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RENOVATION OF THE POST-SOVIET HOUSING ESTATES IN THE CONTEXT OF PANDEMIC CHALLENGES ON THE EXAMPLE OF NOVI BUDYNKY IN KHARKIV

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Abstract. This study raises the question of revising the usual ideas about the renovation of post-Soviet housing. The new urban movements that have become popular in the context of the COVID-19 pandemic, namely, the concept of the "15-minute city" are taking into account. The purpose of this publication is to identify possible methodological and theoretical shifts in research approaches in dealing with the transformation of post-Soviet residential areas in connection with the active introduction of new concepts of chrono-urbanism, such as the "15-minute city". In order to achieve the goal, a systematic logical and analytical approaches were used to identify the concept of a 15-minute city that is relevant today as one of those that can be used for the renovation and revitalisation of post-Soviet residential areas. The study uses a comparative method, includes a study of literary and documentary sources. The method of information systematisation was also used to summarise the research results. As a site for field research, the Novi Budynky housing estate in Kharkiv was chosen, on the example of which a historical study was carried out. It was analyzed how this housing estate corresponded to contemporary ideas about normal socio-cultural and living conditions, its new functional content, and also analyzed the possible whether (from the point of view of the formed morphology and the established service system) to introduce the concept of "15-minute city". The first steps that can be taken to get closer to the implementation of this concept were formulated, and practical and methodological problems of its implementation into the reality of post-Soviet cities, in the form in which it was theoretically developed, were identified.
Keywords: Kharkiv, large-scale housing estate, 15-minute cites, chrono-urbanism, COVID-19

Introduction

The COVID-19 pandemic, which has unfolded since the end of 2019, has become a challenge not only for public health and the global health system, but also led to transformations in the way people live. Life in cities began to change. Safety, health, environmental quality, accessibility, the possibility of dispersal in public space have become some of the basic needs of citizens around the world. These issues have become even more pressing in the context of Russia's war against Ukraine, which has affected the viability of residential areas in hundreds of Ukrainian cities due to shelling, street fighting, deliberate homicide, destruction of critical infrastructure, occupation, and depopulation of territories caused by displacement. In such crises, the question of the survival of individual urban structural units, capable of temporary or prolonged self-sufficiency or limited provision, has become even more acute. The question of how to work with the urban environment under extraordinary conditions - whether a pandemic or a war - has begun to be actively discussed in the scientific community.

So, for many researchers, the question of the "death" of cities in the form in which they exist now has become relevant – what the settlements of the future will be, and whether large cities will exist or they will be divided into many small ones [1]. The discussion, which began in the early 2000s with the widespread use of the Internet was updated. Then the disintegration of cities was assumed among the main transformations; significantly reduced need for mobility; replacement of physical networks with virtual ones; spatial homogenization – fragmentation of cities [2]. In this context, great interest has been generated by the possibilities and role of public urban spaces in the cities of the future, which are fundamental elements of the preservation of urban lifestyles [3]. C. Cellucci presented its recommendations for creating healthy, safe and sustainable public spaces, the characteristics of which were formulated in the following key points: contributing to mitigation of current and future pandemics and promoting public health and well-being [4]. N. Antonenko and T. Rumilets [5] considered the possibility of adapting public library spaces, raising the issue of the need to create transformed forms – both architectural objects themselves and internal and external library public spaces. Researchers identify several directions in the development of cities of the future [6] – the creation of multifunctional, transformable spaces; operational data management in urban planning; an inclusive city; changing the scale of urban networks and political power.

One of the most popular urbanistic concepts, which to some extent included these areas, was the concept of the "15-minute city" (in a short time, several developments similar in content appeared), which began to seem to be an effective response to the climate crisis and a way out of the crisis cities that was launched by the pandemic. The "15-minute city" concept calls for dividing the city into a series of so-called 15-minute or pedestrian neighborhoods so that all city residents are able to meet most of their needs within walking or cycling (e-bike) from their homes [7]. At the same time, the concept was operationalized differently in various contexts: in Paris, through quartier-scale reorganization of everyday services [8]; in Melbourne, as part of its long-term metropolitan strategy with the "20-minute neighbourhoods" programme [9]; and in Shanghai, via the creation of "15-minute community life circles" in the 2016 Master Plan [10]. By 2024, more than 70 initiatives aimed at transforming urban areas according to the key principles of the 15-minute city had been recorded [11]. Initiatives related to the 15-minute city are predominantly concentrated in Western Europe, North America, and Oceania.

In recent years, the problems of renovating post-Soviet housing estates, as well as the broader issues of transforming post-Soviet and post-industrial cities, have been actively discussed [12;13;14]. In this context, the question has arisen whether the concept of the "15-minute city" can be adapted to such territories, which are characterized by a complex set of challenges: peripheral location within the urban structure, physical and morphological fragmentation, pronounced social and economic inequality, transport challenges, problems of social organization and the formation of resilient local communities, as well as institutional and governance

barriers.

A review of the existing literature indicates that the 15-minute city concept is increasingly entering scholarly debates on post-socialist urban contexts. Mocák [15] initiated discussions on its potential application in Slovak cities, while Michalska-Żyła [16] highlights its role in fostering social revitalization of urban environments. Hess, Kocaj, and Gorcica [17] advance a conceptual framework for transforming Soviet-era housing estates into sustainable eco-villages by enhancing local services, pedestrian and cycling accessibility. Špirić and Đukić [18] underscore the significance of community-based initiatives in reshaping public open spaces and cultivating local communities – an essential precondition for adapting large housing estates to the principles of the 15-minute city. Complementing these perspectives, Pásztor [19] offers a critical assessment of the opportunities and challenges of chrono-urbanism in post-socialist settings, stressing the importance of socio-economic and cultural particularities. Taken together, these contributions outline a multidimensional research agenda for adapting the 15-minute city framework to the realities of Central and Eastern Europe [20].

However, the limited research on this topic and the lack of sufficient practical transformations have so far prevented the formulation of fundamental principles for the regeneration of residential areas, which could enable prefab housing districts to evolve within the framework of fully-fledged 15-minute cities.

The purpose of this publication is to identify potential methodological and theoretical shifts in the study of transformations of post-Soviet housing estates in connection with the active implementation of new chrono-urbanism approaches, particularly the "15-minute city." Although the article does not aim to provide a systematic comparison with international cases, the juxtaposition with a specific post-socialist housing district helps to mitigate the gap between an ideal-type model and a historically layered urban environment.

The hypothesis advanced in this article is that modernist housing projects, despite their idealism and detachment from residents' everyday lives, were originally designed to improve living conditions and ensure access to essential services and goods. This embedded urban planning principle can serve as a foundation for rethinking and redesigning post-Soviet estates within the framework of contemporary chrono-urbanism.

Such an approach makes it possible to transform existing socio-functional structures into more effective ones that correspond both to the current needs of urban residents and to their perceptions of a high-quality living environment.

The following tasks were set: to formulate the principles and mechanisms of the system of access to household and socio-cultural services and consumer goods within the framework of the "15-minute city" concept; to conduct a comparative analysis of this system and the Soviet staged public service model; to determine the potential and reference points for the renovation of the Novi Budynky housing estate in Kharkiv in accordance with the principles of the "15-minute city"; to identify methodological and practical challenges in adapting and implementing this concept in the post-socialist context.

The selected case for this study, the Novi Budynky housing estate in Kharkiv, represents a post-Soviet urban territory that has been developing since the 1960s. Widespread industrial and residential construction in Kharkiv, which began in the 1930s [21; 22], eventually brought the lands of the Selection Station into the urban fabric. The relatively close location of this site to major industrial enterprises, combined with favorable sanitary, hygienic, and natural conditions, predetermined its use for residential development [23]. The housing estate possesses a number of characteristics that ensure its relative stability. These include compactness, proximity to the city center, a convenient transport interchange, a comparatively well-developed system of public service enterprises (relative to other housing estates of the Soviet period), and a high degree of landscaping. From the perspective of analyzing the applicability of the "15-minute city" concept, Novi Budynky is of particular interest due to its historical territorial isolation. The estate is almost entirely surrounded by large closed industrial areas and other housing estates (Figures 1, 2). At the same time, it benefits from a convenient transport system, including metro, trolleybus, tram, and bus routes.

The study is based on a comparative method, which made it possible:

- to identify similarities and differences in the formal spatial and functional characteristics of the 15-minute city and the Soviet residential area of Novi Budynky;
- to identify ongoing and potential transformations through, site visits, interviews with local residents and document analysis.

To achieve this goal, systematic, logical, and analytical approaches were employed to determine which aspects of the 15-minute city concept are relevant today and can be applied for the renovation and revitalization of post-Soviet residential areas.

The work includes a study of literary and documentary sources, including archive documents (Archive of "Kharkivproekt" Limited Liability Company). Additionally, the method of information systematisation was also used to summarise the research results.

The 15-Minute City Concept as a Response to Global Public Health Challenges

The cars invention only at first did not have any impact on cities. The city was becoming uncomfortable for people. A growing number of cars took up more and more space in urban areas. Narrow sidewalks were allocated to pedestrians, while the maximum number of lanes was created for cars, which is only possible on old streets.

Beyond the immediate pandemic impetus, proximity-based urbanism has a longer lineage. The 15-minute city concept builds upon established urbanist approaches that emphasize compact form and everyday accessibility, including New Urbanism's neighbourhood unit, the walkability canon, smart-city instrumentation, and small-scale ("tactical"/"acupuncture") interventions that re-programme streets and squares. Situating the concept within this continuum clarifies that it re-articulates established aspirations rather than proposing an entirely new paradigm.

In this regard, in the 1960s an opposition movement emerged as an alternative to modernism, began to form, which opposed itself to the active dissemination and implementation of large-scale renovations of centers, and the construction of huge housing estates in cities. By the end of the twentieth century New Urbanism, one of the most influential urban planning concepts, was formulated. It was a movement for reforms in planning and urban design, which involved the revival of small compact cities (or districts), as opposed to automobile suburbs.The pedestrian issue has been updated and its quality has been revised since 2019, in view of the emergence of a global threat – the COVID-19 pandemic. It turned out that the measures that were previously taken to ensure urban accessibility are insufficient even in developed cities. There has been an increased focus on standardizing urban life, not only in terms of convenience, but, above all, to what extent

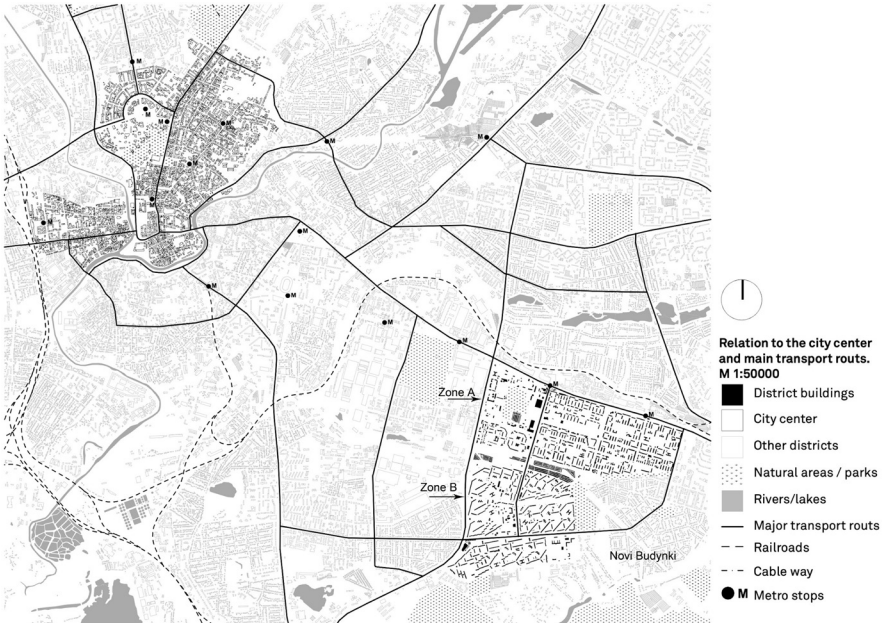

Fig. 1. Novi Budynky. Connection of the housing estate Novi Budynki with the city center [created by authors]

the urban environment contributes to the preservation of the health of citizens [24]. Today, the focus extends beyond the mere presence of roads or long cycling and walking routes to their functional quality: the diversity of services along these routes, the accessibility of essential household and socio-cultural services, and the extent to which these factors support both physical and mental health.

In 2020, K. Moreno introduced the concept of the "15-minute city" as a way to ensure that residents of cities equally remote from the center can perform six main functions – life, work, trade, health care, education and entertainment – in within a 15-minute walk or bike ride from your home. The rhythm of city life should follow a person, not cars. The 15-minute city structure of this model has four components: density, proximity, diversity, and digitalization. According to the authors, dense development will stimulate the emergence of more services offered to the population; proximity – will ensure their payback; diversity – will improve the urban experience and increase the participation of local communities in urban processes; digitalization is a key aspect of modern cities, built on the basis of smart city technology.

Similar ideas were also developed by Weng, who proposed creating 15-minute neighborhoods in Shanghai based on creating a healthy environment, they noted that one of the most important factors that maintains health is walking and minimizing the use of any means of transportation. other than a bicycle [10]. Da Silva using Tempe as an example, Arizona proposed to consider the concept of a 20-minute city, focusing on the accessibility of the urban environment [25]. In April 2020, Barcelona published the Manifesto for the Reorganization of the City after COVID-19, signed by 160 academics and 300 architects, which was based on four key elements: reorganizing mobility, renaturalizing the city, decommodifying housing and halting sprawl [26]. And in July 2020, the C40 Cities Climate Leadership Group published a framework for adapting cities to new conditions, developed based on the concept of the "15-minute city", which emphasized the importance of involving communities in transforming the urban environment using tools that will strengthen local communities: joint budgeting, joint adjustment of city plans and infrastructure development.

In recent years, the concept of the 15-minute city has remained at the center of intensive academic debate, particularly with regard to its adaptation across diverse socio-economic contexts, technological instruments, and potential risks. While practical initiatives—primarily in Western Europe and North America—have demonstrated positive outcomes such as reduced transport demand, strengthened local infrastructure, and improved quality of life, the most radical critiques have largely receded. Nevertheless, substantial scholarly and professional discussions persist, focusing on the risks of gentrification, socio-spatial segregation, and the challenges of applying the model in low-density cities or those with post-socialist morphologies. Current research highlights the necessity of contextual adaptation, requiring planning tools and strategies that are sensitive to specific socio-economic and cultural conditions, particularly in resource-constrained environments [27]. Other studies examine the operational dimensions of the concept, emphasizing the role of smart technologies in supporting decentralized development and reshaping local lifestyles [28]. Further work seeks to establish universal frameworks for inclusive 15-minute cities, exploring how digital instruments such as IoT, 6G, and digital twins can be leveraged to evaluate accessibility and urban resilience [11].

Moreover, the preservation and promotion of public health remain central to the evolution of the 15-minute city model. While much of the recent scholarship emphasizes accessibility, sustainability, and the role of technology, it is essential to underscore that a healthy urban environment is not merely a desirable outcome – but a foundational requirement.

Studies have demonstrated that 15-minute cities, by facilitating walkability and proximity to services, actively contribute to physical activity, reduced air pollution, improved mental health, and overall well-being. For instance, integrating services such as clinics, pharmacies, and parks within walking distance promotes preventive healthcare and enhances mental resilience by fostering regular social interactions and access to green spaces . A critical framework specifically targeting public health and equity within chrono-urbanism is now emerging, arguing for urban designs that explicitly integrate health considerations – from universal accessibility to inclusive engagement – to avoid unintended consequences such as gentrification or inequitable infrastructure distribution [29; 30].

Features of the spatial development of the Novi Budynky residential district in Kharkiv

The Novi Budynky housing estate is located in the southeastern part of the city of Kharkiv on the former lands of the Research Institute of Genetics and Breeding (former selection station) on an area of 445.9 hectares (Figure 1). Design work on the construction of housing began in 1958. From the north, the building site was bounded by a corridor of high-voltage lines and the then projected East-West road, from the west – by an individual development area (Gertsen village) and reconstructed for the estimated period. Communal, from the south – the area of the city airport, from the east – individual residential buildings of the Novozapadny settlement.

The territory of the future housing estate was divided into zones A and B, between which a high-voltage line was laid. Since section A was adjacent to the main transport artery of the city – Heroes of Kharkiv Avenue, they began to build it up in the first place (according to the project of Ukrgorstroyproekt, architects A. D. Matorin, N. Kireeva, Yu. Koltsov, A. I. Nesterenko and others). Zone "B" of this estate was designed a little later by Kharkivproekt (architects G.B. Kesler, Yu. A. Plaksiev, P.I .Areshkin, etc.) [31; 32].

Initially, it was planned to build only a few microrayons here, but as the pace of construction increased in the 1960s. it was decided to create a large housing estate, consisting of 10 micro-districts, and to resettle more than 150 thousand people. The area of streets and driveways per person was significantly lower than the normative ones, which was associated with the need to save money.

Transport connection of the housing estate with the central part of the city and places of employment were carried out as follows: along Byron Street, which is a city-wide highway of regulated traffic, bus and trolleybus routes were provided towards Gagarin Avenue (to the city center), as well as towards the Kosiora Street (settlement of the Kharkiv Tractor Plant); along Kommunalnaya Street, which is a city-wide highway of unregulated traffic, there are bus and trolleybus routes in the direction of Heroes of Kharkiv Avenue (industrial enterprises, city center), as well as in the direction of the civil airport; the express road along the northern border of the district provides express communication with the central and other remote parts of the city.

The main elements of the greening system of the Novi Budynky housing estate were courtyards-gardens with groups of houses, neighborhood gardens and a garden of a housing estate, greening of a public center and a stadium, boulevards [33]. In addition to the aforementioned green spaces of general use, there were also green spaces for special purposes: the protection zone from the expressway (in the north of the housing estate) and the gap from the civil airport (in the south). The layout of the garden of the housing estate and the site of sports facilities (stadium) was adopted landscape with the wide use of group plantings of trees and shrubs and sustainable grass lawns (Figure 2) [34].

Practical and methodological problems of applying the concept of a 15-minute city to post-Soviet

The structural system of the housing estate was based on the principle of stepwise division and service with the organization of: the first stage – residential group based on primary service (2500-3000 people); the second stage – a residential neighborhood consisting of several residential groups; the third stage – a housing estate, consisting of several microrayons. The number of necessary household and socio-cultural institutions of the service system was determined according to the technical and economic calculations of the general plan of Kharkiv city. The types of cultural and domestic facilities were adopted in accordance with the nomenclature of a complex series of public buildings. The main elements of this system were:

- primary service institutions, within a coverage radius of 150-200 meters, serving a residential group with a population of 2-3 thousand people and consisting of kindergarten-nursery buildings and primary service blocks;
- institutions of daily service, within a coverage radius of 400-500 meters, serving the population of the microrayon and consisting of buildings of secondary schools and public centers of the microrayon; the community center of the microrayon includes the premises required for centralized services to the population (a canteen, a grocery store, a consumer services plant, a housing maintenance office with public premises, a universal hall and a library);
- institutions of periodic services, within a coverage radius of 1200 meters, serving the population of a housing estate of 78-100 thousand people), consisting of buildings of shopping and cultural and educational

Fig. 2. Landscaping scheme for Zone B of the Novi Budynky housing estate [archive of "Kharkivproekt" Limited Liability Company]

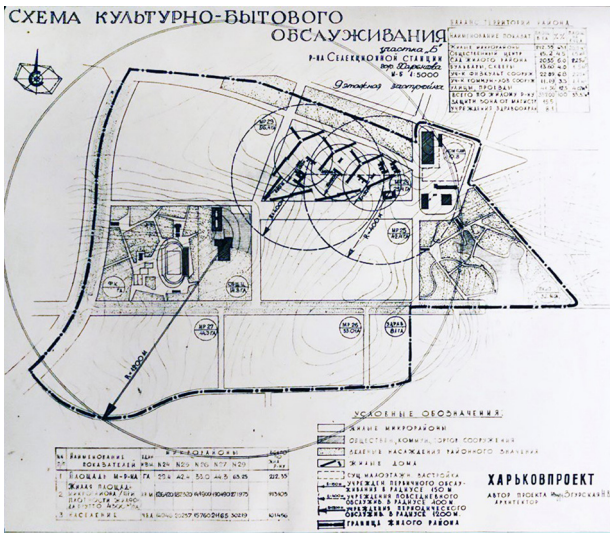

Fig. 3. Scheme of cultural and public services in Zone B of the Novi Budynky housing estate [archive of "Kharkivproekt" Limited Liability Company]

centers, as well as sports facilities (the clinic is part of the hospital complex serving the districts A and B);
- institutions of occasional (rare) use were located in a public center of urban importance, which was common for 6 and 7 industrial and housing estates (Figure 3).

The public and trade center of the housing estate was conveniently connected with housing groups – the farthest distance from the dwelling did not exceed 1.5 km. It housed trade, food and service buildings, a cinema, a restaurant and a Palace of Culture. The center was connected by a 100-meter-wide boulevard street with a park that housed a stadium and an artificial reservoir. In the opinion of the designers, such a concentration of cultural and household buildings in one place created great convenience for serving the population. According to the testimony of the interviewed local residents, it was really rare to go to the center – everything needed was within walking distance. Schools and kindergartens were isolated from the noise and dust of the streets and formed isolated green areas.

The main elements of the system of cultural and consumer services for the population of individual microrayons of a housing estate were (Figure 4):
- primary care institutions, consisting of kindergarten buildings and primary care units, which served the population of housing groups and were located within a radius of 150-200 meters.
- institutions of daily service, consisting of buildings of general education schools and community centers in housing groups. These institutions served the population of the entire microrayon and were located within a radius of 400-500 meters (Table 1).

During the Soviet era, public health was organized through the centralized Semashko system — a state-funded healthcare model that emphasized specialized medical services over primary care [35].

Due to budgetary constraints, measures that were intended to have a direct impact on population health and were included in initial plans for expanding community medical facilities or blue-green infrastructure were often left unimplemented or executed only superficially and on a reduced scale.

With the collapse of the Soviet Union, the Novi Budynky housing estate, as well as many others, began to undergo changes associated primarily with the breakup of the Soviet centralized system of public services and the emergence of other forms of services for the local population. Began to appear en masse: commercial outlets, which in the busiest places were united into markets; garage cooperatives; the housing stock of the first floors of the main highways was transferred to non-residential stock – small grocery stores, beauty salons, bank branches, cafes, private children's centers, and offices appeared. Their location was predetermined by living market mechanisms, therefore, microrayons close to metro stations and ground transport interchange stations, over time, turned out to be more functionally filled than remote peripheral areas of the housing estate.

The functional content of the buildings of the former Soviet infrastructure of the housing estate has been changed. So, for example, since the 1990s the Palace of Sports, in parallel with the sports function, began to play a permanent role as a commercial exhibition center and concert venue. Markets have sprung up on empty areas close to transport. In the late 1990s, some of the kindergartens were transferred for another purpose, which was associated with a demographic failure: courtyards with playgrounds and green spaces began to decline, and the territories of kindergartens and schools were often used for walks with children. A large area between two zones A and B, previously an empty space of the security zone of high voltage power grids, was occupied by temporary garages and paid parking lots. Green areas, gardens, school grounds, local areas gradually fell into decay – funding for housing and communal services fell sharply.

In the 2000s – 2010s the western part of Petra Grigorenko Avenue began to be actively built up with new multi-storey residential buildings and retail outlets. The design of this territory was not carried out within the framework of the general concept and construction and was point-to-point. Central Yuryev Boulevard has turned from a recreational area into an active trade and recreation area. Jasmine Boulevard, which for a long time served as a transit, after reconstruction has become an attractive public place where local residents of different age groups began to spend their time. Park "Zustrich", which in the 1990s it was also a large vacant lot, later

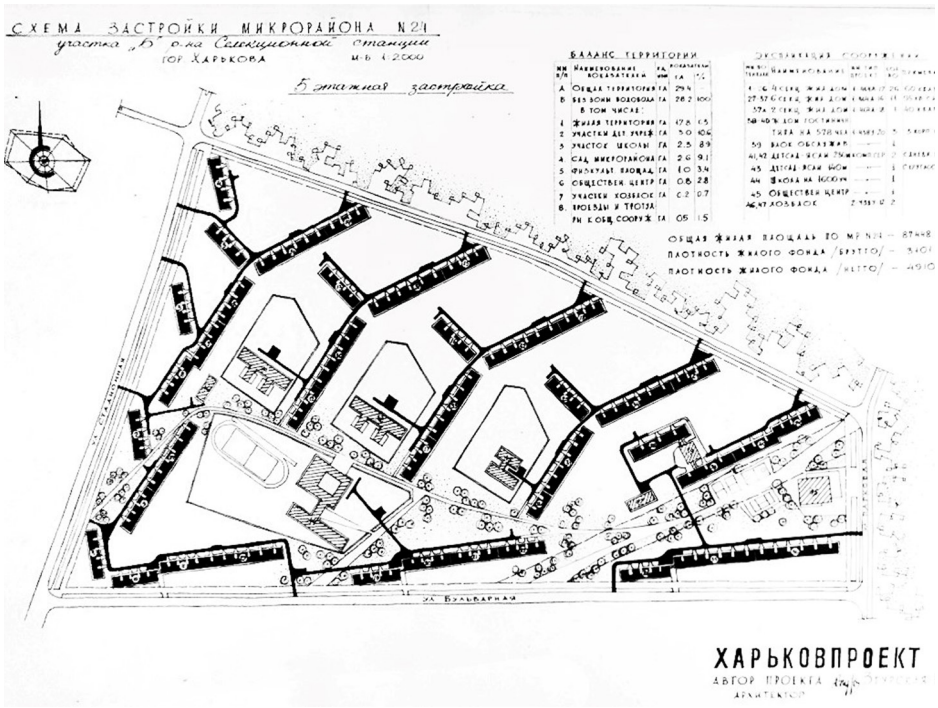

Fig. 5. Scheme of development of microrayon No. 24 [archive of "Kharkivproekt" Limited Liability Company]

TABLE 1

List of public buildings intended to serve the population of microrayon no. 24 with different number of storeys of buildings*

No.	The name of the structure and the adopted standard design	Number	
		5-storey building	9-storey building
1	Community center of the microrayon (for 8-10 thousand inhabitants), type 2	1	-
2	Community center of the microrayon (for 11-13 thousand inhabitants), type 1	-	1
3	School for 1600 students, type 1	1	-
4	School for 2,200 students, type 1	-	1
5	Kindergarten-nursery for 280 places (with day groups), type 1	2	3
5	Kindergarten Nursery for 140 places (with 24-hour groups), type 4	1	1
6	Primary service unit type. project 2-438У-12	2	2
7	Primary service unit type. project 2-438У-13	0	1

* The community center in this microrayon was located in its eastern part, since the center of the housing estate adjoins the microrayon from the west

it was put in order and began to be used by local residents as an additional place for recreation – walks, picnics. At the same time, most of the kindergartens were returned to their original function. The renovated cinema "Kyiv" continued to be the socio-cultural anchor of the community center of the housing estate. Supermarkets and shopping centers have sprung up in the buildings of supermarkets and department stores. In the same years, new standard complexes of children's playgrounds and sports complexes for workout began to be installed in the courtyards of microrayons.

In general, the housing estate is characterized as a comfortable, quiet area of Kharkiv for living with a fairly convenient existing infrastructure of consumer services. According to real estate companies, the housing estate is in the top 10 of the best areas for living in the city, since it has good transport connection, developed infrastructure, sufficient filling with recreation and sports areas, has a reputation as a relatively safe and environmentally friendly area.

Since 2022, the situation has changed dramatically: the city, located near the border, has been subjected to intense shelling by Russian forces. In this context, the Novi Budynky housing estate has proven to be one of the most livable districts, sustaining minimal damage to both residential buildings and essential infrastructure. Many residents have remained in their homes, determined to maintain their connection to the neighborhood and gradually restore their daily lives.

Following the collapse of the Soviet Union, Ukraine's healthcare system underwent significant transformations between 1990 and 2021. The centralized Semashko system gradually gave way to a more decentralized model, with hospitals and local medical institutions gaining greater autonomy in management and financing. Over time, new forms of governance emerged, including the transfer of hospital ownership to local authorities, corporatization of hospitals, and an increasing role for private healthcare providers. These changes redistributed decision-making powers and financial responsibilities between state and non-state actors, affecting the efficiency and accessibility of medical services. Although the reforms aimed to improve the quality and responsiveness of healthcare, their implementation was uneven, particularly in residential districts.

Since 2022, with the outbreak of full-scale war, the healthcare system and urban infrastructure have faced unprecedented pressures. The fact that the Novi Budynky district sustained minimal damage to its functional infrastructure has allowed basic medical services and public spaces to continue operating, albeit under extremely difficult conditions. The district's blue-green infrastructure has proven critically important for maintaining residents' physical and mental health amid disrupted urban life.

Key differences in the system of consumer services and socio-cultural services in Soviet neighborhoods in the 1960s -1980s and the concept of "15-minute city"

To assess whether a post-Soviet residential area can be reorganized according to the 15-minute city concept, it is necessary to compare the key principles and theoretical ideas of the 15-minute city with the planning principles of socialist housing estates, as well as with examples of how these estates have adapted after the 1990s (in our case, the Novi Budynky housing estate in Kharkiv). It is important to note that the data about post-Soviet housing estates should not be generalized: the features of adaptation, although sometimes similar, are highly context-dependent. The example of Novi Budynky illustrates only the trends that should be considered in further analyses and is not a universal model of adaptation. Against this backdrop, it becomes crucial to outline the general ideas underpinning the 15-minute city concept, which remain consistent with its original theoretical framework: (1) the principle of pedestrian accessibility, which prioritizes walkability and inclusivity, particularly for groups previously overlooked in urban planning such as women, children, people with disabilities, and the elderly; (2) the principle of diversity, which highlights the role of social infrastructure—schools, parks, and cultural facilities—in maximizing urban functions for residents; and (3) the principle of health, which underscores the importance of green spaces for environmental sustainability and public well-being [36].

1. Principle of Accessibility

The concept of a 15-minute city divides urban areas into nested accessibility zones, structured according to modes of movement and the frequency of daily needs. These include 5-minute walking areas, 15-minute pedestrian districts, and regions accessible by e-bike, corresponding to short, medium, and long urban mobility distances. Within these zones, residents should have access to essential goods, everyday services, educational, cultural, and recreational facilities, as well as residential and commercial spaces, satisfying daily and weekly needs without having to travel long distances. Public squares or central thoroughfares often serve as nodal points, supporting social interaction and mixed-use activity. The 15-minute city concept acknowledges the impossibility of creating a completely homogeneous environment, recognizing that residents in central areas may have access to a greater number and higher quality of services, while peripheral areas rely on smaller, local facilities.

In contrast, Soviet housing estates implemented a graded system of socio-cultural and consumer services within a planned economy. Formally, this system was similar in structure, but it differed fundamentally in flexibility and adaptability.

Soviet planning was based on two main principles: first, consumer demand was divided into three categories — daily, periodic, and episodic — allowing calculation of the minimum number of service facilities required to meet residents' needs; second, the more frequent the demand, the closer the facility was located to residential buildings to ensure convenient access to daily necessities. Level-one facilities served daily needs (kindergartens, schools, grocery stores, pharmacies, workshops) within a radius of approximately 0.6 km; level-two facilities addressed periodic needs (cultural centers, libraries, clubs, polyclinics, district hospitals) within a 1.5 km radius. Episodic or specialized needs were served at the city level, accessible via public transport to administrative offices, theaters, museums, and large hospitals. Recreational services, such as beaches, sports centers, and out-of-town facilities, constituted a fourth level and also required transport access. Although this system provided formal accessibility, it was rigid and did not account for real social behavior, "live" demand, or market changes.

Post-Soviet housing estates, exemplified by the Novi Budynky residential district in Kharkiv, demonstrate both preservation and adaptation of the Soviet accessibility system. First-level services have been maintained: kindergartens, schools, grocery stores, department stores, cafes, pharmacies, and workshops continue to operate. Additionally, new points of sale and services have emerged: law offices, beauty salons, children's clubs, supermarkets, bars, cafes, and bank branches, expanding the local network of available services. Level-two services continue to meet periodic demand, although socio-cultural institutions (clubs, cultural centers, cinemas, libraries) functioned less effectively due to funding shortages; meanwhile, shopping centers were renovated or newly built. Third-level services, covering episodic demand, require the use of public transport, primarily the metro, to reach administrative and economic offices, museums, theaters, large cinemas, circuses, concert halls, educational and scientific centers, and specialized hospitals. This demand is partially met by locally situated cultural palaces, municipal sports centers, commercial, and medical facilities. Unique fourth-level recreational facilities are absent within the district, requiring public transport to access them.

Comparative analysis shows that the 15-minute city concept envisions smaller primary service zones — approximately 1.5 times smaller than those assumed in Soviet planning — allowing more precise accommodation of residents' needs. "Shadow" or border zones between 5-minute blocks become important concentrations of diverse functions required by residents of adjacent microdistricts, though they are not always systematically organized in practice. Unlike the fixed Soviet model, the 15-minute city emphasizes continuous monitoring of actual demand, especially for socio-cultural services, enabling dynamic adaptation to changes in community needs. Modern planning additionally accounts for e-bike accessibility as a separate category, expanding residents' ability to reach unique cultural, educational, and recreational facilities within roughly 8 km, depending on local infrastructure. Smart city technologies allow real-time data collection and analysis, enabling responses to changes in mobility, service usage, and population behavior — a level of adaptability that was previously impossible under the Soviet system.

2. Principle of Diversity

The principle of diversity is central to the concept of the "15-minute city," where social composition, service systems, morphology, and temporary spaces are directed toward creating a dynamic and integrated environment. Within such districts, diversity is understood as the coexistence of multiple social groups, including different age categories, income levels, and household types, which fosters social interaction and inclusivity. The spatial structure is complemented by a wide range of everyday and periodic services, cultural, educational, and recreational facilities, as well as diverse housing typologies – from townhouses to multi-story apartment buildings. Temporary and experimental spaces, such as seasonal markets or co-working hubs, enhance adaptability and allow neighborhoods to respond flexibly to emerging needs.

In contrast, Soviet housing estates, although formally combining residential, public, and service buildings, lacked genuine diversity both socially and morphologically. The social composition was determined by the system of state allocation through enterprises and organizations, which did not aim to achieve heterogeneity, even though the population was not entirely homogeneous. Despite the presence in plans of a developed network of socio-cultural and household facilities, budgetary constraints during project implementation led to a significant reduction in functional diversity. The dominance of prefabricated construction, which depended on the capacities of local housing factories, created monotonous environments with limited morphological variability. Temporary or experimental spaces were marginal and mostly limited to episodic cultural events such as open-air cinemas.

The post-Soviet transformation of housing estates revealed a different trajectory, well illustrated by the case of Novi Budynky in Kharkiv. Housing privatization enabled the free circulation of apartments on the market, fostering demographic renewal, although in recent years the neighborhood has experienced population aging due to urban migration caused by the war. The service network significantly expanded through spontaneous business development, particularly along major thoroughfares. Morphological diversity increased with the emergence of new high-rise buildings on vacant plots, though this also intensified the aesthetic fragmentation of the environment. Informal and temporary spaces—market stalls, garages, seasonal entertainment facilities – became widespread, reflecting a new but uncoordinated form of diversity.

3. Principle of Health

The principle of health in a 15-minute city emphasizes the importance of physical activity, mental well-being, and environmental quality, integrating walkability, cycling infrastructure, green and recreational spaces, as well as access to services to support a healthy urban lifestyle. Within a 15-minute city, residents should have access to parks, playgrounds, sports fields, and other recreational areas within walking distance, supporting both physical and mental health. Safe and convenient pedestrian and cycling routes enable active mobility without relying on cars. Monitoring air quality and noise levels, along with the use of green barriers and landscaping, contributes to an improved microclimate. Access to healthcare services—hospitals, clinics, and pharmacies – ensures a rapid response to residents' needs, while markets and stores offering healthy products support proper nutrition. Lighting, security monitoring, and a sense of safety in public spaces further enhance well-being and encourage outdoor activity.

In Soviet housing estates, although a system of green spaces was planned as an interconnected network of parks, squares, protective belts, and water bodies for recreation and microclimate improvement, these areas were often limited or poorly maintained. The transport and pedestrian network

was designed to separate pedestrian and vehicle flows and to ensure connectivity between residential buildings and public facilities, but bicycle infrastructure was not provided. Sanitary and microclimatic controls, including green belts and integration of water bodies, were intended to reduce noise and pollution. The state healthcare system provided territorially organized access to district polyclinics, outpatient clinics, and specialized hospitals. Planned retail trade and markets supplied basic food and consumer goods. Public space safety was primarily ensured through state supervision and patrolling, restricted access to certain areas, and spatial design that emphasized visibility and control. However, state oversight could not fully ensure the safety of residents in remote districts, which contributed to the formation of youth gangs in the 1970s–1980s, and lighting was functional rather than aimed at creating a comfortable environment. Overall, the Soviet system provided basic conditions for supporting health but had limited integration with social life, flexibility, and adaptability to residents' needs.

Post-Soviet transformations of housing estates, illustrated by the Novi Budynky residential area in Kharkiv, show mixed trends. Green spaces were long in decline, partly built over, disrupting the connectivity of green corridors. Public green spaces were later restored; however, overall landscaping remains informal and unmanaged, with trees planted independently by residents often in unsatisfactory condition. Internal pedestrian pathways have been preserved, forming a convenient walking network, but the increase in private car ownership has led to informal parking and higher traffic flows, while cycling infrastructure remains insufficiently developed. Air quality monitoring has gradually developed since the mid-2010s, but targeted measures to improve air quality have been lacking, and the war has introduced a new source of pollution through shelling. Accessibility to healthcare services has remained adequate due to a combination of preserved Soviet facilities and private clinics and laboratories. Retail trade has undergone commercialization, transitioning from Soviet planned stores and informal 1990s markets to stable sources of fresh products within the residential area. Public oversight has weakened; the district is not highly criminalized but not completely safe either, and lighting remains inadequate due to budget constraints and the war. Under these conditions, health-related infrastructure functions unevenly, demonstrating both the resilience and limitations of post-Soviet transformations in supporting the physical and mental well-being of residents.

A comparative analysis of three urban development models – the 15-minute city, Soviet housing estates, and post-Soviet transformations exemplified by Novi Budynky – highlights key differences in accessibility, diversity, and health-oriented planning. Unlike the rigid planned model of the Soviet era, the 15-minute city emphasizes continuous monitoring of actual demand, particularly for socio-cultural services, allowing for dynamic adaptation to changing community needs. Considering e-bike accessibility as a separate category further expands residents' ability to reach unique cultural, educational, and recreational facilities within approximately 8 km, complementing traditional pedestrian and cycling networks. Smart city technologies enable real-time data collection and analysis, allowing for prompt responses to changes in mobility, service usage, and population behavior – a level of adaptability that was impossible under the Soviet system.

Although Soviet microdistricts provided a formally organized service network and a hierarchy of accessibility, they did not account for actual resident behavior, "live" demand for services, or the flexibility necessary to support diverse urban practices.

Post-Soviet transformations, including adaptation to the market conditions of the 1990s, demonstrate that the formal spatial structures of the Soviet period can support variable mobility patterns, service provision, and social interaction, but only with continuous monitoring, adaptive planning, and integration of new technologies. Examples of post-Soviet districts, such as Novi Budynky, show that through strategic interventions, inherited spatial structures can be leveraged to approximate the 15-minute city model, enhancing quality of life, mobility, and social cohesion. This underscores the potential for post-Soviet housing districts to be reorganized or upgraded according to the principles of the 15-minute city, taking into account historical constraints and the capacities of the existing urban fabric (Table 2).

In the course of analyzing the housing estate for the possibility of dividing Novi Budynky it into 15-minute cities, it was revealed that the original structure, which was laid by Soviet designers, allows leaving the contours of the territories of zones A and B as the territory of two 15-minute cities practically unchanged. At the same time, each of them can accommodate seven 5-minute districts, the boundaries of which practically coincided with the boundaries of the existing micro-districts. Each potential 5-minute city has a sufficient building density, a convenient location of children's educational institutions, enterprises that provide various goods and services and compete with each other are represented, there are not enough parking spaces within microrayons, but there are stable accessible garage areas that help reduce the number of parked cars in courtyards.

During the analysis of isochrones, it was found that the original structure laid out by Soviet designers allows zones A and B to function as the territories of two potential 15-minute cities. Within each of these zones, seven 5-minute districts can be delineated, with boundaries closely matching the existing microdistrict borders. Each 5-minute district offers sufficient building density, conveniently located educational facilities for children, and a variety of enterprises providing goods and services in competition with each other. Shortages of parking spaces within the microdistricts are mitigated by the presence of stable, accessible garage areas that reduce the number of cars parked in courtyards. The principle of pedestrian accessibility is largely observed (Figure 6).

The Novi Budynky housing estate partially meets the principle of diversity, but it remains overall limited. Social diversity recovered after the war, during which the number of young families and children significantly decreased. Access to services is basically ensured, and the network of goods and services expanded from the 1990s. However, facilities that would promote social interaction and community development are insufficient, forcing residents to go to the city center. Morphological diversity is limited due to serial housing development. Extensions and the conversion of ground floors into non-residential spaces have somewhat increased functional flexibility, but fragmented interventions create visual noise and do not alter the overall uniformity. Temporary spaces (retail outlets, informal markets, children's zones) add dynamism but do not provide full functional diversity.

This is primarily within the framework of developing a network of urban sub-centers (Figure 7), where the community center of the housing estate could acquire its unique functional socio-cultural specialization. The support for creating and the main potential for establishing such a sub-center is provided by the belt of post-industrial enterprises located along one of

TABLE 2

Comparison of the formal spatial and functional characteristics of 15-minute city Soviet city Housing Estate

15-minute city	Housing estate of Soviet city	Housing estate of Post-Soviet city (Novi Budynky)
Key components	Key components	Key components
the principle of pedestrian accessibility		
5-minute walking area (0,4 km)	Service Stage One: daily demand (0,6 km)	Adapted Service Stage One: daily demand (0,6 km)
15-minute walking area (or 5-minute cycling) (1,2 -1,6 km)	Service Stage Two: periodic demand (1,5 km)	Adapted Service Stage Two: periodic demand (1,5 km)
15-minute e-bike area (8 km)	Service Level Three: sporadic demand	Adapted Service Level Three: sporadic demand
Using infrastructure of the whole city	Service Level Four: sporadic demand (recreation)	Adapted Service Level Four: sporadic demand (recreation)
the principle of diversity		
Social Composition of Residents	Social Composition of Residents	Social Composition of Residents
Services and Goods / Socio-Cultural Facilities	Public service system	Adapted Public service system
Morphology and Housing Variety	Serial prefabricated construction	Adapted housing prefabricated series
Temporary/Experimental Spaces	Temporary Spaces	Post-Soviet Temporary/Experimental Spaces
the principle of health		
Green and Recreational Spaces	Green Structure	Adapted Green Structure
Walkability and Cycling Infrastructure	Transport and pedestrian network	Adapted transport and pedestrian network
Air Quality and Environmental Conditions	Protected Green Structure	Air Quality Monitiring
Access to Healthcare Services	State healthcare system	Adapted healthcare system
Healthy Food Availability	Planned retail trade	Retail trade commercialization
Safety and Security	State control of public order	Loss of public oversight

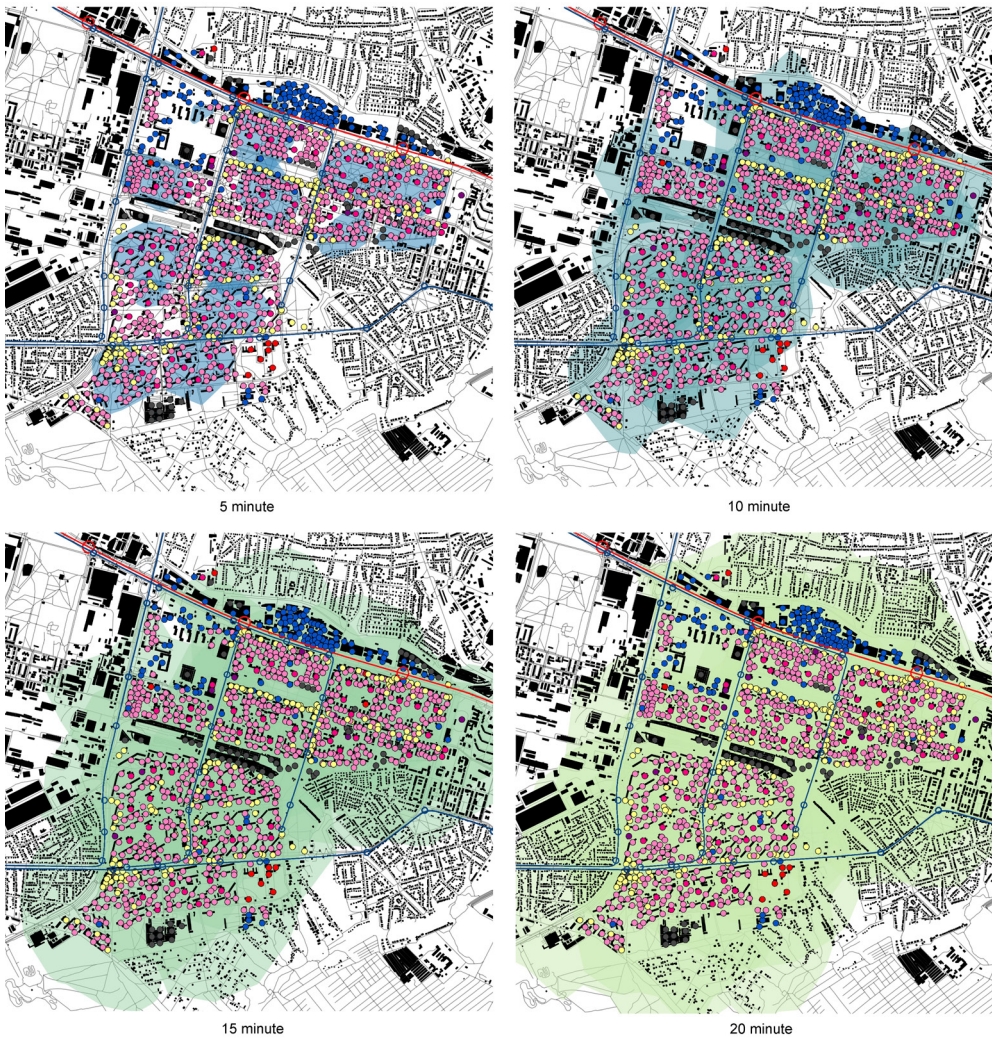

Fig. 6. Analysis of the 10-20-minute accessibility of the socio-cultural infrastructure of Novi Budynki [created by authors]

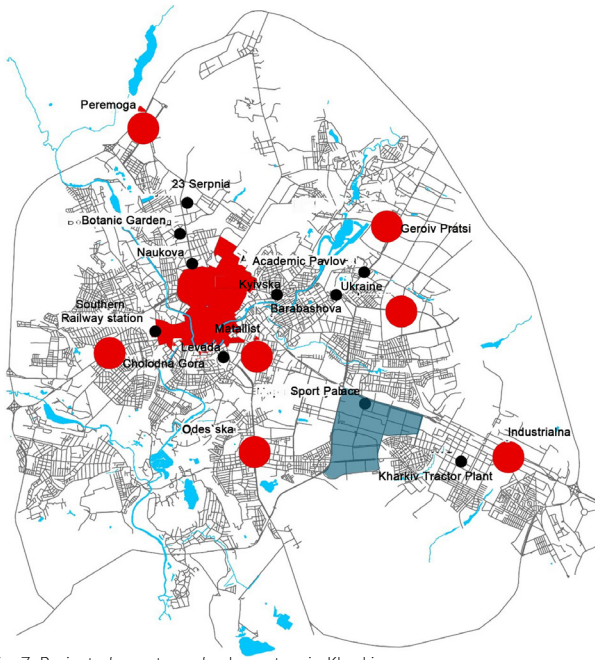

Fig. 7. Project of a system of sub-centers in Kharkiv [provided by prof. O. Buryak]

the city's main thoroughfares - Heroes of Kharkiv Prospect - as well as the area between the turbine plant and the modern public center of the housing estate, which is currently being actively developed.

The Novi Budynky housing estate partially meets the principle of health. Green areas and recreational spaces are largely accessible to residents of all neighborhoods, and the internal network of pedestrian paths is well-developed, promoting physical activity. At the same time, the road network for vehicles fragments the district, and bicycle infrastructure is virtually absent. Air quality improved during the war due to a reduction in traffic flows; however, localized pollution from the use of weapons is observed. Access to medical services is considered adequate, and healthy food is provided by local markets, whereas urban gardening practices are not widespread. Safety in the district has declined during the war; prior to the conflict, it was characterized by adequate street lighting and a positive reputation. Overall, the Novi Budynky housing estate remains relatively environmentally favorable.

Practical and methodological problems of applying the concept of a 15-minute city to post-Soviet housing estates and case of Novi Budynki

The search for an optimal solution for the system of cultural and consumer services for micro-district populations was carried out until the collapse of the USSR. However, the schemes and calculation methods that were developed and implemented did not ensure the real satisfaction of residents' needs.

Contemporary approaches to the development of residential districts encompass a wide range of urbanistic tools, which enable the creation of flexible, adaptive, and multifunctional spaces tailored to the needs of all population groups. International experience demonstrates that the application of these tools enhances the social resilience of districts, improves residents' quality of life, and promotes public health, including access to green spaces, recreational areas, and sports facilities.

Due to a complex of reasons, primarily related to war and economic constraints, Western models are difficult to implement in post-Soviet cities. For instance, Kharkiv, as a non-capital city, had limited socio-cultural infrastructure during the Soviet period, making it impossible to build a system according to the principles of completeness of public services and reproduction, as proposed by the 15-minute city concept. Under these conditions, the Novi Budynky housing estate received a standard minimal set of institutions to serve the local population.

Reconsideration of the imperfect spatial network of socio-cultural facilities should occur in two ways: bottom-up, reflecting the real needs of residents, and top-down, for example, when forming a network of multifunctional subcenters that strengthen key urban nodes that have historically developed more successfully. Such subcenters should be unique and attractive to people with diverse needs, interests, characteristics, and those with limited mobility [37]. Integration of public health elements, such as medical facilities, rehabilitation centers, sports facilities, and green spaces, will contribute to creating a safe and comfortable environment for residents.

International experience shows that creating a flexible network of subcenters with diverse functions (retail, culture, education, coworking) not only meets local needs but also fosters social interaction and builds resilient communities. Examples include district-level initiatives in Paris, Melbourne's 20-minute neighborhoods, and Shanghai's 15-minute life circles, where subcenters are integrated into the existing urban fabric and take into account the morphological characteristics of the districts.

When considering the potential of the Novi Budynky housing estate for transformation into a 15-minute city, it is important to account for both internal characteristics and the district's place within the broader urban structure. Empty industrial areas near Novi Budynky can be used to create attractive centers of gravity, and rehabilitating such abandoned spaces can facilitate the formation of new subcenters both within the district and within walking distance on the periphery. Growth should focus not only on commercial establishments, which organically generate urban activity, but primarily on facilities that ensure health, social cohesion, safety, and the enhancement of urban nature.

The main problems and potential growth points of the district include:

- The medical network is fragmented and partially commercialized, limiting access to healthcare services for all residents.
- Low socio-cultural content, represented by cinemas, libraries, sports facilities, commercial sports clubs, children's entertainment centers, and religious buildings.
- A large number of abandoned industrial buildings have potential for conversion into creative hubs, coworking spaces, social housing, and offices, providing jobs for local residents. Currently, these sites remain unsafe and largely inaccessible to the general public.
- The urban environment inaccessible to all categories of the population
- The methodological issue of extending functions to "empty" areas and minimizing negative consequences should be considered in the context of the impact of a new subcenter on the existing urban fabric of the Novi Budynky housing estate. This approach would contribute to the capitalization of the area, create an attractive investment climate, and introduce new functional elements that enhance safety and residents' comfort.

Implementing the 15-minute city concept with optimal conditions for comfortable stay and mobility for people with diverse needs requires interdisciplinary research, discussions, project development, and workshops. Detailed sociological

and anthropological studies are needed to determine the district's population composition. Investment is required both in the development of new subcenters with unique socio-cultural functions and in the district's external infrastructure, designed for users of different groups, interests, and characteristics, including people with limited mobility.

It is essential to involve local residents in the pre-project analysis and the development of project proposals. From a methodological perspective, using participatory planning tools - such as participatory budgeting, resident workshops, and pilot urban interventions - is beneficial. These tools allow concepts to be tested on-site, local practices to be considered, and practically applicable recommendations to be formulated within the specific context of the district.

Conclusion

The conducted analysis confirmed the proposed hypothesis that the spatial structure of post-socialist housing estates can, at least formally, be interpreted as a potential framework for developing 15-minute cities. At the same time, the study revealed a critical vulnerability: the insufficient focus on building a multi-component public health infrastructure. Functional frameworks, blue-green systems, transport and logistics networks, and even the existing urban morphology require reconsideration from the perspective of supporting and strengthening public health.

As a result of the study:

1. It was established that the formal planning and basic functional structure of the Soviet housing estate demonstrate similarities to the concept of the "15-minute city" in terms of the principle of walkability. The radii of the 5-minute pedestrian zone practically coincide with the isochrones of microdistrict accessibility, while the 10- and 15-minute isochrones indicate that each housing district can be considered as a potential "15-minute city." Within the defined 5–15-minute pedestrian territories, residents' basic needs are, in general, met.
2. The Novi Budynky housing estate, examined as a case study, does not correspond to the contemporary principles of the "15-minute city"; in particular, a discrepancy was revealed with regard to the principles of diversity and a healthy environment. This difference should serve as the basis for the development of regeneration plans for residential areas using a "bottom-up" approach, oriented toward creating comfortable and healthy living conditions.
3. It was determined that the integration of the "15-minute city" concept into post-Soviet housing estates is beneficial for improving public health, as it is capable of combining the development of medical infrastructure with supportive ecological infrastructure. This is of particular importance in housing areas affected by military conflict.
4. Key directions for the sustainable development of the housing estate in line with the principles of the "15-minute city" have been formulated. They envisage the development of "top-down" urban projects aimed at creating a network of multifunctional urban sub-centers with the inclusion of participatory practices.

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Kopsavilkums

Pētījumā tiek aktualizēts jautājums par ierastajām idejām attiecībā uz pēcpadomju dzīvojamo māju renovāciju. Ņem vērā jaunās urbānās kustības, kas kļuvušas populāras COVID-19 pandēmijas kontekstā, īpaši konceptu par "15 minūšu pilsētu". Publikācijas mērķis ir identificēt iespējamos metodoloģiskos un teorētiskos pavērsienus pētniecības pieejās, risinot pēcpadomju dzīvojamo rajonu transformāciju saistībā ar jauno hrono-urbanisma koncepciju aktīvu ieviešanu, piemēram, "15 minūšu pilsētas" principu. Lai sasniegtu pētījuma mērķi, tika izmantotas sistematiskas, loģiskas un analītiskas pieejas, lai identificētu mūsdienu kontekstam atbilstošo 15 minūšu pilsētas konceptu kā vienu no iespējamiem instrumentiem pēcpadomju dzīvojamo rajonu renovācijai un revitalizācijai.
Pētījumā izmantota salīdzinošā metode, iekļaujot literatūras un dokumentālo avotu izpēti. Tika veikta arī informācijas sistematizācijas metode, lai apkopotu pētījuma rezultātus. Lauka pētījuma vieta: Novi Budynky dzīvojamais kvartāls Harkovā, uz kura piemēra tika veikta vēsturiskā analīze.
Pētījumā kopumā analizēts, kā konkrētais dzīvojamais rajons atbilst mūsdienīgām idejām par normāliem sociāli kultūras un dzīvošanas apstākļiem, tā jaunajam funkcionālajam saturam, kā arī tika izvērtēts, vai, ņemot vērā izveidoto morfoloģiju un pastāvošo pakalpojumu sistēmu, iespējams ieviest "15 minūšu pilsētas" konceptu. Tika formulēti pirmie soļi, kas varētu tuvināt konkrētā koncepta īstenošanu mūsdienās.