recent research and publications. Low-rise buildings using modern innovative technology, like most of the achievements of modern technology, began to appear on the pages of science fiction stories. But the idea began to materialize only in the twentieth century after the widespread introduction of electricity in buildings and the development of information technology. The first report of remote control devices can be attributed to Nikola Tesla's development of remote control of ships and vehicles in 1898.

Ideas more developed to the concepts of modern home automation systems were demonstrated at fairs in Chicago (1934) and New York. In the Big Apple, a little later (1964-1965), plans for electrified and automated premises were presented. Eventually, the first serious analog of an innovative residential building appeared in 1966. It was an experimental home automation system called the "Westinghouse Electric home computer. Echo IV". Its inventor was Jim Sutherland, an engineer at the company His technology was a private, non-profit project. American amateur inventors built the first "wired homes" in the 1960s, but they were severely limited by the capabilities of the technology of the time.

The American Association of Homebuilders first coined the innovative residential building in 1984. The same organization noted that such a home is different from the usual one in its ability to provide productive and efficient use of the working and living environment.

A comprehensive design program is aimed at overcoming social exclusion and creating a high-quality urban environment that meets the modern lifestyle using modern innovative technologies. Rational solutions for development planning, such as ecology, dense planning, climate conditions, pedestrian accessibility and social connectivity, and autonomous infrastructure systems. All these factors together contribute to the creation of a comfortable and environmentally friendly urban space for its residents.

Residential buildings in the life of every person in any historical era were an important element of life, as they ensured the satisfaction of physiological needs for protection from a dangerous environment. Famous domestic and foreign scientists and architects dealt with the problems of housing formation: Smadych I.P. [1], Yaremenko L.V. [2], Habrel M.M. [3], Sleptsov O.S. [5], Hnat H.O. [6], Alexander C.A. [7], Jacobs J. [8], Kartashova K.K. [4], Thi Thu Thuy Vo [9], Inglkhart R. [10], Kozlovets M.A. [11], Khachatriants K.K. [12], Hamziuk M.V. [13], Smadych I.P. [14], Koniuk A. [16,17,18,19]. Attention is drawn mainly to historical, social, and architectural aspects.

Statement of the objective. This article aims to address the challenges of the urban new stage of development of construction technologies. The following works were performed in the field of design and construction at that time: - design and construction works, including interior decoration and design; - repair, reconstruction and restoration of building facades using modern energy-saving technologies (hinged ventilated facades made of ceramics, granite, marble, cassettes made of aluminum composite material "alucobond", painted metal sheet or profiled painted sheet, etc); - arrangement of attic floors; - architectural and construction design of buildings, structures, interiors and their implementation; - design and engineering works; - thermal modernization of residential,

administrative and public buildings; - manufacturing and installation of aluminum translucent structures: windows, doors and stained-glass windows made of aluminum profiles; - production of high-quality aluminum and metal cassettes/

Main material and results. In order to overcome the peripherally of isolated settlements, it is necessary to expand the field of design to include issues of managing the development of territories and maintaining the sustainability of small towns. Perhaps, this will be associated with the prospect of turning "urbanists" into a separate profession that provides an urban lifestyle for residents of small and remote settlements.

The practical orientation of the "urbanists" can be represented as a "visible spectrum of urban planning problems" consisting of the following areas [3]: - natural environment; - ecology; - functional infrastructure; - communications; - social organization; - spatial organization; - historical content; - cultural content; - artistic appearance; - figurative expressiveness.

For the systematic construction of this direction of small town development, a calculation scheme is proposed, which includes oppositions: - artificial; - natural environment; - social; - economic processes that make up the functional part of cities.

As a result, "the systemic representation of rehabilitation settlements includes the following blocks: Social life, Modern innovative technology, Economy, Ecology, Natural environment; Urban environment infrastructure" [4].

Project directions are being formed: *social block* (individual development and health, social life and employment, participation in public life in accordance with tradition and culture); *settlement infrastructure* (engineering, transportation, urban services, building architecture and urban environment); *nature* (development and transformation of the landscape, care for a positive microclimate, ecology and recreation); *economy* (telecommunications and communications, energy supply and information, distribution centers and jobs).

In the environmental aspect, the design is aimed at reducing long-distance travel and using alternative modes of transportation, introducing landscape urbanism technologies, circulating energy and resources, maintaining a balance between the natural and anthropogenic environment, creating green open spaces and transforming the surrounding landscape. In the social sphere, the plan is to create conditions for a healthy lifestyle and upbringing of children, to create a climate of friendly neighborliness and participation in social events. An important criterion for success is the level of integration into social and political processes and the indicator of social connectedness of the population. In economic terms, the city's project direction strives for self-sufficiency, infrastructure development and access to foreign markets for information services, and the use of environmentally friendly technologies and energy sources. An important criterion for success is the level of income of the local population. The purpose of planning the infrastructure of small towns is to make intensive use of the territory while maintaining reserves for spatial growth. Emphasis is placed on compactness, pedestrian accessibility of "points of interest" and efficient transport links with the "outside world" [15, 16].

Eco-resettlement is based on the selection of the most favorable living conditions, which leads to a mosaic (distributed) model of territory development in accordance with individual characteristics of the landscape and infrastructure.

Comparison of projects of promising small cities. Comparing two concepts for the formation of small urban formations with a population of up to 12,000 people (Wood Hood and Felled by). Small towns are conceived as clusters of separate residential units separated by green spaces. Both settlements are located in the zone of influence of large cities, but are developing in an isolated area. The planning structure is different: Wood hood [15], ADEPT (Denmark, Copenhagen) - an eco-cluster of pedestrian enclaves; Felled by, Henning Larsen (Denmark, Copenhagen) - a group of three pedestrian districts.

*Wood Hood project - architectural bureau ADEPT, Denmark.*Wood Hood is a small town project that combines urban and rural lifestyles, accommodates a variety of building typologies, structures, open spaces, and planning elements for living, working, educating, and socializing, providing space for different social groups (Fig. 1) [15]. The planning structure of the Wood Hood

settlement is based on five micro-settlements, which, according to the classification of cognitive urbanism, can be classified as enlarged "pedestrian enclaves" ranging from 3.7 to 10 hectares. Each enclave contains several residential groups united by a common space [17, 18].

The model of a "pedestrian enclave" is characterized by an open interior space [4]. In this case, socially significant centers are located there, which expands the variety of services, places of work, and contributes to the creation of communities of different sizes. A continuous network of bicycle and pedestrian paths is organized throughout the settlement, both along streets and other open spaces, including squares, parks, and gardens. These paths lead to the main anchor points of pedestrian traffic - schools and kindergartens, trade and service facilities, culture, recreation and leisure, and public transport stops (Fig. 2) [15]. Each enclave combines different types of buildings for living, working, education, and leisure activities. The area of the school sites has been reduced by moving some of the recreational functions to the adjacent park (Fig. 3) [15].

Green infrastructure connects natural forest, diverse landscapes and agricultural land, creating space for active and recreational programs. Biodiversity of man-made landscapes is ensured through the use of local flora and fauna species. Green public spaces of 0.5 to 2 hectares are used by residents of the adjacent development and are designed for outdoor recreation and leisure activities and co for able pedestrian/bicycle transit (Fig. 4) [15].

Fig. 1. Wood Hood project, architectural bureau ADEPT [15]

Fig. 2. Transportation schemes, Wood Hood project, ADEPT architectural bureau [15]

Fig. 3. Functional diagram, Wood Hood project, architectural bureau ADEPT [15]

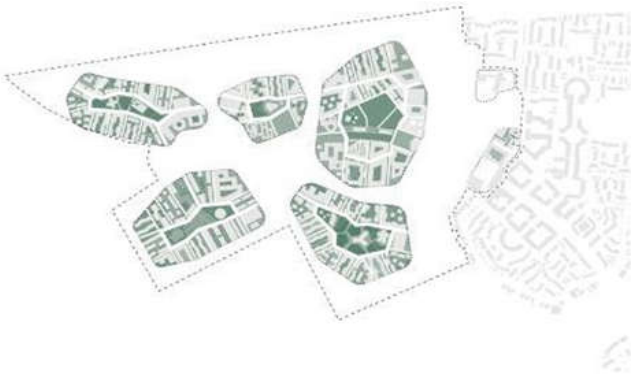

Fig. 4. Landscaping scheme, Wood Hood project, ADEPT architectural office. Public green spaces [15]

The development of neighborhoods is formed by buildings from 2 to 8 floors, which provides a variety of housing stock. The volume-spatial solution of buildings in the blocks changes from the central street to the periphery. The U-shaped blocks open up to the natural landscape. A variety of building types and layouts are used: multi-family sectional houses, detached and blockhouses, block development forming a continuous street front, urban villas, individual residential houses. When comparing the idea of micro-village clusters with the basic models of urban environment, a number of shortcomings can be traced [5]. The settlement layout lacks public centers, which should be located outside residential enclaves, on city streets and in places with the greatest social

connectivity. To maintain diversity and preserve privacy, the inner part of enclaves should be built not as a transit part of bicycle and pedestrian routes.

Faled by Project, Henning Larsen Architecture, Denmark. The settlement pattern in Falled by is organized into three pedestrian districts, each with a number of gated residential groups. The pedestrian district model is characterized by a central public space in the form of pedestrian streets and squares. Unlike the gated enclaves, the centers of the districts are open to transit pedestrian traffic, providing a good setting for services and public buildings.

Mid-rise development preserves more than 40 percent of undeveloped natural area at high densities of 350-380 persons/ha. Felles by has an active daily urban life with a local elementary school, two kindergartens, a childcare center, a café, a grocery store and small retail stores located in central squares connected by a common street. The planning structure combines urban and rural elements to create a hybrid town/settlement/village/village (Fig. 5)

Fig. 5. Axonometric diagrams, Faledby project, Henning Larsen, enmark.
Three-dimensional model of the development and open spaces [15]

The surrounding landscape penetrates the settlement in the form of three through corridors that provide residents with wide and direct access to the natural environment, allowing birds and animals to move freely through the settlement. The majority of homes in Felles by are rental stock where private or social rented accommodation will be available. Some of the homes will be for sale into private ownership. 25% of the housing stock will be allocated to social housing - care homes, family housing and housing for the disadvantaged. The facades of the residential buildings have various finishes, including brick, wood and recycled materials.

The analysis of the development project allowed to identify promising types of residential groups of small and medium storey [5] (Tabl. 1). The integrated design program of the small settlement is aimed at overcoming the social isolation of residents, creating a high-quality urban environment that corresponds to the modern way of life. Spatially dispersed system of three centers, the distance between which neighborhoods facing the street should receive more public functions than peripheral residential groups. it is possible to improve the conditions of crowded and lively public spaces by creating a central core, which is necessary in the model of “pedestrian district” [4].

Accelerated introduction of communication and transportation technologies create prerequisites for the development of promising small towns. The choice of location and design direction of a small town is conditioned by: - climatic conditions; - geographical location; - landscape features; - innovative infrastructure; - historical heritage.

Tabl. 1. Perspective groups of mixed residential development of low story [5]

volume, (cubic meters)	building footprint (square meter)	floor area (square meter)	estimated number (people)
10 000	2 000	8 500	170
11 400	1 300	3 900	75
27 700	2 195	8 700	175
10 000	1 200	3 600	72
23 700	1 800	7 200	145
18 000	1 300	6 000	120
15 000	1 400	4 200	85
15 500	1 956	5 868	118
35 600	2 710	7 800	158

Various models of small towns represent the embodiment of the idea of the arrangement of an ideal social space. In the historical city, there are examples of a harmonious environment that is favorable for the life of both the local population and visitors, tourists. In cities and settlements invented for fictional forms of social life, there is often discomfort, which is felt by the lack of security, coziness. As a result, the following principles are revealed:

Mixed development. Integration within the group of mixed residential development of low storey buildings and premises of different purposes designed for, recreation, health care [6].

Human scale. Formation of buildings of predominantly low storey creates favorable conditions for social interaction of citizens. Interaction of people in the urban environment is determined by pedestrian accessibility, compact location of infrastructure facilities, comfort of open urban spaces and comfort of housing conditions [19].

Connectivity and accessibility. Compactness and high level of territorial connectivity increases the availability of services and facilities. For citizens it is important to have a variety of services, choice of employment, high level of social connectedness, use of innovative modern technologies. Regulating factors of social connectivity are the size and area of elements of the planning structure, permeability and isolation of the territory, density and number of floors, diversity and efficiency of public transportation routes.

Control and safety. It is important to emphasize the main objectives of - separation of traffic and pedestrian flows, - preservation of clean air, - ensuring conditions of social control in public areas, including the illumination of public spaces.

Matching housing to the needs of citizens. The combination of different types of low-rise residential development provides comfort for representatives of different social groups, stimulates community development and social mobility of citizens.

Development of natural potential and transformation of the urban landscape. Identification and strengthening of the natural framework of the territory, including the thoughtful organization of surface runoff and protection from waterlogging from heavy rainfall and snowmelt. The goal of the unified concept of maintaining a comfortable microclimate for human life is to protect against wind, freezing, overheating, excessive moisture and dust.

Conclusions. The combination of favorable ecology, psychological climate of friendly neighborhood, accessibility of the transport system and the possibility of autonomous infrastructure contributes to the creation of a convenient, environmentally friendly urban space. The program of formation of a prospective settlement includes four aspects: environmental, social, economic, infrastructural.

In addition, the planning should take into account the mechanisms of realization of architectural, urban planning and investment and construction projects, technologies of management and monitoring of infrastructure, security and protection from risks of various origins. The key principles of spatial organization of small towns include: compactness of the planning structure, functional diversity, human scale of development, connectivity and accessibility of public

spaces, control and safety, compliance of housing with the needs of citizens, development of natural potential, as well as flexibility and adaptability to future initiatives of the local community, use of modern innovative technology in living space.

Consideration of foreign experience is important for the formation of a conceptual model of architectural and spatial organization of promising small towns as part of eco-settlement.

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СУЧАСНІ ТЕХНОЛОГІЇ ТА ПРИНЦИПИ УРБАНІСТИКИ ФОРМУВАННЯ ВІДКРИТИХ ГРОМАДСЬКИХ ПРОСТОРІВ

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Анотація. У статті досліджено основні планувальні принципи реабілітації міських територій на прикладі населених пунктів Данії, зокрема Копенгагена. Розглянуто комплексний підхід до проєктування, спрямований на подолання соціальної ізоляції та формування якісного міського середовища, що відповідає сучасному способу життя з урахуванням інноваційних технологій. Проаналізовано раціональні рішення розвитку територій, серед яких екологічна збалансованість, щільність забудови, урахування кліматичних умов, пішохідна доступність, соціальна взаємодія та впровадження автономних інфраструктурних систем. Обґрунтовано, що сукупність зазначених чинників сприяє створенню комфортного та екологічно безпечного міського простору.

Визначено сучасні тенденції розвитку малоповерхового житла в Україні в межах екологічних поселень Київської, Одеської та Карпатської областей. Показано, що перспективні малі міста орієнтовані на міських жителів і можуть функціонувати як основне або додаткове житло з рівнем сервісів, наближеним до міського. Окреслено необхідність формування умов для розвитку соціального житла як у периферійних зонах великих агломерацій, так і в малорозвинених регіонах.

Сформульовано програму створення перспективного життєвого середовища, що включає екологічний, соціальний, економічний та інфраструктурний аспекти. Визначено принципи просторової організації малих міст: компактність планувальної структури, функціональне різноманіття, людський масштаб забудови, доступність і зв'язність громадських просторів, безпеку, адаптивність житла до потреб мешканців, ефективне використання природного потенціалу та гнучкість до майбутніх ініціатив місцевих громад. Наголошено на важливості врахування зарубіжного досвіду для формування концептуальної моделі архітектурно-просторової організації перспективних малих міст у складі екологічних поселень.

Ключові слова: архітектура, урбаністика, модернізація, моделі міського та житлового середовища, проектування малих міст, малоповерхове екологічне житло, інноваційні технології.

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