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## Renovation of residences from previous historical eras and styles

**Abstract.** The central part of historic cities is developed by ordinary residential buildings that do not correspond to the current architectural and functional requirements and building codes, and therefore require comprehensive reconstruction. Therefore, it is essential to explore the types of residential development in historic cities and the current state of the planning structure of historic apartments, which will allow for professional restoration in the future. The purpose of this research was to determine the current state of historic buildings, and their architectural features, and to propose the basic principles of reconstruction of residential buildings of different historical eras. The research used general scientific research methods (method of comparison, method of analysis) and special methods: typological classification, architectural and planning, three-dimensional, stylistic and retrospective analysis, and graphic comparison. It has been established that in modern urban development today there is a significant share of residential buildings from previous historical eras and styles, consisting of: detached urban estates with their courtyard, ordinary street buildings of 2-4 floors with courtyards, offices and entrance gates, multi-storey buildings, etc. Detached urban estates have now lost their original function as housing and are mainly used as public facilities. Residential buildings of street-level construction have several disadvantages, from the chaotic redevelopment of apartments with access to bathrooms through kitchens or the development of dark rooms to the loss of structural stability of the buildings. Thus, to improve the comfort level of existing apartments in residential buildings from previous historical eras, it is advisable to develop comprehensive programmes for the reconstruction of this type of housing. The practical value of this research is that the recommendations for the reconstruction and preservation of residential buildings from previous historical eras can be used in the reconstruction of existing residential buildings in the central historical cities of Ukraine, and considered in strategies for the reconstruction of residential buildings after the end of the Russian-Ukrainian war

**Keywords:** residential row housing; redevelopment; planning structure; development strategy

### INTRODUCTION

Most of the historical buildings in Ukrainian cities are residential buildings of the 1860s-1910s (Onyshchuk, 2004). It is this period of industrial growth that is responsible for the dramatic changes that resulted in a significant change in the architectural environment of many historic cities in just half a century. The main element of urban complexes and

ensembles was the tenement house (the western version of the term is “chynszowy”, from the Polish “czynsz” – rent, lease).

An apartment building is a type of multi-apartment housing intended for rent, widespread in the development of cities in the second half of the 19<sup>th</sup> and early 20<sup>th</sup> centuries (Subin-Kozhevnikova, 2016). The foundation of the

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planning and spatial structure of an apartment building is a vertical multi-storey volume, which, having a specific spatial and functional autonomy, unites apartments in one staircase.

The processes of renovation of ordinary buildings and the massive spread of tenement houses were common to all European regions. Although the tenement house as an architectural type first appeared in Eastern Europe in the late 18<sup>th</sup> century, its heyday dates back to the second half of the 19<sup>th</sup> and early 20<sup>th</sup> centuries. Dense perimeter buildings consisting of tenement houses were established over large areas in such European metropolises as Warsaw, Vienna, and Berlin (Zakharov *et al.*, 2019).

Historic cities in Ukraine are characterised by high building density. However, as of 2023, such buildings do not correspond to the architectural and planning requirements for housing and require comprehensive reconstruction. According to the Law of Ukraine No. 525-V (2006), the reconstruction of a residential building is the reconstruction of a residential building to improve living conditions, operation, change the number of residential apartments, total and living space, etc. due to changes in geometric dimensions, functional purpose, replacement of individual structures, their elements, and key technical and economic indicators.

The issue of reconstruction of historic residential buildings is relevant enough that it has been raised by many scholars. O.P. Pekarchuk (2013) and I.H. Novosad (2015) analyse foreign experience in the reconstruction of typical residential buildings in European countries. Three main methods of housing reconstruction can be distinguished, namely: the addition of attic floors and the establishment of energy-saving facades; partial dismantling of an existing building and the completion of new volumes; demolition of an existing building and construction of a new one.

D.Ye. Prusov (2014), Iu.S. Sokolan & L.V. Kucherenko (2021) in their works propose the concept of reconstruction of urban residential buildings, which has an integrated approach to its planning based on scientific and technical justification of its implementation to preserve historical buildings and structures and protect the surrounding areas.

The problem of using historical buildings in the context of intensification of the urban environment in the period of increasing urbanisation is covered in the work of B.S. Cherkas *et al.* (2018). Due to the population growth in Ukrainian cities in the early 20<sup>th</sup> century, there was a need to provide housing for the general population. During this period, large multi-sectional residential buildings with architectural volumes and courtyard out-buildings developed deep into the plot. The second option is single-section single-family houses, which were intended for wealthy tenants. They can be called mansion-type apartment buildings, as each floor was a kind of mini-mansion with 10-12 rooms. The functional set of premises in such buildings is significantly expanded by

the front apartments and rooms for servants. Externally, such buildings often imitated the image of a mansion by using characteristic details such as lavishly decorated portals, porticos, colonnades, sculptural decor, and small front gardens.

However, nowadays tenement houses are used as apartment buildings with separate apartments and, accordingly, must comply with building provisions established at the legislative level. The purpose of the study was to identify the basic principles of residential development in historic cities of Ukraine, explore its features, analyse the structural schemes of such buildings and, based on this analysis, develop recommendations for the reconstruction of residential buildings of different historical eras. This purpose can be achieved by performing the following tasks outlined in the research: to analyse the features of historic residential buildings, to explore foreign examples of reconstruction of historically established housing stock, to characterise the current technical condition of historic buildings and to identify the main types of reconstruction of this type of building.

## MATERIALS AND METHODS

General scientific and special methods of scientific research have been chosen for the research, and a research methodology has been developed, which is necessary for the implementation of the tasks set in the research of historical residential buildings and the definition of the basic principles of reconstruction of this type of object.

The primary objective in the research of residential buildings of previous historical eras was to examine State construction norms of Ukraine 360-92\*\* "Urban planning. Planning and construction of urban and rural settlements" (1992), State construction norms of Ukraine V.3.2-2-2009 "Reconstruction, repair, restoration of construction objects. Residential buildings. Reconstruction and overhaul" (2010), scientific literature and determining the level of research on this subject. For this purpose, such general scientific research methods as comparison, analysis and synthesis were used.

Using the sampling method, a list of cities was developed, the central part of which was developed by historic residential buildings. After selecting the objects of research, the state of preservation and the nature of using these objects were analysed, and the architectural characteristics of the palaces were determined. The following methods were used during the desk research: analytical, systematisation, generalisation and comparison.

Using special research methods, namely: methods of visual inspection and system analysis, methods of graphic comparison, and architectural-compositional and architectural-planning analysis, the basic principles of reconstruction of residential buildings from previous eras and styles are proposed. For example, the method of visual inspection was used to determine the state of preservation and explore the architectural features of buildings. This method allows mapping losses on the facades of historic



residential buildings, identifying problems of use, and subsequently developing proposals for the restoration of facades and reconstruction of buildings in general. After compiling a list of cities based on a comprehensive analysis and graphical comparison, the architect's creative method was explored.

The research of historic residential buildings was conducted according to two criteria – architectural and planning and constructive analysis. For the former, a comprehensive methodology for analysing the architectural and planning elements of apartments was used, and for the latter, a methodology for analysing the structural scheme of buildings and their volumetric and spatial features was used.

## RESULTS AND DISCUSSION

Most of the ordinary street buildings in the major historical cities of Ukraine (Kyiv, Lviv, Ternopil, Ivano-Frankivsk,

Vinnitsia, etc.) are formed by residential buildings of the historicist or secession period (Fig. 1). The buildings that were constructed in the central part of historic cities during the Austrian Empire in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries designed the background urban development. They established street ensembles, were located close to the red lines, and in rare cases, there could be curtain walls with landscaping in front of the house. Depending on the width of the parcel, the facade composition was developed by 3, 5, 7, or 9 window axes. In narrow parcels, the entrance gates were placed in the side parts, and if the width was sufficient, they were placed in the centre. It resulted in a building layout that had a configuration with a right or left gate or established a closed courtyard (Demkiv & Pohranychna, 2022). Floor plans and apartment plans can be seen on the inventory plans of residential buildings, which, in addition, demonstrated the structural diagrams of foundations, load-bearing walls, partitions, etc.



**Figure 1.** View of a street with ordinary residential buildings in Lviv

**Source:** Mapio.net. Lviv (n.d.)

Such rooms as lavatories were not designed in each apartment but were shared by the residents of the building and placed in the courtyards, later in offices on floors with access from the galleries, which oriented the position of the staircases with exit platforms to the gallery.

After the Second World War, there was modernisation, division of large apartments, and later privatisation of residential apartments (Subin-Kozhevnikova, 2016). The apartments were redesigned many times in an attempt to improve living conditions, and bathrooms were installed instead of kitchen sinks. Accordingly, the bathroom was located next to the kitchen, sometimes without a brick partition separating the two rooms. This type of bathroom and kitchen layout is not acceptable today and requires a comprehensive reconstruction. When reconstructing individual apartments, if structural and engineering systems allow it, it is permissible to increase the area of apartments by combining several apartments, redeveloping existing apartments, etc. When reconstructing a building, it is generally permitted to install additional staircases, lifts, extensions

and additions to the premises, etc. However, to perform all these works, it is necessary to conduct a visual inspection of the building and the adjacent territory, analyse the existing planning structure, collect analogues of residential building reconstruction, perform a pre-design analysis of the building, analyse the structural scheme of the building, its technical condition and possible reconstruction options, conduct stages of sketching, where the main concepts for reconstruction are developed, their presentation and approval, develop a reconstruction project, including interiors (drawing furniture on the house plans).

The main types of reconstruction: without changing the physical size of the house (reconstruction is performed by redeveloping the premises, arranging a residential attic within the attic, redeveloping the basement, etc.); reconstruction with an extension (Fig. 2); reconstruction with a superstructure (Fig. 3); combined (with an extension and a superstructure) (Fig. 4). Any type of reconstruction is necessarily accompanied by requirements and provisions for the performance of the relevant works (Table 1).





**Figure 2.** Reconstruction with an extension

**Source:** A. Griffiths (2014), M. Slatalla (2016), A. Waligore (2018)



**Figure 3.** Reconstruction with a superstructure

**Source:** Stuttgart daily photo (2010), A. Griffiths (2015)



**Figure 4.** Reconstruction of a residential building with an extension and a superstructure

**Source:** Ch. Hosea (2013)

**Table 1.** Requirements for the construction of extensions and additions to historic residential buildings in Ukraine

Requirements for adding floors to an existing historic residential building	Requirements for additions to the established facade of historic residential buildings
1. The superstructure should be performed if the existing street panorama allows it, to ensure that the building does not discord with the existing historical environment.	1. The planting should be performed in a suitable location (preferably the courtyard of a residential building).
2. The construction should be performed within the existing width of the external dimensions of the existing building.	2. The existing original members of the facade must be retained in the attached part of the building.
3. The vertical and horizontal divisions of the existing building should be preserved in the newly designed part.	3. In the second half of the year, the position for the largest volume of membership and the actual decision of the central crop will be used.
4. In the most frequent years, try to maintain the rhythm of the facade's decorative finishes (pilasters, columns, rallies, etc.).	4. For a harmonious and architectural solution, the extension should be designed using the existing building's existing details.
5. Composite window axes should be placed above the existing ones in the lower part.	5. The annual passages should be provided for at the same level as in the previous section.
6. The window fenestration is to be designed in a fashionable manner, using the authentic window divisions, the original stylistic design and building materials of the historic part.	6. Window and door framing is recommended to be designed using the previous solution in the older version.
7. The porch cornice of the historic part of the residential building should be preserved for easy access to the overall view of the spire, and the superstructure should be extended higher with a slight deviation from the overall plane of the facade.	7. The porch cornice in the attached part should be extended at the level of the historic building, and its overall characteristics should be repeated within the existing one.
8. It is allowed using the fronts, sunroofs and small windows to complete the position of the acquired volume.	8. During the professional arrangement of the extension, gables, skylights and skylights are used to stylistically combine the two parts of the object.
9. The gift should be designed in such a way that it captures the configuration of the plan and the strategy of the actual decision.	9. The added part should be designed in such a way that it does not exceed the volume of the original part.
10. The rooms are recommended to be designed as a small architectural detail, thus, they are the logical conclusion of the building.	10. The rooms are designed to be similar to the existing ones so that the extension looks like a logical completion of the existing building.

**Source:** State construction norms of Ukraine V.3.2-2-2009 (2010)

To determine the type of reconstruction, it is necessary to conduct an architectural and engineering survey of the object. A detailed inspection of a residential building usually begins with an external inspection of all external, facade walls, followed by an inspection of the interior. During the inspection, photographs of the building's facades are taken with the date of the photo. In addition to the main photographs, the expert may take large-scale photographs of individual fragments and details of the facades.

Photography allows obtaining a documentary image within the shortest possible time and with great accuracy and frequently with sufficient completeness. Therewith, it is unacceptable to photograph buildings from a strong angle, which establishes a false impression of the proportions of buildings. Sharp contrasts between light and shadow should be avoided, as details are captured much better in diffused light. It is advisable to capture details and fragments, and if possible, entire facades, in close to orthogonal images. In addition, it is advisable to place a person next to the object being photographed to determine the proportions of the building or its size.

While photographing a building, it is not necessary to limit oneself to the exterior and interior views of the building and its details. Everything that indicates the condition of the building and the situation in it should be photographed. Older parts of the building and remnants of its decorative finishes that have been preserved in attics,

inside later additions, etc., and places where alterations and distortions are visible, or building materials, or deformations and destruction of individual elements.

A detailed examination of cracks and other damage to the masonry of the facade walls is conducted at the next stage of the building inspection, when determining the technical condition of its supporting structures. During the inspection of the building, the surviving technical documentation is checked against the actual site, and, if necessary, corrections are made to it, and the places of damage to individual structures and parts of the building are recorded. In addition, the presence of water supply, sewerage, gas supply, heating, ventilation, heating and ventilation networks, telephony networks, boiler rooms, etc. in the building is established.

The time of construction is determined. The facades of many buildings have inscriptions on the date of construction. Sometimes these inscriptions are made on floors and balcony railings. A critical approach should be taken to assessing the appearance of a building. Many old buildings have been built on, rebuilt, sometimes repeatedly. It is not always the case that sufficient care was taken to ensure the composition of the facades and their stylistic unity. Identifying the need to change the architecture of facades is a task of the survey. It is very important to establish whether any reconstruction work has been performed in the building before: the addition of floors, extensions, deepening of



basements, whether the purpose of the building, the roof, the design of its facades and other works that caused the punching or sealing of window and door openings in the main walls, and other alterations to the supporting structures.

The next step is to analyse the existing planning structure and identify existing problems. When examining the internal layout of buildings, it is necessary to examine the layout of apartments, the location of load-bearing walls, columns, and pillars on all floors. In the course of this survey, the existing floor plans and sections of the building should be compared with the actual building. If necessary, the drawings are adjusted. Only after a detailed examination of the technical condition and the existing architectural and planning solution of the apartments can the design of the redevelopment of the apartments and the design of the courtyard reconstruction be started (Fig. 5).

The drawing of the adjacent territory improvement should be combined with an open plan of the first entrance in M 1:100. Such a drawing is made with an indication of the object's reference to the reference points on the territory, detailed planning of pedestrian and transport links, main entrances, fire passages and exits, orientation of the design site by the cardinal points, with conventional designations of coating and decoration materials (lawns, flower beds, bushes, trees; different types of pavement (concrete elements, asphalt, natural stone, paving, pebbles, pitch, poke, etc.)), highlighting the functional zoning of the territory (representative, recreation, sports area, maintenance area, etc.). In addition, the plan for the improvement of the adjacent territory should indicate the existing and projected elevations, with the beginning and end of the staircases, pans, terraces, platforms, etc.

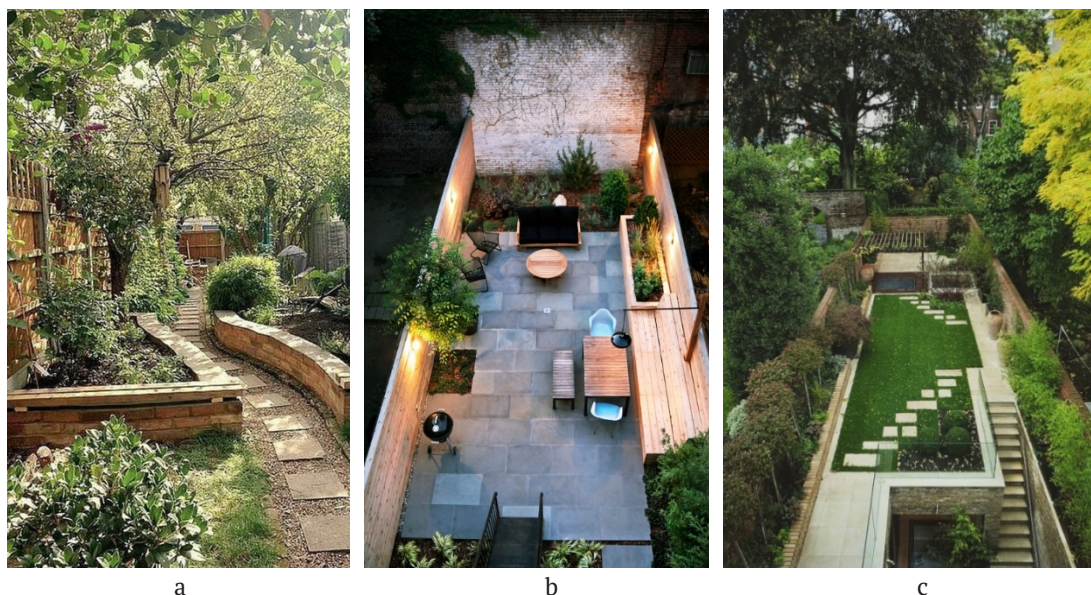


Figure 5. Improvement of the courtyard of a historic residential building

Source: L. Lloyd & S. Allen (2022)

In addition, an important element of the reconstruction of a residential building is the drawing of the existing state of the facade with a mapping of losses and, accordingly, the development of a passport for the facade finishing after reconstruction.

## DISCUSSION

The research of Yu.I. Zakharov *et al.* (2019), which identifies the features and characteristics of historical residential buildings, and analyses the foreign experience of reconstruction and the principle of subsidisation in housing reconstruction, is supplemented in the present research. The author agrees with the opinion that this approach is relevant and will be widely used in Ukraine.

In addition, the research clarifies the current state of preservation and use of historic residential buildings in Ukraine. The compositional, planning, and structural schemes of the objects presented in the research by

M.V. Demkiv & I.I. Pohranychna (2022) have been supplemented. It has been determined that the most common structural scheme of buildings was a scheme with longitudinal load-bearing walls, sometimes with transverse or mixed walls. Additionally, the structure of the house was developed by the design of the staircase and transverse diaphragms. The load-bearing and outer enclosing walls were brick, which decreased in width along the height of the building. Smoke and ventilation ducts were located in the middle load-bearing wall and the walls of the stairwell load-bearing structure. The boundary walls between the buildings are mostly self-contained, ending at the roof level with a firewall. The floors in historic residential buildings were made of wooden beams with a spacing of 800-1300 cm. The ceilings between the basement and the first floor were vaulted, and made of brick or metal beams (klein). At the end of the 19<sup>th</sup> and early 20<sup>th</sup> centuries, the ceilings in kitchen and bathroom areas were



already made of reinforced concrete, as were the stairwell platforms in Secessionist buildings. The roofs were single or double-pitched, with roofs with slopes in case of large widths. The roofs were ventilated by dormer windows or vents. Structural elements were made of wood. The rafters are supported by maurlats, supported by chairs with braces. The roof design for each house depended on its configuration and possible water runoff. The roofs were covered with wooden battens. The roofing material used was tiles or metal sheeting.

However, it is not uncommon to notice the deterioration or destruction of structural elements in historic buildings. Therefore, this research confirms the assumptions of scientists I.H. Novosad (2015), O.S. Bezlyubchenko & T.M. Apatenko (2019), V.V. Kovalov *et al.* (2019) about the necessity of an integrated approach to the reconstruction of historic residential buildings and the renovation of the adjacent territory. Based on a comparative analysis of the historical and actual state of apartment buildings, the research confirms the opinion of T.A. Tsimbalova (2015) about the inconsistency of outdated classification characteristics with modern building requirements for the living environment.

Considering the above, to select the most optimal option for the reconstruction of a residential building, it is necessary to develop a comprehensive method of qualitative assessment in terms of technical, architectural, planning and economic indicators (factors).

## CONCLUSIONS

Having analysed the features of historical residential buildings and studied foreign examples of reconstruction of the historically developed housing stock, it is determined that the reconstruction of residential buildings requires a comprehensive approach.

Before developing a comprehensive project for the reconstruction of a historic residential building, a technical inspection of the building is conducted. During the inspection of the object, the following should be established: geometric parameters of the building, type of building structures, type of building materials, condition of building elements as of the date of the inspection, and previous

repair work. The inspection begins with the examination of the existing technical documentation, inventory materials, building passport, and technical expertise materials, and is conducted by individual component elements, including underground structures foundations, basement walls exterior and interior walls, floors, stairs, elevators, extractors, roof, windows and doors, floors, facades and their finishes, interior decoration, internal engineering equipment and networks (water, electricity, sewerage, ventilation, heating, etc.), the presence of stoves and fireplaces in the premises. In addition, it is necessary to examine the internal layout of the house, landscaping, etc.

The current technical condition, architectural and planning design, condition of the facades and decorative elements of the historic buildings is unsatisfactory and requires professional restoration of the facades (with the development of a facade decoration passport), changes (redevelopment) of the architectural and planning scheme of existing apartments, and adaptation of existing historic buildings for convenient use by less mobile groups of the population.

The scientific originality of the obtained results lies in the systematisation and supplementation of the general picture of the technical condition of historical residential buildings, clarification of the current state of preservation of historical buildings, and the basic architectural, planning and functional principles of reconstruction of residential buildings of different historical eras.

Prospects for further research include conducting detailed surveys of historic residential buildings (probing walls, ceilings and other structural elements to identify decorative paintings, etc.; performing 3D scanning of such objects and establishing an electronic fund with detailed drawings of facades and decorative elements of historic residential buildings). The following scientific developments will be devoted to the solution of this problem.

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## CONFLICT OF INTEREST

None.

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з попередніх історичних епох і стилів**

**Анотація.** Центральну частину історичних міст формує рядова житлова забудова, яка не відповідає теперішнім архітектурно-функціональним вимогам та будівельним нормам, а тому вимагає комплексної реконструкції. Через це актуальним є питання дослідження типів житлової забудови історичних міст та сучасного стану планувальної структури історичних квартир, що в подальшому дозволить провести фахову реставрацію. Метою даного дослідження було визначити сучасний стан історичної забудови, її архітектурні особливості та запропонувати основні принципи реконструкції житлових будинків різних історичних епох. Під час дослідження було використано загальнонаукові методи дослідження (метод порівняння, метод аналізу) і спеціальні методи: типологічної класифікації, архітектурно-планувального, об'ємно-просторового, стилістичного і ретроспективного аналізу та графічного зіставлення. Встановлено, що в сучасній міській забудові сьогодні існує значна частка житлових будинків з попередніх історичних епох і стилів, які складаються з: окремо розташованих міських садиб з власним подвір'ям, будинків рядової вуличної забудови в 2-4 поверхи з внутрішніми дворами, офіцинами і в'їзними брамами, багатоповерхових будинків тощо. Окремо розташовані міські садиби зараз втратили свою первісну функцію житла і переважно використовуються як громадські об'єкти. Житлові будинки вуличної рядової забудови мають ряд недоліків, від хаотичного перепланування квартир з входом до санвузлів через кухні чи формування темних кімнат, до втрати конструктивної стійкості об'єктів. Саме тому для підвищення рівня комфорту існуючих квартир в житлових будинках з попередніх історичних епох доцільно розробляти комплексні програми з реконструкції такого типу житла. Практична цінність даного дослідження полягає в тому, що рекомендації щодо реконструкції та збереження житлових будинків з попередніх історичних епох можуть бути використані під час реконструкції існуючих житлових будинків в центральних історичних містах України, а також враховані в стратегіях відбудови житлової забудови після завершення російсько-української війни

**Ключові слова:** житлова рядова забудова; перепланування; планувальна структура; стратегія розвитку

